A case study analysis of the role of intermodal transport in port regionalisation

Jason Monios

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Transport Research Institute

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Abstract

This thesis presents an analysis of the role of intermodal transport in Notteboom and Rodrigue's (2005) port regionalisation concept, an approach to port development that focuses on the inland aspects of the process, as well as taking port development models from a spatial focus to a focus on institutions. It is argued that the port regionalisation concept is insufficiently disaggregated; it does not identify or classify different processes within the concept, nor does it explain how they operate or who drives them.

In this thesis, the port regionalisation concept is broken down into its three constituent parts: inland terminals, market and logistics and the resolution of collective action problems. Each of these is examined in its own chapter, based on a case study methodology. The methodology was chosen for its ability to provide rich detail and build or extend theory, as the overall aim of this thesis is to critique the port regionalisation concept and extend its explanatory power. Part one follows a multiple-case design, analysing numerous European inland terminal developments in order to improve inland terminal classifications that can then contribute to the port regionalisation concept. Parts two and three each utilise a single case design, taking a single case in depth in order to explore in rich detail how these issues play out in industry. Part two studies the role of large retailers as the primary drivers of intermodal transport in the UK, while part three examines the development of an intermodal corridor in the United States, offering the opportunity to study a collective action problem in detail.

Part one reveals that port actors, both port authorities and port terminal operators, can be directly involved in the development of inland terminals, and that differences can be observed between terminals developed by port actors and those developed by inland actors. A conceptual distinction is proposed to capture this observation. Part two identifies barriers to port regionalisation, such as operational issues, spatial development decisions and a lack of integration between inland market players. Part three demonstrates the difficulties faced by public bodies attempting to direct regionalisation strategies, constrained by legitimacy and agency conflicts and an institutional structure that limits their effectiveness. An added contribution to the

literature is the theoretical framework that is developed for the analysis of the institutional factors at play in resolving a collective action problem.

While additional cases are required to advance the concept further, the cases in this thesis elucidate reasons why ports may not be controlling or capturing hinterlands through the strategies of integration that the port regionalisation concept suggests. It may be more accurate to state that port regionalisation can only occur as long as a set of favourable commercial and institutional conditions are maintained. The findings from the cases presented in this thesis suggest that it is not easy to maintain such conditions, implying that port regionalisation may be the exception rather than the norm.

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Contents

List of figures

List of tables

List of abbreviations

3PL	Third-party logistics provider
AAR	American Association of Railroads
AASHTO	American Association of State Highway Transportation Officials
ARC	Appalachian Regional Commission
BNSF	Burlington Northern Santa Fe
CNRS	Company neutral revenue support
DC	Distribution centre
DFT	Department for Transport
DOT	Department of Transport
DRS	Direct Rail Services
ECML	East Coast Mainline
ECT	European Container Terminals
EFLHD	Eastern Federal Lands Highway Division
FCL	Full container load
FFG	Freight Facilities Grant
FGP	Factory gate pricing
FHA	Federal Highways Association
HAR	Hinterland Access Regime
HMT	Harbour Maintenance Tax
ISTEA	Intermodal Surface Transportation Efficiency Act
LCL	Less than container load
MarAd	Maritime Administration
MPO	Metropolitan Planning Organisation
MSRS	Modal Shift Revenue Support
MTO	Multimodal transport operator
NDC	National distribution centre
NIE	New institutional economics
NS	Norfolk Southern
ORDC	Ohio Rail Development Commission
PCC	Primary consolidation centre
PPP	Public-private partnership
RDC	Regional distribution centre
REPS	Rail environmental benefit procurement scheme
RTI	Nick J. Rahall Appalachian Transportation Institute
RTP	Regional transport partnership
SAFETEA-LU	Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users

SFN	Strategic freight network
TAG	Track access grant
TEA-21	Transportation Equity Act for the 21st Century
TEU	Twenty-foot equivalent unit
TIGER	Transportation Investment Generating Economic Recovery
UP	Union Pacific
VDRPT	Virginia Department of Rail and Public Transportation
WCML	West Coast Mainline
WFG	Waterborne freight grant

Publications

Edinburgh Napier University regulations state that any publications resulting from the research undertaken for this thesis must be noted. The following papers have been published or accepted for publication.

Chapter four: inland terminals

- Monios, J., Wilmsmeier, G. (2012). Giving a direction to port regionalisation. *Transportation Research Part A: Policy & Practice.* 46 (10): 1551-1561.
- Wilmsmeier, G., Monios, J., Lambert, B. (2011). The directional development of intermodal freight corridors in relation to inland terminals. *Journal of Transport Geography.* 19 (6): 1379-1386.
- Monios, J. (2011). The role of inland terminal development in the hinterland access strategies of Spanish ports. *Research in Transportation Economics.* 33 (1): 59-66.

Chapter six: collective action problem resolution

- Monios, J., Lambert, B. (2012). The Heartland Intermodal Corridor: public-private partnerships and the transformation of institutional settings. *Journal of Transport Geography.* In press.

"The term 'theorist' is often applied to those who deal mainly in abstractions and abjure empirical verification, rather than to those who take up knotty problems, hypothesize about their nature and causality, and marshal evidence in support of their views."

(Markusen, 2003; p704)

"A scientific discipline without a large number of thoroughly-executed case studies is a discipline without systematic production of exemplars, and a discipline without exemplars is an ineffective one."

(Flyvbjerg, 2006; p219)

1. Introduction

1.1. Background to the thesis topic

A key challenge of transport geography is to understand shifting notions of infrastructure provision brought about by changing roles of the public and private sectors (Hall et al., 2006; Hesse, 2008), while acknowledging the difficulty of predicting the effect of government investment (Rodrigue, 2006).

Cullinane and Wilmsmeier (2011) wrote that "While the expansion of reach on the maritime side of a port's operational environment is clearly recognised and relatively widely analysed, the process of a port's spatial development of its hinterland (other than simply the fact of its expansion) has received considerably less attention" (pp.9-10). Ng and Pallis (2010) identified a research gap with regard to port development, stating a need for research towards "a general theory explaining the ways in which institutional frameworks and political traditions affect the process of reforming a unique (in certain respects) economic sector and, not least, to develop a better understanding of the evolution of port development" (p.2164).

These two recent calls for new research have served as the twin motivations for the thesis topic. First, the landward side of port development, and second, an institutional approach. These ideas will be explored through an analysis of the port regionalisation concept proposed by Notteboom and Rodrigue (2005), as the primary contributions of their approach are the importance of the inland aspect of port development and taking port development models from a spatial focus to a focus on institutions.

It is argued in this thesis that port regionalisation is an umbrella concept that remains insufficiently disaggregated. Few would question that hinterland access is more important for ports now than in the past, or that these relationships are becoming more complex in an increasingly sophisticated and integrated transport and logistics environment. However, the port regionalisation concept, in its current state, does not identify or classify different processes within the concept, nor does it explain how they operate or who drives them.

The main contribution of this thesis is that it will identify, disaggregate and classify some of the processes that are implicit within the concept of regionalisation. However, this thesis does not aim to develop a comprehensive normative theory that would enable

explanation and prediction of port development. Rather, the qualitative analysis in this thesis presents a more multidimensional view, offering new insights to port development theory and indicating challenges faced in a variety of contexts.

1.2 Research questions

It will be demonstrated in the literature review that the port regionalisation concept is insufficiently disaggregated, and it will be argued that more detailed research is required in order to improve the concept's explanatory power. Notteboom and Rodrigue (2005) assert that regionalisation is imposed on ports but the dynamics of this concept are unclear, such as the determinants of the "varying degrees of formal linkages" (p.302) and the way that "market forces and political influences" (p.302) affect the processes embedded within the concept.

If port regionalisation is proposed as an observable stage in port development theory, the implication is that these processes of inland integration are possible or even probable in the majority of instances. While one thesis cannot cover all possibilities, the literature review analyses the port regionalisation concept and identifies three key aspects for further study, which are then formulated as the research questions for this thesis:

1. How can different strategies of inland terminal development influence port regionalisation processes?
2. How can logistics integration and inland freight circulation influence port regionalisation processes?
3. How can collective action problems influence port regionalisation processes?

These questions are deliberately open-ended as the aim of the research is to learn about the processes of which the port regionalisation concept is comprised. Notteboom and Rodrigue (2005) do not elaborate on these issues therefore this thesis will examine the literature to determine the main features of each of the three questions. Case studies will be selected through which to describe and discuss how the integration processes as defined within the port regionalisation concept are enabled or constrained, before ascertaining whether and how these descriptions and explanations can add to or elaborate upon the port regionalisation concept.

Once the research questions have been answered, a conceptualisation will be proposed that can tie these observed processes into a more robust model of what is actually described by the concept of port regionalisation, including recognition of barriers to port regionalisation processes.

While port regionalisation is a broad concept, some decisions had to be taken in this thesis to narrow the focus to a manageable object of study. The focus in this research is intermodal container transport, in particular rail transport (as opposed to barge). Therefore when each of the three research questions is examined, the object of the study will be rail container transport.

1.3 Methodology

A case study methodology has been adopted to address the three research questions, which will be explained in detail in the appropriate chapter. The data collection was based primarily on expert interviews; more than 100 subjects were interviewed for this thesis. These data were supplemented by document analysis in order to build robust case studies that could then be analysed through thematic matrix construction. The case study approach has been adopted because it provides the rich data that is required to achieve the inductive aims of this thesis. The port regionalisation concept requires greater disaggregation, thus it is only after the analysis of detailed case studies that explanations can be offered and theories developed that can improve upon and refine the port regionalisation concept. The thesis does not have a spatial focus but is guided by theory. Thus the research questions are open-ended because the goal is not to apply findings to a specific spatial context (e.g. port regionalisation in the UK), but to generalise to theory (e.g. how can the theory be improved or expanded). A case study methodology is suitable for these inductive aims.

Part one follows a multiple-case design, analysing numerous inland terminal developments in order to improve inland terminal classifications that can then contribute to the port regionalisation concept, including classifications such as "dry port", "extended gate" and "freight village". Parts two and three each utilise a single case design, taking a single case in depth in order to explore in rich detail how these issues play out in industry. Part two studies the role of large retailers as the primary drivers of intermodal transport in the UK, while part three examines the development of the Heartland Intermodal Corridor in the United States, a large public-private partnership that offers the opportunity to study a collective action problem in detail.

Generalising from case studies can be problematic; the methodology chapter will explain how this difficulty has been addressed, as well as the limitations of the findings. It is recognised that additional case studies will be required to continue this line of theoretical enquiry and strengthen the validity of the explanations offered in this thesis. On the other hand, one of the strengths of this thesis is the access to high calibre interviewees, particularly in parts two and three. Therefore the case study methodology based primarily on semi-structured interviews offered the opportunity to capture valuable industry knowledge that would not have been possible through a different research design.

During the course of this research, many papers have been published on inland terminals, inland ports and dry ports, from both theoretical and applied perspectives, including some case study approaches. However, when this research began in 2009, few case studies on inland terminals were to be found in the literature. Thus one aim of this thesis was to add case studies to the literature, exploring the conceptualisation of inland terminals but also providing detailed evidence of the process, to increase understanding of the qualitative aspects of site development and operation that were missing from the literature. In particular, the intention was to highlight the difficulties in attracting intermodal traffic, against the policy background in Europe to promote modal shift from road to rail.

1.4 Impact and relevance of the findings

Each of the three parts has its own findings, and these are also brought together in an inductive discussion on critiquing and expanding the port regionalisation concept.

Part one shows that ports can actively develop inland terminals, and differences exist between those developed by port authorities and those developed by port terminal operators. Furthermore, differences can be observed between those developed by ports and those developed by inland actors. A conceptualisation is proposed to capture these differences.

Part two addresses a topic that has not been covered in the literature before: the overlap of retail logistics and intermodal transport (Woodburn, 2012). As large retailers are the primary drivers of intermodal transport in the UK, lessons can be learned for promoting intermodal transport across the UK and comparable contexts such as Europe where similar operational conditions prevail. The findings reveal that while rail remains a marginal business, while the industry remains fragmented, while consolidation is not

happening and while fragile government subsidy is still the basis of many flows, intermodal corridors cannot become instruments of hinterland capture and control for UK ports. The integration processes predicted by the port regionalisation concept cannot happen until the inland freight system becomes more integrated.

In part three, an interdisciplinary theoretical model is developed from the literature, attempting to unite institutional economics and economic geography. The literature suggested a conflict between legitimacy and agency and a limitation of political organisations due to their design, both of which were confirmed in the findings. These issues account for the high incidence of policy churn, lack of agency and, sometimes, lack of communication between the public and private sectors. The role of informal networking was found to be important as it can overcome institutional inertia, although it is difficult to capture this process, and harder still to attempt to institute it in another setting through policy action. An additional contribution to the literature is the theoretical framework developed for analysis of the institutional factors at play in resolving a collective action problem. Findings from part three show that institutional design will continue to constrain integration between maritime and inland transport systems, suggesting that port regionalisation processes may not develop as the concept assumes. Legitimacy and agency are a problem for these organisations and if an infrastructure for collective action is not in place (and it is usually predominately a *public* infrastructure for collective action), then private firms will not act, thus challenging attempts at port regionalisation and keeping the maritime and inland spaces separate.

While additional cases are required to advance the findings further, the cases in this thesis elucidate reasons why ports may not be controlling or capturing hinterlands through the strategies of integration that the port regionalisation concept suggests. The thesis also argues for greater disaggregation of the factors that challenge or enable port regionalisation processes, comparing the institutional models of ports and other stakeholders, particularly public sector planners and funders. It may be more accurate to state that port regionalisation can only occur as long as a set of favourable commercial and institutional conditions are maintained. The findings from the cases presented in this thesis suggest that it is not easy to maintain such conditions, implying that port regionalisation may be the exception rather than the norm.

The impact of these findings is primarily theoretical, by advancing the port regionalisation concept and disaggregating different tendencies within it. In addition, a

number of practical lessons can be drawn, such as the difficulty in developing intermodal freight transport by the public sector while operational difficulties remain, thus questioning the ability of public policy to support the industry. Thus more work is required on the correct approach in government policy. Some lessons for the UK could be learned from the US example, while recognising major differences in the operational environment. The concluding chapter discusses the potential for future research arising from the findings in this thesis.

1.5 Structure of the thesis

Figure 1-1 depicts the thesis structure. The thesis begins with the introduction, literature review and methodology chapters. The literature review examines the port regionalisation concept, in order to identify gaps in explanation and to derive the key aspects to be studied in detail in this thesis: inland terminals, market and logistics and collective action problems. Each of these three topics is then addressed in turn, in order to develop the relevant features of each that will structure the data collection and analysis in each part. The methodology chapter explains the choice of methodology and data collection methods, as well as methods of analysis that will answer the research questions. Chapter four presents a pilot study that was undertaken in order to test and strengthen the methodology before proceeding to the formal data collection stage.

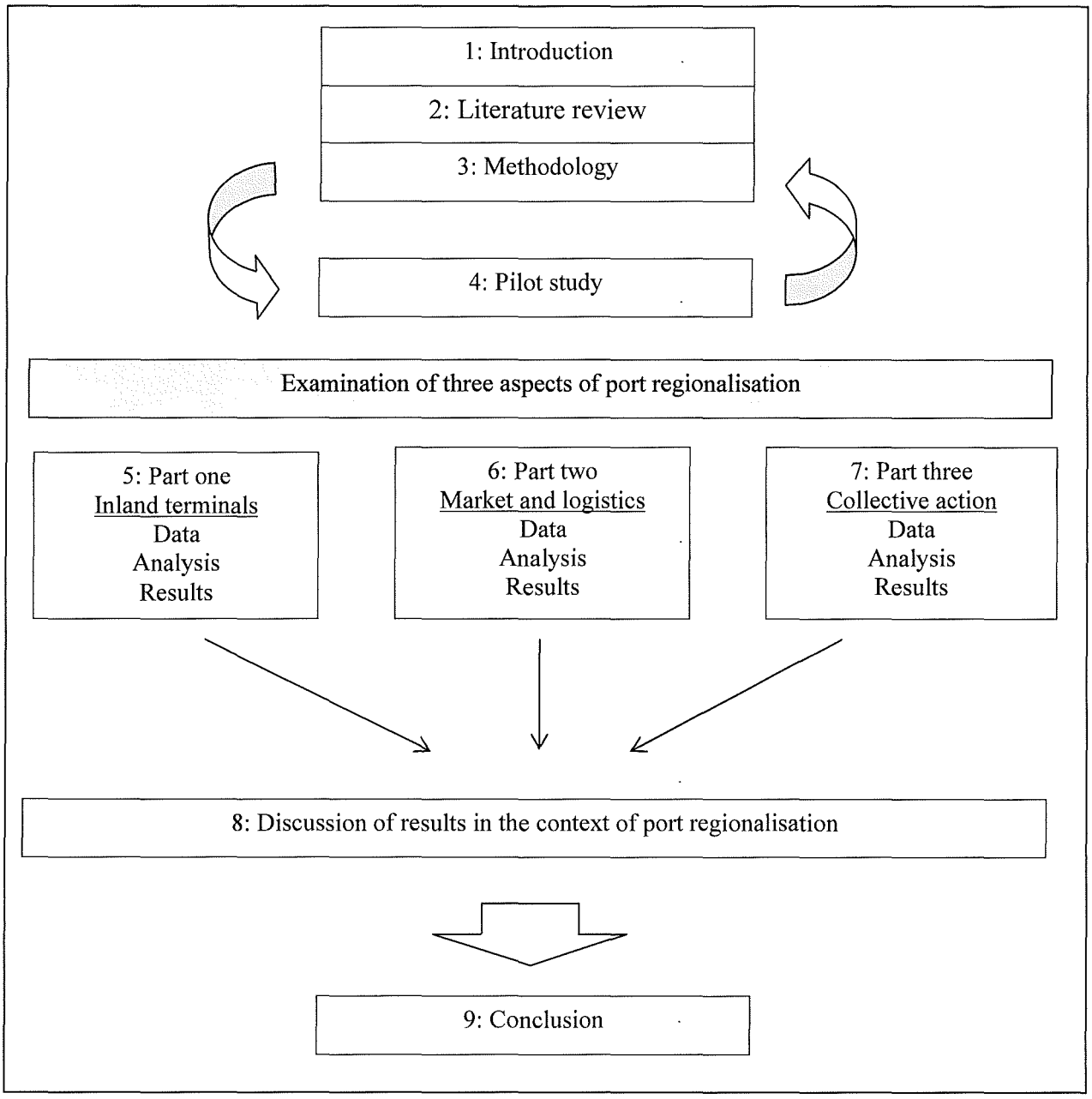

Figure 1-1.Thesis structure

Chapters 5-7 present the three studies, each structured by case study, analysis and results. Each of these three chapters produces contributions in its own right, and chapter 8 draws them together to analyse, critique and expand the port regionalisation concept. Chapter 9 concludes, followed by references and appendices.

2. Literature Review

2.1. Introduction

Transport geography has tended to be less theoretical than economic geography (Hall et al., 2006), but wider use of ideas from other disciplines can help to address the key challenges of transport geography, such as to understand shifting notions of infrastructure provision brought about by changing roles of the public and private sectors (Hall et al., 2006; Hesse, 2008), while acknowledging the difficulty of predicting the effect of government investment (Rodrigue, 2006). Pallis et al. (2010) noted in their review of the literature on port economics, policy and management that more theoretical papers have been published in recent years, which, in their view, "indicates a growing interest to (re)conceptualize the port sector in the light of the structural adjustments that have taken place, and the emerging complex and dynamic economic context" (p.122). The literature reviewed in this chapter comes from different disciplines, from transport and economic geography to logistics to institutional economics, in the context of recent calls for a more qualitative, interdisciplinary and higher-profile transport geography (Hall, 2010).

Cullinane and Wilmsmeier (2011) wrote that "while the expansion of reach on the maritime side of a port's operational environment is clearly recognised and relatively widely analysed, the process of a port's spatial development of its hinterland (other than simply the fact of its expansion) has received considerably less attention" (pp.9-10). Ng and Pallis (2010) identified a research gap with regard to port development, stating a need for research towards "a general theory explaining the ways in which institutional frameworks and political traditions affect the process of reforming a unique (in certain respects) economic sector and, not least, to develop a better understanding of the evolution of port development" (p.2164).

These two recent calls for new research have served as the twin inspirations behind this PhD thesis. Firstly, the landward side of port development, and secondly, an institutional approach. These ideas will be explored through an analysis of the port regionalisation concept proposed by Notteboom and Rodrigue (2005), as the primary contributions of their approach are to focus on the inland aspect of port development and taking port development models from a spatial focus to a focus on institutions.

The literature review is structured in four parts. It begins with an examination of the port regionalisation concept, in order to identify gaps in explanation and derive the research questions for this thesis. Each of these three topics will then be addressed in turn, in order to develop the research factors used to collect and analyse data for each part of the thesis.

2.2. An examination of the port regionalisation concept

2.2.1 Earlier models of the spatial development of ports

A number of authors have attempted to explain the complex process of port development by proposing different conceptual frameworks. One early influential model was the "main street" concept outlined by Taaffe et al. (1963), whereby "since certain centres will grow at the expense of the others, the result will be a set of high-priority linkages among the largest" (p.505). However, the location and functions of the nodes connected along these priority corridors are changing. Whereas in the past these corridors were more static, due primarily to the geographical entry barrier represented by port location, they have become increasingly dynamic.

The "Anyport" model of Bird (1963) was an early attempt to categorise port development, and his model is still widely referenced today. His model was developed through a study of British ports, and although this work was written before the advent of containerisation, his model remains useful. Bird also recognised that different parts of the port may be at different stages of development, which means that potentially sub-optimal facilities will still be in use in parts of the port: "Because of the great capital cost of port installations, it is often cheaper progressively to downgrade a dock or quay in traffic importance rather than scrap it altogether" (Bird, 1963; p.34). The two general development strategies charted by Bird are expansion away from the original town site towards large purpose-built berths with deeper water, and the move towards specialised handling facilities, for example oil products or containers.

Rimmer (1967) discussed the models of both Taaffe et al. (1963) and Bird (1963), producing a five-stage model, while Hoyle (1968) presented a modified version of Bird's model, demonstrating the different stages of development for East African ports that were built in the twentieth-century, unlike those in Bird's model that grew out of medieval estuary port sites. Some authors consider that Bird's six phases can be condensed to three: setting, expansion and specialisation (Rodrigue et al., 2009).

Bird (1971) commented that his model was not intended to fit every port, and he conceded that limitations may be apparent due to the fact that port development models can be based on different factors. While his "Anyport" model is based on port installations, Bird noted that these structures generally reflect wider issues such as changing ship requirements or developments in hinterland access.

Hayuth (1981) developed the concept of dominant ports or load centres that increase their inland penetration and hinterland capture, very much like in the models of Taaffe et al. (1963) and Rimmer (1967). Hayuth noted that "it is difficult to weigh the importance of each factor in the development of a load centre port, but a large-scale local market, high accessibility to inland markets, advantageous site and location, early adoption of the new system, and aggressiveness of port management are major factors to consider" (p.160).

Barke (1986) produced a similar model, with an additional focus on decentralisation, whereby some port activities are moved from the port to less congested areas. However, in contrast to some of the inland terminal concepts discussed in this thesis, Barke specifically noted that these activities remain "within the city region, and transport and communications technology ensure that they are within easy contact of the core" (p.122).

Van Klink (1998) suggested port city, port area and port region as summaries of previous port models, and identified the rise of port networks as a fourth stage in port development, including logistical control of inland access as a new role for the port in this phase of development, particularly related to the integration of activities at non-contiguous sites. The idea is then developed into a discussion of the kind of networks possible, based on directions of interdependence. This development leads to the importance of cooperation strategies throughout the hinterland area, rather than the old model of investment in the port area alone. The concept of selectiveness of core activities points to a strategy of moving non-core activities to other locations, allowing the port to focus on the core activity of container throughput, for example the use of ECT's inland terminals for Rotterdam traffic that will be discussed in this thesis. Kuipers (2002) supports this observation.

Later authors have suggested that simplistic models such as Bird's or the UNCTAD generational model (UNCTAD, 1992) are unable to capture the complexity of port infrastructure, operations and services (Bichou & Gray, 2005). Beresford et al. (2004)

developed the WORKPORT model as a response to the need to conceptualise the complexity of this operational environment.

2.2.2 Other relevant issues in the literature

While early models aimed to classify and explain the spatial aspects of port development, the literature over the last two decades has addressed many other issues that have an impact on port development and should therefore be considered here.

The changing role of the port in the transport chain and the greater focus on the terminal rather than the port have become key issues over recent years (e.g. Slack, 1993; Notteboom & Winkelmans, 2001; Robinson, 2002; Slack & Wang, 2002; Slack, 2007). Olivier and Slack (2006) proposed a renewed focus on questions of agency, upon the ability of ports to "steer their own future" (p.1414). Likewise, Heaver at al. (2000) asked: "Will port authorities become fully-fledged partners in the logistics chain, will their involvement be restricted to a supporting role (safety, land-use and concession policy), or might they disappear from the scene entirely? In order to find answers to these questions, further research, in particular more disaggregated empirical research, is urgently required" (p.373). Notteboom and Rodrigue (2009) contended that port authorities have been concerned about losing influence to inland terminals, while recognising that there are many benefits to cooperation.

Based on the product lifecycle theory and following Schaetzl (1996), Cullinane and Wilmsmeier (2011) argued for "location splitting" (standortspaltung) as a means to extend the port lifecycle when limitations in feasible rationalisation, investment and access are reached. Such creation of a subsidiary in the hinterland provides a potential solution that avoids an inevitable decline, caused either by the emerging inappropriateness of the actual port location (e.g. once-central urban ports) or an increasingly competitive environment. One question that arises is whether location splitting as proposed by these authors can be induced by landside-driven factors as well.

The concept of centrality that explains to some extent the formation of gateways can be augmented by the concept of intermediacy (Fleming and Hayuth, 1994), where a large direct hinterland market is not a necessary condition for concentrating large traffic volumes. Instead, discontinuous hinterlands are supported by logistics zones and inland distribution centres that are connected to ports by high volume transport corridors. Ng and Gujar (2009a) and Ng and Cetin (2012) discussed centrality and intermediacy as determining concepts of inland nodes and how they can be affected by government

policy. In the UK, port-centric logistics is being used as a way for regional ports to compete with mainports (Mangan et al., 2008; Pettit & Beresford, 2009; Monios & Wilmsmeier, 2012).

Governments can attempt to direct infrastructure development strategies through policies and funding mechanisms to meet objectives of modal shift or economic development. Such approaches are prevalent in Europe (Tsamboulas et al., 2007; Proost et al., 2011; Bontekoning et al., 2004), but government involvement is also becoming more common in large intermodal schemes in the United States. In light of the complex institutional arrangements governing modern ports, the interplay of the private sector and government at different scales is often unclear (Bichou & Gray, 2005).

Hayuth (2007) observed the increasing vertical integration of shipping lines in order to penetrate logistical and supply chain management, and noted that one result of this behaviour is that port choice is increasingly being determined by landside factors such as intermodal infrastructure. This issue is related to the degree of logistics integration in the supply chain (e.g. Heaver et al., 2000; Heaver et al., 2001; Frémont & Soppé, 2007; Hayuth, 2007; Olivier & Slack, 2006; Notteboom, 2008). A variety of coordination mechanisms are arising to manage this process, such as vertical integration, partnerships, collective action and changing the incentive structure of contracts (Van der Horst and De Langen, 2008). The terminal rather than the port has increasingly become the primary focus of study (Konings, 1996; Slack, 2007); subsequently the land-side activities of the seaport have come under closer scrutiny (Bichou & Gray, 2004; Parola & Sciomachen, 2009), leading to the inevitable focus on inland terminals.

In this literature a trend may be observed towards using inland terminals to enlarge the hinterland of the seaport (van Klink & van den Berg, 1998), and the integration of logistics services within the transport chain, as inland costs (both transport and value-added services) have increased in importance to the door-to-door cost (Notteboom & Winkelmans, 2001). Notteboom and Rodrigue (2005) noted that "the portion of inland costs in the total costs of container shipping would range from 40% to 80%. Many shipping lines therefore consider inland logistics as the most vital area still left to cut costs" (p.302). Increasingly relevant is the recognition that the port's position has changed from a monopoly to a dynamic interlinkage and a subsystem in the logistics chain (Robinson, 2002; Woo et al., 2011a). However, Graham (1998) wrote that "the land-side is characterized by relatively low investment, high operating expenses, little

scale incentive to collective operation and a considerable level of unremunerated activity requiring cross payment out of sea freight" (p.135).

Notteboom and Winkelmans (2001) discussed the importance of ports and inland terminals cooperating, but expressed doubts over public authorities being proactive in this role. They posited that this problem is due to the focus of the (public) ports being on expanding the local economy, rather than possessing the nature of a private sector organisation that would pursue the interests of the port itself.

The extension of a port's influence into the hinterland is one opportunity for port authorities to intervene and better influence the future, but hierarchies in the transport chain are changing. Ports therefore need to be active in extending or even maintaining their hinterlands (Van Klink & van den Berg, 1998; McCalla, 1999; Notteboom & Rodrigue, 2005). Moglia and Sanguineri (2003) analysed the role of a public port authority in the activities of private companies such as terminal operators, particularly in terms of stimulating private investment, for example acquiring land within the port for logistics operations. The authors also highlighted the importance of port authorities having a member on the board of private organisations carrying out commercial activities within the ports. The "hinterland access regime" proposed by De Langen and Chouly (2004) views the collaborative activities undertaken by a number of actors as a governance issue. The governance issue comes to the fore because port authorities have limited influence on infrastructure development beyond the port perimeter.

2.2.3. Port regionalisation

Notteboom and Rodrigue (2005) added a phase of "port regionalisation" to Bird's port development model. They argued that the work of Bird (1963), Taaffe et al. (1963), Hayuth (1981) and Barke (1986) did not address the rising importance of inland load centres to port development, particularly the integration of inland terminals within the transport network. In some ways, the regionalisation concept can be seen as a combination of load centres (Hayuth, 1981) and priority corridors (Taaffe et al., 1963), and Rimmer and Comtois (2009) asked: "what is regionalisation but decentralisation?" (p.38). Rimmer and Comtois (2009) are critical not just of the port regionalisation concept but of what in their view is an overly land-focused approach taken by Taaffe et al. (1963) and subsequent authors. They believe that developments in maritime space have been incorrectly de-prioritised vis-à-vis landside developments.

The port regionalisation concept has never been defined adequately. It has been called a phase and a process, an accumulation of various strategies. The closest the original paper comes to a definition is when the authors assert:

> Port regionalisation thus represents the next stage in port development (imposed on ports by market dynamics), where efficiency is derived with higher levels of integration with inland freight distribution systems. . . . Many ports are reaching a stage of regionalisation in which market forces and political influences gradually shape regional load centre networks with varying degrees of formal linkages between the nodes of the observed networks (p.302).

Port regionalisation is thus a term that encapsulates a variety of integration and cooperation strategies, with varying motivations of hinterland capture, control and competition.

The term "regionalisation" is generally understood in political discourse to refer to a shift in focus, power or responsibility to the regional level, a process of devolution from the national level. A vast literature exists on issues of "hollowing out" and "filling in" of governance capacity (e.g. Goodwin et al., 2005), including critiques of the "new regionalism" (Lovering, 1999) as much European Union funding is channelled directly from the EU to regions, thus bypassing the national scale. However, none of these issues are raised in the port regionalisation discussion. The term appears to be used in the sense that the port's focus moves spatially from a local to a regional focus, a change in focus that is reflected in the seeking of new ways of integrating with inland transport systems.

The port regionalisation concept has both spatial and institutional aspects. Spatial refers to physical developments such as terminals and rail/barge corridors. However, an essential component is market capture which is not based on physical developments but institutional relationships; in most cases the infrastructure is common-user so the port authority or terminal cannot control the physical corridors but rather focuses on making agreements for the traffic to come through its port, regardless of who the transport operator is, what mode they use and which corridor they follow.

The early port development literature was focused more on spatial development than actor-centric approaches, due in part to the historical industry structure. While recent literature makes more of the distinction between port actors, it is argued in this thesis that insufficient attention has been given to the identification of different strategies. Notteboom and Rodrigue (2005) assert that regionalisation is imposed on ports but the

dynamics of this concept are unclear, such as the determinants of the "varying degrees of formal linkages" (p.302) and the way that "market forces and political influences" (p.302) affect these processes embedded within the concept. While one thesis cannot cover all possibilities, three key aspects will be selected for further study.

2.2.4 Deriving the research questions

While port regionalisation is a broad concept, some decisions had to be taken in this thesis to narrow the focus to a manageable object of study. The focus in this research is intermodal container transport, in particular rail transport (as opposed to barge). Therefore when each of the three research questions is examined, the object of the study will be rail container transport.

An important precept underpinning this thesis is that port regionalisation is an umbrella concept that remains insufficiently disaggregated. Few would question that hinterland access is more important for ports now than in the past, or that these relationships are becoming more complex in an increasingly sophisticated and integrated transport and logistics environment. However, Notteboom and Rodrigue (2005) do not identify or classify different processes within the port regionalisation concept, nor do they explain how they operate or who drives them.

Therefore this thesis will disaggregate some of these regionalisation processes to identify and classify them, as well as explore how they occur. However, this thesis does not aim to develop a comprehensive theory that would enable explanation and prediction of port development. Rather, the qualitative analysis in this thesis presents a more multidimensional view, offering new insights into port development theory and indicating challenges in a variety of contexts such as the spatial structure and direction of trade, the resulting logistics structures and the equipment requirements they dictate. Three key aspects of the port regionalisation concept can be identified for further study.

The first key distinction of the port regionalisation concept is its focus on inland terminals. Notteboom and Rodrigue (2005) state that the concept "incorporate[s] inland freight distribution centres and terminals as active nodes in shaping load centre development" (p.299), and that this process is "characterised by strong functional interdependency and even joint development of a specific load centre and (selected) multimodal logistics platforms in its hinterland" (p.300). The authors also propose that the regionalisation phase "promote[s] the formation of discontinuous hinterlands"

(p.302) suggesting that "a port might intrude in the natural hinterland of competing ports" (p.303) by using an inland terminal as an "island formation" (p.303).

The second key aspect of the concept is the role of the market, in particular the changing nature of logistics operations. Notteboom and Rodrigue (2005) state that "regionalisation results from logistics decisions and subsequent actions of shippers and third-party logistics providers" (p.306), and that "the transition towards the port regionalisation phase is a gradual and market-driven process, imposed on ports, that mirrors the increased focus of market players on logistics integration" (p.301). They go on to note that "logistics integration . . . requires responses and the formulation of strategies concerning inland freight circulation. The responses to these challenges go beyond the traditional perspectives centered on the port itself" (p.302).

Thirdly, Notteboom and Rodrigue (2005) discuss proactive attempts to influence load centre or inland terminal development, as something of an alternative to their suggestion that port regionalisation is "imposed on ports" (p.301). They state that "the trend towards spatial (de)concentration of logistics sites in many cases occurs spontaneously as the result of a slow, market-driven process. But also national, regional and/or local authorities try to direct this process by means of offering financial incentives or by reserving land for future logistics development" (p.306). Yet they warn against the danger of optimism bias: "a lack of clear insights into market dynamics could lead to wishful thinking by local governments. . . . This can lead to overcapacity situations" (p.307). While the authors suggest that ports should not "act as passive players" (p.306), and should adopt "appropriate port governance structures" (p.306) to deal with these new challenges, they state clearly that "the port itself is not the chief motivator for and instigator of regionalisation" (p.306). However, they note that "the port authority can be a catalyst even when its direct impact on cargo flows is limited" (p.307). They observe that many different types of relationships can be developed between the port and the inland actors, depending largely on "the institutional and legal status of the partners involved" (p.307). Essential to an understanding of this aspect is the uneven distribution of costs and benefits resulting in a free rider problem: "Port authorities are generally aware that free-rider problems do exist. This might make port authorities less eager to embark on direct formal strategic partnerships with a selected number of inland terminals. Instead, port authorities typically favour forms of indirect cooperation . . . which are less binding and require less financial means" (p.310) as "a seaport cannot make cargo generated by an inland terminal captive to the port" (p.310).

If port regionalisation is proposed as an observable stage in port development theory, the implication is that its presence is possible or even probable in the majority of instances. This thesis will look at the three key aspects just addressed in order to identify how they enable or constrain these integration processes embedded within the port regionalisation concept. This is not to state that port regionalisation is not happening, but rather to pay more attention to how it occurs and in particular what barriers exist. The research questions for this study relate to each of these three aspects:

1. How can different strategies of inland terminal development influence port regionalisation processes?
2. How can logistics integration and inland freight circulation influence port regionalisation processes?
3. How can collective action problems influence port regionalisation processes?

Once these questions have been addressed, it is hoped that the findings can then contribute to a discussion on expanding the port regionalisation concept.

The literature review will now address each of these three topics in order to develop the key factors for the study, appropriate to focus each case. These factors (with sub-factors where relevant) will be used to guide data collection and analysis. For each part of the thesis, a matrix based on these factors will form the basis of the research process, producing findings that can be used to answer each of the three research questions.

2.3 The role of inland terminals

2.3.1 The spatial development of inland terminals

As noted above, Notteboom and Rodrigue (2005) stated that their model "incorporate[s] inland freight distribution centres and terminals as active nodes in shaping load centre development" (p.299), and that this process is "characterised by strong functional interdependency and even joint development of a specific load centre and (selected) multimodal logistics platforms in its hinterland" (p.300). The authors also propose that the regionalisation phase "promote[s] the formation of discontinuous hinterlands" (p.302) suggesting that "a port might intrude in the natural hinterland of competing ports" (p.303) by using an inland terminal as an "island formation" (p.303). While location splitting via spatially discontinuous inland development of ports has begun to be treated in the theoretical literature (Cullinane and Wilmsmeier, 2011), the

role of the inland terminal in this spatial theory has been lacking. This thesis will extend the understanding of port regionalisation by exploring its relation to different types of inland terminal concepts; in this way the under-theorised area of inland terminals can be tied into the established theoretical grounding of the spatial development of ports.

A node may be defined simply as a location or a point in space; in the case of transport this would represent an origin or destination of a linkage. In practice, we are interested only in nodes of a certain size, where a certain level of activity may be concentrated. Nodes can also be defined as points of articulation, which are interfaces between spatial systems (Rodrigue, 2004), particularly different levels (e.g. local and regional) and types (e.g. intermodal connections), but the articulation concept can also include joining different categories of activity, for instance joining the transport activity with processing or storage, all activities within the wider logistics system (Hesse & Rodrigue, 2004).

Classification of inland ports and the activities in which they engage is difficult. Rodrigue et al. (2010) asserted that "while a port is an obligatory node for the maritime/land interface, albeit with some level of inter-port competition, the inland port is only an option for inland freight distribution that is more suitable as long as a set of favourable commercial conditions are maintained" (p.2). Similarly, Notteboom and Rodrigue (2009) stated that "there is no single strategy in terms of modal preferences as the regional effect remains fundamental. Each inland port remains the outcome of the considerations of a transport geography pertaining to modal availability and efficiency, market function and intensity as well as the regulatory framework and governance" (p.2).

Notteboom and Rodrigue (2009) suggested that it is impossible to have firm definitions as each site is different, therefore it is best to focus on the key aspects of each. Rodrigue et al. (2010) related the multiplicity of terms to the variety of geographical settings, functions, regulatory settings and the related range of relevant actors, and proposed that the key distinction is between transport functions (e.g. transloading between modes, satellite overspill terminals or load centres) and supply chain functions (e.g. storage, processing, value-added). This functional approach is similar to the Roso et al. (2009) distinction between close, mid-range and distant terminals, and the later seaport-based, city-based and border-based model proposed by Beresford et al. (2012), as both of these tripartite divisions are distinguished by the typical functions of each node.

Table 2-1 lists the inland terminal classifications found in the literature.

Table 2-1. Inland freight node taxonomies

No.	Name	Description
1	Inland clearance (or container) depot	The focus here is on the ability to clear customs at the inland origin/destination site rather than at the port. Started to spring up in the 1960s. Therefore some kind of warehouse area (could just be small) with customs clearance. Any transport mode is acceptable within this definition. See Beresford & Dubey (1991); Garnwa et al. (2009); Jaržemskis & Vasiliauskas (2007); Pettit & Beresford (2009).
2	Container freight station	This is basically a shed for container stuffing/stripping/ (de-)consolidation. It is not a node in itself but more of a service that may be provided within a port or an inland site.
3	Dry port 1	Synonymous with ICD, either in a landlocked country or one that has its own seaports (see Beresford & Dubey, 1991; Garnwa et al., 2009).
4	Inland port	Favoured in the USA (see Rodrigue et al., 2010). Customs is less of an issue in the USA because 89% of their freight is domestic. As the railroads run on their own private track, terminals are also private nodes, so the management of containers is a closed system for that firm to manage the flow. Some reservations to using it in Europe because there an inland port generally has water access, and in any case inland terminals are not normally the massive gateway nodes that they are in the USA (i.e. fewer than 100,000 lifts annually vs many times that in the USA).
5	Intermodal terminal	Generic term for an intermodal interchange, i.e. road/rail, road/barge. Could strictly speaking be just the terminal with no services or storage nearby, but would generally involve such services. Also referred to as transmodal centre by Rodrigue et al. (2010), which draws attention to its primary function, which is interchange rather than servicing an O/D market but in practice would presumably do some O/D freight as well to make the site more feasible.

6	Freight village, logistics park, interporto, GVZ, ZAL, distripark (if located in or near a port)	These are big sites with many sheds for warehousing, logistics, etc. and usually relevant services too. May have intermodal terminal or may be road only. May have customs or may not. Distripark is used to denote a site based within or on the outskirts of a port. (Notteboom & Rodrigue, 2009; Pettit & Beresford, 2009).
7	Extended gate	Specific kind of intermodal service whereby the port and the inland node are operated by the same operator, managing container flows within a closed system, thus achieving greater efficiency and the shipper can leave or pick up the container at the inland node just as with a port. See Van Klink (2000); Rodrigue and Notteboom (2009); Roso et al., (2009); Veenstra et al. (2012).
8	Dry port 2	New definition by Roso et al. (2009). This would seem to be an ICD with large logistics area and intermodal (rail or barge) connection to the port, in combination with extended gate functionality, thus providing an integrated intermodal container handling service between the port and the fully-serviced inland node.
9	Satellite terminal	See Slack (1999). Usually a close-distance overspill site, operated almost as if it is part of the port. Could be considered a short-distance extended gate concept. This should really be rail-connected but some sites are linked by road shuttles (that would seem to ignore the main function which is to overcome congestion, but it can reduce congestion by reducing the time each truck spends in the port on administrative matters).
10	Load centre	This concept could apply to inland terminals or ports, but in the case of the former it refers to a large inland terminal to service a large region of production or consumption. Probably the classic kind of inland node as it serves as a gateway to a large region. Tends to fit well with the American inland port typology. It normally refers specifically to the terminal but generally in this sort of location one would expect to have a lot of warehousing, etc. in the area if not part of the actual site. See Notteboom & Rodrigue (2005); Rodrigue & Notteboom (2009).

It can be seen from Table 2-1 that, as Rodrigue et al. (2010) argue, inland freight nodes can be divided into two key aspects: the transport function and the supply chain function, with each classification exhibiting various aspects of each. Categories 5, 7 and 8 in Table 2-1 specifically require an intermodal transport connection, while all the others relate to other functions, such as customs, warehousing, consolidation, logistics and other supply chain activities. In practice, many of these sites would have intermodal connections but it is not specifically required within the categorisation.

Relating these issues to the role of the inland terminal in the port regionalisation concept, the key issues are its ability to be an "active node", to "impose on ports" and to reflect a focus on "logistics integration." The literature review will now look in more detail at how these issues are reflected in recent classifications.

2.3.2 Dry ports and extended gates

Depending on which services they offer, freight handling nodes can be grouped under different categories, as noted in Table 2-1. Some facilities can fall under more than one definition, for example an ICD that includes a CFS within the site. Moreover, logistics centres have been established throughout Europe, known as Gueterverkehrszentren or GVZ (Germany), Plateformes Multimodales Logistiques (France), Freight Villages (UK), Zonas de Actividades Logisticas (Spain) and Interporti (Italy). These are often attached to an intermodal terminal and due to the increasing focus on logistics integration (Hesse, 2004), they are often considered as a complete site together, which further confuses the conceptual situation.

Rodrigue et al. (2010) have suggested that the American term "inland port" be adopted to refer to inland sites, as, like seaports, they encompass the entire site within which numerous activities may be undertaken, of which container handling is only one. Therefore they argue that "inland terminal" is too restrictive as it would seem to exclude the larger entity, governance structure, etc. In their definition then, "inland port" is analogous to "port" or "seaport", while a container terminal within the inland port is analogous to the container terminal within the seaport. Likewise with logistics zones, which can be sited within a port or an inland port, and again with any other entities that may exist within the site, all overseen by some kind of governance body analogous to a port authority. While the use of generic "inland port" terminology represents an elegant solution for encompassing all kinds of inland nodes, two points need to be made.

Firstly, in Europe "inland port" generally designates an inland waterway port. Secondly, inland ports in the US are generally far larger than most inland terminals in Europe, some handling several hundred thousand containers annually, therefore supporting large scale warehousing or production districts in the wider area. Thus there are obstacles to using the term "inland port" to describe an intermodal terminal in Europe that has no water access and may handle fewer than 100,000 containers (in many cases, fewer than 50,000) annually.

The term Inland Clearance (or Container) Depot (ICD), has been a common classification, evincing a particular focus on the ability to provide customs clearance at an inland location. Similarly, the term "dry port" has been in use for decades now. It has often been used interchangeably with ICD, and can either refer to an ICD in a landlocked country or to one in a country that has its own seaports (Beresford & Dubey, 1991; Garnwa et al., 2009). The dry port concept in itself is not new, going back at least to UNCTAD (1982), but it has recently returned to prominence in the academic community as a number of journal papers have been published on the topic in the last few years. The 1982 UN definition focused on the dry port as a site to which carriers could issue bills of lading, and this definition was developed in the 1991 UNCTAD document *Handbook for the Management and Operation of Dry Ports*, in which the terms dry port and ICD were used interchangeably (Beresford & Dubey, 1991). Beresford and Dubey (1991) established the basic features of a dry port as well as additional facilities that may be present depending on the local situation. The potential benefits of a dry port were also listed, along with the warning that fiscal incentives and a high level of promotion were often necessary in the early stages of a development.

The primary meaning of both terms (dry port and ICD) is the extension of the bill of lading to an inland destination where customs clearance is performed. Thus the ICD or dry port acts as a gateway "port" for the inland region. Overuse of the term in recent years has resulted in a multiplicity of understandings; while technically the terms are interchangeable (see Beresford & Dubey, 1991), the term dry port tends to be used instead of ICD to refer to a larger site with many services offered such as storage, containerisation and related logistics activities. It is therefore often used when a site is promoted by public bodies desiring economic benefits for their region through the establishment of such a site. While the transport mode is not an essential part of the definition, a high capacity mode is commonly assumed (most often rail but also inland waterway), as an integral aim of the site is to lower transport costs. This often leads to

confusion over whether the term refers to the intermodal terminal or the container processing activities (e.g. customs, storage, etc.), especially as in many cases the two functions are operated by separate companies. More recently, the dry port term has been used in industry as a marketing tool, perhaps to imply that a facility has reached a particular level of sophistication in terms of services offered, such as customs or the presence of Third Party Logistics (3PL) firms within the site and/or an adjoining freight village or similar (see also GVZ in Germany, ZAL in Spain, interporti in Italy).

Why discuss dry ports in the first place? As discussed above, different terminals will have different facilities, but they can be grouped under various headings depending on their primary features, and it has been shown that the terms dry port and ICD have been and continue to be used interchangeably. According to Roso et al. (2009), "the dry port concept goes beyond the conventional use of rail shuttles for connecting a seaport with its hinterland. Being strategically and consciously implemented jointly by several actors, it also goes beyond the common practice in the transport industry" (p.344). Roso et al. (2009) also state that "the dry port concept mainly offers seaports the possibility of securing a market in the hinterland" (p.344), and quote the extended gate concept of Van Klink: "Inland terminals may be considered as 'extended gates' for seaports, through which transport flows can be better controlled and adjusted to match conditions in the port itself" (Van Klink, 2000; p.134).

Dry ports in the original usage were generally developed by inland actors, a requirement emerging from being landlocked or otherwise suffering from poor port access. It thus appears that the Roso et al. (2009) definition may contradict the original definition of a dry port, as the authors prescribe that it is driven by actors from the maritime system; indeed the authors state that a dry port is "consciously implemented" (p.344) to improve container flows at the seaport. A contradiction can therefore be observed, which is relevant to the discussion within the port regionalisation concept as to whether the inland terminal is an active node imposing on the port or whether the port is consciously involved in developing inland terminals as a strategy of hinterland capture.

Roso et al. (2009) state that: "A dry port is an inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardised units as if directly to a seaport" (p.341). The key aspect of this definition is the authors' contention that "for a fully developed dry port concept the seaport or shipping companies control the rail operations" (p.341). One aim of this

thesis is to consider to what degree this situation actually obtains in the industry. Are rail operations to sites labelling themselves "dry ports" run by the seaport or shipping companies?

Additionally, the same dry port definition contends that the seaport and the dry port confront the user with a single interface, with the goal being to provide a smoother operation to users of both the port facility and the hinterland served by the port. The authors further state that their definition includes the "extended gate" concept, which has been discussed by Van Klink (2000) and more recently by Rodrigue and Notteboom (2009) and Veenstra et al. (2012). Veenstra et al. (2012) defined the extended gate concept: "seaport terminals should be able to push blocks of containers into the hinterland . . . without prior involvement of the shipping company, the shipper/receiver or customs" (p.15), and they claimed that the idea whereby the seaport controls the flow of containers to the inland terminal is an addition to the Roso et al. (2009) dry port concept. However, Roso et al. (2009) do claim that "for a fully developed dry port concept the seaport or shipping companies control the rail operations" (p.341). This statement may refer to the train haulage rather than the actual decision with regard to container movement, so a potential confusion exists in the overlap between these definitions.

The critical relevance of the dry port concept as developed in Roso et al. (2009) relates to the conscious attempts to secure hinterland markets, and is particularly driven from the seaward side. Examples given by Roso et al. (2009) are Isaka Dry Port, Virginia Inland Port and the Alameda Corridor. However, it is not demonstrated that in any of these cases the seaport or shipping line controls the operations, and no discussion of an extended gate relationship is provided. In a separate paper (Roso and Lumsden, 2010), examples of dry ports are in Europe (Azuqueca de Henares, Madrid Coslada, Santander Ebro, Eskilstuna, Hallsberg, Muizen), Africa (Isaka, Matsapha) and Asia (Riyadh, Birgunj, Faisalabad).[1] However, on the basis of the data provided, it is not shown that these examples fit the Roso et al. (2009) definition, as in no instance does the seaport or shipping line control the rail connection; in addition, one does not offer customs clearance (Muizen) and one does not handle containers (Santander Ebro).

[1] This paper states that the sampling procedure was "to review the world's existing dry ports, that is freight terminals that use the term 'dry port' in their name" (p.198), but the authors then go on to utilise the Roso et al. (2009) dry port definition, without assessing if these sites calling themselves "dry ports" actually fit that definition.

Therefore, as the extended gate aspect of the Roso et al. (2009) dry port concept is crucial to its stated claim as a consciously used strategy for securing hinterlands, further research is required on this point. As the first objective of the research is to examine the influence of different inland terminal development strategies in port regionalisation, particularly the active role they play and the role of ports, this issue will be explored through the lens of the consciously used dry port or extended gate concept. As a contrast, another set of inland terminals without this port relation will be examined in order to learn about the difficulties of integrating or cooperating with ports. If such terminology is to be clarified, the relationship between the port and the inland terminal must be understood in more detail.

Dry port and ICD continue to be used interchangeably, and if the term dry port is to have a distinct identity not synonymous with ICD, it is either to differentiate a site in a landlocked country, or, in the more recent definition, to identify an extended gate of a seaport, where the shuttle is operated by an actor from the seaport as a conscious activity to extend their hinterland. But how many sites would fit this definition? Are the rail links to the European sites that self-identify as dry ports operated by seaports? This issue will need to be tested as site data is compiled.

2.3.3 Developing the research factors

Research factors to address the first research question can be derived from the port regionalisation concept in conjunction with the literature just reviewed. Notteboom and Rodrigue (2005) claim that regionalisation is imposed on ports, and that the port is not the main actor, whereas the dry port concept proposed by Roso et al. (2009) claims that dry ports are inland terminals consciously used to capture hinterlands and compete with other ports. Roso et al. (2009) suggest that the rail/barge operations are controlled by the shipping line or other sea actor, rather than a rail operator or inland logistics or transport provider. First, this definition competes with both the regionalisation concept and the earlier dry port concept, which was very much an inland activity, providing administrative services (bill of lading extension, customs, etc.) for a landlocked or otherwise poorly accessible inland region or country. Second, the notion of a sea actor controlling the rail operations seems unusual, and might be covered by the extended gate concept already found in the literature (even if, as shown above, the literature is not always consistent on these definitions and relations with the dry port concept).

Four factors can be used to structure the research, guiding data collection, analysis and comparison:

1. Development process
2. Relation with ports
3. Operational issues
4. Logistics

These factors can be used to examine different development strategies, different levels of port involvement and integration of rail operations between the port and the inland terminal. The detailed research plan with sub-factors, methods of data collection and analysis will be described in the appropriate chapter.

2.4 The role of logistics integration and inland freight circulation

2.4.1. Logistics and intermodal transport

The second key aspect of the port regionalisation concept is the role of the inland market, in particular the changing nature of logistics operations. Notteboom & Rodrigue (2005) state that "regionalisation results from logistics decisions and subsequent actions of shippers and third-party logistics providers" (p.306), and that "the transition towards the port regionalisation phase is a gradual and market-driven process, imposed on ports, that mirrors the increased focus of market players on logistics integration" (p.301). They go on to note that "logistics integration . . . requires responses and the formulation of strategies concerning inland freight circulation. The responses to these challenges go beyond the traditional perspectives centred on the port itself" (p.302). Before ports can integrate inland, the specific characteristics of inland freight circulation must be examined, in particular the "logistics decisions and subsequent actions of shippers and third-party logistics providers" (p.306).

Menzter et al. (2004) stated that "logistics management is a within-firm function that has cross-function and cross-firm . . . aspects to it" (p.607). It involves the management of demand, in particular through information management, as well as directing supply, involving distribution strategies including decisions relating to transport, inventory levels and location decisions for storage and intermediate processing. Many of these logistics decisions, as part of a wider focus on supply chain

management, exert considerable impact on transport flows, operational requirements and location decisions (Hesse, 2004). Additionally, the notion of transport solely as a derived demand has been challenged and reformulated as an integrated demand (Hesse & Rodrigue, 2004; Rodrigue, 2006; Panayides, 2006). As such, the relationship between goods flows and spatial development is complicated by networks of nodes and corridors that may not perform their key functions adequately, potentially constrained not just by physical infrastructure deficits, but a lack of connectivity or an inability to fit into wider networks. The focus of this thesis is on the use of rail transport; a firm's decision to shift to this mode can be driven by many factors, such as external pressures (e.g. fuel price, legislation, customer pressure) or logistics strategy (e.g. central warehouse or distributed network, private fleet or 3PL) (Eng-Larsson & Kohn, 2012). Yet, according to some authors, the role of transport in logistics and the broader field of supply chain management has been under researched (Mason et al., 2007).

Woodburn (2003) investigated the relationship between supply chain structure and the potential for modal shift to rail, and found that "for rail freight to become a much more serious competitor to road haulage would require considerable restructuring of either the whole logistical operations of companies within supply chains or far-reaching changes to the capabilities of the rail industry to cope with the demands placed upon it" (p.244). Eng-Larsson and Kohn (2012) found that when making a decision to use intermodal transport, the convenience of the purchase was more important than the price. From an operational perspective, they found that other supply chain decisions had to be made to incorporate intermodal transport, such as increasing inventory, extended delivery windows, and improvements in planning and ordering due to less flexible departure times of intermodal transport. However, in each case the additional cost was offset by the savings in transport costs from the new transport mode. They even postulated that some firms may be paying unnecessarily for a higher degree of transport quality (e.g. flexibility, reliability, frequency) than they actually need, thus they could reduce these requirements while still achieving their supply chain objectives.

Breakeven distances for intermodal transport are generally considered to be in the region of 500km (Van Klink & Van den Berg, 1998), although this distance can be shortened by other factors such as removing the road leg at one end and the existence of regular unitised demand to ensure high rates of utilisation. In the UK, break-even estimates for a route that requires no road haulage have been estimated as low as around 90km. With a road haul at one end only, the figure is roughly 200km, and if both pre-

and end-hauls are required, the distance is approximately 450km (MDS Transmodal, 2002). Other aspects of intermodal freight transport have been discussed by Arnold et al. (2004), Janic (2007) and Woodburn (2011). Whether or not a particular product flow is suitable for intermodal transport includes such considerations as the lead time and size of orders, the value and the physical characteristics of the product. Problems with intermodal transport include distance, lack of flexibility, lead time for service development and the role of the last mile (Slack & Vogt, 2007). In addition, high fixed costs of rail operators and the requirement to consolidate flows on key routes make profitable service development difficult. Setting up a rail service is a complicated task, which is a barrier to intermodal growth and also a barrier to market entry for new operators (Slack & Vogt, 2007).

Cooperation is needed to achieve economies of scale on certain routes, but research has found industry reluctant to pursue such a strategy (Van der Horst & de Langen, 2008). Similarly, a service needs to be well-developed before shippers will use it (Van Schijndel and Dinwoodie, 2000). There is also a severe inertia in the industry. Runhaar and van der Heijden (2005) found that over a proposed ten-year period, even a 50% increase in transport costs would not make producers any more likely to relocate their production or distribution facilities. This inertia can in some ways be considered a bigger obstacle than infrastructure problems, and needs a restructuring of the transport chain in order to change transport requirements.

In order to examine these issues further, a specific market sector must be selected. The methodology chapter will explain in more detail the decision to conduct a case study on the use of intermodal transport by UK retailers. The primary reason is because it exemplifies the issues of developing intermodal transport, the roles of the key players and how they collaborate. The availability of high calibre interviewees also played a role in selecting this case study. Woodburn (2012) identified large retailers as the main driver behind intermodal traffic growth in the UK and called for interviews with them to understand the reasons behind the observed growth, in addition to calling for an examination of the role of port-hinterland flows in relation to domestic intermodal routes. Thus the UK intermodal market provides a good example of the role of domestic and port flows in efficient rail operations that is a necessary part of successful port regionalisation. In order to research this market properly, an additional literature review is now required to examine the specific issues of the UK retail sector.

2.4.2 The spatial development of the retail sector in the UK

The spatial distribution of the retail sector has evolved over the last few decades from a system whereby suppliers delivered directly to stores to the introduction of distribution centres (DCs) in the 1970s and 80s to the arrival in the 1990s of primary consolidation centres (PCCs) (Fernie et al., 2000). Lead times and inventories were greatly reduced as part of impressive efficiency advances over this period. Figure 2-1 illustrates the intersection of spatial developments with operational evolution, with the broken line representing supplier control and the unbroken line representing retailer control.

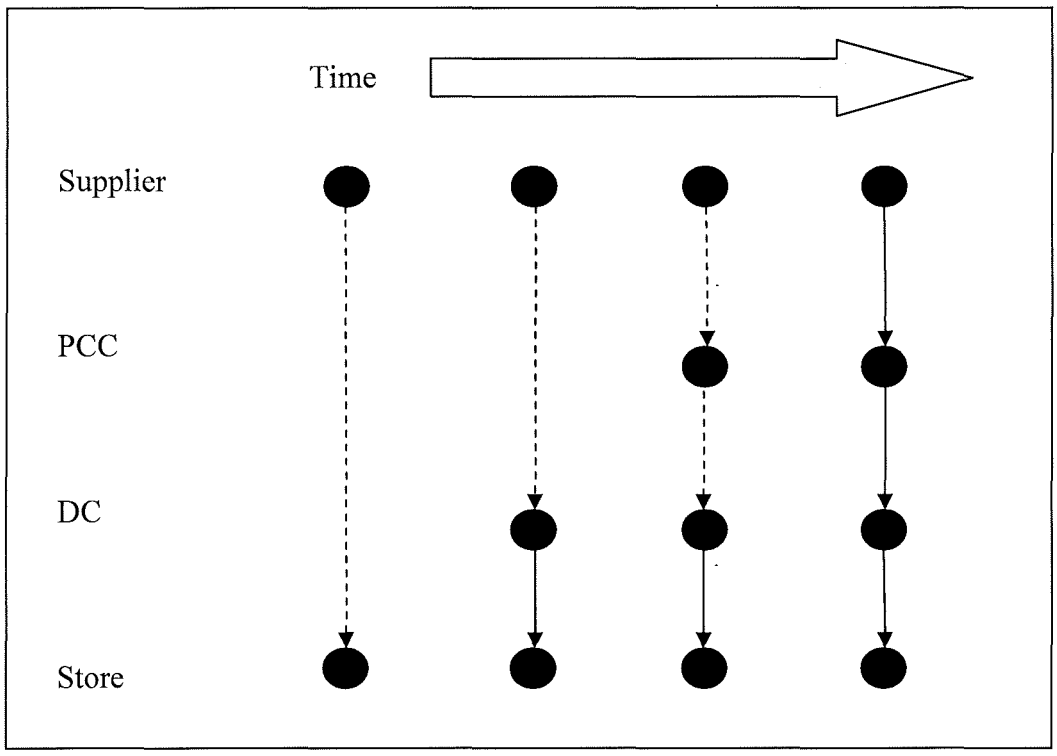

Figure 2-1. Spatial and operational evolution of grocery supply chains in the UK
Source: Potter et al., 2007; Fernie et al., 2000

A number of trends have been observed in the literature, such as the centralisation and relocation of plants and distribution centres, a reduction in the supplier base and a consolidation of the carrier base (Lemoine & Skjoett-Larsen, 2004; Abrahamsson & Brege, 1997; O'Laughlin et al., 1993). Market power has also been concentrated among a few large retailers due to mergers and acquisitions (Burt & Sparks, 2003). Supply chains are being reconfigured around rationalisation of transport requirements and new distribution strategies and hub locations. (Lemoine & Skjoett-Larsen, 2004). Distribution centres are being optimised and new purpose-built facilities are appearing.

This ongoing process of rationalisation means that trying to embed them in intermodal chains is difficult.

Large retailers in the UK drive distribution patterns to a significant degree, not just transport movements but location of facilities. McKinnon (2009) found that "since 2004, roughly 60% of the demand for large DCs has come from retailers" (p.S295). Large firms are reducing the number of their DCs while increasing the size and efficiency of those that remain. Fewer, larger DCs means greater centralisation and potentially greater miles travelled, but also greater potential for intermodal transport due to consolidation on key routes. Food and grocery companies currently contribute one in four of all truck miles travelled in the UK (IGD, 2012). Direct container train services from UK ports to the Midlands have grown over the last decade while direct services from UK ports to Scotland (i.e. Coatbridge) have fallen (Woodburn, 2007). This finding represents the integration of Scottish trade flows into UK-wide distribution networks centred on key sites in the Midlands and to a lesser extent north England.

The spatial development just described was built around the motorway network, but some discussion of locating import-focused distribution centres at ports has taken place in recent years (Mangan et al., 2008; Pettit & Beresford, 2009; Monios & Wilmsmeier, 2012). In the context of the recent increase in research on the importance of inland terminals, perhaps a renewed focus on the potential of the port as a logistics hub is warranted. Revisiting the potential of port-based versus inland-based logistics can even be viewed as another name for optimising the primary and secondary legs of the supply chain, challenging the inertia of supply chains that were constructed in different contexts. Major supermarket retailers Tesco and Asda have both located large general merchandise import centres at the port of Teesport.

A centralised UK inland network, developed when industrial and retail inputs were primarily UK-sourced, may have some drivers to decentralise, focusing on the processing of imports arriving at coastal ports. From a port's point of view, this allows them not only to secure cargo throughput, but to earn additional revenue from these activities on their land (Pettit & Beresford, 2009). Import containers are offloaded from ships, shunted to the warehouse, stripped, and the empty then returned for repositioning. The load will then be reconfigured for inland movement. Potential efficiencies arise as this movement may be direct from the port-based DC to the final store, thus removing the inland DC from the chain.

Modal shift from road to rail faces a number of challenges. The customer desires low transit time, reliability, flexibility and safety from damage, and it has been suggested that customers do not perceive that intermodal transport can provide these (RHA, 2007). Access has been reduced as the UK rail industry has seen a major decline in wagonload services over the last few decades. Better information for potential shippers is also required regarding train services, timetables and wagon capacity. Due to a lack of marketing and information availability, rail is often not visible to prospective customers. There is also an issue of visibility of the true cost of rail movements. MDS Transmodal (2002) found that "there are no published rates for rail freight charges and rail freight users have only a poor understanding of their suppliers' cost structures as there are dominant operators in the market and little on-rail competition" (p.49).

From an operational point of view, greater use of ICT has allowed more accurate forecasting and more responsive ordering (thus a move from push to pull replenishment), which in turn required a more tightly optimised spatial distribution of facilities, as well as an integration and optimisation of primary and secondary networks. Thus some retailers work with hauliers to optimise their distribution (e.g. reducing empty running or reducing inventory holding requirements) or work with suppliers to optimise product flows (e.g. forecasting, planning and ordering). These relationships are becoming increasingly important in intermodal transport as working rail into a supply chain requires much closer relationships and greater knowledge sharing between partners to solve operational issues. The result of these spatial and operational evolutions has been increasing integration of operations, ranging from increasingly efficient use of backhauling to the implementation of factory gate pricing (Mason et al., 2007; Potter et al., 2007).

When the retailer purchases the supplied goods "ex works" or "from the factory gate", rather than paying the supplier to deliver the goods to the DC, it gives the retailer greater control over the primary distribution leg. This can achieve greater transport efficiencies (even more by the use of primary consolidation centres), reducing empty and part-full running in both directions, and also improve planning efficiency and responsiveness through greater visibility of flows. It has been estimated that total distance travelled can be reduced by around 25% through the use of a primary consolidation centre (Potter et al., 2007), while another study found that total cost reduction from the use of FGP can reach approximately 8% (le Blanc et al., 2006).

Potter et al. (2007) discussed how FGP strengthens the negotiating position of the retailer. It gives the retailer greater power over the supplier, as the supplier loses the opportunity to cross-subsidise a lower product price with a higher transport price. It also enables the retailer to operate or sub-contract the primary distribution as a single large business rather than negotiating with many small hauliers working for single suppliers. An additional result from this practice is to make it more difficult for smaller transport operators to enter the market. Therefore large 3PLs could benefit while independent hauliers would lose. Burt and Sparks (2003) also noted that non-FGP retailers will find their supply prices increasing because for the supplier the transport cost per unit for non-FGP flows will increase as volume is removed from this stream to the FGP retailer's distribution network. Similarly, Towill (2005) showed how the category management paradigm allows supermarkets to streamline their supplier base and increase their margins.

This period also saw increased use of 3PLs to handle the growing and increasingly complex transport requirements resulting from these developments, as well as more frequent, smaller deliveries from suppliers to reduce inventories, which also encouraged suppliers to make use of primary consolidation centres (Smith & Sparks, 2004; Fernie & McKinnon, 2003). Distribution facilities continued to evolve, from single-product warehouses to composite environments housing ambient, chilled and fresh produce, all scanned in and out using barcodes that were integrated within the IT system used for forecasting, planning and ordering. Fernie et al. (2000) found that in 1992 Tesco replaced 26 single temperature warehouses with nine composite sites. The use of composite warehouses and trucks as part of increasingly sophisticated temperature-controlled supply chains has doubled the shelf life of some items (Smith & Sparks, 2009). Reverse logistics also became more important, with packaging and other recycling travelling back up the chain from the store to the DC.

Collaboration with competitors is also a key theme in the literature. Successful retail intermodal logistics includes the retailers themselves as well as rail operators and 3PLs. Schmoltzi and Wallenburg (2011) found that while almost 60% of 3PLs in their study operated at least one horizontal partnership, the failure rate was below 19%, against an average failure rate for horizontal collaborations in many industries ranging from 50% to 70%. This is an encouraging result, but to what extent retailers can put aside their intense rivalries and collaborate on transport, particularly filling trains, will be a key determinant in the future potential of intermodal transport. Schmoltzi and Wallenburg

(2011) also found that, while horizontal collaboration might be thought to be based on cost reduction, the primary motivations revealed in their study were service quality improvement and market share enhancement. Similarly, Hingley et al. (2011) found that cost efficiencies from horizontal collaboration were less important to grocery retailers than retaining supply chain control.

2.4.3 Developing the research factors

From the above review, it can be seen that the key issues are the consolidation of the market through mergers and acquisitions, a reduction in the number of locations through processes of rationalisation and centralisation and the increasing role of ICT for planning and forecasting. These changes have led to high levels of collaboration, if not actual integration, through the use of practices such as factory gate pricing and category management. Intermediaries such as 3PLs play a greater role in the process, intervening between large shippers and transport providers. Operational transport issues include the need to consolidate flows at specific locations, the inertia in the industry and issues relating to lead times and process planning. The role of government was not raised in this review, but it has been important in the UK in terms of promoting intermodal transport through a variety of grants. The small literature on this topic will be included at the appropriate juncture in the discussion.

Four factors can thus be used to structure the research, guiding data collection, analysis and comparison:

1. Spatial development of the market
2. Operational rail issues
3. Strategies of integration and collaboration
4. The government role in developing intermodal transport

These factors are fairly broad at this stage, but will be applied to a specific sector in case study analysis; the methodology chapter will contain more detail on this process. The detailed analysis matrix with sub-factors for each factor, methods of data collection and analysis will be described in the appropriate chapter.

2.5 The role of collective action problem resolution

2.5.1. Introduction

The third aspect of the port regionalisation concept identified above is the influence of collective action problem resolution. Notteboom and Rodrigue (2005) stated that "the trend towards spatial (de)concentration of logistics sites in many cases occurs spontaneously as the result of a slow, market-driven process. But also national, regional and/or local authorities try to direct this process by means of offering financial incentives or by reserving land for future logistics development" (p.306). Yet they warn against the danger of optimism bias: "a lack of clear insights into market dynamics could lead to wishful thinking by local governments. . . . This can lead to overcapacity situations" (p.307). While the authors suggested that ports should not "act as passive players" (p.306), and should adopt "appropriate port governance structures" (p.306) to deal with these new challenges, they stated clearly that "the port itself is not the chief motivator for and instigator of regionalisation" (p.306). However, they noted that "the port authority can be a catalyst even when its direct impact on cargo flows is limited" (p.307). They observed that many different types of relationships can be developed between the port and the inland actors, depending largely on "the institutional and legal status of the partners involved" (p.307). Essential to an understanding of this aspect is the uneven distribution of costs and benefits resulting in a free rider problem. Therefore "port authorities typically favour forms of indirect cooperation . . . which are less binding and require less financial means" (p.310) as "a seaport cannot make cargo generated by an inland terminal captive to the port" (p.310).

This third part of the thesis represents the culmination of ideas explored in the previous two sections, because the most important unexamined aspect within the port regionalisation concept is not "what" but "how". The classification of inland terminal development models and the raising of relevant market-related and operational issues are important, but analysis of how these processes are performed is essential, as port regionalisation has been found to lead to a number of planning conflicts (Flämig & Hesse, 2011). This issue is the subject of the institutional analysis in the third part of the thesis.

An extensive literature exists on the relevant institutional issues involved in studying such a collective action problem, which will now be reviewed in order to develop the appropriate factors on which to collect and analyse data that can answer the third research question. Institutional theory has been utilised extensively in economic

geography and in political geography as well as institutional economics. The aim of this section of the literature review is to derive key insights from these literature streams and forge an institutional approach for transport geography.

2.5.2. Approaches to institutions in the literature

Institutionalism first emerged from neoclassical economics through an increasing focus on the social, cultural and historical context of economic events rather than what was viewed as an overly theoretical and non-contextual framework of universal laws. Jaccoby (1990) summarised the departure in four themes: moving from determinacy to indeterminacy, from endogenous to exogenous determination of preferences, from simplifying assumptions to behavioural realism, and from synchronic to diachronic analysis.

This early or "old" institutional economics was, however, not theoretical enough to prevail against neoclassical approaches (Coase, 1983). Interestingly, Scott (2008) suggested that "new institutionalism" in the social sciences is the direct descendent of "old" institutional economics, whereas new institutional economics (NIE) is closer to the original (and still prevailing) neoclassical economics. This is because NIE tends to operate within the neoclassical view, in which the firm behaves rationally by acting in certain ways to reduce transaction costs (Jessop, 2001). Yet NIE has departed from some neoclassical assumptions, such as perfect information and costless transactions (Rafiqui, 2009).

While the term "new institutional economics" was first used by Williamson (1975), it developed out of Coase's (1937) work on transaction costs, which are the costs incurred when dealing with a separate firm through the price mechanism. For example, if two firms vertically integrate then the previously external costs of doing business will be internalised. Neo-institutional economists use the theory of the firm to examine different methods of lowering transaction costs such as mergers, alliances and contracts.

NIE has been used in maritime transport studies, where authors have explored different methods of coordinating hinterland transport chains (e.g. de Langen & Chouly, 2004; Van der Horst & de Langen, 2008; Van der Horst & Van der Lugt, 2009). In contrast, institutional geography examines how these structures vary across space, place and scale (e.g. Hall, 2003; Jacobs, 2007; Ng and Pallis, 2010).

For North (1990), institutions represent the rules of the game, while organisations are the players. This issue is particularly complicated when attempting to define the

state vis-à-vis organisations and institutions. Jessop (1990) defined the state as a "specific institutional ensemble with multiple boundaries, no institutional fixity and no pre-given formal or substantive unity" (p.267). Government influence or capacity to innovate is rooted not only in formal but informal institutions, "located in the practices through which governance relations are played out and not only in the formal rules and allocation of competences for collective action as defined by government laws and procedures" (González and Healey, 2005; p.2059).

In a similar vein, Aoki (2007) identified exogenous and endogenous institutions. The former represent the rules of the game (following North, 1990), while the latter represent the equilibrium outcome of the game. Combining these two elements, Aoki (2007) provided the following definition: "An institution is self-sustaining, salient patterns of social interactions, as represented by meaningful rules that every agent knows and are incorporated as agents' shared beliefs about how the game is played and to be played" (p.6).

Legitimacy is a key concept for a successful organisation, and it is derived from its relation to institutions. Suchman (1995) defined legitimacy as "a generalised perception or assumption that the actions of an entity are desirable, proper or appropriate within some socially constructed system of norms, values, beliefs and definitions" (p.574). Yet Meyer and Rowan (1977) traced a conflict between legitimacy and efficiency. They argued that organisations adopt formal structures in order to achieve legitimacy rather than out of any practical requirement arising naturally from their operations. Indeed, such formal structures may even decrease efficiency. They went further to insist on a divergence between the formal structure of an organisation and its day-to-day activities. The result of this divergence is that innovation may be stifled by inappropriate formal structures, and monitoring may become primarily ceremonial and related to the formal structure rather than to the real activities of the organisation.

Problems can arise when transferring a governance structure from elsewhere (Ng and Pallis, 2010). Meyer and Rowan's (1977) description of the creation of new organisations has a great deal of relevance for modern organisational design, particularly when transferring a governance structure from one scale or space to another: "The building blocks for organizations come to be littered around the societal landscape; it takes only a little entrepreneurial energy to assemble them into a structure. And because these building blocks are considered proper, adequate, rational and necessary, organizations must incorporate them to avoid illegitimacy" (p.345).

Furthermore, the process engenders more of the same kind of structural legitimacy, which may be observed in the rise in the number of quangos (quasi-non-governmental organisations). The authors noted that "institutionalized rationality becomes a myth with explosive organizing potential" (p.346).

The constant changing and re-making of institutions is also a notable problem. Jessop (2001) remarked on "the contingently necessary incompleteness, provisional nature and instability of attempts to govern or guide them" (p.1230). This point can be developed with particular focus on multi-scaled governance (Hooghe & Marks, 2001), leading to complications through confused sovereignty, multiple authorities and funding sources (Meyer and Scott, 1983; Scott and Meyer, 1983).

Moe (1990) noted that political organisations must make trade-offs that economic organisations do not:

> [Political organizations] are threatened by political uncertainty. They want their organizations to be effective, and they also want to control them; but they do not have the luxury of designing them for effectiveness and control. Economic decision-makers do have this luxury – because their property rights are guaranteed. They get to keep what they create (p.228).

Moreover, the eventual structures of political organisations depend on the interaction between voters (or other political interest groups), politicians and the civil service. An attractive strategy then becomes "not to try to control how it gets exercised over time, but instead to limit it ex ante through detailed formal requirements. . . . In politics, it is rational for social actors to fear one another, to fear the state, and to use structure to protect themselves – even though it may hobble the agencies that are supposed to be serving them" (Moe, 1990; p.235). One key application of this insight is in the way governments channel money towards infrastructure investment to the benefit of private firms. Public bodies often establish complex funding and grant structures so that any decisions are based on rules set out from the start rather than being the decision of individual politicians or administrators. The result can be a "hobbled" ability to wield effective influence.

Path dependency is a key issue, arising from high setup costs, learning effects, coordination effects and adaptive expectations and can lead to indeterminacy, inefficiencies, lock-in and the primacy of early events (Martin, 2000). Martin (2000) wrote that institutions "tend to evolve incrementally in a self-reproducing and continuity-preserving way" (p.80) and also noted the importance of different

development paths of institutions at different regional and local contexts: "if institutional path dependence matters, it matters in different ways in different places: institutional-economic path dependence is itself place-dependent" (p.80).

States at all levels are under increasing pressure to provide an attractive entrepreneurial culture to draw increasingly mobile global capital flows, but scales are becoming important because "the capital-labour nexus was nationally regulated but the circulation of capital spiralled out to encompass ever-larger spatial scales" (Swyngedouw, 2000; p.69). In light of the decreasing role of the national state, local and regional authorities attempt to secure these flows through strategies of clustering and agglomeration.

2.5.3. Developing the research factors

The concept of "institutional thickness" was defined by Amin and Thrift (1994, 1995) as a measure of the quality of an institutional setting. It has four elements: a strong institutional presence; a high level of interaction among these institutions; a well-defined structure of domination, coalition building and networking; and the emergence of a common sense of purpose and shared agenda. Institutional thickness has not been used extensively, but where it has been applied the focus has been almost exclusively on economic development (see Raco, 1998, 1999; Henry and Pinch, 2001). Henry and Pinch (2001) noted a coalescence between the rise of institutionalism in economic geography and the rise of the "new regionalism" as a focus on regional economic development.

MacLeod (1997, 2001) highlighted resonances with other concepts such as Lipietz's (1994) "regional armature", Cooke and Morgan's (1998) "institutions of innovation" and Storper's (1997) "institutions of the learning economy". He demonstrated the institutional density of lowland Scotland which therefore represented a good case of institutional thickness. Indeed, he noted that lowland Scotland has potentially achieved "institutional overkill" by establishing too many organisations: "These processes help to illustrate that, as Amin outlines, attempts to achieve collaboration between entrepreneurs and institutions through policy dictate and 'overnight institution building' can be deeply problematic (Amin, 1994)" (p.308). MacLeod noted that this institutional thickness has not helped Scotland retain transnational capital, nor develop new Scottish-controlled industry, leading him to conclude that one must be careful when de-emphasising the role of the nation-state.

MacLeod (2001) insisted on a multiscalar perspective on the state, "so as to reveal which particular regulatory practices and elements of an 'institutional thickness' are scaled at which particular level. . . . These spatial and scalar selectivities (Jones, 1997) can occur through state-run policies like defence or through targeted urban and regional policies" (p.1159). Furthermore, such scaling represents an ongoing process, therefore it cannot be accepted uncritically as an input into an institutional analysis: "far from being existentially given, geographical demarcations such as cities and regions are politically constructed stakes in a perpetual sociospatial struggle over capitalist relations and regulatory capacities" (p.1159). Amin (2001) added that "is the management of the region's wider connectivity that is of prime importance, rather than its intrinsic supply-side qualities" (p.375).

Pemberton (2000) applied Amin and Thrift's institutional thickness concept to a study of transport governance in the northeast of England. Concurring with MacLeod's observation of the absence of the role of the nation state in Amin and Thrift's concept, Pemberton included Jessop's use of neo-Gramscian state theory. Coulson and Ferrario (2007) discussed the advantages and disadvantages of the institutional thickness theory and its lack of penetration over the last decade. They identified potential issues with cause and effect, a risk of conflating organisations with institutions and the difficulty of creating or replicating an institutional structure through policy actions.

The concept of hinterland access regimes (HAR) was introduced by De Langen and Chouly (2004), in which hinterland access was framed as a governance issue because individual firms face a collective action problem: "Even though collective action is in the interest of all the firms in the port cluster, it does not arise spontaneously" (p.362). The hinterland access regime is defined as "the set of collaborative initiatives, taken by the relevant actors in the port cluster with the aim to improve the quality of the hinterland access" (p.363). The concept is then broken down into six modes of cooperation: "markets, corporate hierarchies (firms), interfirm alliances (joint ventures), associations, public-private partnerships and public organisations" (p.363). The authors refer to issues such as path dependence and how it can be overcome. Five factors are identified that influence the quality of the HAR: the presence of an infrastructure for collective action, the role of public organisations, the voice of firms, a sense of community and the involvement of leader firms. This framework was used by de Langen (2004) and de Langen and Visser (2005) to analyse collective action problems in port clusters.

While the study of collective action problems fits firmly within new institutional economics, these five indicators provide a means to explore the effects of space and scale and thus tie into geographical approaches. Indeed, these five indicators have much in common with the four indicators of institutional thickness mentioned earlier. While institutional thickness is a measure of the institutional setting, hinterland access regimes refer to specific projects. The aim of the theoretical framework developed in this thesis is to draw both approaches together.

Van der Horst and de Langen (2008) highlighted five reasons why coordination problems exist: unequal distribution of costs and benefits (free rider problem), lack of resources or willingness to invest, strategic considerations, lack of a dominant firm, risk-averse behaviour/short-term focus. In another interesting use of institutionalism in transport studies, Groenewegen and de Jong (2008) attempted to apply the new institutional economics models of Williamson (1975) and Aoki (2007) to an analysis of institutional change in road authorities in the Nordic countries. They concluded that those models were unable to capture the complexity of political power play and social and cognitive learning among actors, and developed a ten-step model through which actors become "institutional entrepreneurs". These actors benchmark their own "institutional equilibrium" against a new "pool of ideas", then spread this new belief system through "windows of opportunity", using their own "power instruments or resources", also dealing with "reactive moves made by the formerly dominant actors" (pp.68-9). While ostensibly working in the field of institutional economics, their approach fits well into earlier discussions of agency and legitimacy found in sociological institutionalism. Aoki (2007) also contributed interesting ideas in relation to how a political champion can alter the game.

Therefore the research factors adopted for this part of the thesis result from a combination of institutional thickness and hinterland access regimes, modified to include insights from MacLeod (1997; 2001) and others on the role of the state, Groenewegen and de Jong (2008) on actor behaviour game theory and Van der Horst and de Langen (2008) on defining the collection action problem. The research factors are as follows:

1. Reasons for the collective action problem
2. The institutional setting 1: the roles, scales and institutional presence of public organisations

3. The institutional setting 2: the presence (or otherwise) of a well-defined infrastructure for collective action
4. The kinds of interaction among (public and private) organisations and institutional presences
5. A common sense of purpose and shared agenda
6. The role of leader firms

The detailed analysis matrix with sub-factors for each factor, methods of data collection and analysis will be described in the appropriate chapter.

2.6 Summary

Table 2-2 lists the three research questions and the appropriate factors for analysis derived from the literature review.

Table 2-2. List of research questions and factors

Question 1	How can different strategies of inland terminal development influence port regionalisation processes?	
	1	Development process
	2	Relation with ports
	3	Operational issues
	4	Logistics
Question 2	How can logistics integration and inland freight circulation influence port regionalisation processes?	
	5	Spatial development of the market
	6	Operational rail issues
	7	Strategies of integration and collaboration
	8	The government role in developing intermodal transport
Question 3	How can collective action problems influence port regionalisation processes?	
	9	Reasons for the collective action problem
	10	Institutional setting 1: Roles, scales and institutional presence of public organisations
	11	Institutional setting 2: The presence (or otherwise) of a well-defined infrastructure for collective action
	12	The kind of interaction between (public and private) organisations and institutional presences
	13	A common sense of purpose and shared agenda
	14	Role of leader firms

For each part of the thesis, a matrix based on these factors, divided further into sub-factors where relevant, will be used to guide data collection and analysis, producing findings that can be used to answer each of the three research questions.

3. Methodology and research design

3.1. Introduction

This chapter will discuss the overall methodological approach to the research project, the methods adopted to collect data and the methods of analysis through which conclusions may be drawn. Potential limitations of the research design will also be discussed.

3.2. Philosophical approach

A research paradigm relates to the beliefs of the researcher in terms of the nature of reality (ontology) and, more directly pertinent, how this reality can be known (epistemology). Ontology and epistemology are particularly important in research design because ontology relates to objectivity and subjectivity, while epistemology reflects whether the researcher is considered to interact with the subject of the research or whether true detachment is possible. A broad spectrum is often proposed with positivism (objective, detached, deductive and generalisable) at one end and social constructivism (subjective, interacting, inductive and of only limited generalisability) at the other (Guba & Lincoln, 1994). Positivism tends to be equated with quantitative research methodologies, whereas constructivism tends to be associated with qualitative methodologies.

Positivist and constructivist approaches are also referred to as materialist and idealist. The "critical realist" position has become popular because it avoids this dichotomy via a position that reality, while objective and external to the researcher (hence not necessarily a mental construct), cannot be captured directly (therefore involving an element of construction on the part of the researcher). Aastrup and Halldórsson (2008) developed an epistemological foundation for case study research based on the critical realist approach.

Most writers now consider that both positivist and constructivist paradigms and both quantitative and qualitative methodologies are valuable and advocate a pragmatic position whereby the methodology is selected to suit the research problem (e.g. Tashakkori & Teddite, 1998; Mangan et al., 2004). In this thesis, the research problem is to examine three aspects of port regionalisation in depth, to advance understanding

and potentially to induce new theory, if the findings warrant such a response. Therefore a qualitative approach is suitable, tending towards the constructivist paradigm. Interaction with the research subjects will be required, a degree of interpretation on behalf of the researcher in recording and analysing this qualitative data will be inevitable, and generalisations and causal linkages may be difficult, requiring careful management. Having said that, some element of deductive reasoning will be involved in part one, where pre-existing classifications (the "dry port" concept) will be tested through the case studies, along with an inductive attempt to develop new classifications.

Markusen (2003) discussed the potential difficulties of "fuzzy concepts", commenting that "the term 'theorist' is often applied to those who deal mainly in abstractions and abjure empirical verification, rather than to those who take up knotty problems, hypothesise about their nature and causality, and marshal evidence in support of their views" (p.704). She makes a case for clear explication that clarifies what data is available and what inferences may legitimately be made, and developing what theory is possible while also conceding where data are lacking: "Having to commit oneself to stating where and when a concept applies and where it does not is often the easiest way to pare fuzzy concepts down to a sharp and clear profile" (p.705).

The research in this thesis follows a predominantly inductive approach. Inductive reasoning generally proceeds from the specific to the general (as opposed to deductive approaches which flow in the opposite direction). It begins with observations then identifies patterns, from which hypotheses and theory may be developed. Like deductive approaches, inductive research may also begin with theory from the literature; however, while deductive research aims to test a theory (or to test hypotheses derived from a theory), in this case the inductive approach looks for aspects that are not explained by the current theory, and attempts to develop new theory that can account for these gaps.

While the strict method of grounded theory is not followed in this thesis, the approach taken shares some of its processes (Glaser & Strauss, 1967). Thomas and James (2006) argued that grounded theory "is not in fact theory in any meaningful sense" (p.767). They say that grounded theories "do not explain anything . . . instead, they help us to understand. Understanding is a no less worthy ambition and there is a paradox in grounded theorists' continuing strivings for explanations" (p.774). The authors claim that theory is not built by induction; rather, the scholar proposes theories from the evidence, which can in future be tested via deductive methodologies. The data

provide understanding and the researcher proposes explanations, but these are not yet theory, not yet "more secure epistemologically" (p.778). Furthermore, the authors say that "procedural objectivity" cannot lead to "ontological objectivity" (p.780), "a method . . . will not enable one to substitute some formula for divining meaning" and they criticise grounded theory as "the search for explanatory phenomena which become accessible via a neutral observation language where the observer rises above the merely contingent and interpretable" (p.781). So some difficulties remain in attempting to induce objective theory from methodologies that are based on flexible iteration with risks of subjectivity in the processes of recording, analysing and interpreting. Thomas and James (2006) conclude thus: "a preoccupation with method (and not just in grounded theory) makes for mirages of some kind of reliable knowing, and this in the end makes us almost more concerned with the method than the message" (p.792).

Kelle (1997) suggested that "the theoretical knowledge of the qualitative researcher does not represent a fully coherent network of explicit propositions from which precisely formulated and empirically testable statements can be deduced. Rather it forms a loosely connected 'heuristic framework' of concepts which helps the researcher focus his or her attention on certain phenomena in the field" (unpaginated). The generalisation remains a working hypothesis or extrapolation rather than a grand theory, based on logic rather than statistics or probability (Cronbach, 1975; Patton, 2002). Seale (1999) recommended taking a view whereby the researcher is "seeking for evidence within a fallibilistic framework that at no point claims ultimate truth, but regards claims as always subject to possible revision by new evidence" (p.52). He took this view forward by focusing on the skills of the individual researcher to construct a valid argument based on observable and presentable data. He argued that it is possible to follow a middle ground between positivist truth and socially constructed knowledge by remaining cognisant of the constructed nature of research even as this imperfect edifice is utilised to investigate a subject.

3.3 Choosing a methodology

According to Yin (2009), a case study approach is appropriate when "how" or "why" questions are being asked, when the investigator does not have control over events (as one might in an experimental methodology) and when the phenomenon being studied cannot be separated from its context. Since all of these criteria are present in the current research, a case study methodology has been adopted, with differing approaches

to the case study format in each of the three parts addressing each of the three research questions.

Yin (2009) defined a case study as "an empirical enquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident" (p.18). Case studies generally rely on multiple sources of evidence and provide a deep understanding through the provision of rich detail on the individual case, although they can exist on a continuum between rich detail and more abstract designs attempting to focus more on cause and effect that can be generalised.

As noted above, some element of deductive theory testing is included in this research (the "dry port" concept in part one) but the majority of the work is based on inductive theory building. Therefore rich data are required, which suggests that surveys and Delphi approaches are less appropriate than interviews. However, interview data can be supplemented with desk research, so that triangulation can be employed as much as possible, in order to build a case. Case study data are often unstructured (Hammersley & Gomm, 2000), making analysis difficult, a topic that will be covered later in this chapter, but this approach provides the opportunity to collect rich data. Indeed, the case study methodology has been defined as "the study of the particularity and complexity of a single case" (Stake, 1995; p.xi).

Case studies can be based on both quantitative and qualitative data and indeed combined (Mangan et al., 2004; Näslund, 2002; Woo et al., 2011b). Qualitative case studies capture rich data and derive explanations from this "thick description" (Stake, 1995). According to Merriam (1988), case studies are "particularistic, descriptive, and heuristic and rely heavily on inductive reasoning in handling multiple data sources" (p.16). Therefore the key aspects of the case study approach are the depth available from the qualitative data, the particularity of each case, the fact that it is situated within its context and the attempt to understand the phenomenon from multiple perspectives (Simons, 2009).

One difficulty arising from the context-laden environment is the fact that, as Yin (2009) put it, the "boundaries between phenomenon and context are not clearly evident" (p.18). This problem can make it difficult to construct suitably specific research questions for the study. Thus inductive research designs tend to be more flexible, requiring iteration between data collection and analysis in order to develop the findings inductively from a large amount of rich context-specific detail in which the

phenomenon is situated. In this thesis, the three research questions drawn from the port regionalisation concept are deliberately open-ended, and the factors and sub-factors derived from the literature are used to structure the data collection and analysis without forcing the process into an overly prescriptive pattern.

As case studies are useful for capturing the depth and complexity of real-life phenomena, they are suitable not only to the theory-building goals of this thesis, but particularly for making the most of the high calibre of interviewees. Some expert interviewees were available for this study (in particular representatives of major retailers in part two and senior transport planners in the United States in part three). It was important not to lose the richness of the data derived from these expert interviews through the quantitative approach of a survey or Delphi technique.

Case study research inherently possesses a number of difficulties not associated with an experimental research design, such as the potential subjectivity of the researcher, the unstructured nature and large quantity of data, the difficulty in presenting to the reader the richness of the data, the robustness of the analysis and the validity of the inferences. All of these will be covered in a later section of this chapter. Flyvbjerg (2006) addressed a number of "myths" about case studies, arguing for the importance of context-dependent knowledge and the role of intense observation in building theory rather than statistical generalisations.

As this section is covering the larger methodological issues pertaining to the study, the issue of generalising from case studies will now be addressed. Bryman (2008) stated that generalisability or external validity is not the aim: "case study researchers . . . do not think that a case study is a sample of one" (p.55). Case studies can be used to generalise to theoretical propositions rather than samples, meaning that the aim is to "expand and generalise theories (analytic generalisation) and not to enumerate frequencies (statistical generalisation)" (Yin, 2009; p.15). Hammersley (1992) named these two kinds of generalisation theoretical and empirical and Lewis and Ritchie (2003) split statistical or empirical generalisability into two kinds, representational and inferential. In this research the goal is analytic generalisability, or generalising to theoretical propositions.

Other methodologies besides case studies were considered during the research design process. Much research on intermodal transport has been based on qualitative case studies, but some research has made use of quantitative approaches, such as surveys or experiments. A scientific experimental approach is taken by research that

analyses savings in cost, time or carbon emissions, testing various transport modes or routes, or testing the best location for an intermodal terminal. These do not relate to the aims of this study and so have not been pursued. Surveys of shippers or transport operators can reveal broad trends, but these are not relevant to the research questions. The argument in this thesis is that the broad trends have already been described in the port regionalisation concept, but detailed examination has not taken place. This relates partly to the lack of resources for most researchers who are unable to travel and interview many subjects due to the expense in both money and time. Having the opportunity to do this, it was felt more valuable to capture this resource via a qualitative approach.

Moreover, the survey methodology has weaknesses that are rarely acknowledged (Näslund, 2002). The response rate to a questionnaire sent to intermodal terminals would likely be very low,[2] and the data gathered would be basic information on drivers of intermodal transport and some basic facts about the terminal. Even during a personal interview, it can be difficult to gather such information, and answers often require further explication or clarification. This is often the case when English is not the first language of the subject, as in the many European case studies undertaken for this thesis. Additionally, industry interviews can be difficult for academic researchers, for example sometimes the subject may not be familiar with the context of somewhat abstract questions. Other times a subject may not have the answer to hand and may promise to provide information at a later date but fail to do so. In an interview situation the researcher has some ability to minimise these problems, and at least awareness of them can be built into the data analysis.

3.4 Case study design

To address the research questions for this thesis, different cases are required; moreover, each of the three parts of the thesis follows its own design. Part one (inland terminals) will be based on a multiple-case design, while parts two (market/logistics) and three (collective action problem) will each be based on a single case design. This is because inland terminals have been a large area of research interest in recent years, but have not been theorised properly. The aim is to identify and classify different types of inland terminals rather than going in-depth into the details, so more cases are required. A multiple-case design is considered suitable when the aim is primarily conceptual

[2] Larson & Poist (2004) found that survey response rates in logistics declined between 1992 and 2003.

(Miles & Huberman, 1994). Yin (2012) says that there is no formula to decide how many cases are required in a multiple-case design, and numerical reasoning would be insufficient to support a conclusion (e.g. if four out of five cases support the hypothesis). As the goal is analytic generalisation (i.e. generalisation to a theoretical proposition), the test must be how well the case studies contribute towards that goal. No doubt additional cases could refine the theory further but as long as the current cases have established the proposition sufficiently, they will remain open to refinement or challenge in future work. Such is the nature of case study enquiry. In contrast to part one, the aim of parts two and three is to go in depth; however, while they are both based on single case designs, part two will have multiple units of analysis embedded within the case.

In terms of case selection, Bryman (2008) followed Yin's (2009) five-way split of cases (critical, extreme/unique, representative/typical, revelatory and longitudinal), while allowing that, not only can any case study involve elements of more than one type, but that these distinctions can become apparent during the course of the research. Thus it is not always possible to categorise such features definitively. Most important when designing a case study is not which typology is adopted but a clear understanding of the purpose for which it is being used, as methods of data collection and analysis will flow from that initial decision (Simons, 2009). Typical or representative cases can be valuable, but critical or unique cases often have more to teach (Flyvbjerg, 2006). Stake (1995) recommended that "the first criterion should be to maximise what we can learn" (p.4). Some scholars advise case selection based not on the representativeness of the case, but its usefulness to explain or develop the theory (Mitchell, 1983) or the level of access available (Silverman, 2005). In this kind of approach, "the validity of the extrapolation depends not on the typicality of the case, but on the strength of the theoretical reasoning" (Seale, 1999; p.109). Yin (2009) asserted that, "by definition, the unusual or rare case, the critical case, and the revelatory case all are likely to involve only single cases" (p.53).

Flyvberg (2006) suggested that selection of a critical case should be guided by the requirement to make hypotheses, whereby if a conclusion is drawn for that case, then it is "most likely" to apply to other cases (and vice versa). For example, in this thesis, if the "dry port" cases do not fit the "dry port" definition, then it is unlikely to be met in cases not calling themselves "dry ports". So it is not proven, but by analysing the cases "most likely" to fit the concept, if they don't fit then other "less likely" cases (i.e. the

rest of the population) are unlikely to fit either, so it can be proposed with a reasonable degree of confidence that the definition does not fit the population. Similarly, in part two the case is based on the most successful users of intermodal transport. If the findings from this case do not suggest a likelihood of successful port regionalisation strategies, then other market sectors with less use of intermodal transport are unlikely to do so. In part three, choosing a successful example of collective action problem resolution means that any barriers to port regionalisation in that case will be more likely in other cases with a less successful history of collective action problem resolution.

In this thesis, each of the three parts will follow a different design, as explained in the previous section, therefore different kinds of cases are required. In the multiple-case design of part one, the cases are selected as representative of two types of inland terminal development (port-driven and inland-driven – see next section on case selection). In conjunction, they are being used to extend theory, so can be considered critical cases by that reasoning.

In part two, the situation is more complicated as the focus is broader. From a case study methodology, this can also be considered a "critical" case according to Yin's (2003) schema but also considered simply, as Mitchell (1983) suggested, as a useful case for discussion and learning. Again, it could be considered a revelatory case because access to large retailers is very difficult, therefore simply taking advantage of the opportunity to describe how they use intermodal transport is a valid motivation in itself.

In part three, the data have been arranged inside a single case, the Heartland intermodal corridor, which can be considered a "critical" case, used to extend theory, as the analysis is based on a theoretical framework developed from the literature.

3.5 Case selection

3.5.1 Use of purposive theoretical sampling

The cases have been selected through purposive sampling (as opposed to random sampling utilised for a survey methodology), chosen to represent certain characteristics. In particular, the cases have been chosen primarily for theoretical purposes, as they are guided by their potential contribution to theory. They can be used to test current categories, explore new categories and refine them. This is particularly the case in part one, which is based on a multiple-case design, as each case contributes to the emerging classification of inland terminals. Parts two and three are based on in-depth analysis of single cases, therefore while those cases are relevant for theory, they have also been

chosen partly because of their representative nature and in particular the access to a high calibre of interviewee. They can thus be expected to yield findings of high relevance.

3.5.2 Pilot study

For part one, it was decided to perform a pilot study first, which would provide an opportunity to explore the issues and test the interview questions and experience. It would enable an evaluation of the appropriateness of the case study methodology to address these issues, as well as difficulties encountered in the field work and how to resolve them in the rest of the study. It would also influence subsequent site selection, as well as issues such as contacting potential interviewees, arranging site visits (including travel time and cost), the pros and cons of interviews as the main data collection method and ways to improve the case study design, planning and practice.

The overall goal of the pilot study was to consider whether the research questions could be addressed through the case study methodology. For example, what are the main issues, what data are required to address them and can those data be acquired through this process? A test run of the analysis procedure would also prove valuable in ensuring that meaningful results could be produced. These issues are discussed in chapter 4.

Yin (2009) wrote that "pilot cases may be conducted for several reasons unrelated to the criteria for selecting the final cases in the case study design. For example, the informants at a pilot site may be unusually congenial and accessible, or the site may be geographically convenient or may have an unusual amount of documentation and data" (p.92). The inland terminal development at the town of Falköping in Sweden was chosen because of good contacts there through colleagues, meaning that a site visit would certainly be allowed, a long, detailed interview would be possible and documents would be made available for analysis. It has been called a "dry port", and indeed is part of an EU-funded "Dryport" project, so those involved are familiar with the academic context of the term, which would further enable a more nuanced discussion than might be expected at any other site. This would provide a good case in which to tease out the issues and clarify the interview questions.

3.5.3 Part one

Part one is based on a multiple-case design, therefore replication logic was applied in the case selection. The cases for this part are divided in two. The first set will address

the issue of "consciously implemented" inland terminals, exploring the "dry port" and "extended gate" concepts. Therefore each case in this first set has been selected according to a replication logic of these concepts, based on whether they have been developed by a port. However, two types of replication are possible (Yin, 2012; p.146). In this set, the "dry ports" are direct replicants. The "extended gate" Venlo is a theoretical replicant, as it was selected to vary from the direct replicant in a predictable way according to theory. This will become clearer in the later discussion.

Six sites were selected for the first group. Four use the term "dry port" in their name (Coslada, Azuqueca, Muizen, Mouscron/Lille) and the first three of these sites were included in a review of "dry ports" (Roso and Lumsden, 2010). As only three intermodal terminals with direct connections to ports exist in Spain, and two of these were already selected, it made sense to visit the third (Zaragoza). Finally, the sixth site was the Venlo "extended gate" system, a concept that shares many similarities with the Roso et al. (2009) "dry port" concept. This construction also makes the background description easier; the three Spanish sites go together, and two of the other cases can be discussed together, since Dry Port Mouscron/Lille is just inside the French border but is operated by a Belgian company with its primary base in Belgium.

The second set will consist of inland terminals not developed by ports. Notteboom and Rodrigue (2005) highlighted a focus on logistics integration, so it was considered important to examine logistics-focused sites. These sites will also follow replication logic by analysing five freight villages in Italy. As with the cases above, this group within one national system allows greater ability for cross-case comparison.

The two sets of inland terminals examined in part one are listed in Table 3-1.

Table 3-1. List of inland terminal sites for part one of the thesis

Country	**Set**	**No. of sites**	**Site locations**
Spain	Port-driven	3	Coslada/Madrid, Azuqueca de Henares, Zaragoza
Belgium (& France)	Port-driven	2	Muizen, Mouscron/Lille
Netherlands	Port-driven	1	Venlo
Italy	Inland-driven	5	Nola, Marcianise, Bologna, Verona, Rivalta Scrivia
Total		11	

3.5.4 Part two

In part two, the goal was to study the issues of intermodal transport market, logistics and inland freight circulation in depth via a single case design. The case was selected based first on access and second because of the high calibre of the interviewees, who are generally very difficult to access. Large retailers are the main drivers of intermodal traffic growth but they are very difficult to approach hence there is little in the literature on them. It was possible to gain access through industry contacts so this was chosen as the case. It was considered that this successful and growing intermodal market would provide good data on what features of inland freight circulation need to be addressed in the port regionalisation concept if ports are to integrate with this market through intermodal corridors and terminals.

The study began with desk research to identify 3PLs, rail operators and retailers involved in intermodal transport. In this business, a few large players dominate, thus the interviewees are representative of their sector, and in fact the majority of retailers, 3PLs and rail operators involved in this small market have been interviewed. All meetings were with the personnel directly responsible for intermodal services.

3.5.5 Part three

The aim of part three was an in-depth analysis of solving a collective action problem. As with part two, this case was selected based on both access and the quality of the available interviewees. Through contacts in the USA, the possibility existed to meet with senior transport planners in the federal Department of Transport (DOT), as well as the Heartland project and its stakeholders. This project was still live and the first train on the new corridor was about to run in 2010, therefore it provided an excellent opportunity to interview people directly involved at all levels of the project.

3.6 Data collection

3.6.1 General issues relating to data collection methods

Research methods authors have discussed the relative merits of using pre-defined categories drawn from the literature or starting with the data and identifying categories during the analysis. Yin (2009) recommended "prior development of theoretical propositions to guide data collection and analysis" (p.19). Pre-defined categories have been used to guide this research as it makes data collection and analysis easier. While

this method entails a risk of "forcing" the data to fit the categories and potentially missing some data that do not fit these categories, this danger has been reduced by retaining blank spaces in the matrix for additional themes that may arise. This approach contrasts with grounded theory, which generally begins without specifying any categories, preferring to allow these to emerge from the data; it is appropriate for the current research because the goal is to improve existing concepts rather than develop entirely new ones.

Data for case studies can come from six sources: documents, archival records, interviews, direct observation, participant observation and physical artefacts (Yin, 2009). In this research, the case studies are based on site visits, where it will be possible to collect primary data through interviews and direct observation, and secondary data through documents. Each method has strengths and weaknesses (see Yin, 2009; p.102), therefore triangulation is recommended where possible. However, when case studies are based heavily on interviews, it is not always possible to triangulate every statement with other data sources. As noted above, interviews form the main data collection method because of the availability of high calibre interviewees, but it remains important to be critical of interview data and treat it as only one method within the case study. Yin (2009) suggested that data collection should continue until enough data has been collected to have evidence from more than one source on most main topics and the evidence includes attempts to prove rival explanations.

It is not always possible to obtain the same information in all respects for each case study. In all cases of part one, for example, questions were asked about current traffic, in terms of numbers of trains, containers or TEU, but answers differed in their specificity, and even with prompting and further questioning, it was not always possible to get exact details. Therefore, in the narrative, whatever information was obtained is mentioned, but it will not always be in the same format. Yet it will still be presented because the aim is to provide rich detail and to understand each case as far as is possible.

3.6.2 Interviews

The main source of data for the case studies in this thesis is expert interviews. A total of 74 interviews were conducted for this thesis (19 in part one, 20 in part two and 35 in part three), several of which involved more than one interviewee, therefore the number of individual interviewees was 98 (see Appendix 1 for details). Different aims

were pursued in each part of the thesis, so different questions were used for each section. Six interview schedules were designed for the different groups of interviewees (available in Appendix 2):

1. Inland terminal case studies:
    a) Pilot study
    b) Actual case studies
2. Retail intermodal logistics in the UK:
    a) General freight stakeholders, both planners and industry
    b) Retailers, 3PLs and rail operators
3. Heartland Corridor:
    a) General freight stakeholders, both planners and industry
    b) Heartland Corridor

The interview questions are structured by the factors and sub-factors derived from the research questions, based on the literature review. This structure is replicated in the analysis matrices, thus linking data collection, management and analysis.

The interviews were semi-structured in order to retain openness in the dialogue. Furthermore, "survey fatigue" due to rigid questionnaires must be avoided. It is very important to establish a rapport with the interviewee and create a genuine discussion rather than appearing to be completing merely a "box ticking exercise." The majority of data collected from the interviews were examples of practice and experience; while interview data is obviously drawn from individual opinions, care must be taken to limit the inevitable subjectivity of respondent viewpoints. Where opinions have been given in the discussion, they have been noted as such, as they can be useful for strategic insights (as the interviewees are expert informants) although they do not prove that the situation claimed by the respondent is the entire truth of the matter. Opportunistic discussions with various operational personnel were also possible, resulting in valuable opportunities to gain additional insights as well as build a better picture of the industry.

The interviews were recorded by note taking rather than using a recording device, because in many cases device utilisation was not possible due to outdoor locations or walking or driving around the site. It has also been found in previous research by the author that recording interviewees from commercial organisations makes the conversation uncomfortable. As the aim was not to obtain complete transcripts to

analyse detailed responses but rather to gather data on the development and operational strategies, the lack of recording was not felt to be an issue. Follow-up emails were also utilised in many instances to clarify any issue left unclear in the interview notes. This method was used by Woodburn (2000) undertaking similar PhD research on intermodal transport in the UK so there is a precedent for this approach.

Language was an issue for some of the European interviews. Many interviewees did not have perfect English, thus it was not always possible to convey an understanding of a more complex question or idea. Sometimes, instead of a detailed discussion the answer may be very short. Therefore it is possible to end up with more detailed information on some areas of the interview than others, which has the potential to skew the focus of the results. Hence, caution must be exercised, guided by the structure of the interview schedule and the aims of the research to retain focus and balance.

3.6.3 Desk research

Desktop data collection was a major part of this research. At each site visit in parts one and three, documents were obtained, as well as via the internet afterwards. In part two, academic, industry and government literature were used to supplement the interview results. Triangulation of both method and content was practised where possible, although in some cases the quantity and quality of data available through desk research was not always sufficient to check the accuracy of all interview statements. This is an inevitable weakness of the research design, related to the strength of this research which is the access to expert interviewees. Strategies for dealing with this issue are addressed in a later section of this chapter.

3.6.4 Site visit/ field work/ direct observation

While this research is not based on observation per se, site visits afforded some opportunity to observe the operation of the site. In a few cases this led to additional interview questions on the spot, primarily operational questions about train management. It was not a major part of the data collection, but was utilised where possible.

3.7 Data analysis

3.7.1 Overall approach

Analysing qualitative data presents many difficulties, not just in the analysis itself but in presenting this analysis to the reader. First of all, there is the philosophical issue of the degree of objectivity that can be claimed in what is inevitably a partially subjective process. It is ultimately the researcher who will identify themes and classify the data, decide what and how much evidence to include and draw the inferences that will later form the basis of the conclusions (Simons, 2009; Denzin, 1994).

The research methods literature contains various strategies for reducing the data through indexing or coding, classifying into categories, identifying key themes and patterns, reducing the data to a manageable format that can then be presented, described and explained. Once this has been done, the analysis may be made more robust through strategies such as triangulation, testing rival explanations and evaluating the findings with colleagues and other experts.

Miles and Huberman (1994) identified three stages: data reduction, data display and conclusion drawing and verification, while Wolcott (1994) suggested description, analysis and interpretation. It is important to note that this is an iterative procedure and it involves moving backwards and forwards between stages. Even after the interviews are completed, the researcher must keep looking for other data from documents, emails, discussions with other people, and working back and forth between the analysis and the data. One must always concede that future data may change the results, which is why the analysis must be explicit so it is clear what will change in the explanation if certain aspects of the data are changed.

In each of the three parts of the thesis, the data were analysed twice. The first process was to gather practical and historical detail in order to present the case studies, while the second was to address the specific research factors around which the analysis was structured. In parts one and three, the narratives were primarily historical, covering the chronological account of the site development processes (albeit in part one the case narratives have been structured via a case-specific matrix covering development, operations, port relations and logistics). In part two, the narrative was issue-based, as the case was built around the issues of current practice. The goal of the first cycle of analysis and presentation was to gather rich data so that the process may be understood in detail by the reader. The second level or cycle of analysis was more specific, following the structure of the matrix.

3.7.2 To code or not to code

In much social science research, where the aim is to capture opinions and belief formation, including the processes through which meaning is created by participants, and to understand the experience of individuals, detailed coding is often employed. This begins with the raw data and starts with open codes, then proceeds to get more precise through further rounds of coding.

Coding is generally based on two cycles, although each cycle may be repeated more than once (Saldaña, 2009). First cycle codes are used to describe and categorise the data, while second cycle codes develop these initial categories into concepts, moving towards explanation and theory. Grounded theory moves through an explicit process of open, axial and selective coding (Strauss & Corbin, 1998). In the present research, this is not the aim. What is sought is primarily practical information, based on pre-existing categories drawn from the literature. Open cells are included in order to facilitate capture of unexpected information in the data, but a fully open coding procedure such as recommended by grounded theory is not viewed as appropriate to the research aims. Moreover, as the interviews were not recorded, full transcripts are not available. The goal is not to analyse the words, thoughts or feelings of the interviewees. Practical data is sought, and the volume of the data is less than would otherwise be the case, fitting comfortably within the matrix approach.

Saldaña (2009; pp.50-51) provided a checklist to assist in selecting which type of coding to utilise, including the following attributes:

- Harmonising with the study's conceptual or theoretical framework
- Relating to or addressing the research questions
- Providing the required specificity
- Leading towards an analytic pathway.

As the research questions, factors, sub-factors, interview questions and matrix were tightly related, this procedure was not as complex as it can be in other kinds of qualitative research. Thus, each of the four aims above can be met via the chosen approach of using a thematic matrix to collate the data. Therefore it is not necessary to code the data physically, but instead data can be entered directly into the thematic matrix (Ritchie et al., 2003). However, Miles and Huberman (1994) noted that decisions

must be made on what kind of data to enter into the matrix, ranging from interview quotes to summaries to proposed explanations and ratings. These decisions will need to be made for each matrix used, each of which may have different purposes.

The analysis began with several readings of the data. The data were then organised and reduced by collating evidence in a matrix. Each data source (interview notes, documents and observations) was analysed and notes made in the appropriate matrix. Gaps in the matrix were identified and filled by subsequent reviews of the data, follow-up emails and further data collection via desk research. An iterative process was followed, moving back and forth between data collection, analysis, interpretation and explanation, making use of triangulation where possible to strengthen interpretations. This relates back to the principles of grounded theory as developed by Glaser and Strauss (1967): "the analyst jointly collects, codes and analyses his data and decides what data to collect next and where to find them, in order to develop his theory as it emerges. This process of data collection is controlled by the emerging theory" (p.45). So there is an element of grounded theory present, in the sense that data collection can be influenced by an unplanned and emerging theory, but in this case it is guided by a pre-defined structure. An important note is that "it is the itemised content, not the frequency with which items occur, that matters in descriptive mapping. Even if a descriptor is mentioned only once it still contributes to the full set of elements that form the whole picture" (Ritchie et al., 2003; p.244).

3.7.3 Interpretation

While formal analytical processes such as those described above can enhance the objectivity of the findings, it is ultimately the researcher who creates meaning through identification of patterns via the coding and tabulating process.

In part one, a pattern-matching process was followed, as appropriate to this multiple case design based on replication logic, firstly comparing the "dry port" cases to the key factors defined in the Roso et al. (2009) paper, and then comparing the freight villages according to the same factors. In parts two and three, where single detailed cases were examined, explanation building was more appropriate. This is a more subjective process, guided less by theory than in part one, as the goal was to understand how these processes unfold. In such a process of analytic induction (Spencer at al., 2003), simple description is not enough; the goal is to understand what is happening and offer explanations, which usually takes the form of some kind of classificatory model at some

degree of abstraction (Strauss, 1987; Miles & Huberman, 1994). In this thesis, the degree of abstraction is linked to the port regionalisation concept.

3.7.4 Presentation

In presenting the research findings, it is important to keep the rich data as well as the summarised evidence for answering the research questions. Flyvbjerg (2006) argued that "case studies . . . can neither be briefly recounted nor summarised in a few main results. The case story is itself the result. . . . the payback is meant to be a sensitivity to the issues at hand that cannot be obtained from theory" (pp.238-239). Furthermore, "the problems in summarising case studies . . . are due more often to the properties of the reality studied than to the case study as a research method" (p.241). On the other hand, Miles and Huberman (1994) recommend regular use of tables and matrices both for guiding the analysis and presenting the findings.

The case studies in this thesis will therefore be presented via a combination of narrative form and tabulated summaries of key evidence for the research factors, which will then be discussed at the end of each chapter. Sub-factors are used to structure the findings but the overall research questions are to learn about how the process takes place, therefore a narrative style can discuss those issues and allows for more detail on actual practice.

It is also important not to lose the link to the interview context, as the value of expert interviews is that they provide an insight into actual practice, which should not be subsumed beneath overly abstract categories. Therefore while the key findings have been summarised in tables presented throughout each chapter, they have been supplemented by the inclusion of examples of practice drawn from the interviews. Due to commercial sensitivity the detail has been kept fairly general where necessary (mostly in part two).

The cases in part one are presented in individual tables based on the four research factors, which is suitable to present the simple cases as a precursor to cross-case analysis. Part two, as a single case with multiple embedded units of analysis, is presented via a section on each of the research factors. This part was analysed as a single case study on intermodal transport use by retailers, with multiple embedded units of analysis (being each organisation: the retailers, rail operators and 3PLs). It could have been structured with each retailer as a narrative case study if the goal were simply to compare their experiences of modal shift. But then there would be repetition and

overlap regarding the use of rail and 3PLs by each retailer, and the perspectives of the 3PLs and rail operators would have been pushed to the background. The point of interest was not the chronological story of development (as in parts one and three of the thesis), but the issues pertaining to the use of rail. Therefore the analysis and presentation worked better with an issue-based structure. The single case in part three is presented as a chronological narrative.

3.8 Validity and reliability

The validity of a project relates to how well it measures what it claims to measure. External validity or generalisability, i.e. the extent to which the findings can be generalised to other contexts, has already been discussed earlier in this chapter.

Da Mota Pedrosa et al. (2012) argued that case study research is not generally based on positivist approaches to knowledge; as such, it is the entire research approach, "from design to analysis and its subsequent documentation" (p.277) that should be examined. Therefore, "researchers need to explicate the design and methods in detail so that the reader can judge their adequacy and relevance" (p.277). Finally, they explained that validity and reliability for case study research "cannot be addressed exactly in the same way as in quantitative research" (p.278). Table 3-2 lists the criteria developed by da Mota Pedrosa et al. (2012) and demonstrates how each has been addressed in this thesis.

Table 3-2. Quality criteria and indicators for case study research, based on da Mota Pedrosa et al. (2012)

Criterion	No.	Information to be provided by the researcher	How each requirement was addressed in this thesis
Transferability	1	Theoretical aim must be stated clearly (e.g. testing, building or extension of theory)	The literature review established the goals of this thesis as extension of theory, and how each of the three parts relates to the overall thesis topic, with a degree of theory testing in part one.
	2	Unit(s) of analysis must be stated clearly, with clear boundaries of what is included and what is not	Each of the three parts of the thesis state the boundary of the case. Part one is a multiple-case design where each inland terminal is a case. In part two, the case is intermodal transport use by large retailers in the UK. Each organisation (retailer, 3PL, rail operator) is considered a discrete unit of analysis embedded within the case. Part three is based on a single case of the Heartland Intermodal Corridor.
	3	Case selection criteria controls for variation and underpins relevance to other contexts	See 2.
	4	Number of cases used must be clear	See 2.
Traceability	5	Informant selection process must be clear	This has been described in this chapter.
	6	Number of informants stated	This has been listed in Appendix 1.
	7	Description and/or inclusion of the data collection guidelines	This has been described in this chapter with interview questions and matrices provided in Appendices 1 and 2.
	8	Description of changes made to the research design during the research process	This has been described in each results chapter, in particular the pilot study chapter.
	9	Description of the data collection techniques	This has been described in this chapter.
Truth value (description of the data analysis process)	10	Categorisation identifies relevant data used to build evidence for each theme or topic	Described in this chapter. Not coded but via a process of "pre-coding", i.e. using pre-determined factors.
	11	Abstraction combines these categories under more abstract conceptual groups	Abstraction from initial categories is more of a grounded theory approach, which as explained has not been followed in this research. The abstraction comes from the port regionalisation concept, which has been discussed.
	12	Comparison across groups and identification of patterns	This is described and developed in chapter five, by comparing the inland terminal cases via the thematic matrix.
	13	Dimensionalisation identifies variation within categories	See 12.
	14	Integration develops relationships between concepts	See 12. This concept integration is taken further in the discussion chapter, where the findings from the three results chapters build on each other.
	15	Iteration: moving back and forth between data and analysis to verify the categories	This was done in all three results chapters, mostly to fill empty cells in the matrix but the factors did not change as they were pre-determined. Strengths and weaknesses of that approach have been discussed in this chapter.
	16	Refutation: discuss with interviewees and colleagues, test rival hypotheses	Results form part two were discussed with interviewees. Parts one and three were not but they were discussed with colleagues.

Robson (1993) identified four specific factors that threaten the reliability criterion: subject error, subject bias, observer error and observer bias. These have been addressed by designing an interview schedule based on eliciting primarily practical data rather than opinions of the interview subjects. Some of this information can then be triangulated with desktop research, to increase the objectivity of the case studies. In addition, the research was designed around issues whose existence can be observed with lower degrees of error and bias. For example, the ownership and operation of a site are facts that can often be verified with additional data. Thus subject and observer error have been limited as much as possible.

Subject or response bias in interviews tends to result in a rational account of behaviour, thus potentially obscuring an important part of the process. This problem was reduced somewhat through triangulating interview results with desktop research and document analysis. Triangulating interview data with observational data obtained through action research could produce a better result, but action research would normally focus only on one organisation, thus missing the bigger picture; it would also be at risk of observer bias. In any case, attempting to document institutional processes is always difficult; what the researcher can do to ensure validity is to provide contextual information so that future researchers may make their own decisions about the validity of the conclusions and whether such findings are transferable between two cases.

Meeting the reliability criterion in an inductive methodology such as that adopted in the present project can be difficult, as it cannot be proven that another researcher following the same methods would replicate the results presented in this thesis. One way towards addressing this problem is to ensure that categories or indicators are as straightforward and objective as possible. Furthermore, measures have been taken to ensure that any issues that may threaten the objectivity of the results have been stated clearly for the benefit of the reader, in order to clarify the relevant context of each element of data collection and analysis, so that future researchers may make their own decisions about the similarity of the contexts and whether such findings are transferable between two cases (Seale, 1999; LeCompte & Goetz, 1982; Hammersley, 1992; Patton, 2002; White et al., 2003; da Mota Pedrosa et al., 2012).

3.9 Research ethics

The final criterion is ethics, which can be divided into the researcher's responsibility towards the participants in the study and the responsibility towards the data analysis and

presentation. Regarding the latter, the researcher has the responsibility to analyse the data objectively and to report the results accurately. The greater the efforts taken to ensure validity and reliability, as described above, the higher the confidence the reader may have in the ethical analysis of the data, based on detailed information provided in the thesis. However, Bryman (2008) advised that it is the former that is the most important to research students.

Interview subjects require sufficient detail of the nature of the study, the kind of analysis and the eventual presentation and dissemination of results. These were provided during the initial contact and repeated at the personal meeting, in order for the participants to make informed decisions about their contribution to the PhD research. Confidentiality was offered to all interviewees should they desire it; while no one required personal anonymity, some comments were flagged by participants as confidential and particularly some data in part two of the thesis was confidential due to business reasons and was thus kept general to meet this request. Additionally, while interview subjects have been named in Appendix 1 in the interests of transparency, no direct references have been made in the thesis to specific interviewees.

A researcher can take a specific "stance" on ethics, such as universalism (ethical principles should never be broken) or "situation ethics" (each case should be considered on its own merits) (Bryman, 2008). However, such issues are more relevant in research of a sensitive nature in which respondents may feel uncomfortable or become distressed either during the research process or by the publication of results (see Diener & Crandall, 1978 on harm to participants, lack of informed consent, invasion of privacy and the use of deception). The nature of the current research is such that these issues are very unlikely to be raised. However, as noted above, care has been taken to provide clarity to both research participants and readers of this thesis on the procedures of data collection, analysis and presentation.

Conflicts of interest can also arise, in particular the issue of political motives in research funding (ESRC, 2005). Much of the research for this thesis was funded by the European Union through the "Dryport" project, which was supported by the Interreg IVB North Sea Region programme within the European Regional Development Fund. However, the mandate was quite general, based on researching the role of inland terminals in intermodal transport. There was no influence of project funders on the design or execution of the research, which meant that case studies could be selected freely according to the aims of the PhD research, as long as the overall topic was related

to dry ports or inland terminals. The research in this thesis has been utilised in writing project reports on the case studies for the benefit of project partners.

4. Pilot study

4.1. Introduction

The pilot case is an opportunity to examine both substantive and methodological issues. As noted in the methodology chapter, the case was chosen because of prior contacts, so that arranging the interviews and site visit was easy, and the interviewees were likely to be helpful and forthcoming, with additional provision of documentation where required. As the research for this thesis is based on three parts with different methods (i.e. multiple-case design in part one as opposed to single case designs in parts two and three), this pilot study will only be of direct relevance to part one. However, the general methodological issues will be similar, thus the pilot study can offer ways to improve all three parts of the study.

4.2. The case study

4.2.1 Introduction

The port of Gothenburg is Sweden's primary port, handling two-thirds of Sweden's container volumes, which equated to 880,000 TEU in 2010. Rail's modal share of hinterland traffic has been increasing steadily over the last decade; in 2009, 366,000 TEU went by rail out of a total of 818,000 TEU. Over the last decade, the number of rail terminals in Sweden has grown. Gothenburg is now connected by rail to 25 terminal locations.

4.2.2 The case study: Skaraborg Logistics Centre, Falköping, Sweden

Table 4-1. Case study table: Falköping

Development	A small demonstration site opened in 2007, costing about £400,000. It was built by the municipality and the operating concession was leased (through a tender process) to private operator ISS. A large site is planned on land owned by the municipality, which has also paid for all the planning work. The rail connection to the large site has already been built, with the costs split in three: national government (£1m), national rail infrastructure owner (£1m) and the municipality (£1m). The planned large site will have two terminals. One will be a private timber terminal owned and operated by Stora Enso (a very large paper, packaging and forest products company), while the second will be a common-user container terminal, owned by the municipality but privately operated through a concession process.
Rail operations	The current site has two small rail tracks of 175m each but the planned terminal will have track lengths of 350m initially then extended in future to 600m. The current site is operated by ISS and any company can run services to the terminal. There are no container trains at present, but they did have a small shuttle with the port of Gothenburg moving 8,000 containers per year. Now only some timber traffic exists.
Relationship with ports	None. They did have a container shuttle with the port of Gothenburg but it has since stopped. According to the interviewee, the goal was to build close relations with the port and be used as a "dry port" but it did not happen.
Logistics	The demonstration site has a couple of small sheds but the planned large site will have many large plots available to sell or rent to companies.
Other comments	Even though studies showed that sufficient demand existed in the area to support a rail service, this demand has not materialised. The large planned common-user terminal will not be built until an operator and/or customers have been sourced to locate there.

The feasibility study for the site was originally undertaken by Gothenburg University back in 1995. The municipality owns all the land for the planned site – about 700m^2. They recently spent about £1-1.5m buying some extra sections that they needed. According to the interviewee, it is expensive because sellers know they have a strong position. However, most of the land has been kept aside by the municipality for many years, which illustrates the need for long-term planning.

The location is about 130 km from Gothenburg (see Figure 4-1), but some factors in favour of the route are that there is only a road haul at one end, Swedish track access is subsidised by the government, and the idea was to utilise space on trains going further.

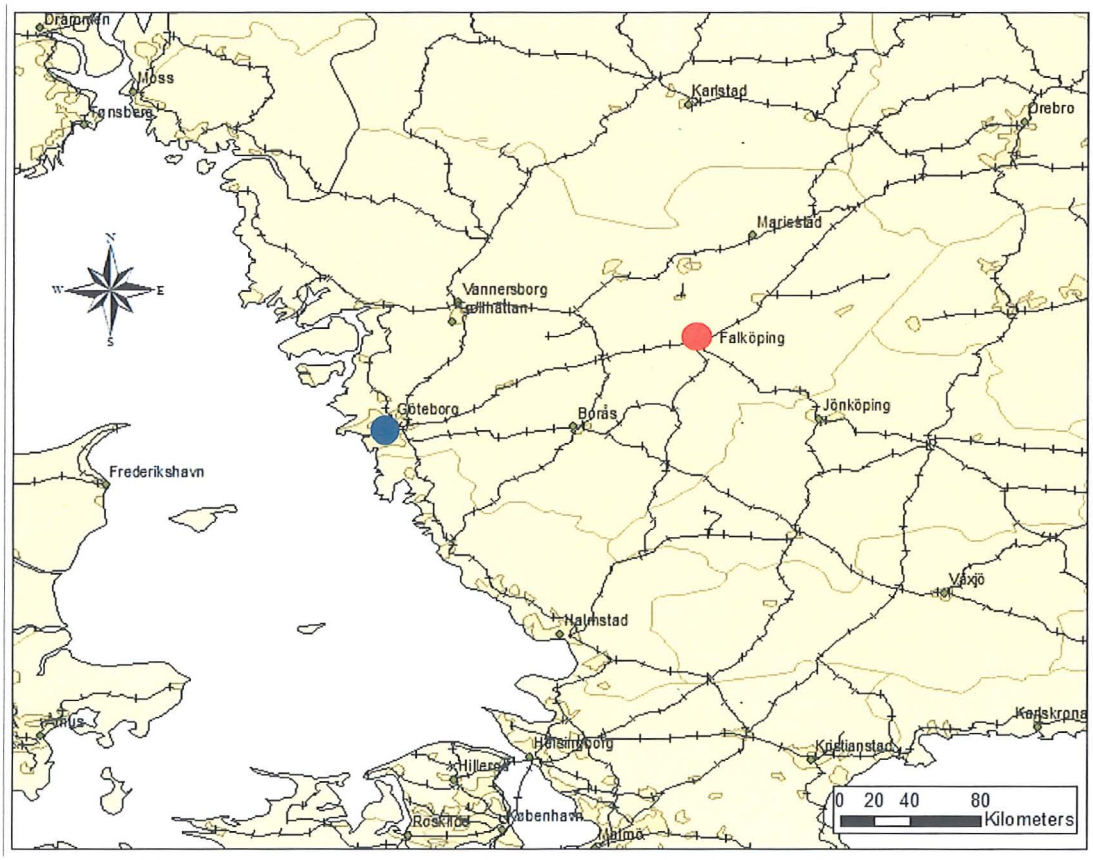

Figure 4-1. Map showing the port of Gothenburg and Falköping

Source: author

There were ongoing problems with a neighbouring town (see Bergqvist, 2008; Bergqvist et al., 2010); the town of Skövde, site of a large Volvo plant, wanted to build its own intermodal terminal. There was a lot of controversy with many meetings and newspaper articles discussing the project. It would not make sense to have two terminals so close together but both municipalities wanted the site to develop business in their own locality. There is no regulation of sites and even the regional authority

cannot overrule the municipality if they have the money. Green Cargo (the main rail freight operator in Sweden) preferred Skövde. ISS will speak to them about the possibility of linking a smaller terminal in Skövde with the main one in Falköping.

The issue was resolved once the Falköping municipality brought large paper manufacturer Stora Enso on board, which brought the rail authority, because the rail authority would commit £1m towards the construction of the rail connection to the site. They would then be unlikely to spend that same amount on a site so close to this one. Of course, Skövde could pay for their own connection if they wanted to go ahead with the development, but that is unlikely.

The first phase was a small demonstration site. It has two tracks of 175m each, a small amount of warehousing, serviced by one reach stacker and a grabber for the timber. It cost about £400,000 and was built in 2007. Once the full terminal is built, this site may be used for low value goods or maintenance.

After an unsuccessful start with the initial operator, ISS took over as terminal operator, while other companies run the services. The cargo is mostly timber and particle board, with some containers. In 2010 it was handling 8,000 containers, 3,000 outbound and 5,000 inbound from the port of Gothenburg. However, there is currently no container traffic at the site.

Meanwhile, the planning process for the proposed terminal has been progressing. The site will have two terminals. One (40,000 m^2) will be operated by Stora Enso for their own goods, and the other will be owned by the municipality and operated by ISS. Stora Enso is already starting on their section. There is also room for a third terminal to be added in the future. The new site will have 350m track lengths in the first phase (total terminal size of 22,000m^2), progressing to 600m in future (total terminal size of 30,000m^2). There will be two tracks for Stora Enso and two tracks for the municipality terminal, with additional space for a fifth track in future. Trains in Sweden are currently about 600-700m in length. The final goal is for five tracks of 750m (therefore handling full trains without cutting); it is estimated that with this layout the terminal could handle well over 200,000 TEU per year.

The municipality will not build the terminal until they have an operator and/or customers ready to use it. The aim is to build traffic at the current demonstration site first. The Stora Enso timber terminal is, however, being built now, as is the rail connection to the site. When a customer is located for the container terminal, they will then need to work out how to finance it, through some kind of concession agreement

and payment plan from the public and private stakeholders. The interviewee also felt that the financial situation between the port and the inland terminal operator needs to be clarified. An agreement is needed to share the money that the port will lose by storing containers inland at Falköping.

4.2.3 Discussion

In Sweden, inland terminals can be built and owned by municipalities. The interest of municipalities is in improving the transport chain, thus hoping to achieve twin aims: increasing modal shift from road to rail, thus benefitting the environment, and increased attractiveness for businesses to locate in the area, thus creating jobs and economic development in the municipality and region. Yet the municipalities are not seeking to control the flows themselves; instead they seek actively to accommodate the port.

The Falköping case represents an example of public sector development, seeking to attract economic development to a region. While there has been an attempt to integrate the terminal with the port operations, the site is simply an intermodal terminal offering rail access to the area, one of many in the country.

In the past, the Port of Gothenburg has not needed to be proactive in developing terminals to extend its hinterland because other actors have been motivated to implement inland terminals themselves. Recently, according to the interviewees, the seaport has become more interested in a share of control in the terminal operations. In return, the inland terminals gain brand association (through the port of Gothenburg's "railport" system) and greater integration with the seaport, which it is hoped will be developed over time into greater IT integration resulting in efficiency gains for the entire transport chain. This finding substantiates the contention of Notteboom and Rodrigue (2009) that port authorities have in the past been afraid of competition with inland terminals but some are recognising that there are many benefits to cooperation. However, this process has not been replicated in the Falköping case.

The development of logistics zones around terminal sites (particularly the sale of earmarked land within development sites to producers or logistics firms) may determine whether more shippers accommodate themselves to the growing network of rail hubs in Sweden, leading to higher train fill rates, increased economies of scale, and a snowball effect of a greater modal share for rail. However, this does not yet appear to be happening in the Falköping case, with the danger of optimism bias on behalf of local authorities leading to a situation of oversupply of terminal facilities. No rail container

service between Gothenburg and the temporary terminal at Falköping is currently running (not to mention the opportunities for traffic at the proposed container terminal), illustrating the difficulty of aligning public policy and planning with market requirements. Almost two decades of work have resulted in a small temporary terminal, a private timber terminal under construction and a vacant space for the planned container terminal, with no customers forthcoming for this site, let alone to fill the proposed logistics zone. Even when the demand has been measured and known to exist, other considerations can prevent the successful operation of a site.

Because terminals are approved and built by municipalities (thus they are scaled at the local rather than at the regional level), problems have arisen with a number of municipalities desiring to build terminals in an area that is not large enough to provide the minimum efficient scale for more than one terminal. Detailed coverage of this issue was provided by Bergqvist (2008) and Bergqvist et al. (2010). Without powers at a regional or national level to regulate terminal implementation, these situations cannot be prevented; nor can they be solved unless a municipality is willing to be the first one to back down.

Regulation at a higher level could help to address this challenge in terms of overall efficiency of the system, as the current situation may impede the potential to reach a level of modal shift that would deliver towards goals of emission reductions. However, the situation may already have progressed past that point. Municipal terminals are generally assisted with some government aid, whether through one-off national grants towards modal shift or through part-finance by the rail authority to build connections to the mainline. Now that terminals are oversupplied in some areas, this co-financing will not be forthcoming, and thus to a degree the situation can be said to be self-regulating. Dangers remain in regions currently undersupplied with terminals, in which individual municipalities compete to build terminals that would then split the necessary economies of scale, however, it remains the task of the sub-regional and regional administrators to bring municipalities together and facilitate cooperation in their infrastructure development. This is done by utilising the Swedish regional political model that aims for consensus among all municipalities rather than, for instance, taking a majority vote and imposing the result from the top down.

4.3 Analysing the case study

The use of a thematic matrix was established in the methodology chapter, based on the literature review. All the data were reviewed and relevant information was entered into the individual matrix that was constructed for use with the individual cases in part one (Table 4-1). The procedure will be to collate data from each of these matrices into a meta-matrix for cross-case analysis. The aim of the pilot study was to test the research process, part of which is the use of the individual matrix.

However, Flyvbjerg (2006) reminds us that "case studies . . . can neither be briefly recounted nor summarised in a few main results. The case story is itself the result" (p.238). Therefore it was desired to present each case study in a narrative form, as it is essential not to be overly reductive by focusing only on the tabulated summaries of key evidence for the research factors. The overall aim of this thesis is to learn how port regionalisation strategies occur in practice and to understand the processes involved. This pilot study provides the opportunity to test both the tabular presentation and the narrative construction. The outcome will be discussed later in this chapter.

The analysis in part one of the thesis will build a meta-matrix based on key data from each individual matrix. Table 4-2 shows the data fields that will be used in the meta-matrix.

Table 4-2. Data from pilot study for meta-matrix analysis

Country	Sweden
Location	Falköping
Owned	Public
Operated	Private
Customs onsite	No
Logistics in same site	No
Driver (organisation)	Municipality
Driver (public/ private)	Public
Relation with port	Low
Method of integration with port	None
Info sharing	Low
Who controls rail operations	Rail operator

4.4 Using the pilot study to improve the research design

4.4.1 Substantive issues

The research question for part one is: how can different strategies of inland terminal development influence port regionalisation processes? The key factors from the literature review have been used to build the matrix. These factors were able to be captured through the methodology adopted in the pilot study. The key data regarding site development, relation with ports, operational issues and the role of logistics have been captured through this methodology, therefore from a substantive perspective the pilot study has shown that the methodology is suitable to the research aims of part one.

Considering how the analysed data would contribute to answering the research question (as part of a cross-case analysis involving other cases), the key data above reveal that this is a public-sector development, thus fitting into the second group of cases analysed in chapter 5 (port-driven and inland-driven). It shows that even when integration with the port is desired, it is not always forthcoming, as well as the difficulties in attracting business for rail container shuttles, even when there is evidence that demand exists. Thus the risks of optimism bias in public sector development are well represented in this case study. The issue of scale is also raised, involving conflicts between local governments, and the role of national funding in developments that are nonetheless scaled at the local level. Thus from a substantive perspective, the data collection and analysis methods have provided the required findings to address the research questions, and the research design for chapter five has been validated.

4.4.2 Methodological issues

While parts two and three of the thesis take different approaches to part one, they also use a case study methodology, so the methodological lessons for the pilot study can be applied to all three parts of the thesis.

The relative merits of the case study methodology have already been considered from a theoretical perspective in the previous chapter. The analysis of the pilot study has shown that the methodology is suitable for answering the research question for the inland terminal part of the research. The data collection was fruitful and the analysis via a thematic matrix furnished sufficient material to address the concerns of the research. The meta-matrix is expected to work well when data from the multiple cases have been collected, although it is acknowledged that all interviewees may not be as forthcoming as those at this site.

Issues that could hamper the research are primarily practical. In this case, contacting the relevant people for interviews and site visits was easy because of prior contact, which may not be the case at other locations. This was also a single site, whereas more travel would be required for the multiple site visits planned in some countries, so time and cost must be considered. The initial strategy for site selection (based on port-driven versus inland-driven, with particular focus on the "dry port" concept) has been bolstered by the pilot study, because the issue of port involvement and the difficulty of integrating ports and inland terminals have been confirmed as important issues.

The English language skills of interviewees in the pilot study were very good, although the majority of documentation available was not in English, limiting that aspect of the study. Language skills may be a bigger issue at other continental locations, which provides one motivation for streamlining the interview procedure. Using interviews as the primary data collection method has already been addressed in the preceding chapter, but it was found in the pilot study to be useful because the goal of the research method is to derive data from in-depth discussion with expert interviewees, who are knowledgeable about the process. As the interviewees in this case are participants in an EU-funded project on inland terminal development, they are used to discussing their issues frankly and being open about challenges. Additionally, as a public sector development, there is more openness and less commercial sensitivity, which may not be the case in other locations, where private sector companies are keen to promote their site.

The main methodological issue from the pilot study was the number and content of the interview questions. The interview questions were shorter and more general for the pilot study and had to be refined for the actual cases. The factual information was set out more explicitly and brought to the beginning, and the key topics were grouped and expanded where necessary to guide the discussion and not waste time having to explain overly open questions. This lesson was also applied to the interview questions for parts two and three, which tried to find a middle way between open-ended questions and a long list of prescriptive questions. Basing a structure on a handful of key topics but split into a few questions each provided enough specificity without turning into a long questionnaire.

The final issue to consider is data presentation. In the pilot study the data have been presented as both a narrative and an individual case matrix, based on key issues of site development, port relations, rail operations and logistics. As discussed in the

methodology chapter, narrative is an important element of case study presentation, allowing a greater level of detail than the matrix, gaining insights into the difficulties of the site development process and the port relations. Due to the good relations with the interviewees, it was possible to construct a detailed narrative with numerous small details of the process, but it is not known if this level of detail will be obtainable from the actual cases where time and access may be more limited.

It has therefore been decided in the actual case analysis to keep the narratives in the matrices as the goal is cross-case analysis rather than in-depth analysis of a single case. It is recognised that the case studies in part one are based on limited data therefore it would not be appropriate to write longer case studies. Parts two and three are in-depth cases based on many interviews and substantial documentation. As such, they provide sufficient material for detailed written presentation.

4.5 Conclusion

The methodology has been tested on a pilot case, and some improvements were made in the form of expanding and focusing the interview questions, to ensure the most important data could be collected during the interviews. Overall, the methodology was found to be suitable for achieving the research aims.

It was found that an interview schedule with overly open questions was less productive, and unexpectedly took longer because of the increased requirement for clarification. The current interviewees were happy to spend more time due to the existence of a previous relationship, but, as other interviewees may not be so forthcoming, there is a risk of running out of time and leaving the interview unfinished. The original interview schedule used for Sweden and the revised version used in later cases can be found in Appendix 2.

Using the matrix to analyse the interview data proved relatively straightforward. This was because the interview questions were tied into the matrix factors, themselves derived from the research question through literature review. It is important to keep the enquiry well structured to enable cross-case comparison. The analysis process discussed above shows that it was possible to answer the research question in this instance, as far as that can be done in just one case. Therefore the overall approach has been validated.

Part one

The role of inland terminal development in port regionalisation

5. Part one: the role of inland terminal development in port regionalisation

"While a port is an obligatory node for the maritime/land interface, albeit with some level of inter-port competition, the inland port is only an option for inland freight distribution that is more suitable as long as a set of favourable commercial conditions are maintained."

(Rodrigue et al., 2010; p.2)

5.1 Introduction

The first research question was: how can different strategies of inland terminal development influence port regionalisation processes? This question was divided into four research factors derived from the literature:

1. Development process
2. Relation with ports
3. Operational issues
4. Logistics.

This chapter will present the eleven case studies undertaken to research the role of inland terminals in port regionalisation. The case studies are divided into two groups, as discussed in the methodology chapter. The first group covers those developed by ports, especially with relevance to the "dry port" and "extended gate" concepts. The second group is comprised of those developed by inland actors.

Following the structured narrative presentation of each case, the data will be analysed through a thematic matrix to analyse these four factors, enabling a cross-case

synthesis. These findings can then be used to address the research question for this part of the thesis.

5.2 Practical aspects of the case studies

The fieldwork for each of these case studies took place during 2010 and 2011. Each case study was based on a site visit to the inland terminal and interviews with the terminal manager and/or other representatives. Full details for each visit can be found in Appendix 1, but in most cases two staff were interviewed, usually the manager and a member of operational staff, depending on the size of the terminal. Other opportunistic discussions with staff were also possible in some instances. Thus most case studies are based on two or more interviews, along with analysis of documents obtained at the site and through desk research, supplemented where possible and made more relevant by observations from the site visit.

Each case study begins with a brief overview of the freight system in that country, based on desk research. Then a structured narrative of each case based on the four factors is presented, followed by a discussion of pertinent issues. Not all cases provide exactly the same information, as this depends on how the interviewees answered the questions. Answers to some questions, such as the amounts of public subsidy received, or throughput or even number of services, were not always easy to obtain. In some cases only a vague answer was given. In other cases the given answer did not tally with published information in documents, and in others the subject promised to email the details but failed to do so, despite prompts. These problems highlight the importance of field work rather than surveys. It can be difficult enough to get a good answer in person; by email or post it is often impossible.

The case study process was guided by the research question, the research factors, the thematic matrix and the interview questions, all based on the literature review. The analysis in this chapter is based on this matrix, which shows the evidence for each aspect and reveals how inferences were drawn and conclusions reached. Lack of data for some aspects will also be made clear through the use of the matrix.

5.3 Presenting the case studies 1 – port-driven inland terminals

5.3.1 Spain: Azuqueca, Coslada, Zaragoza

Introduction

The three significant intermodal terminals currently operating in the Spanish hinterland have been the subject of brief case studies (FDT, 2007, 2009; Roso & Lumsden, 2010; Rodrigue et al., 2010; Van den Berg & de Langen, 2011).[3] Besides these three, there are currently no other sites in Spain that are considered by industry or in the academic literature as significant nodes with direct container shuttles to ports, although there are other small rail terminals (more on this in the discussion section). Some of these inland terminals in Spain are promoted as "dry ports" in marketing material.

Spanish ports are owned by the state, managed by the national body Puertos del Estado and run by port authorities on a landlord model. Port services are provided by private operators, under contract to the port authority. The only inland terminal in which Puertos del Estado is involved is the Dry Port of Madrid at Coslada, in which the national body collaborated with the four major container ports (see case studies below). While there is no national inland terminal strategy as such, the national body can assist in coordinating initiatives, providing inter-regional coherence to the traditionally regional administration of logistics platform development. As an example, Puertos del Estado is collaborating with the port authorities and regional administrative bodies to consider the potential for inland terminals in Andalucía.

Figure 5-1 shows the location of the four major ports in Spain by container throughput. Madrid (the location of Azuqueca and Coslada) and Zaragoza can also be seen.

[3] Santander-Ebro has been mentioned by Roso & Lumsden (2010). At the time of writing, this site was not receiving any rail traffic from the port of Santander and, as it is primarily an automobile platform, it was not considered relevant to the current study which focuses on containers.

Figure 5-1. Map of Spain showing location of the four major container ports

Source: author

Container throughput in the west Mediterranean has increased enormously over the last decade (for a discussion of the reasons behind this development see Gouvernal et al., 2005). Table 5-1 shows the container throughput at the top four Spanish ports in 2009. It is interesting to note that Valencia and Algeciras have maintained their traffic while the other two ports have suffered a noticeable fall in throughput.

Table 5-1. Throughput at top four Spanish ports in 2009

Spain	World	Port	TEU 2009	TEU 2009 (hinterland)	TEU 2008	TEU 2008 (hinterland)
1	27	Valencia	3,653,890	1,829,254	3,602,112	2,023,630
2	34	Algeciras	3,042,759	151,908	3,324,310	159,614
3	58	Barcelona	1,800,213	1,193,917	2,569,550	1,571,962
4	138	Bilbao	443,464	438,818	557,355	543,502

Source: author, based on Containerisation International (2012); Puertos del Estado (2009)

Bilbao traffic is mostly short sea or feeder from northern range ports in Europe due to its location and Algeciras volumes are mostly transhipment. Valencia and Barcelona are the two major ports for Spanish deep sea cargo, although Valencia does more transhipment than Barcelona. The table also shows the hinterland throughput (i.e. transhipment figures have been subtracted to reveal genuine trade flows).

The geography of Spain means that the hinterland of each port is generally not too far inland so intermodal terminals are not relevant to these flows. The only inland markets of significance are the greater Madrid area (pop. 5-6m) and north-eastern Spain, which is the primary industrial region in the country. In general, Spain is a net importer, and this is particularly acute in Madrid, so balancing empty container flows is a problem. Catalonia is more balanced because, as the main industrial area, it exports as well as imports. At the Dry Port of Coslada 99% of import containers are loaded, but for exports this figure is only 40%.

Case studies

Dry Port Azuqueca

Table 5-2. Case study table: Azuqueca

Development	Opened in 1995, this was the first such site to be developed in Spain. Planned and developed initially by the port of Barcelona, with private real estate company Gran Europa (which now owns 75% of the site) becoming involved during the process. The remainder is now owned by the ports of Barcelona, Bilbao and Santander. The site was granted a 45 year lease on the land from the local authority, starting in 1994.
Rail operations	Terminal is operated by the majority owner, real estate company Gran Europa. The trains are run by third-party rail operators on a common-user basis. Total TEU has risen from about 2,000 in 2001 up to approximately 25,000 TEU in 2008, before falling to approximately 15,000 TEU in 2009. Of this, roughly 50% is from Barcelona, 40% Bilbao, and 10% Valencia. The services from Valencia and Bilbao to Azuqueca are run by Continental Rail, while TCB runs the rail operations from Barcelona.
Relationship with ports	Integrated through share ownership but little operational involvement. Services to the ports of Barcelona, Valencia, Bilbao.
Logistics	Gran Europa is a real estate company that developed much of the logistics area in the region and then built this terminal to service this demand. But the site itself is just a terminal.
Other comments	Azuqueca also handles bulk traffic such as steel, cereals and cement. 70% of their traffic is containers, 30% bulk. Heavily marketed as a "dry port" for the port of Barcelona. The interviewee said that they need a wagonload service to build traffic at the site but they are having difficulty convincing a rail operator to provide one.

Dry Port of Coslada

Table 5-3. Case study table: Coslada

Development	Opened in 2000, the site was developed jointly by national port body Puertos del Estado and the four major container ports Barcelona, Valencia, Bilbao and Algeciras, with support from Madrid regional government and the local council. Ownership is 10.2% each by Puertos del Estado and the ports of Barcelona, Valencia, Bilbao and Algeciras. The remainder is split between Madrid Regional Government (25%), Entidad Publica Empresarial de Suelo (13.08%) and Coslada Local Council (10.92%). The facility has a 50 year agreement with the local council to use the land.
Rail operations	After a tender process, the site operation was awarded on a ten-year concession to Conte-Rail which is a private company owned by Dragados (50%), national rail operator RENFE (46%) and Puertos del Estado (4%). However, Continental Rail has been competing for the rail services since 2007. In 2009 the terminal handled 45,000 TEU, down from a high of 60,000 TEU in 2008. Currently the only services are with the port of Valencia.
Relationship with ports	Integrated through share ownership but little operational involvement. However, there is some integration in the sense that the terminal operator is majority owned by the main terminal operator at the port of Valencia (Dragados), which is also the primary source of traffic.
Logistics	There is a logistics park next door but no direct relation between the two sites.
Other comments	The site was developed jointly by the four major container ports but it now only has traffic with one port and the operator of the terminal is majority owned by the terminal operator at Valencia port. Heavily marketed as a "dry port" supporting the Spanish port system.

TM Zaragoza

Table 5-4. Case study table: Zaragoza

Development	While the logistics centre ZAL Mercazaragoza is not new, the Terminal Marítima de Zaragoza was only opened in 2009. The terminal site is owned by the company TM Zaragoza, with a shareholding of 56% ZAL Mercazaragoza (the logistics park), 21% port of Barcelona, 20% from the region of Aragon and the remainder held by local companies.
Rail operations	The terminal is owned and operated by TM Zaragoza. Services are run by third party operators. Throughput in 2009 was 23,864 TEU.
Relationship with ports	The port of Barcelona is integrated through share ownership but has little operational involvement. All traffic is with the port of Barcelona, as the site is within its natural hinterland.
Logistics	The terminal is embedded within and majority owned by the logistics park.
Other comments	At first the Zaragoza logistics platform was only linked to Barcelona by road, but once the rail corridor to Azuqueca was operational, Zaragoza was a stop on the corridor so it made sense to use it. Originally the distance to Zaragoza was too short to compete against road, but it works now as part of the corridor service. Heavily marketed as a "dry port" for the port of Barcelona.

Other sites: Abroñigal and Arganda del Rey

Besides the three inland intermodal terminals noted above, there is another rail terminal in central Madrid at Abroñigal that acts as a consolidation point for landbridge services between Bilbao and Seville (see Figure 5-2). Coslada does not compete for that traffic as it focuses only on rail shuttles directly to the major ports.

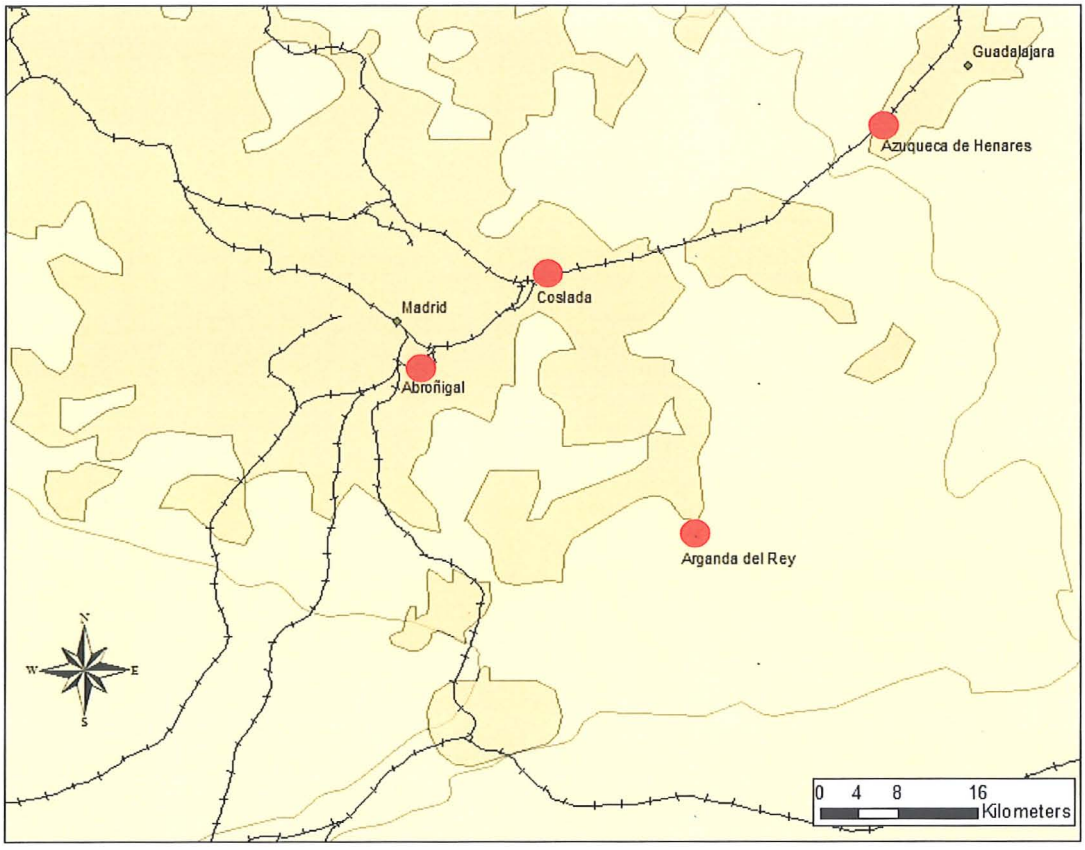

Figure 5-2. Map showing location of current (Coslada, Abroñigal, Azuqueca de Henares) and proposed (Arganda del Rey) rail terminals in the greater Madrid area
Source: author

The greater Madrid area contains about 5-6m inhabitants and that is the hinterland for the Coslada terminal, but it does overlap with the hinterland of Azuqueca and Abroñigal. The hinterland for Azuqueca includes Madrid, but it is mostly the wider Guadelajara area where there are many distribution centres. In fact, it is the consolidation of cargo to fill a train that can go to both sites that can help to make rail viable.

Because land planning decisions are made at a regional level, getting permission for Coslada with respect to the location of other sites was not a problem because Azuqueca is in another region (Guadelajara, as opposed to Madrid). However, both sites required some additional funding to support the rail connection, therefore limiting the danger of over-saturation of terminal sites. A similar case was found in Sweden (see the pilot study), where two neighbouring regions wanted an intermodal terminal. As funding from the rail operator to build the main line connection would only be forthcoming for one site in a given area, the result is a kind of self-regulation.

New developments being proposed show that, like other countries, Spain has regional/municipal bodies who want to develop new logistics sites. A new logistics site is proposed at Arganda del Rey, southeast of Madrid (see Figure 5-2) with 1,350 hectares of land available. The plan also includes installing a new semi-circular rail line running from an interchange site north of Madrid (Alcala de Henares), through the new site southeast of Madrid, and round to a site south of Madrid (Aranjuez). Valencia is the main port involved, but the port of Barcelona also has a small stake in the development process for the new site. Even if the latter does not pursue further involvement, having a seat on the Board means that for the moment they are able to keep abreast of the project (see Moglia and Sanguineri, 2003).

If this project goes ahead, the likely result is that Valencia will use it rather than Coslada, which would perhaps be used for other purposes such as air freight, as it is near Barajas airport. Barcelona would no doubt continue to use Azuqueca, thus the common-user terminals would in reality become primarily single-use, with some small additional traffic from Bilbao and Algeciras. The proposed site is interesting because on the one hand it represents a policy failure, in that if Valencia is the only user of Coslada and its traffic moves to Arganda, then Coslada may be abandoned (with regard to port traffic), even though it was driven by the national port body. On the other hand, if all the Coslada traffic is coming from the Dragados terminal, and Dragados holds the controlling share in the concessionaire of Coslada, it may keep the traffic moving through there rather than Arganda (unless Dragados wins the concession for that too), due to the benefits of vertical integration and lower transaction costs.

Discussion

Dragados Marvalsa is the largest container terminal at the port of Valencia, and 90% of the traffic from Valencia to Coslada is from this terminal. Therefore since 80% of the total traffic at Coslada has been from Valencia (100% in 2010), it could be concluded that the "common-user" terminal is, in reality, a private terminal for Dragados. As was seen above, Dragados owns the controlling share in Conte-Rail, the company operating the terminal. Therefore while officially a publicly-operated facility, there is a degree of vertical integration of a private company here.

Similarly, Valencia only provides about 10% of the traffic to Azuqueca. So it is very much a case of Valencia using Coslada and Barcelona using Azuqueca for access to Madrid traffic. Barcelona's involvement in both Coslada and Azuqueca provides security and flexibility, and considering that future capacity at Coslada is limited, Azuqueca gives them longer term security.

Therefore, although much is made of the common-user nature of Spanish terminals, in fact the majority of usage comes from Spain's two large ports, Barcelona and Valencia. Valencia uses Coslada to access Madrid (as a small part of their Madrid traffic, the rest of which goes by road), while Barcelona is able to compete with Valencia by using Azuqueca for Madrid access. Zaragoza is used by Barcelona to access the industrial area in that region, which is in any case within the natural hinterland of Barcelona port. If the future site at Arganda del Rey is developed, this may replace Coslada as Valencia's primary inland node. The effect on competition between the two ports will depend on what inland rates can be offered. It also depends on which shipping lines are calling at which of the two ports. The choice of which inland terminal (Azuqueca or Arganda) is used for Madrid containers will be primarily a result of the port choice (Barcelona or Valencia, respectively).

Since the liberalisation of Spanish rail operations due to an EU directive, a number of private operators have entered the market to compete with the incumbent RENFE. The benefits are now beginning to be seen. In 2007 Continental Rail handled about 10% of the traffic between Valencia and Coslada, but by 2009 it was up to 25% and in 2010 it was closer to 40%. In fact, after two weeks of working with the terminal Continental Rail had captured all of the Maersk traffic from Valencia to Coslada. Rail operations from Coslada to other ports are all through RENFE, but this represents only 10-20% of the total Coslada throughput.

Ports still have problems with the actual rail connections into the port, so infrastructure improvements are required to reduce shunting. At the moment, rail accounts for only a tiny proportion of inland traffic from Spanish ports. In 2008 Valencia handled 69,048 TEU by rail (Fundación Valenciaport, 2010), while Barcelona's rail throughput was 52,562 TEU (in total, including to France) (Port of Barcelona, 2010). This represents just over 3% of hinterland throughput for each port (see Table 5-1).

Reasons for optimism include the upgrading of the rail line from Barcelona to France to European gauge, which is due for completion in 2012. This will allow direct transport without the need to change from Iberian gauge to European gauge. This will help Barcelona in attempts to compete for French cargo, building on its existing rail service to the inland terminal at Lyon. In addition, the new high speed passenger line running from France through Barcelona to Madrid means that the old line is now available for freight traffic, albeit on Iberian gauge. Meanwhile, Valencia has been investing in upgrading rail connections right into the port, as well as developing an IT system that will increase service integration and make rail more efficient and hence attractive to users.

In all three cases, port authorities have formed partnerships with terminal developers and operators. From a port development point of view, it can be seen that the ports are improving their inland access by ensuring terminal facilities in the appropriate locations. Additionally, Barcelona and Valencia are both developing logistics zones within the port perimeter, as well as being involved in inland load centres. Therefore the port authorities at Spain's two largest container ports (excluding transhipment) are pursuing multi-layered regionalisation strategies in partnership with a number of stakeholders.

5.3.2. Muizen, Belgium. Mouscron/Lille, France

Introduction

Freight transport in the Benelux region is understandably shaped by the large northern range ports (see Figure 5-3). Therefore inland transport needs to be coordinated with developments taking place in each port, necessitating various business relationships, from joint ventures to vertical integration. The development of the extended gate concept by ECT linking the port of Rotterdam with inland terminals will be discussed in another case study; this section will look at developments in Belgium

linking the ports of Antwerp (2009 throughput of 7.3m TEU) and Zeebrugge (2009 throughput of 2.2m TEU) with their hinterlands (Containerisation International, 2012). Sites were visited at Muizen and Mouscron/Lille, and interviews were conducted with InterFerryBoats and Delcatrans.

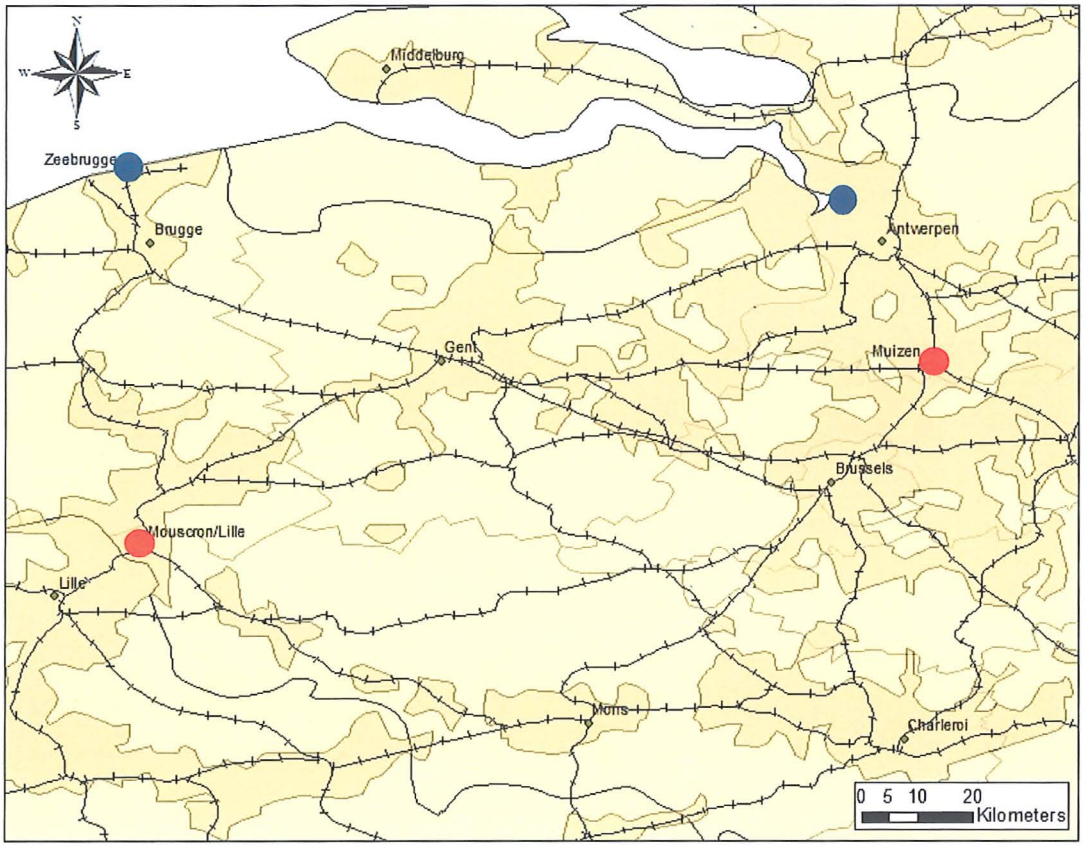

Figure 5-3. Map showing the ports of Antwerp and Zeebrugge and the inland terminals at Mouscron/Lille and Muizen

Source: author

Case studies

Dry Port Muizen

Table 5-5. Case study table: Muizen

Development	The site was opened in 1994. All the investment was public. Belgian railways developed the land, built the infrastructure and bought cranes, while IFB (99% owned by the Belgian Railways) paid for the other superstructure. Due to the EU directive, the Belgian Railways was split into infrastructure (Infrabell) and operations (SNCB). SNCB was then split into three subsidiaries. IFB is one of these, focused on containers. Belgian Railways owns the site and IFB leases it from them.
Rail operations	IFB runs the site but handles trains from any company, including the rail operations arm of their own company. To improve efficiency each train has a fixed set of wagons, so they only lift containers on and off. It only runs five services per week, with an estimated throughput of less than 20,000 TEU. The trains handled at the Muizen terminal are company trains, so IFB has nothing to do with the booking, sales, etc. It just handles the full train for a client.
Relationship with ports	Just a normal inland terminal with no specific relationship with any port. The only direct port service is with the port of Zeebrugge. In terms of maritime actors, it is the shipping line that they deal with, rather than the port authority or terminal operator, although they do deal with port terminal operators when setting up the services.
Logistics	There is no direct involvement with logistics; it is just an intermodal terminal.
Other comments	IFB owns four terminals: three in Antwerp plus Muizen. It operates five sites, and participates in some others, working in partnership with TCA (Athus), Delcatrans, (Mouscron/Lille), CDP (Charleroi), LLI -ECE (Liège) and ATO (Antwerp). According to the interviewee, generally if IFB uses a terminal it will have some ownership of it, say 15%, so that it is involved in what goes on there. It was noted by the interviewee that, in future, collaborations between terminals and freight villages may be more common.

Dry Port Mouscron/Lille, France

Table 5-6. Case study table: Mouscron/Lille

Development	Built by the regional government in 2005, it went out of business and was taken over on a 30 year lease by private company Delcatrans. It is run jointly with its main site at Rekkem which is a couple of miles away inside the Belgian border.
Rail operations	Delcatrans operates the two terminals and sub-contracts rail operator IFB to provide traction for their services but it is Delcatrans who deals with the customer. There are 11 weekly services, with 2009 throughput at both sites of 46,000 TEU, all port flows.
Relationship with ports	It is just a normal inland terminal with no specific relationship with any port. There are services to the ports of Antwerp, Zeebrugge and Rotterdam. Delcatrans deals primarily with the shipping lines, in terms of container throughput, bookings and management.
Logistics	Delcatrans provides logistics services when customers require, and it has some sheds onsite at sister site Rekkem but it is a small business. Most of the customers, but not all, use the full door-to-door service, but take the container offsite. Its core business is trucking; terminals are part of the business, but as the focus is on the door-to-door service, it is difficult to separate them in terms of profitability. Delcatrans also runs a 50,000m^2 freight village next door to Rekkem. About 5% of its customers use the freight village. The others take the containers to their own warehouses.
Other comments	Initially Delcatrans only ran another site (Rekkem, just inside the Belgian border), but Mouscron/Lille (just over the French border) was not making money and Delcatrans took it over. In terms of integration, Delcatrans finds it is easier for the terminal to be independent. It works in partnership with companies like IFB but the interviewee says that they have no need of integration.

Discussion

In these two cases, the relationship between ports and inland terminals is independent but not antagonistic; the large Northern Range ports do not have any direct relationship with these small terminals. The fact that IFB operates a large rail terminal (Mainhub) inside the port of Antwerp means that a degree of operational integration is possible, although the port itself has no direct involvement in the terminal.

These two sites were chosen for study because they are called "dry ports" (and the third site Rekkem is linked to one of these) and have been quoted in other literature as such (FDT, 2009; Roso & Lumsden, 2010). Therefore the aim was to investigate this claim as a means to scrutinise the use and meaning of this term. It was found that neither of the two sites calling themselves "dry ports" fits the Roso et al. (2009) dry port vision of an integrated extended gate type operation, and Muizen does not offer customs clearance, meaning that it does not fit the original UN definition of an Inland Clearance Depot. Both are small common-user terminals with little relation to the ports. Interestingly, the interviewee at Delcatrans wondered why I had any interest in Dry Port Mouscron/Lille as Rekkem is their main site.

These two small intermodal terminals benefit from the subsidised operations of national rail operators. IFB is subsidised by the national rail operator so Muizen is indirectly subsidised, both the terminal operations and the services using it. Similarly, the Delcatrans operation at Mouscron/Lille and Rekkem is indirectly subsidised as it relies on the rail services provided by nationally-subsidised operator IFB.

5.3.3 Venlo, Netherlands

Introduction

Rotterdam is the busiest container port in Europe and the tenth busiest in the world, with a throughput of 9.7m TEU in 2009 (Containerisation International, 2012). Besides calls from the major deep sea lines, the port also offers feeder services to ports all over Europe. Rail, barge and road transport link the port with customers throughout Europe, far beyond its immediate hinterland. However, in common with other large ports, in recent years Rotterdam has experienced congestion problems as a result of its growth, resulting in a number of developments to improve its hinterland access. This case study will focus on the major terminal operator within the port.

As well as conventional rail lines to inland sites, the port of Rotterdam is also the western terminus of the Betuweroute, a multi-billion euro rail line to Germany financed

by the Dutch government. This double-tracked, double-stacked electrified line is expected to have a major impact on Rotterdam's access to German customers in the future.

Europe Container Terminals (ECT) began operation in Rotterdam in 1966, and was bought by HPH in 2002. Its throughput in Rotterdam in 2009 was 5.95m TEU. ECT operates three terminals in the port: the lock-restricted ECT City Terminal close to the city of Rotterdam and two deep water terminals in the Maasvlatke development on the North Sea: ECT Delta Terminal and since 2009 the Euromax Terminal. 50% of the new Euromax terminal is owned jointly by four shipping lines: Cosco, K-Line, Yang Ming and Hanjin.

ECT operates a number of inland terminals, all linked to the Rotterdam terminals. Located near the German border (see Figure 5-4), TCT Venlo is the largest inland terminal in the Netherlands, with a 2009 rail throughput of 115,000 TEU. It offers both rail and barge connections. Over the border in Germany, ECT operates one terminal of the five on a large site at Duisburg, which offers rail and barge transport. The DeCeTe Duisburg site handled 184,000 TEU in 2009. Two smaller sites offer barge transport only. Moerdijk (Netherlands) is close to Rotterdam and acts in some ways as an overspill facility, handling 57,000 TEU in 2009. TCT Belgium (Willebroek) had a 2009 throughput of 76,000 TEU.

All of these terminals are operated in partnership with other companies, and ECT has been endeavouring to develop what it calls the "extended gate" concept, offering document-free passage of containers from the shipping line through the port to the inland location. Carrier haulage is less than 20% of their throughput, therefore merchant haulage is very important; ECT is developing the concept of "terminal haulage." This case study is focused on Venlo, as it is the primary exponent of the extended gate concept. ECT terminals at Rotterdam and Venlo were visited and interviews conducted with site managers.

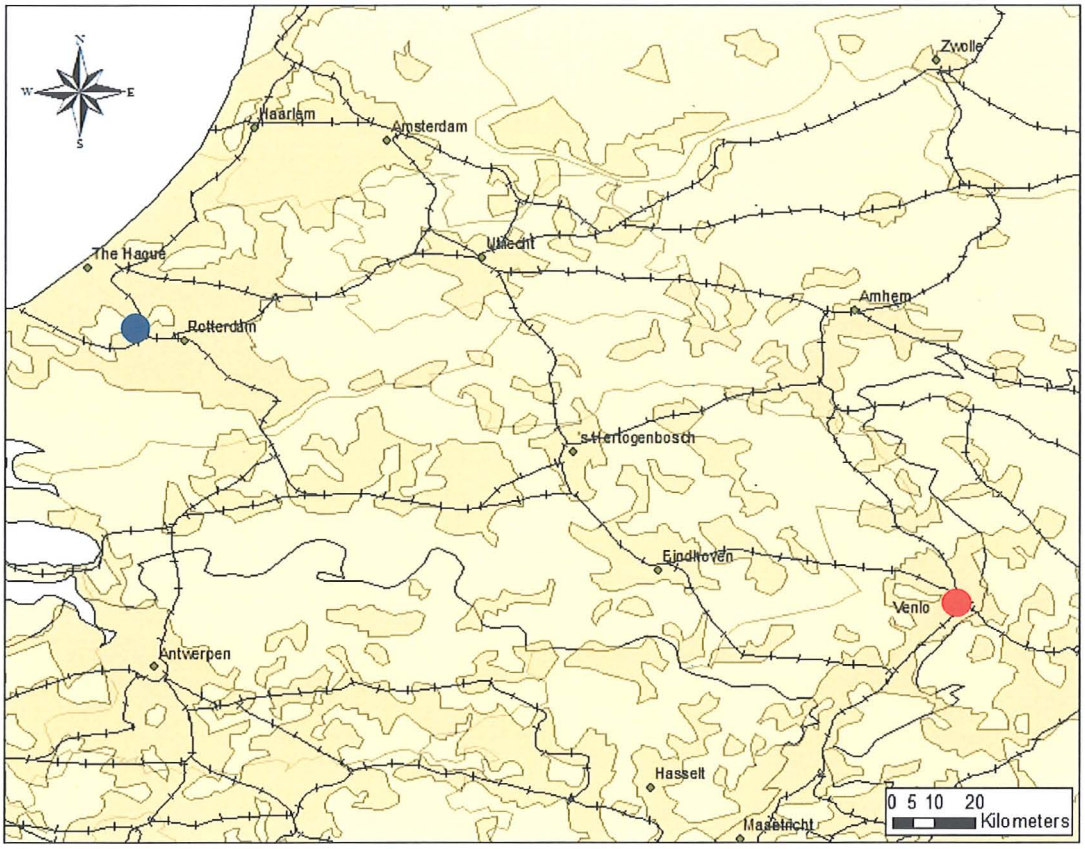

Figure 5-4. Map showing locations of the port of Rotterdam and the inland terminal at Venlo

Source: author

Case study

Table 5-7. Case study table: Venlo

Development	Opened in 1992, with about 15-25% of investment coming from the national government. The regional government was also a shareholder. Otherwise a private initiative and majority owned by ECT.
Rail operations	ECT is the majority owner as well as the operator of the rail terminal. The services are run as a closed loop "extended gate" system between the port terminal and the inland terminal, managed by ECT with sub-contracted traction. This is in contrast to the Venlo barge, which is independent, and Duisburg, where the local freight forwarder runs the train. 2009 rail throughput of 115,000 TEU.
Relationship with ports	Full integration as the port terminal operator ECT owns the inland terminal at Venlo. 20 trains per week with Rotterdam.
Logistics	ECT has a 50/50 joint venture with Seacon Logistics to operate the adjoining freight village.
Other comments	There was no industry in the area at the time; it has grown with the business, and indeed the terminal was built with warehousing nearby in order to develop this business. This was why they considered it crucial to have a partner on the logistics side. The partnership is successful because, according to Seacon, "ECT thinks in terms of containers, while we think in terms of the contents". The "extended gate" system is an interesting example of the port operator taking direct involvement in hinterland flows. ECT does all the booking. They have scheduled services and it is up to ECT to organise the containers on each one. However, ECT can cancel a train if they don't need it. It is all run from Venlo; the operator there will tell the port which containers they need and which train to put them on. Their computer system shows every container on each deep sea vessel, when they are unloaded and where they go. The operator at Venlo can see if the containers he is expecting are not ready to go on the train so he can rearrange schedules where required. Likewise, customers can look up their containers at any time and see exactly where they are. Some customers say they want a specific train, while others just want the container at a certain destination by a certain time and leave it up to ECT.

Discussion

ECT has been using the extended gate concept since around 2007. There have been a number of problems with documentation in terms of using the extended gate concept. Firstly the operator must be authorised (Authorised Economic Operator) to move containers on behalf of the client. At Venlo they worked on an EU-funded project called INTEGRITY which investigated customs clearance with no checks all the way through the chain. If Seacon is doing the logistics then it is easier for it to plan and manage container movements including documentation because it has knowledge of where the final destination is and other information. Other bottlenecks that need to be overcome are the time taken to book a container on a service, who makes that decision and when.

The development of the Venlo terminal by port terminal operator ECT is a particularly interesting example of a port regionalisation strategy. Operational issues (primarily port congestion) have driven the port actor to develop a hinterland strategy, but they have chosen to integrate fully through acquisition of the intermodal terminal (the logistics park is a joint venture) rather than through a joint venture or contractual situation as is more common elsewhere. They have developed a model of terminal haulage rather than carrier or merchant haulage, which results in greater efficiency within the closed system.

Notteboom and Rodrigue (2009) noted that the success of such an integrated haulage concept depends on the visibility of cargo in the transport chain. By integrating not only the port and the inland terminal, but also the logistics operation through a joint venture, ECT is able to combine knowledge of the primary and secondary haul requirements, which enables better planning of cargo movements. Veenstra et al. (2012) provided more detail on the information sharing within ECT's extended gate system.

Rodrigue and Notteboom (2009) have discussed how terminals can be used to move beyond push or pull logistics to "hold" logistics, absorbing time in the supply chain, and that is what is being done at Venlo. In this way, they are able to align the system requirements arising from container management, cargo transportation requirements that drive demand for those containers, and the requirements from the supply chain in which the cargo is embedded. All of these issues then need to be aligned with the vessel management imperative of shipping lines. Indeed, the container movement requirements of shipping lines can raise difficulties for inland container management, when

containers used for merchant haulage must be returned immediately to the port for repositioning by the shipping line.

Another interesting aspect of the Venlo development is that it straddles two classifications. It is a load centre serving a major source of transport demand, and the trimodal terminal is surrounded by logistics and supply chain facilities. However, the operational integration between the port terminal and the inland terminal makes the site function as a satellite terminal, operationally integrated with the container yard in the port. This kind of operation is generally more likely to be found in close proximity to the port, functioning as an overspill facility to provide an extension to operations, rather than being linked to shippers far inland.

Therefore this case study demonstrates several interesting developments in inland terminal operations and functions. However, as noted above, it still requires much work on the part of stakeholders to overcome legal and practical obstacles to achieve the full potential of the site, and then to extend the system further through ECT's other inland terminals.

Like many European countries, there is some evidence of optimism bias in government support of inland terminals in the Netherlands. The interviewees complained about terminals that have been built with government subsidy but end up not being used. According to the interviewees, in the 1990s inland terminals (the Netherlands) and GVZs/freight villages (Germany) were springing up around this part of Europe, as it is the heart of the industrial zone, but not all of them had a solid enough market to survive the current economic climate. So the interviewees raised some questions about the potential misalignment of public subsidy with market and operational realities.

5.4 Presenting the case studies 2 – inland-driven inland terminals

Introduction

Table 5-8 lists the ports in Italy with the highest container throughput, and the top five are shown in Figure 5-5.

Table 5-8. Top ten Italian ports by container throughput (2010)

Port	Coast	TEU
Gioia Tauro	South	2,851,261
Genoa	West	1,758,858
La Spezia	West	1,285,455
Livorno	West	635,270
Taranto	South	581,936
Cagliari	Sardinia	576,092
Naples	West	532,432
Venice	East	393,913
Trieste	East	281,629
Salerno	West	274,940

Source: author, based on Containerisation International (2012)

Figure 5-5. Top five Italian container ports

Source: author

Italian ports are run on the landlord model; they are publicly owned and the terminals are privately operated on a concession basis. There is no national body to coordinate them as there is in Spain. According to one interviewee, port authorities have to give most of the revenues to the national government, leaving little for reinvestment in the port; the port authority must then either obtain private investment or else ask the national government for money. Therefore there may be a misalignment of strategy between national and local scales, but that is a separate topic of research, beyond the scope of these inland terminal case studies.

Italy exhibits a distinctive model of interporti or freight villages, which are large logistics parks with attached intermodal terminals. The definitive aspect of this model is that the focus is firmly on logistics as much as transport. Almost all of these sites have had public involvement at some point in their development, and many retain public-private ownership models. Unlike most of the case studies in this research, the intermodal terminal has not been built as an independent site but has been built into a

logistics park (usually from the outset but in some cases added later), and remains a key but less significant part of the overall business at the site.

There are currently 24 members of the Italian interporti association (UIR: Unione Interporti Riuniti). Most of these sites are in the north of the country, where the majority of industry and production centres are located, close to the heart of Europe. While interporti were developed through a variety of mechanisms (see case studies), they have gradually been brought into a national planning strategy. The National Transport Master Plan (PGT) of 1986 identified first and second level interporti, and the next version in 1990 devolved responsibility to the regional level. National law 240/90 was important because it officially recognised interporti in a national network, making them eligible for national funding. In order to be considered a freight village under this law and thus be eligible for funding, the site must include an intermodal terminal. All interviewees noted the importance of this law, although there was disagreement on whether the money was distributed fairly and indeed how much each had received. According to the official figures, a total of 533m euros was spent by the national government on all the interporti between 1992 and 2003 (UIR, 2009).

The five freight villages visited for this research are shown in Figure 5-6.

Figure 5-6. Map showing the five Italian freight villages

Source: author

Case studies
Interporto Sud Europa, Marcianise

Table 5-9. Case study table: Marcianise

Development	Opened in 1999. Developed with mostly private money although did receive some federal grants (although amount is disputed). Owned and operated by private company Interporto Sud Europa.
Rail operations	Interporto Sud Europa owns Rail Italia (which runs the terminal) and Rail Services Logistics (which operates the trains and deals with the clients). As well as the large terminal within the site, there is a very large marshalling yard (the biggest in Italy) operated by national operator RFI/Trenitalia just outside the terminal. They will handle trains by any operator but currently the trains are run by their own operating company Rail Services Logistics. They are trying to have an integrated service between their own or partner terminals but it is difficult to compete with the nationally owned operator Trenitalia due to their government subsidy. Precise details on current services were difficult to obtain, but despite a very large intermodal terminal they run only a handful of services, with container throughput estimated at below 10,000 TEU.
Relationship with ports	There are currently no services to ports, although there was a service with Naples in the past. The interviewee noted that they have had difficulty establishing good relations with ports. The interviewee felt that the ports do not cooperate and will only do so if they are very congested and have no choice. When the interporto did work with the port, it was the terminal operator not the port authority with whom they worked.
Logistics	As with all the interporti, logistics is the main focus; this site concentrates on industrial and manufacturing clients.
Other comments	The site is not yet complete so there is a large amount of land still to be developed. The interviewee said that the shunting yard outside the site was built with EU funding with the intention of linking to the port of Gioia Tauro, but this traffic did not develop.

Interporto Campania, Nola

Table 5-10. Case study table: Nola

Development	In 1989 the National General Transport Plan identified the need for a freight village in the Campania region. Interporto Campania is a private company that was awarded the right from the region to build and operate the site, which was opened in 1997. The rail terminal was opened in 2006.
Rail operations	The terminal is operated by Terminal Intermodal Nola, which is owned 60% by Interporto Campania and 40% by Galozzi (the operator of Salerno port). They also started their own train company Interporto Servizi Cargo in 2009 which both provides traction and deals with customers. That is the only company currently running trains there but others can if they want. 2010 throughput was 25,250 units or approximately just over 40,000 TEU. There is also a very large shunting yard, just outside the terminal but within the overall site boundary, owned and operated by national operator RFI/Trenitalia.
Relationship with ports	A daily container service runs to the port of Naples. The terminal operator is building a closer integrated relationship, and the operator of the rail terminal at the port of Naples is owned jointly by the Naples port authority, Interporto Campania and national operator Trenitalia so there is some vertical integration there.
Logistics	As well as the interporto, there is a large wholesale distribution centre built in 1986 (Centro Ingrosso Sviluppo - CIS). Many customers use both the CIS and the interporto. As with all the interporti, logistics is the main focus; this site concentrates on retail and wholesale clients. It is mostly in-house logistics provided here rather than by 3PLs like at Marcianise.
Other comments	Much of the rail freight is for customers at the site, but the interviewee said that probably the majority goes outside the site. The terminal handles a mixture of containers and swap bodies on their services with Bologna, Milan and Verona, whereas their Naples service is 98% containers. It is interesting that the only port service is with the port of Naples, and the rail terminal at the port is partly owned by the Nola interporto. However, the rail terminal at Nola is partly owned by the port of Salerno, with no investment from the port of Naples.

Interporto Bologna

Table 5-11. Case study table: Bologna

Development	Opened in 1980. It was mostly public money at first to set up the site, while private investors came later. Ownership of the company is 35% the municipality of Bologna, 18% the province of Bologna, 6% the Bologna chamber of commerce, 23% of shares are held by banks, 16.5% by private companies and 1.5% by Trenitalia.
Rail operations	Interporto Bologna owns the freight village but national rail operator Trenitalia owns the two large intermodal terminals, and they are operated by Terminali Italia (the terminal operating arm of RFI/Trenitalia). Interporto Bologna is planning a new intermodal terminal that it will own and run. This is to overcome problems it is having with Trenitalia Cargo. These problems were described as twofold: as operator, Trenitalia is cutting services, and as the infrastructure provider, it is not investing. Trains to the site are run by third-party operators. In 2010, the terminal handled 190,000 TEU, with mostly inland origins and destinations.
Relationship with ports	Just a normal inland terminal with no specific relationship with any port. They have direct services with the ports of La Spezia, Livorno, Ravenna and Ancona, and via Piacenza to Rotterdam and Zeebrugge. The interporto has agreements to collaborate with ports. When they have done this, it has been with the port authority rather than the terminal.
Logistics	As with all the interporti, logistics is the main focus. The majority of users of the intermodal terminal are outside the freight village. However, the aim of the interporto is to get more customers to use rail.
Other comments	While the aim of the interporto is to get more customers to use rail, it is not a requirement for site customers that they must use it if they locate here.

Interporto Quadrante Europa, Verona

Table 5-12. Case study table: Verona

Development	Consorzio ZAI is a fully public company that owns and operates the site (three shareholders: town, province, chamber of commerce). The interporto was built in the late 1960s, with the rail terminal built in 1977. Consorzio ZAI is like a port authority; it does not run anything in the site, but just manages it. The aim is not to maximise profit but to develop logistics infrastructure in the region, therefore profit is re-invested in the company. It builds the infrastructure and rents the warehouses to clients.
Rail operations	Two main intermodal terminals are owned by Quadrante Europa Terminal (owned 50% by Consorzio ZAI, 50% by RFI/Trenitalia) and operated by Terminali Italia (part of RFI/Trenitalia). There are also two small ones. Trains are run by third-party operators. The vast majority of traffic is swap bodies rather than containers, so it is almost all internal European traffic. There is very little port traffic. In 2010 the site handled 327,433 units (equating to 480,017 TEU by their calculations).
Relationship with ports	Just a normal inland terminal with no specific relationship with any port. Most of their traffic is intra-European; the only port with a direct service is La Spezia.
Logistics	As with all the interporti, logistics is the main focus; but they are like a port authority and don't deal with users directly.
Other comments	About 80% of their intermodal traffic goes to customers outside the site.

Interporto Rivalta Scrivia

Table 5-13. Case study table: Rivalta Scrivia

Development	Developed initially in 1963 as a "dry port" for the port of Genoa, so there was a specific focus on clearing customs inland as the port was congested, although it was not possible to get more detail on what was meant by that designation. This is in contrast to the other interporti. Interporto Rivalta Scrivia is fully privately owned (68% Fagioli Finance, 22% F21 logistics, 8% by other private companies and 2% by the region). The rail terminal opened in 2006 and is owned by Rivalta Terminal Europa, which is itself owned 47.87% by Interporto Rivalta Scrivia, 47.87% by the Gavio Group, and the remainder is owned by public partners: the Piemonte region, the port authority of Savona, the province of Alessandria and the township of Tortona.
Rail operations	Rivalta Terminal Europa owns and operates the terminal, and is also involved in booking slots and selling the train services to customers. The rail operators are just traction providers. About 90% of their rail business is from ports, especially the port of Genoa, 75km away, and of that, about 90% is from Voltri Terminal Europa. Maritime containers are their main equipment. This is different to the others which handle mainly swap bodies. Throughput in 2010 was approximately 150,000 TEU.
Relationship with ports	Direct services to the ports of Genoa, Savona and La Spezia. Currently managed through contracts but they are discussing a potentially closer collaboration with the ports. The interviewee said that the port is considering becoming a shareholder in the site. The terminal deals with the port terminal (Voltri) rather than the port authority, as well as shipping lines. The method of service development is by way of contracts rather than full integration. The most important client of the terminal is the shipping lines.
Logistics	As with all the interporti, logistics is the main focus, but the difference here is that Rivalta Scrivia is a logistics operator so they deal directly with the clients rather than 3PLs doing it. This is the reason, according to the interviewee, that most of its rail traffic is for the site customers whereas for other sites most of the rail throughput is for customers

	outside the site. The terminal mostly attracts the business of big companies, mainly shipping lines (therefore carrier haulage): e.g. CMA CGM, Maersk, MSC.
Other comments	There are problems with congestion at the port of Genoa therefore rail can compete over this distance. In addition, the port is surrounded by mountains, which makes road haulage less attractive. A new intermodal terminal is being built, with the goal of an estimated capacity of 500,000 containers annually (double the current capacity). Unlike the current intermodal terminal which is inside the interporto border, the new larger terminal is just outside.

Discussion

Freight villages in Italy can get public funding due to being designated an official freight village (and meeting the conditions) under the 1990 law, but it was difficult to get a clear answer from any of the interviewees on the specifics of the funding award process. Many sites were built long before the law came into being so they did not receive money in their start-up period. The amount of government money depends on meeting certain criteria so each project has to justify its request to the Ministry of Transport. However, although it is a national law, the sites are developed at regional and local level. The sites are naturally jealous of each other's receipts of funding from the national level. Most sites were publicly planned (the most common model is PPP), but unusually, Verona is fully public. There are currently 24 freight villages in the association, and the government is in the process of drafting a report to update the 1990 law.

An opportunistic interview was obtained with the operator of a distribution company for hardware/DIY/homewares, who imports 95% of his product through the port of Salerno (from Asia, mostly China). He distributes in southern and central Italy, solely by road. "Rail does not exist in Italy," he said. He said that road regulations are not adhered to in Italy, resulting in many overweight trucks and long driving hours. He fills his containers completely rather than using pallets because that would leave empty space in the container. Using pallets would be more convenient but would cost more

due to this wasted space. There is no problem taking these over-filled containers on the road because he says that hauliers do not adhere to the regulations.

One interviewee at a freight village expressed deep scepticism about the potential for intermodal transport to develop in Italy. There are only a few shipping lines competing for the sea leg, but he said there are 200,000 transport companies in southern Europe alone. He estimated that France and Germany each have about 35,000 transport companies, whereas Italy has about 100,000. Therefore the system is much more fragmented. Moreover, a lack of regulatory oversight, illegal driving hours and overloaded weights makes it very difficult for rail to compete with road. If a normal distance for rail to break even is about 350km in northern Europe, it was suggested that in Italy it is 600km because of these problems. Even within companies, departments are very fragmented so it is hard to put together a new transport model. The potential for Gioia Tauro to be a significant gateway for Italian traffic is constrained because the shipping lines don't want it to be, the interviewee said.

One interviewee said that Europe has many small sites, but not a proper linked system of infrastructure with major nodes, therefore what is needed is a system of major hubs linked by regular shuttles like a road system. Rail used to be a single national body with knowledge of all the network, brownfield sites, old rail heads, etc. so they were better at utilising assets cheaply and making it work. Now this knowledge has been lost due to fragmentation and the break up of organisations and institutional knowledge. According to this interviewee, this is a big obstacle to the development of intermodality. He also said that a rail company doesn't look at it from the logistics perspective and vice versa. He feels that it is very difficult to put all the relevant views together and integrate strategic infrastructure with population zones, O/Ds, etc. but on the other hand, government planning is not enough; the private sector is also needed.

The Rivalta Scrivia freight village in the hinterland of the port of Genoa has high port traffic and it is even working towards a potential trial of an extended gate concept (for more detailed discussion see Caballini & Gattorna, 2009). The terminal has a good relationship with the port, unlike many other freight villages in Italy, but this is because the port needs the inland node due to its congestion issues. This is not the case with other ports in Italy. The port of Naples has problems with congestion and long dwell times, and Iannone (2012) showed that it can actually be cheaper to send the container by rail to an inland node even at relatively short distance, due to the saving of dwell

time charges. However, problems of fragmented transport operators and the inability to build cooperation between organisations have prevented these services from prospering.

A key point to note when discussing freight villages as integrated sites is that, firstly, the general model is for the intermodal terminal to be operated by a separate company, and secondly, the terminals are common-user facilities, with some shippers located within the freight village and some not. Indeed, the majority of the rail traffic at large freight villages such as Bologna and Verona is actually for companies outside the site. Rivalta Scrivia proves an exception to this rule, as the operators of the site work directly with the shippers located there rather than through 3PLs.

5.5 Analysing the case studies

The use of a thematic matrix was established in the methodology chapter, with factors based on the literature review. All the data were reviewed and relevant information was entered into the individual matrices that were constructed for each case. The meta-matrices presented below have collated the key data from each case, facilitating cross-case analysis. The data collection, primarily through interviews but supplemented with document analysis and observation, was guided by the pre-determined factors. Thus, while the analysis proceeds by induction, a strict grounded theory approach is not followed here.

Table 5-14 and Table 5-15 set out the thematic meta-matrices, with the relevant data noted against each factor.

Table 5-14. Key features of the inland terminals (port-driven)

Country	Location	Owned	Operated	Customs onsite	Logistics in same site	Driver (organisation)	Driver (public/ private)	Relation with port	Method of integration with port	Info sharing	Who controls rail operations
Spain	Azuqueca	Mixed	Private	Yes	No	Port authority/private investor	Mixed	Med	Partial investment	Med	Rail operator
Spain	Coslada	Public	Private	Yes	No	Port authorities/region/ municipality	Public	Med	Partial investment	Med	Rail operator
Spain	Zaragoza	Mixed	Private	Yes	Yes	Port authority/private investor/region	Mixed	Med	Partial investment	Med	Rail operator
NL	Venlo	Private	Private	Yes	Yes	Port terminal operator	Private	High	Ownership	High	Inland terminal

Table 5-15. Key features of the inland terminals (inland-driven)

Country	Location	Owned	Operated	Customs onsite	Logistics in same site	Driver (organisation)	Driver (public/ private)	Relation with port	Method of integration with port	Info sharing	Who controls rail operations
Belgium	Muizen	Public	Public	No	No	Rail operator	Public	Low	None	Low	Rail operator
France	Mouscron/Lille	Private	Private	Yes	No	Region	Public	Low	None	Low	Inland terminal
Italy	Marcianise	Private	Private	Yes	Yes	Private investor	Private	Low	None	Low	Rail operator
Italy	Nola	Private	Private	Yes	Yes	Region/private investor	Mixed	Med	Joint ownership of rail terminal in port	Low	Rail operator
Italy	Bologna	Mixed	Mixed	Yes	Yes	Municipality/region/ private investor	Mixed	Low	None	Low	Rail operator
Italy	Verona	Public	Public	Yes	Yes	Municipality/region	Public	Low	None	Low	Inland terminal
Italy	Rivalta Scrivia	Private	Mixed	Yes	Yes	Private investor	Private	Med	Contracts	Med	Rail operator

The meta-matrix has been divided in two, one for port-driven terminals and one for inland-driven. These labels were used based on the discussion in the literature review, where the two classes were established. However, it was found in the analysis that, not only is it difficult to claim with certainty which organisation took the lead in a development process, in many cases even the "port-driven" sites were not actually led by the port actor. However, the terminology will be retained during the discussion, as that was how the data collection and analysis were structured.

Some cases that were selected under the port-driven category were in fact not developed by ports. Dry Port Muizen and Dry Port Mouscron/Lille were both selected because they call themselves "dry ports" and Muizen was included in the Roso and Lumsden (2010) review of "dry ports". Findings from the research revealed that these sites were actually developed by inland actors, either rail operators or regions, so they have been put into the second matrix along with the freight villages. Yin (2012) discussed how to deal with cross-case synthesis processes when the actual cases turn out to be different from what was thought during the screening process. It is possible to analyse the cases as theoretical replicants ("predicted to have different experiences, but with conceptually consistent explanations" [p.146]) rather than direct replicants ("predicted to follow courses of events similar enough that they repeat or replicate each other's experience in a conceptual, not literal, sense" [p.146]).

Beginning with the port-driven terminals, results show that Venlo was an example of a terminal driven by a private port terminal operator, while all three terminals in Spain were examples of terminals driven primarily by public port authorities. The cases have shown that the Venlo case has been arguably the most successful. The port terminal operator is directly involved in the operations at the inland terminal, whereas the port authorities are not. Not only is the terminal operator ECT involved in the intermodal terminal, but a 50% joint venture in the logistics park means greater information sharing is possible. There is therefore a possibility of developing different conceptual models according to whether the port actor is the authority or a terminal operator. Ports can use a variety of mechanisms to coordinate the hinterland transport chain and thus reduce transaction costs (de Langen & Chouly, 2004; Van der Horst & de Langen, 2008; Van der Horst & Van der Lugt, 2009), but full integration is rare, and thus stands out as an innovative development. Venlo represents an attractive hinterland access strategy, but many institutional, operational and legal difficulties prevent comparable developments elsewhere (Veenstra et al., 2012).

In Spain, public port authorities are involved in inland terminal development, yet despite their heavy marketing of this fact, in none of these sites do the port authorities own a majority shareholding or direct the operations. By contrast, ECT is a private port terminal operator actively integrated with the inland site. While in all the cases above a port actor is involved to some degree, the results reflect the difficulty for a port authority (and, to a lesser extent, a port terminal operator) to exert influence beyond the port's perimeter (de Langen, 2008; Moglia & Sanguineri, 2003). The underlying theme is that port actors want improved inland access to further their business aims but they can rarely be said to be driving these developments. In most cases the port actor is a partner in someone else's plan. Similarly, with the exception of Venlo, all inland terminals in the above sample are independent from the port. It would therefore appear that the trend towards vertical integration between shipping lines and port terminals has not extended inland to any significant degree, at least in this sample.

Frequency counts are not relevant in this kind of analysis as statistical inferences may not be drawn from a theoretically-driven sample. However, Table 5-14 and Table 5-15 reveal the expected result that the port-driven inland terminals in this sample have a higher level of port involvement. Table 5-14 shows that in the Venlo case the port terminal operator owns the terminal rather than a minority shareholding; it therefore has a close relationship with the terminal and information is shared via their container management system, as discussed in the case study. Furthermore, the rail operations are managed via a sub-contracted traction provider, which means that a closed system operates between the port terminal and the inland terminal. In none of the Spanish cases does this kind of operation exist. The inland terminals are independent from the port and the rail operations are on a common-user competitive basis, just as with any intermodal terminal; they are not integrated with the port in any meaningful way beyond conventional practice.

While the cases have shown that ports can actively develop inland terminals, the analysis has revealed that the reality in practice is often overstated. Of the six sites identified from the literature as port-driven, two (Muizen and Mouscron/Lille) were not developed by ports at all, while three (the Spanish sites) have minority port investment, but are otherwise run as conventional inland intermodal terminals. Only Venlo can be considered a genuine port-driven site or a genuinely distinct regionalisation strategy. Therefore questions are raised about the ability or actuality of ports integrating with inland terminals.

By comparing Table 5-14 and Table 5-15, it can be seen that there is a difference between terminals developed by port actors and those developed by inland actors. In all of the port-driven cases, the port actor does have some investment in the inland terminal, although it differs between each one. Likewise, the operational relations are higher in the port-driven group, as would be expected. However, the inland-driven group have no investment from the port and low operational cooperation. A likely explanation is that if a port actor is involved from the beginning in developing an inland terminal, then motivation exists to maintain a good relationship to achieve the operational efficiencies or other benefits that were the motivation for the initial investment. Whereas if the port actor is not involved from the beginning, then inland actors struggle to obtain port involvement later. Further explanation of port motivations for inland investment and cooperation and the limitations on their ability to do so would require additional research on ports, which is beyond the scope of this thesis.

Table 5-16 groups the cases by the main driver, in order to follow a pattern-matching procedure to look for conceptual groups.

Table 5-16. Four models of inland terminal development

	Driver			
	Port authority	**Port terminal operator**	**Rail operator**	**Public body**
Cases	Coslada Azuqueca Zaragoza	Venlo	Muizen	Mouscron/Lille Nola Marcianise Bologna Verona Rivalta Scrivia
Government role in development	Some regional and local government investment	There was some national government subsidy in the initial development of the site and some share ownership by the regional government	The government was not directly involved but the rail operator who developed the site is nationally owned	Most were developed by the regional or local government, but some had majority or total private investment
Government role now	Regional and local government retains some investment	Regional government retains some investment	Indirect subsidy of national rail operator	M/L: none Italy: all the sites developed by government retain a percentage of local/regional government investment, but the level varies. Also, since the 1990 federal law, federal funds are available for all, even privately-developed sites
Port role in development	Port authority investment and initial impetus	Port operator was main investor in the inland terminal	None	None except Rivalta Scrivia, which was developed as a "dry port" from the beginning

Relations with port	Good relations and info sharing but no direct integration	Port operator owns and operates the inland terminal and manages the rail services (with sub-contracted traction)	Just standard operational relations	Low at all except developing good relations at Rivalta Scrivia, and some integration of rail operations between Nola and the port of Naples
Rail operations	Third party, no specific integration or cooperation	Managed directly by use of sub-contracted traction, closed loop, extended gate	Terminal owner/ operator is one arm of the national rail operator and it handles trains of any company, including the rail operating arm of its own company	M/L: terminal owner/operator handles trains of any company, including its own (sub-contracted traction) Italy: terminal operations operated by different companies at each site, mostly either owned by the interporto or the national operator RFI/Trenitalia Terminals will handle trains from any company, although in some cases the main operator is owned (at least partly) by the interporto

Logistics role	Coslada: freight village next door Azuqueca: surrounded by logistics/ warehousing of individual companies Zaragoza: situated within logistics park	Port terminal operator has a 50% JV in the adjoining freight village	None	M/L: low. The operator provides logistics as well as transport services but it is only a small company Italy: high. All sites are primarily logistics parks
Motivation for building site	Hinterland capture	Hinterland capture as well as improving port operations to reduce congestion. Also the port of Rotterdam requires a certain level of containers to go by rail	An operational decision, to serve customers in that region	M/L: current owner did not develop the site but it is speculated that it was to support local/regional businesses Italy: support local/ regional businesses. Rail use is more important now as they must have a rail terminal to meet the criteria of the 1990 law allowing federal funds

The pilot study in Falköping would fit into the fourth category above, being developed by a municipality. It is difficult to draw definitive conclusions from the data in Table 5-16, as more cases are required. However, it can be seen that port-driven terminals take different forms, whether they are driven by port authorities or port terminal operators. It appears from the cases above that port terminal operators are better placed institutionally to forge a closer relationship with the inland site due to their ability to integrate operationally, while a public port authority cannot. This underlies the requirement for information sharing through logistics operations. However, this is

difficult, and hence most port-driven terminals may be expected to have a purely transport focus, i.e. to get the container out of the port as soon as possible rather than any true operational integration.

The role of all intermodal terminals in this context is the transport function of changing mode between road and rail. However, as load centres serving zones of production or consumption, which is the point of bundling container flows on high capacity links, logistics is important. Locating a terminal within a logistics site is one way to improve the feasibility of the services, by removing the last mile. The Italian sites were all built to this model, although the take-up of the rail services has varied. In most cases they have struggled to attract port traffic.

All rail terminals at the Italian freight villages were much larger than the sites in the port-driven category, sometimes with more than one terminal within the site, including over 10 tracks in some instances and also with lengths up to 800m per track. Therefore these sites are designed for very large rail traffic, making them quite different to the smaller sites in the port-driven category. The majority of the traffic is domestic European traffic, however. The three northern freight villages with regular intra-European traffic had very high intermodal throughput (including both containers and swap bodies), whereas the two southern Italian freight villages, despite large rail terminals, had very low traffic.

It is not necessarily that inland-driven terminals are logistics-focused, but that port-driven terminals are less likely to be so, due to institutional and operational reasons. It may be that logistics tends to be more important for those sites developed by public bodies, as the aim is to support businesses, but further research is required. In the Italian cases, the majority of users of the intermodal terminal were not in fact site tenants, which was an unexpected finding. More detailed analysis of this point would be valuable.

Results from field work in Italy showed that the freight village concept is good for logistics, but has had very little success integrating with ports. Indeed, even getting rail traffic at all is not easy due to the road-dominated and fragmented Italian logistics system (Evangelista & Morvillo, 2000), and some freight villages have very large intermodal terminals with very low rail traffic. "Rail does not exist in Italy" was the comment of one shipper. Yet this is not the entire story, as was already illustrated in the comparison above between the ports of Genoa and Naples in respect of their relations with inland terminals.

All of the inland-driven terminals were developed predominantly by the public sector. Most were developed by the regional government, although most of the Italian freight villages have had some private investment. In Muizen, it was the publicly-owned rail operator that initially developed the site, although now the terminal operating arm of the company is operationally separate from the rail operating part, due to the EU directive on liberalisation. It is interesting that, for all terminals that had direct government involvement, the scale of government was predominantly regional rather than national.

A potential conflict can be identified between two broad conceptual groupings: on one hand a port-driven, operationally focused, potential satellite terminal/extended gate concept and on the other, a public-sector-driven load centre concept. A lack of integration between port and inland systems was observed, and even antagonism suggested by many inland terminal interviewees. While more case studies of alternative practice are required, the case studies in this chapter show that even in instances where port-inland integration is desired, the actuality is rare and, except for Venlo, only focused on the transportation function (i.e. moving the container inland), whereas the logistics and supply chain functions are more the interest of inland actors. Even the success of the Venlo example requires further legal and practical barriers to be overcome before its potential can be reached.

Thus the first three findings from this analysis are that ports can develop inland terminals, there are different ways of doing it (i.e. port authority or port terminal operator) and, finally, that differences have been observed between port-driven and inland-driven sites. The fourth finding from this chapter is the role of the "dry port" concept.

To begin with, two of the "dry ports" (Muizen and Moscron/Lille) were not developed by ports and retain no port investment or operational involvement. The other two "dry ports" (Azuqueca and Coslada), while they were at least partially driven by port investment, are common-user terminals with competitive rail operations, so there is no extended gate system or port actor controlling the rail operations. Table 5-15 shows that one "dry port" (Muizen) does not even have customs, so it does not even fit the original dry port definition which is that it should provide inland clearance. While the use of the "dry port" terminology by these sites is inconsistent, the "extended gate" operation at Venlo is the only "consciously implemented" terminal in this sample.

Indeed, it can be considered the only example of a true port regionalisation strategy of all the cases analysed in this chapter.

Dry Port of Coslada/Madrid, Dry Port Azuqueca, Dry Port Muizen and Dry Port Mouscon/Lille all use the term "dry port" but they function differently. IFB (the operator of Muizen) runs terminals but it just handles the trains of other companies (including trains of a separate part of their parent company IFB Intermodal). At the Delcatrans terminals (Mouscron/Lille and Rekkem), a rail operator is sub-contracted to provide the traction but Delcatrans does all the bookings and container management. So these two terminal types are a contrast, but what they have in common is that no port actor is involved in any of their operations.

What is even more curious is that Delcatrans runs two sites in conjunction: LAR Rekkem (on the Belgian side of the border) and Dryport Mouscron/Lille, just on the French side. The two sites are only a few miles apart and are run jointly. Dryport Mouscron/Lille was set up by the regional government and went out of business before being taken over by Delcatrans. It is called a "dry port" because of its initial naming, but both sites are the same – simply small intermodal terminals with a couple of rail tracks and some warehousing nearby. Indeed, the interviewee expressed curiosity that I had any interest in Mouscron/Lille as it is the smaller of the two sites and the main Delcatrans office is at Rekkem.

The Swedish example can also be considered because it has the stated intention of "becoming a dry port for the port of Gothenburg." This expression was used by the interviewee in the context of achieving close integration with the port, understanding the "dry port" term in similar fashion to Roso et al. (2009), whereby the inland terminal is "consciously implemented" by the port, becoming potentially a satellite or extended gate. The interviewee noted that they do not consider themselves a dry port for the reason that this integration has not been forthcoming.

Neither the two Spanish sites, nor Muizen or Mouscron/Lille would be considered "dry ports" using the Roso et al. (2009) definition. In none of these sites do "the seaport or shipping companies control the rail operations" (Roso et al.; p.341). In only the Spanish cases can the port be said to have "consciously implemented" these sites. Yet these four sites use the term in their site names and three of these sites (Coslada, Azuqueca, Muizen) were included in a review of "dry ports" (Roso & Lumsden, 2010).

The distinctive aspect of the Roso et al. (2009) definition seems to be the close link between the port and the inland site. The matrix in Table 5-17 presents one way of categorising such developments, applying a pattern-matching process.

Table 5-17. Matrix showing different levels of integration in port-inland systems

Does the port actor manage the inland haulage, i.e. container slots, sales, etc.	**Port involvement in the terminal**	
	Yes	**No**
No	Coslada/ Madrid Azuqueca Zaragoza	Muizen Mouscron/Lille Nola Marcianise Bologna Verona Rivalta Scrivia
Yes	Venlo	

Both Spain and Venlo give examples where the port is involved. The difference is that in Spain it is the port authority, whereas with Venlo it is the terminal operator ECT. Furthermore, in the case of ECT, the port terminal is directly involved in the operations, unlike in Spain where it is just a minority shareholder. Consequently if one asserts that the dry port concept involves an integrated service offering, it is exemplified more by ECT's extended gate concept than by those sites using the dry port terminology. ECT is developing the concept of "terminal haulage" as opposed to the already understood notions of merchant or carrier haulage. Similarly, the port of Valencia has been working on increasing integration with Coslada by developing a port community system to share information in a single unified system, but at this stage it is purely an information management system.

The extended gate system between Rotterdam and Venlo is perhaps the best example of the Roso et al. (2009) "dry port" definition, which envisages a combination of an Inland Clearance Depot (ICD) with a freight village, incorporating extended gate integration with the port operations. Interestingly, ECT does not use this terminology, preferring instead the "extended gate" term. Rodrigue et al (2010) classified Venlo's extended gate operation as a satellite terminal, as it is fully integrated with the port

terminal stack management and can therefore be used as an extension of the port yard or a kind of overspill system. However, unlike a simple overspill or extended yard function, Venlo is also a load centre serving a large hinterland market.

The extended gate or terminal haulage concept (as opposed to carrier or merchant haulage) has been discussed by Van der Horst & de Langen (2008), Notteboom & Rodrigue (2009) and Veenstra et al. (2012). Veenstra et al. (2012) defined the extended gate concept thus: "seaport terminals should be able to push blocks of containers into the hinterland . . . without prior involvement of the shipping company, the shipper/receiver or customs" (p.15), and they claimed that the idea whereby the seaport controls the flow of containers to the inland terminal is an addition to the Roso et al. (2009) dry port concept. However, Roso et al. (2009) do claim that "for a fully developed dry port concept the seaport or shipping companies control the rail operations" (p.341). This statement may refer to the train haulage rather than the actual decision with regard to container movement, so a potential confusion exists in the overlap between these definitions.

It was noted in the literature review that the earliest dry port definition, as well as being synonymous with ICD, made some reference to landlocked countries using the terminal as a maritime access point, primarily for customs rather than necessarily for intermodal connection. A new definition was proposed by Roso et al. (2009), suggesting that the port actor controls the rail operations, resulting in a combination of an inland clearance depot with adjoining freight village and extended gate functionality. In almost all cases in this chapter, this definition does not apply. The sole example of this level of integration is Venlo, which does not currently use the "dry port" term.

It is therefore suggested that the "extended gate" terminology be retained to refer to a specific concept of integrated container flow management between the port and the inland site. The concept of "terminal haulage" (as opposed to carrier or merchant haulage) represents a new stage of integration that could hold significant potential if technical and operational obstacles can be overcome. The extended gate terminal haulage concept can also be related to a move from push to pull logistics strategies or even "hold logistics", as outlined by Rodrigue and Notteboom (2009) in their concept of supply chain terminalisation, whereby inland terminals are actively used to manage inventory flows.

By contrast, for most interchange sites (especially in Europe), "intermodal terminal" or "inland terminal" may be better terms to describe the common denominator linking

the majority of sites; functional analyses can then focus on the activities of each node, for example whether they involve customs clearance, value-added services or overspill functions for a port. Therefore functional distinctions prove themselves to be of greater utility than overall terms.

The inland port terminology adopted in the United States is fairly flexible, focusing primarily on the intermodal terminal itself, but offering the potential to include a multiplicity of sites, including freight villages and any or all transport modes. This was discussed in the literature review, whereby Rodrigue et al. (2010) had suggested the use of this term to cover all inland freight nodes. Reservations were raised there on the applicability of this term to small European sites. It is a potentially useful term, but in usage it tends to designate large gateway sites. As the average intermodal terminal in the USA is much larger than in Europe, this does not pose a classification problem.

The Italian sites represent a distinctive model of interporti, which fit a clear model based on a national transport strategy. They also align closely with other terms as noted in the literature review: freight village, ZAL, GVZ and logistics park. There is no current academic debate on the taxonomy of these sites. The key distinction is that their primary identification is as a logistics park providing warehousing and all associated services to a range of users. The transport mode is secondary to this function. In Italy, all offer road and rail transport, while in other countries rail may not always be present. The difficulty for many intermodal terminals in Europe achieving economies of scale leads to the conclusion that aligning intermodal terminals with such freight village concepts should be an obvious way to address this problem. However, as was seen with Nola and Marcianise, developing intermodal traffic remains difficult, even with excellent facilities.

Rodrigue et al. (2010) drew useful distinctions between the functions of different sites, classifying them as satellite terminals, transmodal centres and load centres. This functional approach is similar to the close, mid-range and distant dry port model presented by Roso et al. (2009) and the later seaport-based, city-based and border-based model proposed by Beresford et al. (2012). This kind of functional approach, based on the usage of each node, has more utility than overall terms such as "dry port" or "inland port". It allows a research agenda to be developed along the lines of the purpose and usage of these nodes in the transport chains that they shape. It also focuses more clearly on the transport operations of the node, as represented in the actual terminal or interchange point, and, in addition, is more closely aligned with the infrastructure

requirements and investment in the site, particularly in terms of planning and public involvement. The "co-location" of warehousing, logistics, etc. at or near the site tends to result from a number of decisions from individual private firms, therefore attempting to include a potential multiplicity of freight villages or logistics clusters within the umbrella of the terminal concept makes classification and taxonomy development increasingly difficult. Therefore the cases in this thesis serve to strengthen the conceptual distinction proposed by Rodrigue et al. (2010), whereby transport and supply chain functions are categorised under separate taxonomies.

5.6 Conclusion: the role of inland terminal development in port regionalisation

Before discussing the relevance for port regionalisation, some findings can be drawn from the specific case analyses. Inland terminals have experienced difficulties attracting port flows unless a port actor has been involved from the beginning. The only case that can be called a true success in attracting port flows is Venlo, where the port terminal operator is directly involved in the operation of the inland terminal. A hypothesis can therefore be proposed that inland terminals developed on the basis of intermodal flows with ports can only be successful if a close operational relationship, if not full integration, with the port terminal operator is established from the outset. However, this possibility requires further research. Most interviewees noted that they experienced difficulties establishing good relationships with port actors, suggesting that port and inland systems remain separate in most instances, although again this point requires further research. How to investigate these issues further will be considered in the concluding chapter. Suggestions of integration with ports and leaving the container at an inland terminal "as if directly to a seaport" (Roso et al., 2009; p.341) can only be possible if a number of difficult obstacles have been overcome. Therefore integrated transport chains with lower transaction costs and increased efficiency are not yet the norm and may not be for some time. Parts two and three of the thesis address these issues in more depth.

Results in this chapter showed that ports can actively develop inland terminals, and differences exist between those developed by port authorities and those developed by port terminal operators. Examples were provided of both port authorities and port terminal operators directly investing in inland terminals. In the cases studied, the most successful model was the port terminal operator, and a suggested explanation was that

this is because it was directly involved in operating the inland terminal and the rail shuttles. The port authority is rarely in a position to do this, thus limiting the potential for successful inland terminal developments by port authorities. A 50% joint venture in the logistics park at Venlo provides the possibility of greater visibility of flows, which enables further efficiencies.

It was found that there are differences between inland terminals that are developed by ports with a conscious aim of hinterland capture and those that are not developed in this way. Those developed by land actors tend to focus on domestic traffic and even when they attempt to develop port traffic they have difficulties engaging with the port. This division suggests that the integration of maritime and land systems implied by the port regionalisation concept faces several challenges. The difficulties highlighted in the case studies represent good reasons why this integration may not be forthcoming in many instances; not just actual integration, which, as Notteboom and Rodrigue (2005) note, is difficult for ports, but even operational cooperation. Inland transport and logistics systems remain fragmented, particularly intermodal transport which is the focus of this thesis. Until these operational issues are resolved, even high levels of cooperation may be prevented, much less any chance of integration. These operational issues will be considered in detail in the following chapter.

Finally from a conceptual perspective, it was found that the sites in this sample calling themselves dry ports do not fit the "dry port" concept proposed by Roso et al. (2009). The only site that fits the definition (Venlo) is already known as an "extended gate" concept. The importance of separating transport and logistics functions when classifying inland terminals, an approach drawn from the literature (Rodrigue et al., 2010), has been strengthened by the findings in this thesis, as it was shown that even in sites where an intermodal terminal is embedded within a larger logistics park, the two functions remain separate.

More cases are required to validate these findings, but the details of how a case works in practice can raise issues about the extent to which port regionalisation can actually happen and what is required for it to happen. The cases elucidate good reasons why ports may not be controlling or capturing hinterlands through the strategies of integration that the port regionalisation concept suggests.

Part two

The role of logistics integration and inland freight circulation in port regionalisation

6. Part two: the role of logistics integration and inland freight circulation in port regionalisation

6.1. Introduction

The second research question was: how can logistics integration and inland freight circulation influence port regionalisation processes? This question was divided into four research factors derived from the literature:

1. Spatial development of the market
2. Operational rail issues
3. Strategies of integration and collaboration
4. The government role in developing intermodal transport.

Many studies have looked at the supply chain evolution of retailers and to a lesser extent the logistics and transport implications of these changes. These studies have tended to be published in the supply chain, logistics and business management fields. On the other hand, intermodal transport has been studied in detail in the transportation literature, with a tendency to focus on operational aspects to improve efficiency and thus reduce cost, making intermodal transport more attractive to prospective users. This chapter will bring these two fields together in an investigation into large retailers as the key drivers of intermodal transport in the UK. Lessons learned from their success may contribute to an understanding of modal shift in other market or geographical contexts.

From the literature review, it is already known that the market has consolidated through mergers and acquisitions, the spatial distribution of distribution centres has been rationalised and centralised, and retailers have achieved greater control of both primary and secondary distribution. Collaboration is less well understood, as it appears to occur in some instances but not others. Likewise, it is known that intermediaries such as 3PLs are playing a greater role, but it is not clear precisely how they are involved in

the shift towards intermodal transport, relating back to the differing strategies of integration and collaboration between shippers, 3PLs and rail operators. From a transport perspective, the need to consolidate flows despite a decline in wagonload traffic are known, as is the inertia in the industry and the issues of lead time and process planning. The role of government was not raised in the literature review, but it has been important in the UK in terms of promoting intermodal transport through a variety of grants. The small literature on this topic will be included at the appropriate juncture in the discussion.

This chapter will determine to what extent these issues are represented in the actual case, as well as what new lessons can be learned from the case. From the perspective of port regionalisation, it is important to understand inland freight circulation, as ports cannot be integrated with hinterlands without understanding the inland system. The umbrella concept of port regionalisation implies that ports can capture and control hinterlands through intermodal corridors, which are supposedly more monolithic due to strategies of logistics integration on behalf of market players. However, these market players make their transport decisions based on a variety of issues that are not explained in the port regionalisation discussion. Therefore this case was chosen to examine these aspects.

6.2 Practical aspects of the case study

The fieldwork for this case study took place from 2010, through 2011 and into early 2012. This long period was due to the difficulties in obtaining interviews with all the desired subjects. The first set of interviews were with general freight stakeholders in the intermodal transport industry (see Appendix 1 for more detail); these were undertaken during 2010 as a general background study to understand the main players and issues in this area, prior to the identification of a specific market sector to examine.

In 2011 plans were finalised to study the retail sector, but these interviewees took time to arrange. A contact in the industry was used to help with the arrangements and was also present at some of the interviews. It is very difficult to get time with large retailers and it was important to structure the interview questions to make sure that the key data could be obtained in case time ran out. As it turned out, the interviewees answered all questions and were mostly open about their business and any issues they faced, although some information had to be kept somewhat general due to commercial sensitivity.

The case study process was guided by the research factors, the thematic matrix and the interview questions, all based on the literature review. Different interview questions were designed for each set of interviewees (general freight stakeholders and retail intermodal logistics), each of which can be found in Appendix 2. The analysis in this chapter is based on a matrix, which breaks down the four factors into 23 sub-factors, clarifying how inferences were drawn and conclusions reached. Lack of data for some aspects will also be made clear through the use of the matrix.

Unlike the cases in parts one and three of this thesis, which are presented as narratives, it is more appropriate to present this case study by issue. This part was analysed as a single case study on intermodal transport use by retailers, with multiple embedded units of analysis (being each organisation: the retailers, rail operators and 3PLs). It could have been structured with each retailer as a case study if the goal were simply to compare their experiences of modal shift. But then there would be repetition and overlap regarding the use of rail and 3PLs by each retailer, and the perspectives of the 3PLs and rail operators would have been pushed to the background. Successful retail intermodal logistics involves numerous actors, therefore the perspectives of all three major stakeholder groups must be considered together. The point of interest was not the chronological story of development (as in parts one and three of the thesis, which is why they are presented as narratives), but the issues pertaining to the use of rail. Therefore the analysis and presentation worked better with an issue-based structure.

6.3 Presenting the case study

6.3.1 Major retailers in the UK

UK retailers employ approximately 3 million people and account for almost 6% of UK GDP (Forum for the Future, 2007; Jones et al., 2008). Figure 6-1 shows that nearly 83% of the retail market of grocery trade in the UK is controlled by five retailers: Tesco (31%), Asda (17%), Sainsbury (16%), Morrison (12%) and the Co-operative (7%).

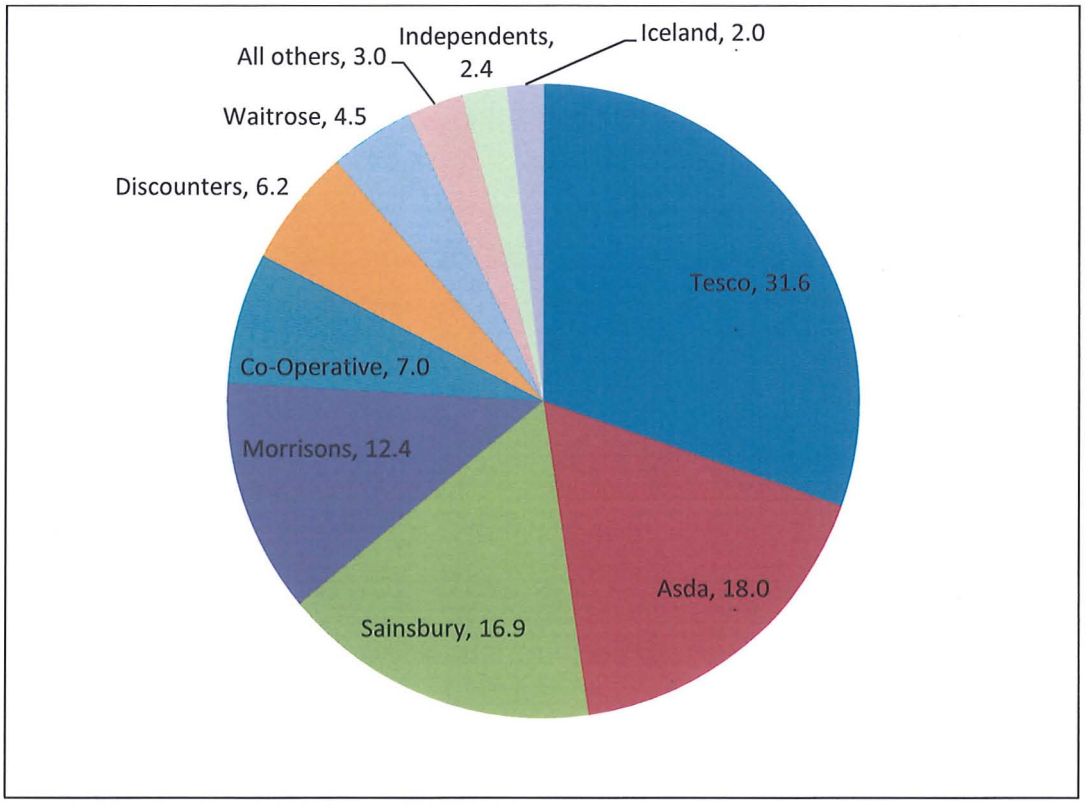

Figure 6-1. 2011 grocery retail revenue in the UK (billion pounds)

Source: author, based on Scottish Government, 2012

Figure 6-2 illustrates the distribution centres of the five major grocery retailers in the UK (PCCs are not shown). The centralisation in the Midlands is clear, as is the lack of coverage in north England, north Scotland and Wales.

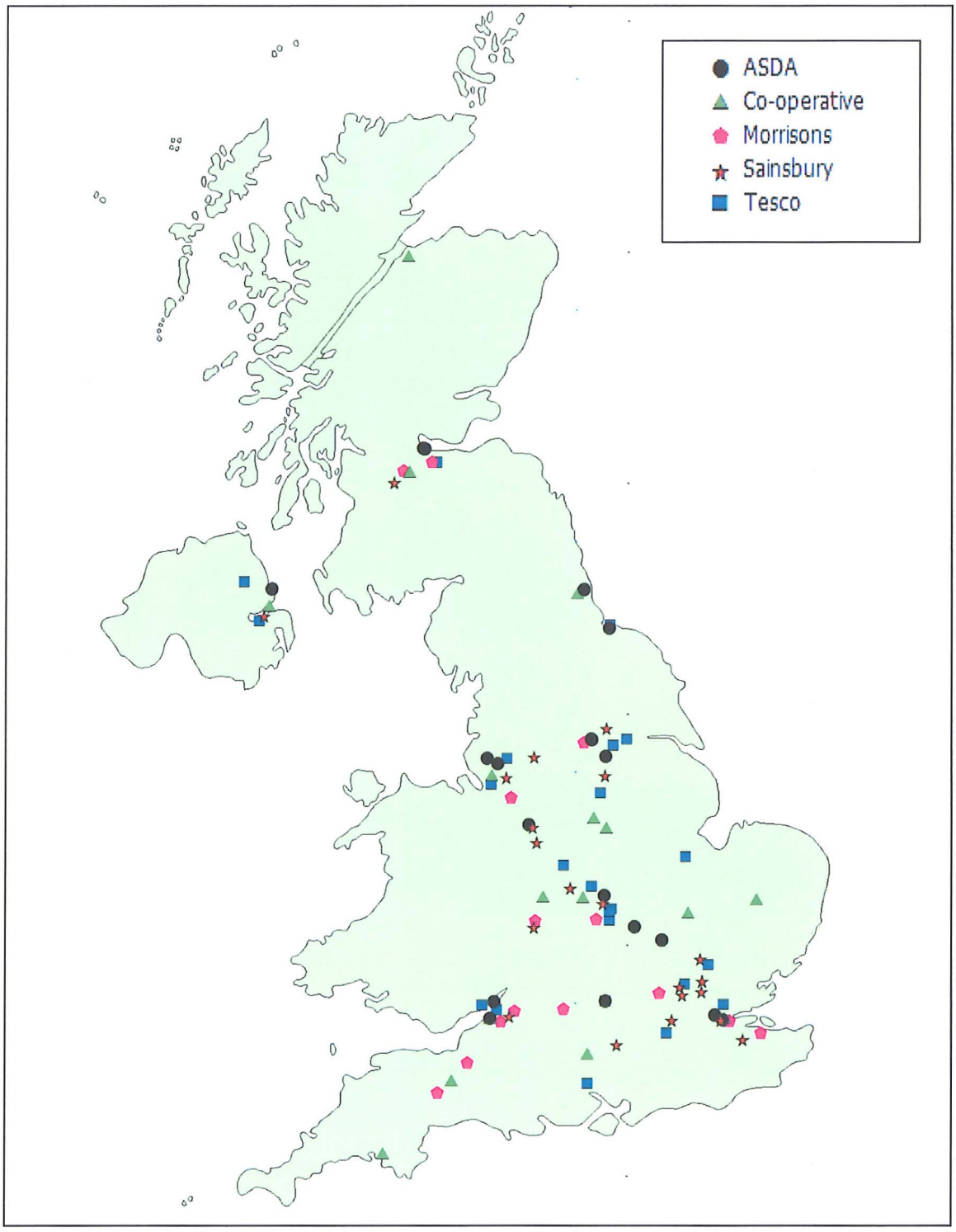

Figure 6-2. Locations of the distribution centres of major supermarkets

Source: author, based on data obtained from retailer websites

While the sector continues to evolve, it is generally considered that retail logistics in the UK has largely reached the maturity stage. Thus the current situation is more a process of perfecting the system rather than major qualitative restructuring. Furthermore, Fernie et al. (2010) noted that the UK grocery sector is distinct from other

countries. They explained that in countries such as the USA, Germany and France, property costs are lower, therefore retailers use this space to hold higher inventory, the costs of which are offset by the discounts obtained from large orders. This stock is forecast and then pushed to stores, discounted if necessary, and customers tend to buy larger amounts of this discounted product. This system is noticeably different to the fast-moving highly-responsive system observed in Britain.

Fernie et al. (2010) stated that Tesco is the market leader in logistics, as with sales. Asda is upgrading its systems in line with parent company Wal-Mart, Morrisons is still processing its Safeway merger, while Sainsbury has spent the first decade of the twenty-first century regaining market share after a difficult period caused by an unsuccessful adoption of a new technological supply chain management system.

In this research the focus is on grocery retailers rather than other retail sectors such as fashion, and a wholesaler has been included as a contrast. The major grocery retailers, however, also sell a significant proportion of non-food lines. Grocery retail is generally broken down into a number of distinct categories, including grocery/ambient (which can be further split into fast and slow moving), fresh, chilled, frozen, convenience, non-food and direct. Other areas such as recycling (reverse flows) can also be considered. Each one of these has different operational requirements, which affect their suitability for intermodal transport; for example, non-food lines tend to have more stock keeping units (SKUs) than food because of product differentiation.

6.3.2 Overview of rail freight in the UK

Network Rail, a nominally private but government-owned company, owns and operates the track infrastructure, with intermodal terminals owned or leased by private operators. A number of private rail operators compete to run services. There are four primary rail operators in the UK: DB Schenker (formerly EWS), Freightliner, Direct Rail Services (DRS) and First GBRf. The other main players are third-party logistics service providers that charter trains from these operators, including John G Russell, WH Malcolm and Eddie Stobart. There has been a significant growth for 3PLs because many customers prefer integrated door-to-door solutions.

The majority of rail freight in the UK has traditionally been bulk, until containers overtook coal for the first time in 2010 (see Figure 6-3).

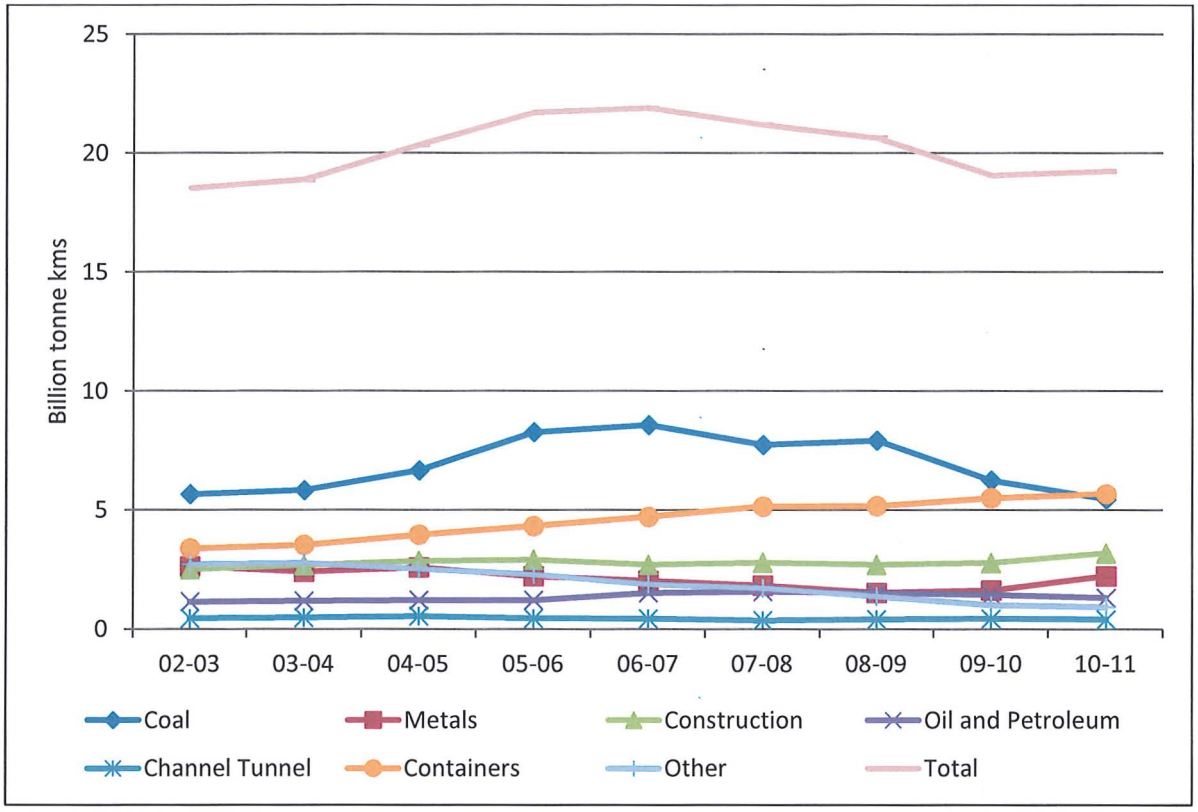

Figure 6-3. Freight moved by sector (billion tonne kms)

Source: author, based on ORR, 2012

Bulk cargo is effectively captive as not only is it most suited to rail carriage but origins and destinations tend to have handling equipment built into the sites. This chapter is focused solely on intermodal flows. The majority of inland container rail traffic in the UK is between Scotland and England; most of this traffic is anchored at the English end of the route at DIRFT Daventry. Currently handling around 175,000 lifts per year, it is the busiest inland intermodal terminal in the UK.

Table 6-1 lists all current intermodal rail services on the Anglo-Scottish route (not only those used by retailers), divided into two categories: ex port (direct service between a port and a Scottish terminal) and domestic (between inland terminals in England and Scotland). Intra-England and intra-Scotland services are not shown.

Table 6-1. List of current intermodal rail services running on the Anglo-Scottish route

Type	Service	Traction	Management	Frequency per week
Ex port	Felixstowe – Coatbridge	Freightliner	Freightliner	5
	Southampton – Coatbridge	Freightliner	Freightliner	5
	Tilbury – Coatbridge	Freightliner	Freightliner	5
	Liverpool – Coatbridge	Freightliner	Freightliner	5
	Teesport – Grangemouth[4]	DRS	WH Malcolm	1
Anglo-Scottish	Tilbury-Barking-Daventry-Coatbridge	DRS	JG Russell	2 daily x 5/6
	Daventry – Mossend (DB Schenker)	DB Schenker	Stobart	6
	Daventry – Mossend (PD Stirling)	DRS	WH Malcolm	5
	Daventry – Grangemouth	DRS	WH Malcolm	6/7
	Hams Hall – Mossend	DB Schenker	DB Schenker	5

Source: author, based on interviews and document analysis

These intermodal services are mostly common-user. The ex port services are majority booked by shipping lines as carrier haulage is dominant in the UK for port flows, but smaller users can also book space on these trains directly with Freightliner or through a 3PL or freight forwarder. The other flows are generally managed by 3PLs serving a variety of customers. The largest sector utilising these trains is the retail sector (Woodburn, 2012).

6.3.3 Use of intermodal transport by retailers

Woodburn (2003) noted that "it is notoriously difficult to identify specific rail freight users and volumes from public sources, particularly in the non-bulk sectors" (p.245). Similarly, a large consultation with stakeholders in the freight industry found that "information on freight movements is not currently available at an adequate level of detail to reflect the underlying supply chain characteristics" (WSP et al., 2006; p.vii). For this research a list of users has been compiled from the interview data and desk research (primarily FTA, 2012). Results are presented in Table 6-2.

[4] Update March 2012. This service has now been suspended due to lack of demand.

Table 6-2. Retailer use of intermodal transport

Retailer	Route	Rail operator	Management
Tesco	Anglo-Scottish	DB Schenker	Stobart
Tesco	Scotland to north	DRS	Stobart
Tesco	Daventry-Tilbury	DRS	Stobart
Tesco	Daventry-Magor	DRS	Stobart
Sainsbury	Anglo-Scottish	DRS	JG Russell
Morrison	Anglo-Scottish	DRS	JG Russell
Waitrose	Anglo-Scottish	DRS	WH Malcolm
M&S (DHL)	Anglo-Scottish	DRS	WH Malcolm
Asda	Anglo-Scottish	DRS	WH Malcolm
Asda	Scotland to north	DRS	DRS
Co-operative	Anglo-Scottish	DRS	WH Malcolm
Costco	Anglo-Scottish	DRS	JG Russell

The majority of companies from Table 6-1 and Table 6-2 have been interviewed for this research and will be discussed in this chapter, but in this section all retailers will be considered in order to provide a complete overview of the UK retail intermodal network.

Tesco is the only retailer large enough to move significant flows by rail, with four dedicated services, matching secondary distribution of picked loads with inbound primary flows, filled out with other materials such as packed-down cages and recycling. Tesco transports 32 45ft loads daily northbound on the Anglo-Scottish corridor, while their new service to Wales takes 34 45ft boxes, and their service to the north of Scotland and the one from Tilbury take 22 containers each. Asda (not interviewed for this study) is the only company that gets close, with 20 loads on the Anglo-Scottish route and 10 going to Aberdeen. Tesco is about to start moving up to 20 loads daily on the Aberdeen route, as well as planning some more potential services in collaboration with DRS, only one of which is likely to be a dedicated service. With the additional Tesco volume, the Aberdeen service is now fully utilised and is about to extend to 7-day operation. In fact, DRS has noted that they have received additional interest from retailers due to the visible success of their Tesco trains.

Wholesaler Costco is the only other significant user of rail transport, sending 10-15 containers daily on the JG Russell service to Scotland. They used to send the Aberdeen deliveries on this train (just to Coatbridge then by truck to Aberdeen), but because of the timings it was found to be quicker to use road. The train arrives early enough to suit the central belt stores but there would not be enough time to drive it up to the Aberdeen store.

Other users only contribute small numbers of containers to the common-user Anglo-Scottish services. Sainsbury has been using rail on some primary hauls to bring product from Scottish suppliers to their Midlands DCs, using the shared JG Russell service (although management of this flow has recently returned to the supplier). Morrisons use the JG Russell service in the opposite direction to move loads of picked pallets from Northampton to Bellshill. In the past, they have trialled services between Trafford Park and Glasgow, and Coatbridge to Inverness. Waitrose uses the WH Malcolm Anglo-Scottish service, as does DHL for M&S. M&S is building its own rail-connected DC at Castle Donington (see below for discussion). The Co-operative is currently running a trial on the WH Malcolm Anglo-Scottish service, taking two containers per night, five nights per week from the Midlands to their Scottish DC at Newhouse.[5]

6.3.4 Distribution patterns

Primary distribution

Primary distribution refers to inbound flows into the DC. These flows can come from overseas through ports, the channel tunnel or by air, or they can come from within the UK. While the primary focus of intermodal transport for UK retailers is the movement of ambient grocery products on the domestic Anglo-Scottish route, consideration of imports through ports is required in order to understand how intermodal transport is based on both port and domestic flows. This mixture causes problems with matching directional imbalances but also raises complications with different wagon and container types, as discussed in the next section. Over the last 30 years, several factors have caused a shift in UK trade from using local ports to using the large south-eastern ports (Hoare, 1986; Overman & Winters, 2005; Pettit & Beresford, 2008). From a retail perspective, port flows are generally non-food lines such as clothes or electronics from the Far East moving through UK deepsea ports such as Felixstowe and Southampton. Tesco is the largest retailer and imports roughly 20,000 containers

[5] Update July 2012. The retailer is now planning to double this trial to four containers per night.

per year from the Far East through these two ports. This translates to about 400 loads per week.

Slow-moving food may be sourced from within the UK or from the continent. There are now significantly more European imports into Britain than in the past, with an increasing UK market for European wine and food. Fresh food is more time-dependent and is thus more likely to be sourced within the UK where possible, but with refrigeration technology it can be brought from the continent and even across the globe.

As discussed in the literature review, primary distribution has changed in recent times, with the introduction of DCs and PCCs further up the chain. This evolution has raised the possibility of the retailer extending control up the chain in order to manage flows more efficiently. Not all retailers have the resources or the desire to do this, as there are pros and cons to managing the primary distribution in-house or sub-contracting it to one or more firms. For example, Sainsbury manages about 90% of their inbound produce, 60% of chilled and 10% of ambient, whereas Tesco has more of a focus on primary distribution, with 60% of ambient/grocery and 70% of fresh flows moving through their primary network.

There is also the potential for an additional leg in the chain for the movement from a national distribution centre (NDC) to a regional distribution centre (RDC), depending on how the company has structured its distribution facilities. This will depend primarily on the product line, as there will tend to be more grocery/ambient DCs around the country to serve each particular area, whereas smaller flows such as frozen may only have one or two NDCs that must then filter product either to RDCs or direct to regional stores. For instance, Sainsbury has many composite DCs (chilled, ambient and fresh produce), whereas it has only two DCs for slow-moving food, health and beauty, and hazardous, two for frozen, two for clothes and only one non-food DC.

For Sainsbury, inbound flows are managed by the suppliers. They may occasionally haul a supply delivery, but generally only if they have a truck going somewhere and they need a backhaul. If Sainsbury only wants half a truckload, the supplier may prefer to take a whole truckload to a PCC, so Sainsbury will pick up that half load and leave the other half until needed. The inbound flows will be de-stuffed and stored at the DC then pallets will be picked from the racks to go to stores. Chilled and fruit will be cross-docked to go to the store the same day it arrives at the DC. A retailer will often only order small loads of exactly what they need. The transport cost may be higher, but they would rather pay more than have to store and manage extra product that is not yet

required. Therefore inventory management strategies (an entire subject that is beyond the scope of this research) affect transport decisions.

A wholesaler like Costco only has about 3,200 SKUs, so this is very different to a supermarket retailer, allowing Costco to maintain a far simpler operation. They have buyers overseas who make decisions for the whole global company (based in the US, Costco is one of the largest retail organisations in the world). The USA division will order so many containers of each product, as will the UK.

The role of shipping lines in primary distribution must also be considered. The UK is unusual in Europe in having a high proportion of carrier haulage (about 70%), which means that the shipping lines control distribution from the port to the inland destination. When this is done by rail, it is usually with Freightliner on its ex port services, although DB Schenker has begun to compete successfully in this market. However, carrier haulage gives less control to the retailers. This is one area in which a large company like Tesco, with growing experience at managing its primary network, can negotiate port-only prices and manage the inland leg itself. The flows currently managed in this way are going by road, but the next step is to shift some of these flows (mostly Felixstowe/Southampton to Daventry) to rail.

Secondary distribution

Secondary distribution refers to the movement from the DC to the store. This move is more likely to be done in-house by the retailer or sub-contracted on a closer relationship. Tesco, Sainsbury and the Co-operative all run their own trucks for secondary distribution but will sub-contract occasionally where required (see Table 6-3).

Table 6-3. Distribution structure of each retailer

Company	**Sector**	**Manage primary distribution**	**Manage secondary distribution**	**DCs**
Tesco	Retailer	Partial – high	Yes	24
Sainsbury	Retailer	Partial - med	Yes, but about 50% on third-party open-book basis	22
The Co-operative	Retailer	No	Yes	16
Costco	Wholesaler	No	Yes	1

Whether secondary flows are suitable for rail will depend to a large degree on the distribution strategy of the retailer, for example which product lines are stored at the RDC and which require trunking from the NDC. When Tesco moves containers by rail from Daventry to Livingston, each container is designated for a specific store, with the relevant cages from Daventry inside. At Livingston they add additional cages into the container, then send it by truck to the store. This is done in the trunking station which is all cross-docked. Empty cages are returned to Daventry. Similarly, the Stobart Tesco train to Inverness takes boxes for specific stores which are then distributed by road by JG Russell, rather than being a DC to DC move.

An average Costco store has 4-5 full truck deliveries per day from the NDC and 20-30 small direct deliveries. As a wholesaler, Costco has a simpler operation for secondary flows. The majority of deliveries are overnight, to arrive at stores early in the morning (around 5am), which gives them time to get the pallets inside before store opening. Everything goes on pallets, which then go straight into the store. All their store deliveries are done by road except one rail service from Daventry to Coatbridge.

Opened in 2007, Tesco's large 1 million square foot DC at Livingston is the only Tesco DC that has fresh, grocery, frozen, trunking and recycling all within the same facility. It sends around 4.5 million cases weekly to about 250 stores across Scotland, north England and Northern Ireland. These 4.5 million cases cover grocery, non-food (picked at the DC in England then trunked up), fresh and frozen. Approximately one-third of product for NI comes through here: frozen and some picked slow-moving lines. There is a fresh (direct to this DC from suppliers) and a grocery depot in NI, but they are quite small.

There are 7,500 SKUs in the grocery part of Livingston DC alone. Tesco monitors which lines should be picked at Daventry and trunked to Livingston and which should be stored there. It changes as different lines rise and fall in sales. All fresh food in Scotland moves through Livingston. On an average day the Livingston DC has around 900 trucks coming in and out, but this is an unusually large DC, as well as the fact that fewer of the trucks are double-decks, because many of the Scottish stores don't use them (partly because they don't have room to accommodate the larger vehicle, but also because they don't have enough demand to require it). Daventry has a higher proportion of double-deck trucks therefore fewer truck are required.

Lead time is crucially important for all movements between DCs and stores. According to interviewees, an ideal scenario would involve overnight picking and

morning departure from the DC to reach the store by mid-afternoon, but this cannot always be done because of passenger trains on the line during the day. Until this can be resolved, intermodal growth will be constrained by operating mostly at night, which requires stores to order from DCs in the morning so that the load can be picked in the afternoon, loaded at the DC at say 1600 to catch a 2000 departure on the train, which will then arrive at its destination in the early morning (0400-0500) for trucking to the store.

Centralisation and decentralisation

The geographical coverage of distribution facilities is being rationalised by the leading retailers to improve the efficiency of their supply chains. However, legacy issues determine to a large extent where the DCs are located, meaning that they do not begin today with a blank map. Most retailers prefer a centralised model but other models have some potential, such as port-centric logistics and continental hubs.

Both Asda and Tesco have recently opened distribution centres to deal with imports at the port of Teesport in the northeast of the UK. Interviews revealed that Tesco does not currently ship anything through this port, instead bringing containers from the ports of Felixstowe and Southampton, which indicates that even with port-centric strategies, centralisation tendencies are very hard to overcome. This could be because Tesco has fewer stores in the northeast than Asda so the port-centric strategy was not suitable to their store coverage. This finding illustrates the difficulty in connecting port regionalisation strategies with inland freight systems.

Interviewees questioned the operational aspects of port-centric logistics, and it was suggested that backhaul and container type issues may be difficult to overcome. If the DC is in the port then imports arrive in maritime containers, are emptied in the DC then the empty goes back to the shipping line. The goods are then distributed from the DC to the stores in 45ft trucks, but the only trucks coming to the port will be bringing maritime containers, so it can be difficult to match these flows. The result could be empty trucks coming to the DC. Another downside is that the company is anchored at that port with little option if a shipping line raises its prices or moves to another port.

Another distribution option is to make use of a continental hub to consolidate flows then bring them to the UK by rail or ferry. Tesco/Stobart work with 2XL in Zeebrugge to consolidate loads there (Red Bull, for example). Similarly, French wine used to come in full loads but now Tesco de-stuffs them at Zeebrugge and consolidates many

different loads into one container which can then go direct to the store in the UK. This means they also reduce their stock holdings from six weeks down to one week. There are difficulties in this model, however. The Channel Tunnel rates are considered by some interviewees to be high, part load patterns are complex, and the ferry also has constraints such as time, frequency and imbalance of flows.

Tesco is also exploring the possibility of consolidation centre use in China. Instead of bringing full containers of each product to the UK which then must go to the NDC for de-stuffing, they could put a mixed load in the container before it leaves China. It might then be able to go straight to a regional DC or even a store, thus removing a leg from the UK distribution. This could have more potential to change distribution patterns. If all importers of freight from the Far East picked loads there before sending them to the UK, the centralised pattern of DCs in the UK could be altered. However, as these products are mostly non-time sensitive products, they do not constitute the majority of product lines discussed in this chapter.

6.3.5 Operational issues

Rail operations

Loading gauge restriction on the UK network is a well-known issue, mostly in the north of Scotland and on the East Coast Mainline (ECML), which is used when services are diverted from the UK's primary rail freight corridor, the West Coast Mainline (WCML). This is generally more of an issue for maritime containers coming through ports, as these are gradually moving towards a standard of high cube (i.e. 9ft6 height rather than the old standard of 8ft6). While the major parts of the network (Felixstowe and Southampton to the Midlands and thence to Scotland on the WCML) can now take these containers on standard wagons (W10 loading gauge), significant portions can only take them on special low wagons (W9 or W8 gauge). Containers designed for purely domestic flows (e.g. the Tesco rail containers designed in conjunction with Stobart Rail) are more likely to be standard 8ft6 height, thus avoiding this problem.

These constraints represent a specific challenge for intermodal transport of deep sea containers, as many routes linking ports to inland terminals have not yet been upgraded to W10 gauge. Moreover, high cube containers are expected to increase to 65-70% of the market by 2023 (Network Rail, 2007; Woodburn, 2008). As the cost is too prohibitive to raise the required bridges to allow high cubes through on some routes, the only feasible option is to use low wagons; a representative comment was that "a wagon

solution would be more cost-effective." However, purchase and maintenance of specialist wagons is typically more expensive and they reduce capacity, with a maximum capacity of a single 45ft container per 54ft wagon instead of a standard 60ft wagon used for port flows, which can take combinations of 3x 20ft or 40ft + 20ft containers. This makes low wagons economically undesirable for freight operators (Woodburn, 2008; Network Rail, 2007). There is also the problem of a mismatch of wagon configurations for operators wanting to run both port and domestic routes.

Lack of visibility and knowledge has been cited as a key barrier to modal shift, in conjunction with lower flexibility, frequency and reliability than road. While flexibility and frequency are difficult to alter, the perception in the industry regarding reliability is changing. While some reports still claim a negative perception among small hauliers (RHA, 2007), all rail users interviewed for this thesis stated that their use of rail had been extremely reliable. In fact, rail had proved more reliable than road during the hard winter in 2010/11. As shippers gain experience using rail, they know that they can contact a freight forwarder or rail operator and put even a single container on a timetabled rail service. However, to achieve this position (and extend it) has required and will continue to require work on behalf of 3PLs who can provide a door-to-door solution to customers, providing the responsiveness of a road haulier.

It has been suggested that the UK suffers from an insufficiency of intermodal terminals, in particular that many smaller sites and sheds should be rail connected (SRA, 2004; Berkeley, 2010). Access is also an issue; the Office of Rail Regulation (ORR) is pursuing an investigation into whether withholding of terminal access by incumbent operators is anti-competitive (ORR, 2011). 3PLs interviewed suggested that a strategy of more rail-connected warehouses is less desirable and the major intermodal terminals are sufficient in the short term.

The interviewees in this study claimed that asset utilisation is more important than break-even distance, even if made up by a number of short-distance services. One interviewee said to "beware of management accountants" because they look at the individual costs of running a train, but they don't factor in things like utilisation and cross subsidy across their service portfolio. Most freight trains run at night due to path restrictions during the day, which means that they often sit idle all day. They can generally run during the day in Scotland because the lines are not as busy but this is difficult in England. The view of rail operators is that if a train can be kept running most of the day then it will make money, so if a train is standing idle then any service, no

matter how short, is worth running. This marginal cost approach explains the short service between Elderslie and Grangemouth run by DRS.

Handling charges involved in changing between modes have always been a barrier to greater use of intermodal transport. However, it was found in the interviews that the price paid by shippers for handling is something of a contentious topic. Users feel that they are being given a nominal price to pay, without evidence of a relation to the actual cost to the terminal operator of providing this service. Tesco has been able to bargain this price down, but rail operators feel that they cannot go any further or they will not be able to provide the service. Moreover, this is related to a wider issue of the visibility of the true cost of rail movements. It was suggested by one retailer that the quote they are given is simply based on being "slightly cheaper than road" rather than being based on the actual costs of the rail service. Some shippers say that they would like greater visibility of the cost to the provider of the entire rail service, including the trunk haul, so that they know the basis for the price. This is similar to the greater control over primary distribution sought through the use of factory gate pricing. It is a way of removing the need for the retailer to pay a profit margin on top of the base cost of the transport service.

Backhauls are another significant aspect of the economics of rail. Rail is considered to be cheaper than road if there are flows in both directions, therefore the backhaul is often the key issue in making intermodal transport work. By integrating its primary and secondary distribution, Tesco has been able to match supplier deliveries inbound to the Daventry NDC with outbound distribution to RDCs. Tesco sells space on its dedicated trains to its suppliers, thus inserting itself in a chain of vertical cooperation that draws the rail operator, 3PL and supplier together.

More backhauls from Scotland to England are needed to support the Anglo-Scottish services. Chilled trucks returning from Scotland are currently backloaded with fish and meat. One interviewee noted that it can be difficult to get ambient backloads from Scotland, while another felt certain that the loads are there, saying that "it is just a matter of making it work," sometimes just convincing a company that has not used rail before to give it a try. He suggested that there are many companies with a few containers a day that could use it, or that may require consolidation of LCL before sending them south by rail. Therefore consolidation could be a key issue to promote further use of intermodal transport and to integrate road and rail more seamlessly, and could be pursued in future research.

Road operations also need to be understood in order to contribute to supporting the growth of intermodal transport. Road is built into supply chains because of its inherent qualities. For example, with road haulage the deliveries can be staggered. If 30 containers arrived together it could be difficult to handle. "Staggered delivery is easier to manage," one retailer said.

Wagons, containers and retail cages

The key issues in terms of container dimensions relate to pallets and retail cages. A standard truck will take 26 UK pallets (or 52 if pallets are loaded less high so they can be stacked double). The internal width of a truck is 2.48m, which means UK pallets can fit 2x 1.2m across, whereas an ISO container has an internal width of 2.35m which prevents this configuration. Whether a shipper is using UK or Euro pallets is a big issue in terms of getting the maximum value from a container. UK pallets (GKN or CHEP) measure 1200mm x 1000mm, thus fitting into a trailer more efficiently, whereas European pallets measure 800mm x 1000m. A road trailer takes 26 UK pallets or 33 Euro pallets, whereas a 40ft maritime container takes only 22 UK pallets or 25 euro pallets.

Imports from the Far East are generally not palletised; the contents are loaded loose or break bulk in the deepsea container. This will be de-stuffed in the importing country and then put into a trailer for domestic movement. For intra-European loads, this is not practical therefore "pallet-wide" containers have been developed on European short sea routes. These are 2.4 inches wider than standard containers (i.e. just over 8ft2 rather than 8ft wide), giving an internal width of 2.44m, similar to a road trailer. A pallet-wide 40ft container will take 30 euro pallets rather than 25 in standard width or 33 in a road trailer. 45ft length is the preferred option, taking the same pallet loading (UK or Euro) as a road trailer.

There is a move in Europe to make 45ft pallet-wide maritime containers the industry standard (Bouley, 2012). Problems exist because most deepsea ships cannot accommodate these containers in their cellular holds and EU directive 96/53/EC forbids standard 45ft long containers on trucks (although modified designs with chamfered corners can fit within this limit).

The next issue is retail cages. Retail movements to stores are generally done in cages, and greater economies can be achieved by transporting these in double-deck trucks, which are almost unique to the UK (McKinnon, 2010). A standard truck takes 45

retail cages, as does a 45ft rail container, whereas a double-deck truck can take 72 cages. As confirmed by a retailer in an interview: "because we run double-deck road trailers, it is difficult for the rail operators to compete on price." Double-decks currently form about 20% of the Tesco fleet. That might eventually get up to around 40-50% but it will never be 100% because of the reasons explained in an earlier section.

Most domestic intermodal containers used by 3PLs such as Stobart, WH Malcolm and JG Russell are 45ft pallet-wide to deal with the issues noted above. However, their design differs across companies. The Stobart/Tesco containers are curtain siders, which is common on trucks but not on trains. As trains are often required to stop on the line, they can be targets for pilferage, therefore rigid boxes are generally preferred. Similarly, curtain siders, like swap bodies, cannot be stacked as standard ISO maritime boxes can. Another difference between road trailers and rail containers is that HGVs can be compartmentalised for chilled, frozen and ambient product but current rail containers cannot, which limits their flexibility. All of these operational issues contribute to the decision to use rail (or not).

Taking high-cube containers on non-gauge-cleared routes means using special wagons such as Megafrets and Lowliners, which are more expensive to buy and to maintain. Similarly, these wagons are generally 54ft and carry 45ft domestic boxes, meaning 9ft of length is wasted per wagon. This is now being addressed by new low wagons that are 45ft long. There is also the conflict between port flows (generally hauled by Freightliner on 60ft wagons to cater for 20ft and 40ft containers) vs domestic flows (which are primarily 45ft boxes).

It was seen in the discussion of primary and secondary distribution that, for a large retailer like Tesco, managing both legs allows the matching of flows to increase the economic viability of a service. However, this approach is threatened by the acute container imbalance on the Anglo-Scottish route. Figure 6-4 shows that, while the large deepsea ports export empty containers back to the Far East, smaller ports, particularly in the north, are required to import empty containers to fill with exports.

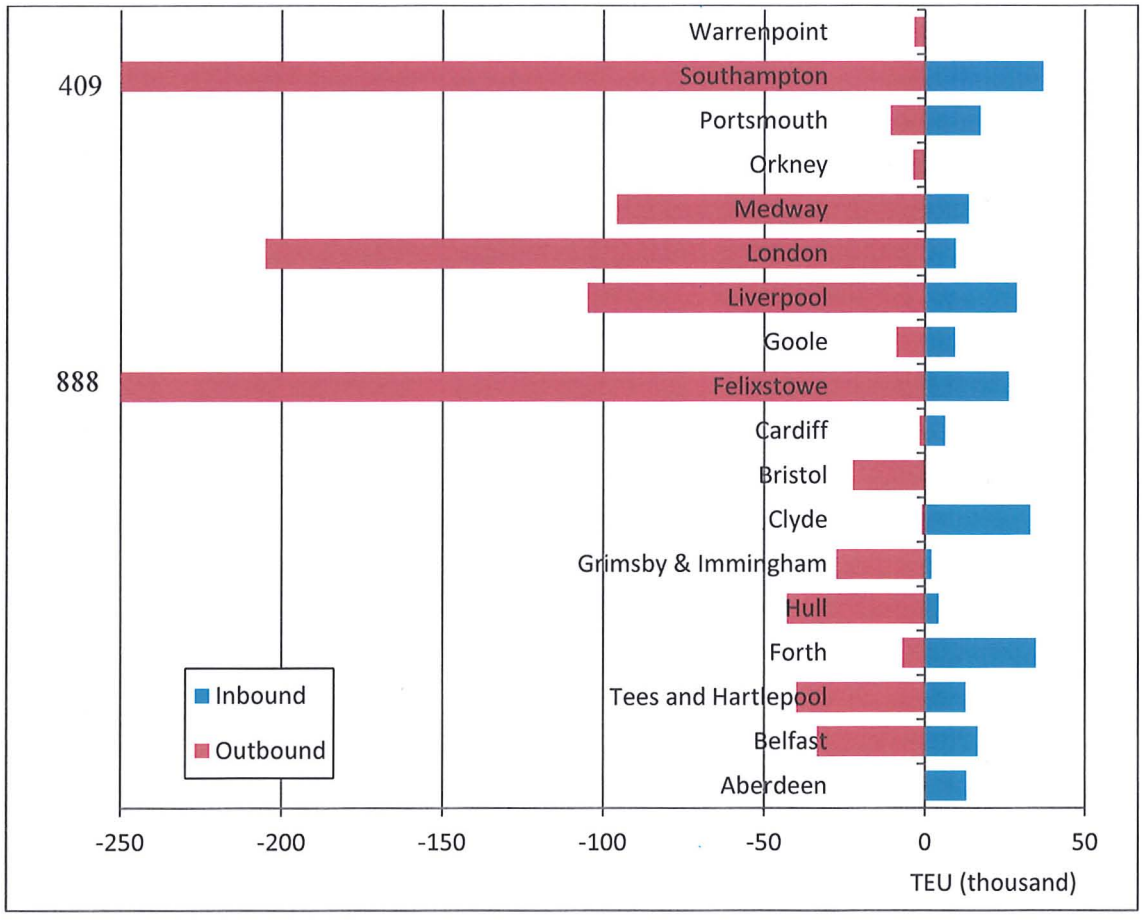

Figure 6-4. Empty container movements through UK ports 2010

Note: Felixstowe and Southampton have been truncated

Source: author, based on DfT (2011)

Northbound imports to Scotland come mostly as 45ft pallet-wide road trailers or swap bodies (and now rail containers), as they are retail and other movements from DCs in the Midlands. The majority of Scotland's exports leave as 20ft/40ft maritime containers, either through ports or on rail. This container mismatch also affects wagon configurations, for example sometimes 45ft containers are carried on 60ft wagons designed for 20ft/40ft combinations.

It was found in the interviews that industry discussions have taken place with regard to the possibility of a joint action between retailers (northbound 45ft boxes) and whisky producers (southbound 20ft/40ft boxes). If both were to use the same type of container and transload the contents at one end, the problem could be resolved, as long as the savings made from matching the flows outweigh the cost of transloading. However, distillers do not want their high value cargo to be handled any more than is necessary,

and retailers have no motivation to inconvenience their operations in order to reduce the repositioning costs paid by Scottish shippers.

6.3.6 Integration and collaboration

Vertical

Both vertical and horizontal collaboration can be observed in the industry, but it is the former that is having the greatest impact. Most noticeable is the relationship between retailer Tesco, logistics provider Stobart and rail operator DRS. Working closely together has allowed all parties to develop knowledge of requirements and adjust operations to suit. They work together to develop new services, discuss requirements and solve operational issues. A special container has been designed to transport Tesco flows by rail. While the original blue containers were branded "Tesco Less CO_2", the new generation of containers do not display the Tesco brand, as part of a move towards the possibility of transporting loads from other shippers in these containers. However, it is unclear whether competitors would use these containers which retain their brand identity in the well-known blue boxes.

Vertical collaboration or integration between all levels of rail operations (from terminal operation, traction provision, train management and road haulage) presents an interesting dynamic. Terminals can be run by rail operators (e.g. Freightliner or DB Schenker), 3PLs (e.g. WH Malcolm) or other companies (e.g. ABP at Hams Hall), or even be private sidings for which the operation is sub-contracted (e.g. Stobart operating the Tesco shed at DIRFT). Likewise, the customer side of trains is normally managed by a 3PL rather than the rail operator (e.g. JG Russell, WH Malcolm and Stobart operating trains with traction provided by DRS or DB Schenker), but for other trains the management is also done by the rail operator (e.g. Freightliner or DB Schenker). Therefore various levels of vertical cooperation and integration exist, depending on the particular service which may or may not be running into the terminal of the rail operator.

Whether a 3PL is going to operate another terminal depends largely on the structure of their existing business. It would need to fit in with their other operations; for example, the location of their existing haulage and distribution customers. Whether they would move into direct rail operation is a more complicated question as a whole new level of expertise is required and many barriers make market entry difficult (Slack & Vogt, 2007). However, it is interesting that the three 3PLs involved in intermodal

transport are smaller than the huge global businesses that are predominantly road-based, such as Wincanton and Norbert Dentressangle. These larger companies tend to focus on running distribution centres and supply chain logistics rather than intermodal transport.

Horizontal

Turning to horizontal collaboration, this can relate to retailers sharing space, either within containers (or using each other's containers), or sharing space on trains. The former does not currently happen, but the latter is already in evidence, with most retailers using common-user 3PL trains as noted earlier. Interviewees have recognised that this may be the only way to make services viable on some routes. It can also refer to 3PLs sharing space on their services, which does already happen. It is sometimes on an ad hoc basis, but also on a regular basis, especially boxes coming from ports, as these services are mostly run by Freightliner who specialises in these flows. 3PLs have not entered this market so they will buy space on those trains (e.g. Stobart bringing boxes from Tilbury to their hub at Widnes). 3PLs can collaborate in other ways; for example, Stobart runs the Tesco train from Mossend to Inverness, where it terminates at the JG Russell terminal, from which point JG Russell distributes the containers to stores by road. Likewise, the Stobart Valencia fruit train utilises the JG Russell terminal at Barking.

Tesco is currently the only retailer large enough to fill a complete train. However, the decision is whether to operate a dedicated service, in which case the retailer pays for the whole train and, therefore, must take responsibility for filling any empty wagons or suffer a financial penalty. Scheduled services may be used by any shippers, but having a dedicated train grants more control over the timings and operation of the service. Establishing a dedicated Tesco train rather than just buying space on a third-party train gives them more control and enables them to plan the primary and secondary distribution as part of a unified system. Rail can only work if both primary and secondary distribution works together (i.e. backhauls), but this needs to be managed.

In an ideal scenario, all retailers would prefer to have their own rail-connected warehouses rather than using a shared terminal to load a common-user train. This means that they would need to run a full train, which would reduce opportunities for collaborating and perhaps shows that they are not so keen on sharing space. The new DC being built by M&S at Castle Donington is rail-connected, but without the retailer being able to provide enough volume for regular services, this development will make

asset utilisation more difficult for rail operators. It can only work if an operator (or someone else) can provide more rail flows to this terminal to get better asset utilisation from the rolling stock.

The primary rail hub in the UK is Daventry, but within the site there is the option of using the common-user terminal operated by WH Malcolm, or private sidings if a company has selected one of the sites with private sidings. This is still a feasible option, but it is representative of the desire for supply chain control evidenced by the large retailers who would prefer not to share third-party trains; as shown above, other than Tesco, all retail use of trains is on third-party services.

Other interesting collaborations occur as responses to unusual circumstances. In the winter of 2010/11 there was a big problem with snow in the UK and the 3PLs needed to move cargo so they put together a train with DRS traction, Freightliner wagons and WH Malcolm traffic. The difference is that while 3PLs will share space when needed, they do not actually run a regular train together. It could be that in the future this kind of collaboration will be required to improve the economics of rail operation.

6.3.7 Role of government

As noted earlier, Network Rail, a nominally private but government-owned company, owns and operates the track infrastructure, with intermodal terminals owned or leased by private operators. Private rail operators compete to run services. Therefore the role of government in intermodal transport development in the UK is limited.

Network Rail has identified a Strategic Freight Network (SFN). Investment is organised in "control periods", and the UK government committed £200m towards the SFN in the current Control Period 4 (2009-2014). Specific goals include longer and heavier trains, efficient operating characteristics, 7-day/24-hour capability, W12 loading gauge on all strategic container routes, European (UIC GB+) loading gauge from High Speed 1 (HS1) to the Midlands, increased freight capacity, electrification of freight routes, development of strategic rail freight interchanges and terminals and protection of strategic freight capacity. Capacity issues are not generally a problem in Scotland or from Scotland down to Crewe. Capacity problems exist from the Midlands down, primarily during the day.

The recent upgrade of Southampton rail line to take high cubes has already yielded significant results, as DB Schenker secured a deal with CMA CGM to take 25,000 boxes by rail to inland terminals at Birmingham, Manchester Trafford Park and

Wakefield (Hailey, 2011). Similarly, Network Rail has recently upgraded to W10 the route from Felixstowe to Nuneaton, meaning W10 trains to the north no longer need to divert through London. The route through the Channel Tunnel and up to Barking is cleared to European gauge.

The common opinion of the interviewees was that Network Rail is very good to work with (as opposed to previous infrastructure owner Railtrack), but more effort is needed in areas such as path flexibility. For example, not all paths are utilised, but incumbent operators are loath to give them up, and need only run a train once a year to retain the path. Some of these could be freed up, and it has also been suggested that some paths are, in reality, a higher loading gauge than listed, and this could be cleared up with "only some paperwork" and a trial run. One interviewee said that they have had to pay double for a terminal to open on a Sunday, so increased Sunday operations would be welcomed by shippers, particularly retailers. Night time deliveries to stores would also help.

Government grants (FFG for infrastructure and MSRS for operating subsidies) have been used to support the shift of retail (and other) flows from road to rail. While FFG infrastructure grants were introduced in the UK in 1974, rail operating grants began with the TAG scheme set up in 1993 by the UK DfT, with the Scottish portion transferred to Scotland in 2001. TAG was complemented by CNRS from 2004 to 2007. Both of these were replaced by REPS (2007-2010) and then MSRS (since 2010).

Woodburn (2007) reported on previous assessments of the FFG system in the 1990s (NAO, 1996; PAC, 1997; Haywood, 1999) as well as assessing the grants from 1997 to 2005. He made an interesting comparison with continental European countries, where national rail operators are still subsidised at a general level, suggesting that the liberalisation of this market will invalidate this approach and require a similar system to the flow-based FFG awards in the UK. He concluded that the FFG system had been largely successful, providing on average two-thirds of the required funding for the facilities, meaning that one-third of the cost was paid by the private operators in situations where these facilities may not otherwise have been built. He found that the vast majority of these grants can be considered successful, with the failed projects attributable mainly to "company or supply chain changes that were not foreseen at the time of the award" (p.325).

Table 6-4 lists FFG funding for intermodal terminals in England and Scotland. This does not include other rail investments such as bulk terminals, rail-connected

warehouses or wagons. For example, Stobart received £200,000 in 2006 from the Scottish Government towards the Tesco containers and a further £525,000 in 2008 towards the Grangemouth to Inverness Tesco route.

Table 6-4. List of FFG awards in England and Scotland to intermodal terminals

Company	**Terminal**	**Year**	**DfT**	**Scottish Government**
Freightliner	Trafford Park	1997	£723,000	
JG Russell	Deanside	1997		£3,045,000
TDG Nexus (site now owned by DB Schenker)	Grangemouth	1999		£3,233,000
Potter Group	Ely	2000	£373,046	
WH Malcolm	Grangemouth	2000		£246,000
Potter Group	Ely	2001	£101,000	
Freightliner	Leeds	2002	£196,656	
Potter Group	Selby	2002	£1,579,051	
WH Malcolm	Grangemouth	2002	£582,602	
Roadway Container Logistics	Manchester	2002	£328,350	
ABP	Hams Hall	2002	£1,192,965	
PD Stirling	Mossend	2002		£1,878,300
EWS (now DB Schenker)	Mossend	2003		£654,000
WH Malcolm	Grangemouth	2003		£882,000
ARR Craib	Aberdeen	2004		£144,546
WH Malcolm	Grangemouth	2004		£137,678
WH Malcolm	Elderslie	2005		£1,647,000
WH Malcolm	Elderslie	2006		£572,000
JG Russell	Coatbridge	2008		£1,842,617
		Total	**£5,076,670**	**£14,282,141**

Source: author, compiled from data from DfT and Scottish Government

The table shows that many of the intermodal terminals discussed in this chapter have received infrastructure funding through the FFG programme. The funding has supported intermodal development in others ways, such as subsidising the construction

of the Tesco/Stobart rail containers. More money has been spent in Scotland on intermodal terminals, while many grants in England and Wales have gone to other operational requirements, as well as some large intermodal projects in ports.

Interviewees were all supportive of the government grants and critical of their reduction and/or removal,[6] although there were some concerns that the FFG system could have been used more strategically and that the process deterred some projects that might have been successful. Economic and operational realities of the freight business can make it difficult to use this funding strategically (e.g. by using the planning system to designate strategic terminals via a top-down process rather than relying on ad hoc funding applications). In terms of other government incentives, while interviewees considered it unfeasible to enforce use of rail, the possibility that the Department for Transport (DfT) could in future allow overweight trucks between DCs and intermodal terminals was felt to be more realistic.

Table 6-5 shows that the key players mentioned in this chapter have received significant operational funding for their intermodal services.

Table 6-5. Recipients of operating subsidies through MSRS intermodal 2010/11

Recipient	**Transport Scotland**	**DfT**	**Total**
DB Schenker	£33,994	£192,749	£226,743
Direct Rail Services	£310,676	£678,817	£989,493
Eddie Stobart	£308,113	£328,209	£636,322
Freightliner	£27,977	£56,190	£84,167
JG Russell	£136,157	£752,158	£888,315
Total	**£816,917**	**£2,008,123**	**£2,825,040**

Source: author, compiled from government sources

Unless the economic competitiveness of rail is improved, these operational subsidies must be ongoing, and if they are removed then some of the services discussed in this chapter could cease to operate. MSRS is an ongoing subsidy, whereas the water-based equivalent subsidy (WFG – waterborne freight grant) is only available if the service can be shown to become feasible within three years, hence the lack of success with that funding stream. FFGs need to be tied to a particular flow, therefore some of the above

[6] FFGs have now been scrapped in England and Wales and significantly reduced in Scotland.

grants may be for non-intermodal traffic but be useful for future traffic flows. It is difficult to be strategic when there are issues such as lead times, purchase or lease of locomotives, wagons and so on.

Another issue that has not yet been covered in this analysis is the misalignment of approach between track and terminals. Network Rail has identified a "strategic freight network" of core and diversionary routes in England and Wales on which to focus investment. Transport Scotland has not yet created such an official route in Scotland, but it is being proposed for Control Period 5 (2014-2019) (Network Rail, 2011). So there is a strategic plan for the infrastructure network (as this is managed by Network Rail) but not for terminals (as these are privately operated). These are developed through ad hoc funding applications without strategic focus. Moreover, an operator has to identify a road flow, set up a service to shift it, then apply for the funding and then develop the terminal facilities, by which time the flow may have evaporated.

It could be more appropriate to look at this problem strategically. One option could be to merge the FFG funding into the strategic Network Rail programme, thus considering terminals as infrastructure, as some authors have suggested (Woxenius & Bärthel, 2008). Some of the budget for the Strategic Freight Network could be made available for terminal upgrades. Network Rail could put out a call for terminal operators to apply, based on their previous flows and business, current usage, upcoming business, etc. This could be supported like a TIGER grant (see discussion of funding in the USA in chapter 7) by a public body and even combined in a package with relevant network upgrades into a corridor approach, which would be a suitable role for a regional body such as the RTPs in Scotland, which are currently under-used. This is easier in the United States with vertical integration linking track, terminal and operator, but even if that system cannot be replicated, a strategic system based on invited applications might work better than the current ad hoc system.

While issues have been noted above with the current grant system, recognised issues with attempting to make intermodal traffic economically competitive with road must be accepted and will not go away. Otherwise it is more of a structural issue of consolidating traffic at large sites to achieve economies of scale, removing the last mile where possible, and other operational issues such as asset utilisation, as discussed above. Big shippers could be incentivised to locate at these sites, otherwise ongoing operating subsidies will be required in perpetuity. Also, when it comes to a discussion of infrastructure subsidies versus operating subsidies, the European case studies and

interviews have revealed the difficulties of this problem. Most grants are for infrastructure and terminal development, yet due to the economics of transport services they cannot compete with road and therefore struggle to get traffic.

6.4 Analysing the case study

The use of a thematic matrix was established in the methodology chapter, based on the literature review. All the data were reviewed and relevant information for each of the four factors, divided into 23 sub-factors, was entered into the matrix. The data collection, primarily through interviews but supplemented with document analysis, was guided by these factors. Thus while the analysis proceeds by induction, a strict grounded theory approach is not followed here. Rather, the analysis is guided by pre-defined factors. The sub-factors, in addition to blank "other" rows within each section, produce a fine level of detail that allows key themes to emerge.

The case study in this chapter has a different structure to those in parts one and three of the thesis. It is based on multiple embedded units of analysis, being the individual firms: the three retailers, one wholesaler, three 3PLs and two rail operators. These were not designed as individual case studies as cross-case analysis would only be possible if the focus were only on one kind of organisation, for example retailers or rail operators. However, the goal of this research was to explore the issues, therefore an issue-based structure was designed, drawing evidence from each unit of analysis where relevant. For instance, the issue of distribution patterns was based primarily on a comparison of the retailers, whereas the issue of rail operations drew data from all organisations.

Now a detailed matrix will be used to examine the research factors in fine detail. The sub-factors in the analysis matrix are there to structure the findings but the overall research question is to learn about how the process takes place, which is why the above sections have explored those issues with rich detail on actual practice.

Table 6-6 sets out the thematic matrix with the relevant data noted against each factor.

Table 6-6. Applying the thematic matrix

Factor	No.	Sub-factor	Data
Spatial distribution of the market	1	Primary distribution	See Table 6-3 for detail on each retailer. In most cases primary distribution is managed by the suppliers, although this involves collaboration with retailers for delivery times, sizes, etc. FGP was not considered attractive in most cases, with the exception of Tesco, most likely being the only retailer large enough to practice FGP.
	2	Secondary distribution	See Table 6-3 for detail on each retailer. All three retailers and the wholesaler manage their secondary distribution and in conjunction with the discussion in the literature, this is considered the dominant paradigm.
	3	Distribution centres	The literature and the interviews confirmed that retailers have been rationalising their distribution centre locations and types, reducing numbers and moving more towards composites. This process continues. These DCs are larger than before and purpose built to fit in with detailed planning of flows and different product types and combinations. Very few have rail connections.
	4	Centralisation or not	Centralisation remains the dominant paradigm, and little interest was evinced in the interviews or in observed practice (see Figure 6-2) to decentralise this system. Some uses of port-centric logistics and continental hubs were revealed, but the latter is only for some niche products like wine, whereas the former has operational limitations as discussed in this chapter. Asda's PCL operation at Teesport may be successful but without interviewing them it is difficult to discuss that further. Tesco's similar operation seems of doubtful success as it doesn't suit their store profile and due to their deals with shipping lines they no longer import their containers through Teesport anyway. In terms of decentralising DCs to the north, the limit has already been reached, with a major DC for each retailer in Scotland already. Flows to Scotland are now composed of stock from Midlands DCs and some SKUs from Scottish DCs, but fully independent Scottish DCs are not going to be feasible.
	5	Product and route characteristics	The primary domestic corridor is the Anglo-Scottish route, where domestic ambient product moves northbound in 45ft pallet-wide containers, backfilled with a variety of loads, from suppliers and other consolidated loads. The port flows are palletised or break bulk general merchandise in 20/40ft deepsea containers.
	6	Intermodal transport	Only one large retailer (Tesco) is making significant use of intermodal transport, partly because it is large enough to fill trains, but also because of a decision to pursue it, although it was unclear to what degree this is a company decision or a personal decision on the part of the staff. All other users are only dabbling, although wholesaler Costco has a regular flow of reasonable significance. On the whole, however, transport is secondary to logistics, and is thus based on road transport. In the interviews, 3PLs seemed confident that intermodal use will increase as it becomes more normal and well understood (in addition to other drivers like fuel price), but while retailers say they are positive about intermodal, actions show that it remains a minority interest, and operational issues (discussed below) suggest that it will remain so at least in the short to medium term.

	7	Logistics	Logistics decisions take precedence over transport. DCs are designed to support logistics and supply chain requirements, located for road access rather than rail, and transport must fit in with product management. There are few signs of logistics being integrated with transport. Even Tesco, the leader in intermodal use, built their Scottish DC at Livingston right next to a rail line but did not build a rail connection.
	8	Other	
Operational rail issues	9	Infrastructure	Rail infrastructure is owned by government (indirectly through Network Rail). Periodic investment takes place (e.g. Strategic Freight Network). Upgrades are needed to increase train length as well as to increase capacity through more passing loops and double tracking. The high-cube issue remains on some routes, but main routes are increasingly cleared to W10. Capacity is generally reasonable in Scotland and north England (although high-cube issues remain on lines to the north of Scotland). Capacity issues during the day in south England limit paths for freight trains. Government investment is ongoing but daytime capacity issues will not be resolved.
	10	Operations	Difficulties were raised in interviews regarding backhauls (which are essential for making routes viable) and the need to cross-subsidise services through high asset utilisation (which is difficult when daytime paths in England are not available). Setting up a new service is costly and has significant lead time. The image of rail among users has improved and all shippers in this research said they were happy with the reliability of rail. However, rail is inherently limited in its flexibility.
	11	Operators	See Table 6-1 and Table 6-2. All but one service on the Anglo-Scottish route used by retailers is provided by one rail operator, although other intermodal services exist in England. There remains a separation between port flows (Freightliner and DB Schenker) and domestic (DRS). Carrier haulage is unusually high in the UK compared to the Continent, which may explain this disjunction.
	12	Equipment	Numerous equipment issues constraining greater development of intermodal transport were identified in interviews and the document analysis. Northbound retail movements of 45ft pallet-wide containers do not balance with southbound whisky movements in 20/40ft deepsea containers. 45ft pallet-wide European containers could help this problem, but no evidence has been found of movement on this issue. The high-cube clearance issue was already raised in point 9. Lack of clearance necessitates low wagons, which are generally 54ft, thus wasting space, and these wagons do not match with 60ft wagons used for port flows, further embedding the disjunction between port and domestic flows. Wagon and container management play crucial roles, and the container imbalance on the Anglo-Scottish corridor increases the difficulty of sourcing backhauls which are essential to the economic viability of these services.

	13	Price	Interviews revealed that the price paid by shippers for handling is a contentious topic. Users feel that they are being given a nominal price to pay without evidence of a relation to the actual cost to the terminal operator of providing this service. Tesco has been able to bargain this price down, but rail operators feel that they cannot go any further or they will not be able to provide the service. It was suggested by one retailer that the quote they are given is simply based on being "slightly cheaper than road" rather than being based on the actual costs of the rail service. Some shippers say that they would like greater visibility of the cost to the provider of the entire rail service, including the trunk haul, so that they know what the prices are based on. Published tariffs would simplify the process but this is unattractive to operators who would lose influence this way, similar to suppliers losing the ability to cross-subsidise their profits through transport costs when retailers force them into FGP contracts.
	14	Other	
Integration and collaboration	15	Horizontal	Very low among retailers and little appetite to change this, which could be a significant barrier to greater use of intermodal transport. 3PLs do collaborate with each other sometimes. Rail operators do so only occasionally to solve operational issues but it is not a regular action.
	16	Vertical	Vertical collaboration is more common than horizontal, as it is necessary in the modern complicated logistics and transport environment. In particular for use of intermodal rather than road transport, high vertical collaboration is essential. Therefore it is Tesco/Stobart/DRS who are collaborating the most because they are the main intermodal configuration. But only collaboration rather than actual integration.
	17	Consolidation	Little appetite for third-party consolidation, which relates to the lack of horizontal collaboration observed. 3PLs were more alert to this requirement than retailers, which perhaps relates to the higher incidence of horizontal collaboration among the 3PLs. In general, the 3PLs seem more focused on solving operational issues while retailers are more concerned with managing their own business rather than altering it to suit larger collaborative interests such as intermodal transport requires.
	18	Evidence of change	There was no evidence in the interviews of a change to the current lack of horizontal collaboration. However increasing vertical collaboration may be possible, as other retailers see that this is the only way to make intermodal transport work. But actual integration or expansion beyond an organisation's core business is not in evidence. For example, none of the 3PLs were interested in becoming a rail operator, although some of them handle trains at their terminals. Any future change would appear to relate purely to a deepening of existing vertical collaborations.
	19	Other	

Role of government in intermodal transport	20	Policy	Some ideas, such as government legislation for taxing C02, enforcing x% use of rail or x% maximum empty running, were discussed by interviewees but considered unrealistic. It was considered more feasible that the DfT could in future allow overweight trucks between DCs and intermodal terminals as a way of stimulating intermodal transport. Generally, however, the role of government was considered more in terms of infrastructure upgrades than direct intervention in operations.
	21	Planning	The UK planning system is important for developing new or expanding current intermodal terminals. This was not a major aspect of the interviews so it was only touched on. It was discussed by some interviewees in the context of third-party or single-user sites. The DIRFT terminal is currently common-user, although some shippers located there, such as Tesco, have their own rail connections. Concern was expressed by some interviewees that planning consent for more single-user sites could split scale economies and make rail more difficult, although the problem is that shippers prefer their own connections rather than sharing either trains or terminals. In terms of planning specifically for the rail network, this is done by Network Rail through their "control periods", each of which schedules upgrades on identified sections of track, but these are subject to grants from the national government.
	22	Funding	Data showed that government grants (FFG for infrastructure and MSRS for operating subsidies) have been instrumental in supporting the shift of retail (and other) flows from road to rail. Many intermodal terminals in the UK have benefited from FFG funding at one time or another, most actors in this chapter receive ongoing operational subsidies and the funding has supported intermodal development in other ways, such as subsidising the construction of the Tesco/Stobart rail containers. Interviewees were all supportive of the government grants and critical of their reduction and/or removal, although there were some concerns that the FFG system could have been used more strategically and that the process deterred some projects that might have been successful. Generally, however, the role of government was considered more in terms of infrastructure upgrades than direct intervention in operations.
	23	Other	Overall, the government has a limited role, but it makes important interventions through infrastructure upgrades and ongoing operational subsidies. Yet there is something of a gap between the strategic infrastructure investment and the ad hoc FFG/MSRS funding. Likewise, there is a break between private sector operations and public sector planning.

Table 6-7 summarises the expectations from the literature review and compares them with the findings from the case study, to highlight where expectations have been confirmed and where new findings have been established.

Table 6-7. Comparing the case findings with the literature

Factor	Sub-factor	Literature	Case study
Spatial distribution of the market	Primary distribution	Generally managed by suppliers but increasing control by retailers.	This was confirmed. Only one retailer (Tesco) is engaged in FGP.
	Secondary distribution	Generally managed by retailers now.	This was confirmed.
	Distribution centres	Rationalisation and centralisation of DCs, larger purpose-built composites.	This was confirmed. Additional point of relevance is that very few have rail connections.
	Centralisation or not	DCs increasingly centralised.	This was confirmed. However, some uses of port-centric logistics and continental hubs were revealed, but the latter is only for some niche products like wine, whereas the former has operational limitations as discussed in this chapter.
	Product and route characteristics	Primarily ambient/grocery products in retail cages moving in containers on the Anglo-Scottish route.	This was confirmed, but the role of port flows was noted. Palletised (and sometimes break bulk) general merchandise in 20/40ft deepsea containers vs domestic ambient in 45ft pallet-wide containers
	Intermodal transport	Little in the literature on this.	Only one large retailer (Tesco) is making significant use of intermodal transport. 3PLs seemed confident that intermodal use will increase, but while retailers are positive about intermodal, actions show that it remains a minority interest. Different product characteristics (e.g. grocery focus on domestic links vs general merchandise on port links) affect the ability to manage intermodal transport efficiently
	Logistics	Logistics decisions take precedence over transport.	This was confirmed. Even Tesco, the leader in intermodal use, built their Scottish DC at Livingston right next to a rail line but did not build a rail connection.

Operational rail issues	Infrastructure	Capacity and high cube clearance issues are known.	This was confirmed. Government investment is ongoing but daytime capacity issues will not be resolved.
	Operations	The literature raised issues with lead time, backhauls, service development and general operational complexities compared to road transport.	Generally confirmed, but, contrary to the common approach in the literature, the importance of asset utilisation rather than simple breakeven distance was raised in the interviews. A new finding was that the image of rail among users has improved and all shippers in this research said they were happy with the reliability of rail.
	Operators	The literature assumes a competitive environment for domestic rail. Little discussion of port vs inland flows.	All but one service on the Anglo-Scottish route used by retailers is provided by one rail operator, although other intermodal services exist in England, so less "on rail" competition than was thought. A separation between port and domestic flows (also linked to equipment issues) was found, which constrains the wider economic feasibility of rail.
	Equipment	Wagon and container imbalances are known.	This was confirmed, although greater detail was established regarding the relations of Scottish exports (20/40ft), northbound retail flows (45ft pallet-wide) and intra-European containers (45ft pallet-wide), as well as wagon configurations (60ft/54ft/45ft). Another particular issue for retailers is the use of cages, which suits the ongoing use of double-deck trucks.
	Price	Literature suggested an ongoing difficulty with pricing for intermodal transport.	This was confirmed, with more detail on the issue. Some shippers say that they would like greater visibility of the cost to the provider of the entire rail service, including the trunk haul, so that they know what the prices are based on.

Integration and collaboration	Horizontal	Horizontal collaboration is uncommon.	This was confirmed. This could be a significant barrier to greater use of intermodal transport.
	Vertical	Little in the literature on this.	Vertical collaboration is more common than horizontal, as it is necessary in the modern complicated logistics and transport environment. Therefore it is Tesco/Stobart/DRS who are collaborating the most because they are the main intermodal configuration. But only collaboration rather than actual integration.
	Consolidation	Little in the literature on this.	Little appetite for third-party consolidation, which relates to the lack of horizontal collaboration observed. 3PLs seem more focused on solving operational issues while retailers are more concerned with managing their own business rather than altering it to suit larger collaborative interests such as intermodal transport requires.
	Evidence of change	Literature suggests increasing collaboration but is unclear on the extent and the process by which it is done.	There was no evidence in the interviews of a change to the current lack of horizontal collaboration. However increasing vertical collaboration may be possible, as other retailers see that this is the only way to make intermodal transport work. However, actual integration or expansion beyond an organisation's core business is not in evidence.
Role of government in intermodal transport	Policy	Government promotes intermodal transport through policy.	Generally the role of government was considered more in terms of infrastructure upgrades than direct intervention in operations.
	Planning	Planning system promotes intermodal transport but the actual process is not well documented.	This was not a major aspect of the interviews so it was only touched on. Concern was expressed by some interviewees that planning consent for more single-user sites could split scale economies and make rail more difficult, although the problem is that shippers prefer their own connections rather than sharing either trains or terminals.
	Funding	Literature suggests that government funding for intermodal transport has been successful.	Confirmed that government grants have been instrumental in supporting the shift from road to rail, although some concerns that the FFG system could have been used more strategically.

Many of the findings from the British case corroborate the previous research discussed in the literature review. However, the case has added new knowledge that is relevant not only to the UK retail sector but also to comparable market sectors within the UK as well as other regions with similar market and geographical characteristics, such as continental Europe.

Analysis of the spatial development of the retail sector confirmed the centralisation of DCs identified in the literature. There are some potential drivers for decentralisation, such as port-centric logistics and continental hubs, which may be classified as regionalisation strategies through which ports attempt to control hinterland links by embedding themselves in distribution chains, but the analysis in this chapter has suggested that they have only limited potential. Centralisation has facilitated trunk hauls between NDCs and DCs, thus being a key reason behind the success of retail intermodal logistics, however, different practices have been observed in the present research. For example, sending a full container from Midlands NDC to Scottish rail terminal and direct to store (e.g. the Co-operative) is different to sending a partially-full container from the NDC to the Scottish DC where further cages are added in the trunking station, and thence to the store (e.g. Tesco).

The examination of the rail industry revealed that the intermodal market is growing, but while healthy competition is observed between three 3PLs, traction for all but one of the services is provided by one operator, thus suggesting that it is not an easy market to enter. There is only one retailer (Tesco) with significant volume, although Asda is making efforts with both rail services and their port-centric import centre, due partly to their greater concentration of stores in the northeast. Interviews revealed that Tesco does not actually ship anything through Teesport at the moment which indicates that, even with port-centric strategies, centralisation tendencies are very hard to overcome. Thus port regionalisation is very difficult to connect with inland freight systems.

The key route is Anglo-Scottish, though port flows are relevant, for example Tesco seeking to replace carrier haulage with their own primary network. Intermodal terminals for these flows in England and Scotland were identified along with current service provision. It was found that government funding has been essential in upgrading freight handling facilities at many UK intermodal terminals, and that annual operational subsidies of £2.8m underpin the services discussed in this chapter.

From an operational perspective, it was found that asset utilisation is key for rail operators as expensive assets are forced to remain idle while daytime paths are used by

passenger trains. This also relates to the lack of horizontal cooperation between retailers in terms of providing enough flows for each train. Other known operational issues such as wagon and container management play crucial roles; it was seen in this case how the container imbalance on the Anglo-Scottish corridor increases the difficulty of sourcing backhauls which are essential to the economic viability of these services. This imbalance in both flows and equipment is exacerbated by the lack of coordination between domestic and port movements. While these flows may be managed by different parts of the retail organisation (e.g. grocery focus on domestic flows and general merchandise for port flows), intermodal transport efficiency requires that they be considered together, and this will form an important aspect of port regionalisation, discussed in the final section.

Horizontal integration is important to achieve full trains, and while this is happening now between 3PLs, it is not happening with retailers. Findings from this case raise the issue of retailers preferring private sidings rather than common-user terminals, which splits economies of scale and can be a barrier to greater use of intermodal transport. Public planners might consider whether common-user platforms should be preferred in the planning system rather than more rail-connected sheds. Vertical integration is more common than horizontal, as was to be expected. The literature hinted at increasing collaboration but did not elaborate, therefore the specificity of this case provided an opportunity to understand this process in greater detail. There was no evidence in the case of a change to the current lack of horizontal collaboration, which confirmed the literature. Increasing vertical collaboration may be possible, as other retailers see that this is the only way to make intermodal transport work. But actual integration or expansion beyond an organisation's core business is not in evidence.

By studying the role of 3PLs as well as retailers, this chapter has demonstrated the value of taking a broader approach to the support of intermodal service development. For example, 3PLs raised the importance of consolidation centres for converting LCL into FCL which can feed intermodal services if they are located at intermodal hubs, in particular southbound flows on the Anglo-Scottish route to provide backhauls for northbound retail flows. They can also be used for retailers de-stuffing containers and consolidating loads for regional stores. This could also be considered by public planners.

In the interviews, it was unclear to what degree a company's interest in using rail is due to a shift in the sector or a purposeful management policy or whether it is just down

to an individual in a company. Therefore it is difficult to drive this through policy when it often comes down to individuals, meetings and discussions between 3PL or rail personnel and the potential client, built on individual relationships. The role of the individual decision maker within an organisation could be a subject for future research.

Future drivers of rail growth include fuel price rises, carbon targets and increasing road congestion, particularly in areas where the road is poor. Fuel price is certainly an issue, as some operators update their costs on their contract weekly due to changing fuel costs. Congestion is less of an issue at the moment but will not go away, and corporate social responsibility has grown in importance, according at least to company reports and promotional literature (Jones et al., 2005). While the green agenda may have fallen in prominence due to the recession, it remains a key driver, according to interviewees.

The relationship between distribution geography and rail operations discussed in this chapter was based on retailers, but many of these features are observed in other industry sectors, so these findings can be applied in other market contexts. Many of the operational issues observed in this chapter have no sign of a solution, such as short distances, fragmented flows, backhaul sourcing, reluctance to share trains, container imbalances and the lack of daytime paths limiting lead times and asset utilisation. Ongoing public subsidy is still provided, which could be removed at any point. Thus even the most successful users of intermodal transport have made only small advances towards solving the perennial problems identified in the literature. Intermodal transport is difficult to make work, and is unlikely to grow until the issues identified in this chapter have been resolved, so intermodal corridors cannot yet be the means of control for ports that port regionalisation implies. Rifts remain between transport and logistics, and between ports and inland systems.

Lessons from this chapter that can be applied in other contexts arise from the approach taken in this research, which was to include retailers, 3PLs and rail operators as they all combine to produce successful retail intermodal logistics. Rail service provision in the UK is competitive but as one provider has become more experienced and built better relationships with retailers and 3PLs, this one provider now dominates, and entering this market will be difficult for others. From a retailer perspective, only one large retailer is directly involved in intermodal logistics, while the others only participate through the use of 3PLs. Thus the 3PL is the main player in retail intermodal logistics in the UK, with high competition between three providers, all of which have been successful in attracting and aggregating small flows.

However, while government policy, planning and funding facilitate private sidings to support retailer preference, this approach may have limited success because it does not sufficiently incorporate the role of the 3PLs, which require the prioritisation of consolidation centres and common-user terminals, supporting the aggregation that underpins the financial viability of rail transport. This limitation in the current approach can be addressed in future research, as well as being translated to other market and geographical contexts and informing government approaches to the support of intermodal transport.

The case confirmed the literature that government grants have been instrumental in supporting the shift from road to rail, although some concerns exist that the FFG system could have been used more strategically. Generally, however, the role of government was considered more in terms of infrastructure upgrades than direct intervention in operations. A finding from this case that adds to the literature is that concern was expressed by some interviewees that planning consent for more single-user sites could split scale economies and make rail more difficult, although the problem is that shippers prefer their own connections rather than sharing either trains or terminals.

6.5 Conclusion: the role of logistics integration and inland freight circulation in port regionalisation

Before discussing the relevance for port regionalisation, some findings can be drawn from the specific case analysis. Findings show that only one retailer in the UK is large enough to fill trains, and that only one rail operator runs almost all of the services. Operational issues in the UK were identified, such as asset utilisation, lack of daytime paths and the crucial role played by wagon and container management. The acute equipment imbalance on the Anglo-Scottish route remains unresolved, and government funding continues to underpin intermodal services. Neither horizontal nor vertical integration are occurring, although some vertical collaboration is clear between Tesco, Stobart and DRS. Private sidings continue to be preferred over common-user terminals, which splits economies of scale and can be a barrier to greater use of intermodal transport. Centralisation tendencies remain strong, and other trends such as port-centric logistics face challenges from the centralised inland system. Finally, difficulties in driving intermodal transport through government policy have been identified, but

natural growth may come from drivers such as fuel price rises, carbon targets and increasing road congestion.

Considering the role of logistics integration and inland freight circulation in port regionalisation, this chapter has shown how operational constraints and spatial development of markets can limit the development of intermodal transport, thus challenging the success of inland terminals and rail corridors to ports. In particular, the economic feasibility of these links can be threatened by operational limitations and industry inertia. Even with ongoing government subsidy, it remains difficult to compete with incumbent road hauliers. There is little evidence of major inland market players having an interest in collaboration with ports. Maritime and inland flows remain quite separate, at least as far as large shippers are concerned.

The case study has shown that the "increased focus of market players on logistics integration" (Notteboom & Rodrigue, 2005; p.301) is not as integrated as the port regionalisation concept tends to suggest. Large retailers are seeking greater control of their distribution in some ways, but it was seen in the UK that only one retailer is large enough to employ factory gate pricing. Furthermore, all retailers studied work in partnership with 3PLs but they are not integrating with them in the way that 3PLs have integrated to some degree with road haulage. Again, 3PLs work closely with rail operators but are not integrated with them. So a series of complex relationships still persists in the industry, suggesting that the dominant players in the market for inland freight circulation are not integrating or even cooperating to the extent that shipping lines are for maritime flows.

The case shows that horizontal integration is not occurring, nor is vertical integration. Reluctance for such integration or even collaboration is a barrier to consolidation, which is necessary for greater use of intermodal transport. If this does not happen, then the ability of ports to capture and control hinterlands through intermodal corridors will remain challenged.

Spatial development patterns based on logistics rather than transport prevent port regionalisation from occurring. While this can be inferred from previous work in the literature, the specific case has shown a lack of interest of market players in integrating with logistics or transport players, which also presents a barrier to the kind of integration with ports required for true port regionalisation processes to occur. Furthermore, the disjunction between different wagon and container configurations required for port and inland flows (a problem in other countries as well as the UK)

challenges the economic feasibility of intermodal corridors, further hampering any ability of ports to dominate such corridors. Port regionalisation cannot take place while the two systems remain separated by such operational issues, and little incentive has been identified for any user to solve this collective action problem. Additionally, the corridors remain common-user and competitive and do not offer opportunities for ports to control their hinterlands. The public sector has some influence, but this is limited due to the privatisation and fragmentation of the industry.

Some ports are pursuing direct intervention by promoting the concept of port-centric logistics, which may indeed be part of a regionalisation strategy. However, it has been shown how centralisation is difficult to overcome in the UK because DCs are embedded in these networks. Most importantly, they will not alter their logistics to suit their transport, and most DCs remain non rail-connected.

While rail remains a marginal business, while the industry remains fragmented, while consolidation is not happening and fragile government subsidy is still the basis of many flows, intermodal corridors cannot be the instruments of hinterland capture and control for UK ports. These issues are common in Europe too, therefore lessons can be applied there. The analysis of market and operations shows that even if they want to, ports do not currently have the opportunity to use these links in a competitive way because the industry itself has not solved its own problems. Thus a detailed case study on market and operations has elucidated some issues that prevent the kind of processes that the port regionalisation concept suggests are happening.

Therefore for port regionalisation to happen in a region (at least in terms of intermodal transport which is the limited focus of this research), it will depend on the regional market sectors, their spatial development strategies, transport requirements and decision-making habits with regard to logistics, and other related issues. These requirements and strategies will require further classification of each sector, with evidence in each case, and cannot be assumed to be the norm. Port regionalisation can only be declared a phase in port development if it can be shown to what extent ports are integrating with these inland developments, which will be different in each region.

Part three

The role of collective action problems in port regionalisation

7. Part three: the role of collective action problems in port regionalisation

7.1. Introduction

This chapter will address the third research question: how can collective action problems influence port regionalisation processes? In the literature review, this question was broken down into six factors:

1. Reasons for the collective action problem
2. The institutional setting 1: the roles, scales and institutional presence of public organisations
3. The institutional setting 2: the presence (or otherwise) of a well-defined infrastructure for collective action
4. The kinds of interaction among (public and private) organisations and institutional presences
5. A common sense of purpose and shared agenda
6. The role of leader firms.

This chapter is based on a case study of the Heartland Intermodal Corridor, linking the Port of Virginia to Columbus Ohio, and eventually to Chicago. This was the first multi-state public-private rail corridor project in the United States. The aim of this project was for peripheral regions such as West Virginia to decrease transport costs and increase competitiveness by upgrading existing branch lines to double-stack capacity and building new intermodal terminals.

Intermodal traffic in this area has been constrained by using older tunnels that could not accommodate double-stack container trains, affecting the competitiveness of regional shippers. Additionally, in relation to the coming expansion of the Panama Canal, east coast ports desire improved hinterland access in order to compete effectively

with west coast ports. Due to historical development and legacy investments, Chicago serves as the largest interchange area for railroads in the United States. However, the agglomeration benefits of such a situation are becoming outweighed by the increasing costs of congestion, additional handling and longer transfer times.

The interviews were triangulated with desktop research to produce a case study, guided by the six factors of the theoretical framework for institutional analysis developed in the literature review. The framework was derived from institutional thickness (Amin and Thrift, 1995) and the hinterland access regime (de Langen and Chouly, 2004) in order to explore the institutional factors at play in the collective action problem faced when attempting to challenge path dependence. While institutional thickness is a measure of the institutional setting, hinterland access regimes refer to specific projects. The aim of the theoretical framework utilised in this chapter is to draw both approaches together, thus providing an additional contribution to theory.

7.2 Practical aspects of the case study

The field work for this case study took place over three weeks in September 2010. The primary interviewees were those along the route of the corridor, whether directly involved in the planning and development of the project or those benefitting from or otherwise using or related to the corridor. Documents were also collected during this process and afterwards, during the analysis process. Additional interviews were arranged with the help of a contact in the USA, first with senior planners in the federal DOT and secondly at a selection of inland terminals and ports. These provided important background to the understanding of the freight system in the USA.

The interviews with stakeholders in the Heartland corridor were group discussions, undertaken in conjunction with a small group of visiting state DOT transport planners, organised by my American colleague. Most of the interviews with general background freight stakeholders were undertaken alone, but in some cases my coleague was also present.

It remains an open question how much data is required for a case study, whether that be number of interviewees or number of documents and other data. Without boundaries, the data collection process could be indefinite. In this case, a very good representation along the length of the corridor was achieved (see Appendix 1 for full details). Interviewees included representatives from the Virginia Port Authority, Norfolk Southern Railroad, federal and state transportation planners, the Association of

American Railroads, the Appalachian Regional Commission, the Rahall Transportation Institute, a state senator and local shippers in Ohio. An innovative aspect of this methodology was that state DOT representatives were present on the study tour, therefore it was possible to interview them as well. This provided additional insights into the planning process, as did interviews at other locations such as Chicago, Memphis and Long Beach.

The case study was guided by the research question, the factors and sub-factors of the thematic matrix and the interview questions, all based on the literature review. Different interview questions were designed for each set of interviewee subjects, each of which can be found in Appendix 2. The analysis in this chapter is based on the matrix, which breaks down the six factors of the framework into 27 sub-factors, clarifying how inferences were drawn and conclusions reached. Lack of data for some aspects will also be made clear through the use of the matrix.

7.3 Presenting the case study

7.3.1 Overview of ports and rail in the United States

Table 7-1 shows the top ten US container ports in 2009.

Table 7-1. Top ten US ports by container throughput in 2009

USA ranking	World ranking	Port name	Trade region	Total TEU
1	15	Los Angeles	West Coast	7,261,539
2	18	Long Beach	West Coast	5,067,597
3	20	New York/New Jersey	East Coast	4,561,831
4	41	Savannah	East Coast	2,356,512
5	51	Oakland	West Coast	2,051,442
6	58	Houston	Gulf Coast	1,797,198
7	59	Virginia	East Coast	1,745,228
8	63	Seattle	West Coast	1,584,596
9	65	Tacoma	West Coast	1,545,855
10	74	Charleston	East Coast	1,277,760

Source: author, based on Containerisation International, 2012

The dominance of the Los Angeles/Long Beach port complex can clearly be seen. Three new opportunities are arising that have the potential to influence port competition in the United States.

The first is the expansion of the Panama Canal, due to accommodate 13,000 TEU vessels by 2014. This will allow large vessels coming from the Far East to bring cargo for the eastern United States through the canal and directly into east coast or gulf ports (draft permitting). The port of Virginia at Hampton Roads is expecting to be the major beneficiary of this development. New York/New Jersey also has the requisite draft, but is currently limited by air draft restrictions (although there is some talk of altering the offending bridge). Other ports in the Gulf and the Atlantic are also struggling to get the necessary depth to receive these larger vessels. However, the additional time taken to traverse the canal and reach the east coast may be unattractive to shipping lines. For example, to reach Chicago via Los Angeles/ Long Beach takes 14 days at sea plus five days on rail, whereas it takes approximately 25 days to reach Norfolk by sea from Shanghai, with an additional two days to Chicago.

Moreover, the role of the Los Angeles area as the largest manufacturing area in the country means that many forwarders will not want to forego the economies of scale that can be gained by transporting all their US cargo to this location then separating freight for inland destinations at this point for onward transportation by rail.

Secondly, the advent of the port of Prince Rupert in Canada provides a one-day shorter west coast option to shipping lines seeking to access North American markets. The port currently has a capacity of 500,000 TEU (but with room for expansion up to 2m TEU), and with sufficient depth to accommodate container ships up to 12,000 TEU (Fan et al., 2009). In 2009 the port handled 265,258 TEU (Containerisation International, 2012).

A third and (less important) development is the gradual westward movement of some manufacturing in the far east (to India, Thailand, etc.), leading to a potential scenario whereby the Suez Canal route to eastern American markets becomes time-competitive with the Pacific route to the west coast, and would require a shorter rail journey once the cargo is landed, not to mention removing the requirement to change from western to eastern railroads at Chicago.

All three developments will challenge the dominance of the San Pedro Bay ports, although it is unlikely that any of these changes have the potential to capture more than a small percentage of their cargo. However, as will be discussed below, the hinterland

access strategies of these ports will have a determinative impact on port competition. Figure 7-1 depicts the major ports and inland terminals in the USA.

Figure 7-1. Map showing major ports and inland locations in the USA

Source: author

There are three classes of railroads in North America: Class I (national), II (regional) and III (shortline).[7] Not including passenger railroads (Amtrak in the US and Via Rail in Canada), there are currently nine class I railroads (annual revenues in 2008 of over $401.4 million) operating in North America. Seven operate in the USA: the big four (BNSF and UP in the west, CSX and NS in the east) plus the two Canadians (CN and CP) and the smaller KCS.[8] There are also two in Mexico: Ferromex and Kansas City Southern de México (wholly owned by Kansas City Southern).

[7] There is also a fourth class of railroad that performs switching and terminal operations.

[8] For ease of reference, the following abbreviations are used. BNSF: Burlington Northern Santa Fe, UP: Union Pacific, NS: Norfolk Southern, CN: Canadian National, CP: Canadian Pacific, KCS: Kansas City Southern. Note that CSX is the full name and not an abbreviation.

2009 revenues at each of the Class I Railroads are shown in Figure 7-2. The difference in revenue between western and eastern railroads is striking, illustrating the earning potential arising from greater distances and fewer interchanges characteristic of the western United States railroad network.

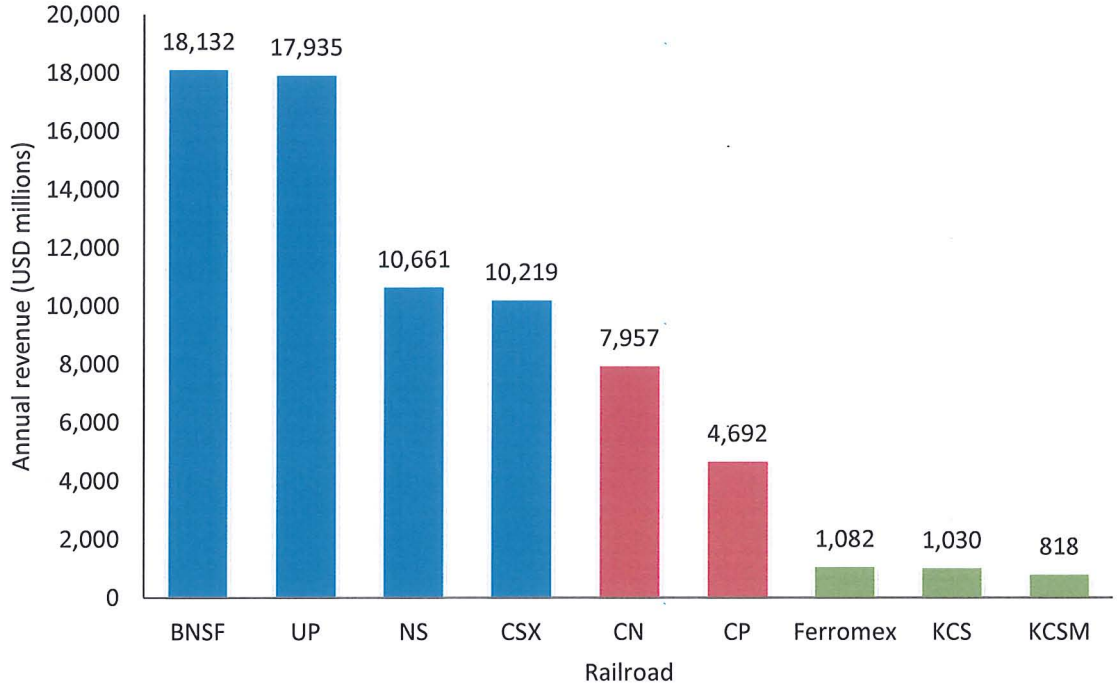

Figure 7-2. Annual revenues at class I railroads in 2009 (USD millions)
Source: author, based on AAR, 2010

A number of key differences exist between rail operations in the USA and Europe, which will now be addressed in turn.

The reason that rail has a higher market share in the US than in Europe is because it is the natural mode for long distance hauls, able to generate economies of scale. This is particularly the case for the western railroads, which enjoy longer distances and fewer interchanges than the eastern operators. Similarly, double-stacked capacity on many lines, in addition to train lengths of over 10,000ft in some cases mean that US trains can reach capacities of 650 TEU (compared to around 80-90 TEU in Europe). Therefore Class I railroads are profitable businesses, unused to government intervention.

In the US, railroads are vertically integrated, meaning that each company owns its own tracks and rolling stock and in most cases terminals. Therefore they operate completely separately from one another, although railroads may allow for track usage in

certain situations. In Europe, rail operating companies compete with each other on common-user track, forcing the maintenance issues into the public sector. Furthermore, in the USA, the east and the west of the country are entirely separate. BNSF and UP compete from the west coast to Chicago, while NS and CSX compete between Chicago and the east coast. The two Canadian railroads, CN and CP operate predominantly in Canada, although CN runs down from Chicago, through Memphis to the Gulf of Mexico.

Due to historical development reasons, all six class I railroads mentioned above meet at Chicago. The city has some of the largest intermodal terminals in the world, each handling many hundred thousand lifts per year. The Chicago area includes approximately 900 miles of track and 25 intermodal terminals, accommodating roughly 1300 trains daily (McCrary, 2010). Approximately 14m TEU transited the metropolitan area in 2004 (Rodrigue, 2008). This amount of traffic brings its own problems, but what is under consideration here is that freight needing to cross Chicago has to be transported between east and west coast railroad terminals, either by rail or road. Whereas full trains that do not require reworking will change crew and power at the arriving terminal and then depart, trains carrying containers for more than one destination will need to be split and reassembled into new trains that may then need to be transported to another railroad across town. This reworking can take up to 48 hours, therefore "rubber tyre transfers" are more common. According to Rodrigue (2008; p.243), "about 4,000 cross-town transfers are made between rail yards each day averaging 40km each."

As cross-town transfers grew more frequent, road congestion at at-grade crossings grew more severe.[9] In the winter of 1999/2000, a large snowstorm caused so much chaos for railfreight that a political tipping point was reached when the city exerted pressure to get the railroads to work towards a collective solution. This was the beginning of the CREATE (Chicago Region Environmental and Transportation Efficiency Program) project, which took shape over the next couple of years. CREATE is a public-private partnership involving the federal DOT, the state of Illinois, the city of Chicago, all the Class I railroads (except KCS) and the passenger lines Amtrak and Metra. The project group was formed in order to seek funding for a number of individual engineering works, including: "six grade separations between passenger and

[9] According to one interviewee, there had been times when long trains being assembled on the mainline were blocking traffic at at-grade crossings for so long that police were putting parking tickets on the trains.

freight railroads to eliminate train interference and associated delay; it includes twenty-five grade separations of highway-rail crossings to reduce motorist delay, and improve safety by eliminating the potential of crossing crashes; and it includes additional rail connections, crossovers, added trackage, and other improvements to expedite passenger and freight train movements nationwide" (FRA 2012, unpaginated). The estimated cost for the entire project is $1.534bn, $232m of which will come from the railroads, described as "an amount which reflects the benefits (as determined by the Participating Railroads and agreed to by CDOT [Chicago Department of Transportation] and IDOT [Illinois Department of Transportation] prior to the execution of this Joint Statement) they are expected to receive from the Project" (CREATE, 2005; p.15). The remainder of the funds are expected to be sourced through a variety of federal, state and local sources. $100m was received through the TIGER grant scheme (see below).

The operational issues discussed above have also led to some innovative responses by individual railroads. Both eastern railroads NS and CSX are developing hubs in Ohio (see below). Likewise, western railroads will sometimes rework trains before they reach Chicago; for example, BNSF will sometimes do this at Clovis (New Mexico) or Fort Madden (Iowa). This strategy allows the train to go straight through to the eastern railroad terminals without being reworked at BNSF's Chicago yard. Another strategy has been pursued by CN, which purchased the old EJ & E line that bypasses the city down the west side. They began operating on this line in January 2009 and also sell paths on the line to other railroads. Therefore the future could see CN moving containers between the port of Prince Rupert and their newly redeveloped hub at Memphis, using the EJ & E line to bypass the congestion in Chicago.

The scale of domestic cargo in the USA needs to be mentioned. As well as the millions of international containers, 89% of cargo in the USA is domestic (FHA, 2010a). Therefore this market dominates, and domestic cargo moves in 53ft boxes (as opposed to 40ft and 20ft maritime containers). Therefore it makes sense both operationally as well as financially (i.e. it is cheaper per tonne for trucks and trains because fewer boxes are moved) to transload foreign cargo at or near the port from 40ft boxes into domestic 53ft boxes. This also makes it expensive to reposition empty containers for outbound shipments from many hinterland markets that do not have sufficient inbound international container traffic. About 25% of all international cargo moved by rail is transloaded into these domestic containers (Rodrigue & Notteboom, 2010). Therefore in the area surrounding Los Angeles/ Long Beach, millions of square

feet of warehousing are dedicated to these transloading activities. Additional reasons to transload include the fact that since the US is a net importer, taking a maritime container thousands of miles inland without an export load to send back means that the container will need to be shipped back empty to the port.

Inland terminals in the USA tend to be larger than in Europe, as railroads are used more as landbridges across the country than as a network of small linked terminals like in Europe (Rodrigue & Notteboom, 2010). A number of interesting operational differences may also be observed between Europe and the USA. In Europe, intermodal terminals are generally grounded facilities, meaning that containers are transferred between train and truck, and if a direct transhipment is not made, the containers are stacked on the ground. The truck driver will arrive at the terminal with a chassis and the container will be lifted onto this. By contrast, in the US, both chassis and containers are owned by the carrier (be that the shipping line or 3PL), while the truck driver simply arrives in a tractor. Containers are loaded onto waiting chassis and the arriving driver will hook up to a loaded chassis and take it away. These wheeled facilities require a great deal more room, as there is less equipment that can be stacked, but they can be quicker for the incoming drivers who do not have to wait for their container to be located in a stack. This also means that cranes make fewer unproductive moves to pick through a stack of containers. They are also less capital intensive than grounded facilities because they require less specialised handling equipment (Talley, 2009).

Yet the problem of having enough available chassis of the correct company has caused problems for terminal operators, and despite the recent establishment of chassis pools (a number of owners sharing each other's equipment), there is now a move by some terminal operators towards the European model of grounded facilities. These require more use of cranes but utilise a far smaller footprint. Therefore they not only avoid the chassis problem but also account for the fact that land is not as available nor as cheap as it was in the early days of intermodal terminal construction.

New terminals of both wheeled and grounded type are being built, largely with automatic stacking equipment. The 185 acre BNSF intermodal yard at Memphis, TN, opened in 2010, is a grounded facility. It represents a $200m development with eight wide-span cranes, five for operating the working tracks and three for the stack. The site has 48,000 feet of track with enough length to work a full train without cutting. Likewise, the new CSX terminal at North Baltimore (due for completion in 2011 as part of the National Gateway project - see below) will be a grounded facility of similar

design. Both sites will have capacity to handle over 500,000 containers per year. By contrast, the NS intermodal terminal at Rickenbacker near Columbus, Ohio (opened in 2008 as part of the Heartland Corridor project – see below) is a wheeled facility covering 125 acres (with 175 acres for development) with a capacity of 250,000 containers annually and 40,580 feet of track.

Rationalisation of the rail business in the 1980s (see discussion on the Staggers Act, below) resulted in fewer, larger intermodal terminals. The rule of thumb for rail operators is now about a minimum of 100,000 lifts annually for a feasible terminal. Therefore shippers will need to locate near these large sites to gain access to the main trunk routes, as has occurred in the Rickenbacker International Airport development.

In terms of port operations, the large shipping lines will have their dedicated terminals (therefore not operated by a railroad). On-dock railheads are very expensive to run because the trains must be loaded using longshore labour, which also raises issues as to whether the trains are loaded to the exact specifications of the rail operator. Shipping lines may not have enough volume destined for one location to fill daily train loads direct from their terminal so often there is no genuine need for on-dock rail. Therefore in some cases it may be more effective to drive the container a couple of miles to a near-dock facility where the containers can be consolidated from multiple terminals into trains bound for each location. If a full load is possible then on-dock is more efficient and cheaper and can, therefore, help to make a rail move more competitive than road (because it removes the pre-haul), but as this is not always the case, using on-dock rather than near-dock can be problematic.

7.3.2 Government policy and funding in the United States

In order to understand the current system of intermodal transport and the role of policy and regulation in the USA, a brief overview of legislation to this point is required. Intermodal freight transport was developing in the 1960s and 1970s, but a number of laws passed in the early 1980s encouraged the development of cooperation between different transportation organisations. The Staggers Act of 1980 partially deregulated some aspects of the railroad industry. The number of crewpersons needed for each train was reduced, thus lowering total labour costs for each train. Second, the Staggers Act removed several pricing and scheduling limitations, which increased the railroad's flexibility in meeting market needs. The goal of these changes was to make the railroads more competitive for long distance domestic freight that had been lost to

road haulage during the 1970s. As in other countries, this eventually led to a number of mergers and there are currently nine Class I railroads operating in the USA (see above). The Shipping Act of 1984 allowed an ocean carrier to provide inland distribution on a single through bill of lading as well as relaxing numerous other restrictions.

The Intermodal Surface Transportation Efficiency Act (ISTEA) (1991) heralded something of an intermodal approach to highway and transit funding, including collaborative planning requirements (Chatterjee & Lakshmanan, 2008). It provided supplementary powers to metropolitan planning organisations (MPOs) and designated High Priority Corridors in the National Highway System. In 1998, the Transportation Equity Act for the 21st Century (TEA-21) authorised the federal transport programme until 2003. The act required a number of planning objectives for regional transport plans, including safety, economic competitiveness, environmental factors, integration and quality of life. However, despite these attempts to foster an intermodal approach to transport planning, key government agencies (such as DOT departments) and industry bodies remain modally-based (Holguin-Veras et al., 2008).

Two key issues often raised by intermodal transport operators that tend to shape discussions on future legislative efforts include the Jones Act (1920) which requires that any vessel operating between two US ports must be US-built, -owned, -registered and -manned, and the Harbour Maintenance Tax (HMT). Originally introduced in 1986, the HMT is a federal tax imposed on shippers based on the value of the goods shipped through ports. Its purpose is to fund maintenance and dredging of waterways, which are the responsibility of the US Army Corps of Engineers. Perakis and Denisis (2008) discussed the obstacle that HMT presents to the development of short sea shipping in the US. As the tax is applied at every port, a water leg in an intermodal chain will attract this fee, whereas transloading to road or rail will not. In addition, a national ports policy is not possible because the US Constitution places limits on the role of the federal government in relation to ports (Talley, 2009).

At this point, US federal freight policy is moving towards a more integrated transportation system, however, the necessary funding to do so remains in various agencies that do not necessarily have the authority to work on cross-jurisdictional projects. In some cases, modal agencies may be more responsible for safety and not infrastructure investment, while in other cases the role of regulatory oversight may reside in different agencies, depending upon the area of concern. Finally, the

infrastructure for waterways is actually managed by the US Army Corps of Engineers, and not the federal Department of Transportation.

Normally, the federal DOT allocates money to the state DOTs and they decide how to spend it, but this system creates little incentive for states to spend money on projects that are perceived to be of primary benefit to other states. Therefore there has been a realisation at national level that attention should be paid to cross-border projects. This led to the projects of national and regional significance (see below). This was quite a new development, and especially for railroads to be eligible rather than just road projects.

The Safe, Accountable, Flexible and Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) (2005) introduced approximately $1.8bn in congressional earmarked funds for designated projects of national and regional significance. These were large infrastructure project funds decided by Congress and generally driven by politicians on behalf of their constituents, and indeed drawing criticism on this point (Proost et al., 2011). Benefits could include improving economic productivity, facilitating international trade, relieving congestion, and improving safety. One example is the Heartland Corridor, which will be discussed below.

The stimulus package, named the American Recovery and Reinvestment Act (2009), provided $1.5bn for transport projects through the Transportation Investment Generating Economic Recovery (TIGER) programme. This money was available for all transportation projects (not just freight) and would be awarded on a competitive basis, with applications due in September 2009 and announcements made in February 2010. Private money in TIGER applications was matched by public money. The five major goals for TIGER grants were economic competitiveness, safety, state of good repair, liveability and environmental sustainability. This was the first time money was awarded in this fashion, and a second round of $600m was awarded in September 2010. The popularity of the funding programme meant that the DOT was swamped with applications for each round of funding, receiving almost 1,500 applications totalling nearly $60bn for the first round, and almost 1,000 applications totalling $19bn for the second round. The recent experiences of the TIGER Program demonstrated the need for such programmes, but also the lack of guidance available to engage in such broad comparisons.

The result of this round of funding has been a significant revival of interest in rail projects. As public bodies (e.g. states, ports, MPOs) were the only eligible applicants,

Class I railroads were required to form partnerships with them in order to process an application. An interviewee from the Federal Railroad Administration said that the list of recipients indicates that taking an integrated approach to transport problems by focusing on corridors was considered an attractive proposition for federal legislators.

The majority of awards were for public transit programmes, highways and other infrastructure upgrading, but freight-specific projects, such as transportation hubs and port upgrades, also received financial support. Some larger freight projects included $98m for the CSX National Gateway project (see below), $100m for the Chicago CREATE project (see above) and $105m for the Norfolk Southern Crescent Corridor (see below). A marine highways project in California was also among the recipients.

The Energy Independence and Security Act (2007) included a provision for "America's Marine Highway Program" to integrate the nation's coastal and inland waterways into the surface transportation system. Therefore Congress instructed the DOT Maritime Administration (MarAd) to create a Marine Highway program that examined ways to utilise waterways where they may provide some services on parallel highway routes to alleviate bottlenecks. They assessed the country's waterways and invited applications and in August 2010 eventually designated 18 marine corridors, eight projects, and six initiatives for further development. These eight projects are now eligible to bid for a total of $7m in pump-priming funding to develop projects.

As will be seen in the following discussion, there is an increasing focus on infrastructure corridors. As these projects encompass a number of localities, regions and states, not to mention private and public stakeholders, they have necessitated new methods of management and new funding schemes. However, the real role for this money is to enable large consortia to come together where public and private benefits can be clearly identified among all the parties. In reality, the federal government could never spend enough money to exert significant influence on the operations of the rail industry. Indeed, railroads in the past have been reluctant to accept public money for fear of strings being attached.

In addition, some problems will be solved by the market without the need for government intervention. As discussed earlier, chassis management has become a problem over the last decade but the issue is beginning to resolve itself, first through chassis pools and then through the growing trend of grounded facilities. In this case, policy intervention has not been required as a combination of operational efficiency on

behalf of railroad terminal operators and the increasing costs to carriers to maintain chassis fleets have resulted in new methods of operation.

Therefore it can be seen that different issues can best be solved by different approaches, whether through policy intervention, planning strategies, operational changes or market forces. The difficulty for politicians and planners lies in recognising which freight issues can best be solved by which measure.

7.3.3 The Heartland Corridor

The Appalachian region covers an area twice the size of Great Britain but with only about one-third the population (see Figure 7-3). The Appalachian Regional Commission (ARC) was created in 1965 to coordinate economic development opportunities in the region.

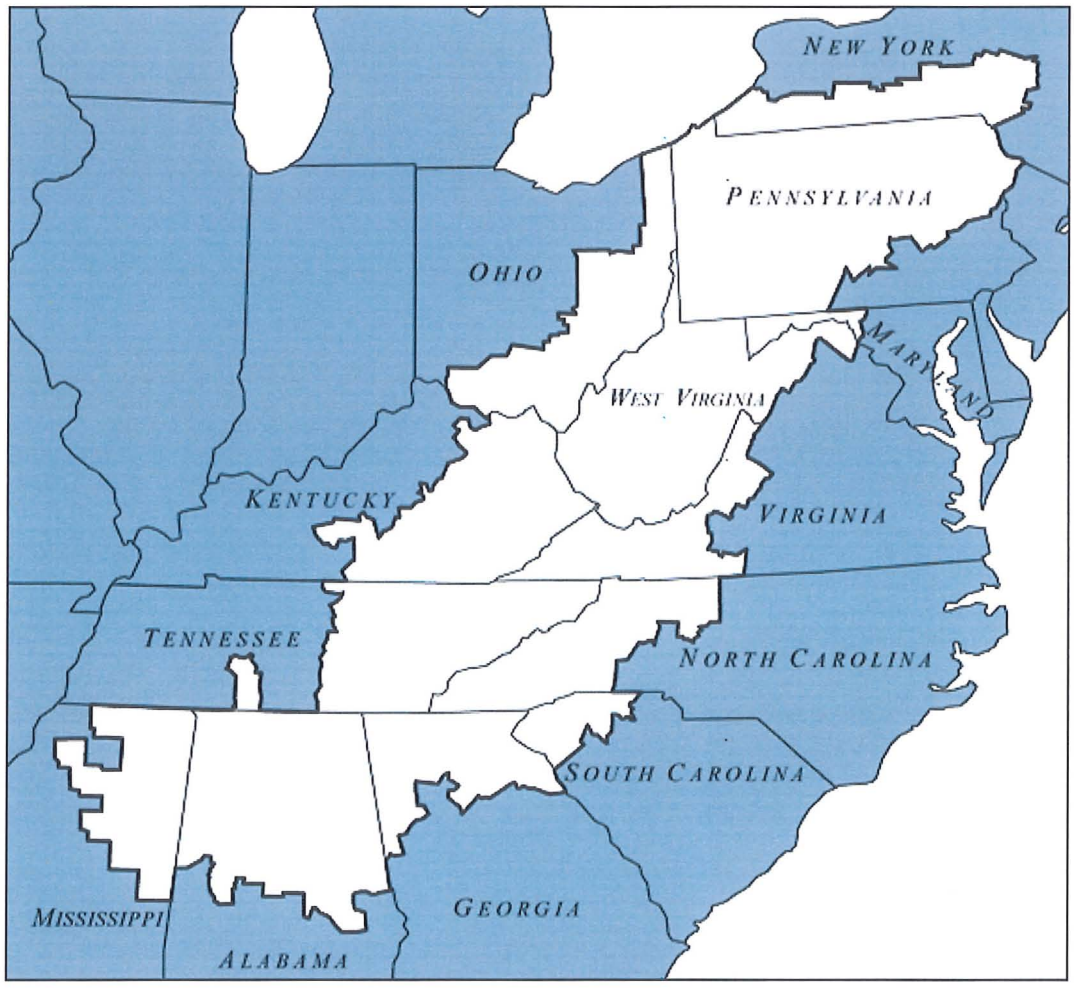

Figure 7-3. Map of the Appalachian region

Source: ARC, 2010

In 1999 the ARC commissioned the Nick J. Rahall Appalachian Transportation Institute (RTI) at Marshall University to undertake studies of commodity flows (phase I) and transport costs (phase II) which found that there were impediments to shippers in the region due to poor access to major rail and port traffic routes. The low traffic volumes and difficulties in sourcing backhauls, in addition to the rugged terrain requiring numerous tunnels (therefore precluding double-stack operation), were all major issues that resulted in increased trade costs to local shippers (RTI, 2000). A detailed study of new track and terminal infrastructure was recommended, including costs and benefits for all parties and increased cooperation between the region, state and national governments, as well as the railroad companies.

After initial meetings in 2000-2001 between the steering group comprising West Virginia DOT, Norfolk Southern railroad, the Ohio Rail Development Authority, Virginia Department of Rail and Public Transportation, ARC and RTI (ARC, 2010), this second study was commissioned. The research was funded by the states of West Virginia and Ohio, RTI, Norfolk Southern and the Federal Highways Administration (FHA), and was tasked with selecting the best route, estimating the costs of double-stack clearance and measuring the project benefits for all stakeholders. Both eastern railroads, Norfolk Southern and CSX, were invited to take part in the study, but after initial meetings CSX declined therefore only Norfolk Southern routes were considered. The selected route (see Figure 7-4) was used primarily by coal trains delivering coal to the port of Norfolk, where the largest export coal terminal in North America is located; its inability to accept double-stacked container trains limited the competitiveness of regional shippers, who had to drive longer distances to access intermodal terminals. The study found that a penalty of $450-650 applied to each container movement.

In order for containers to reach the lower Appalachian area, the main choices were through west coast ports then by rail via the Chicago hub (where the container will change from western to eastern railroads), or via east coast ports. If coming through an east coast port such as Norfolk, the rail options were single-stack direct or double-stack on a route that added over 200 miles and around 24 hours to the journey, hence increased cost. Therefore trade to this region was penalised. At the time West Virginia was ranked 40th out of 50 states in the percentage of Gross State Product derived from exports (RTI, 2003).

The challenging topography in this mountainous area increased the costs of engineering work, which were initially estimated at up to $111m, but the Benefit-Cost-

Ratio was estimated at between 2.0 and 5.1. This finding was supported by the American Association of State Highway Transportation Officials (AASHTO), which identified the corridor as one of three multi-state rail projects with the potential to deliver considerable public benefits (AASHTO, 2003). The study concluded that, despite substantial benefits for the private sector, the corridor upgrade was unlikely to proceed without public support. The next step was to raise interest in, and support, for the project: "In state capitals, town halls and business offices, and on Capitol Hill, scores of familiar questions were answered thousands of times, while both methods and conclusions were constantly scrutinized. As a product of this process, untold numbers of stakeholders helped shape and promote what eventually became a coherent legislative initiative" (ARC, 2010; p.9).

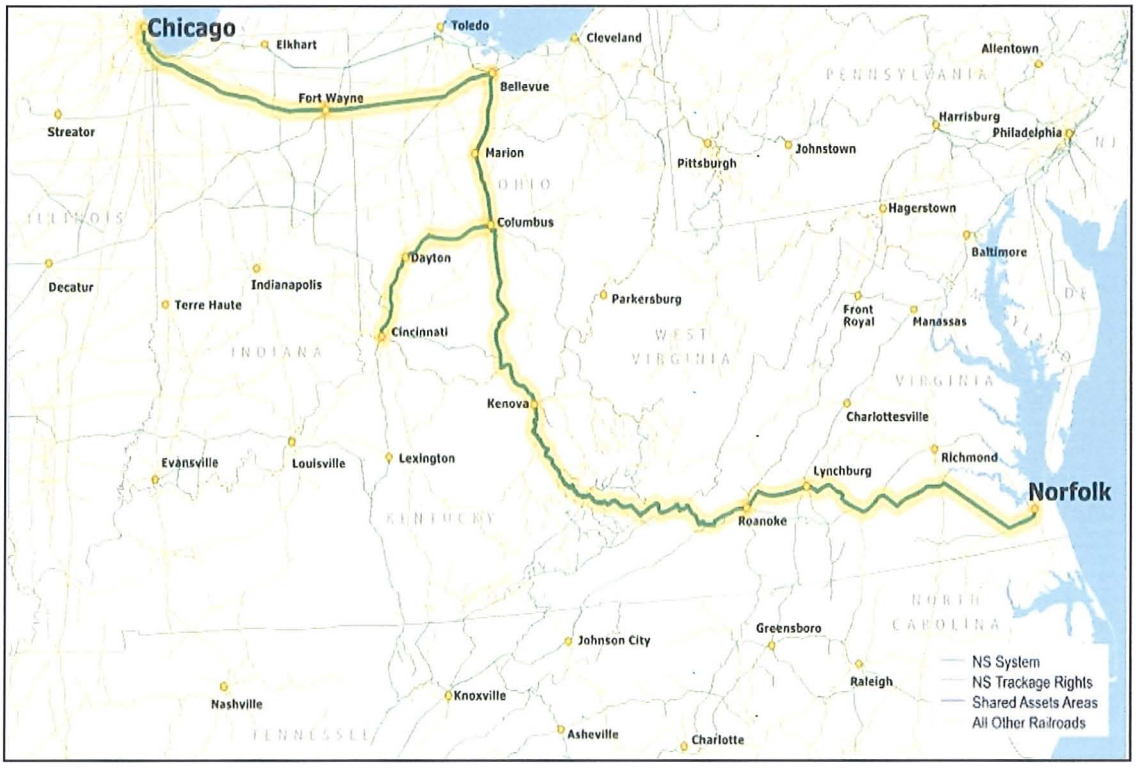

Figure 7-4. Map showing the Heartland Corridor route

Source: Norfolk Southern, 2010

Local interviewees noted that these discussions helped the representatives at the federal level realise the importance of developing corridors of national significance. It took several meetings in Washington DC to promote this agenda and interviewees agreed that it was the trade argument that interested federal legislators the most. While investing government money in the project would benefit a private company, it was

found that significant economic development benefits would accrue to the improved trade access for the region, and it was therefore on that basis that a public-private partnership was pursued.

When the 2005 SAFETEA-LU legislation was passed, the Heartland Corridor was designated as a Project of National and Regional Significance, authorising $95m in federal funds for the project (reduced to $84.4m by estimated obligation limitations, rescissions, etc.). Of the total cost of $195.2m, $84.4m was federally funded, $101.0 million was contributed by Norfolk Southern, $0.8m from the Ohio Rail Development Commission (ORDC) and $9.0m came from the Virginia Department of Rail and Public Transportation (VDRPT).

Two Memoranda of Agreement, one between the Federal Highway Administration (FHA), the Eastern Federal Lands Highway Division (EFLHD) and Norfolk Southern, and the other between FHA, EFLHD and the three states were completed in August 2006. The agreements identified roles and responsibilities for the environmental planning, design and construction of the Heartland Intermodal Corridor Project. Furthermore, the first MoA established an unprecedented funding mechanism that allowed money to flow directly from the federal government to the railroad.

A key aspect of the second MoA was that, since the majority of the tunnels were in West Virginia, the other states had to agree that the majority of the money would be spent there, as they would all benefit. Along the route, 28 tunnels and 26 other overhead obstructions needed to be raised to allow the passage of double-stacked container trains. Construction began in October 2007 and the first double-stack train ran on 9th September 2010. The project removed over 200 miles and nearly 24 hours from the route between Norfolk and the Midwest (ARC, 2010).

A central aspect of the success of the upgraded corridor was a large intermodal terminal within a large logistics park, built to serve as an alternative hub to Chicago in the northeast of the United States. The new intermodal terminal at Rickenbacker, outside Columbus, is owned and operated (through a third party contractor) by rail operator Norfolk Southern. While the port of Virginia at Hampton Roads has played a supportive role throughout the process, as it will benefit from improved inland access in order to compete with west coast ports, it is not actively involved in the developments. The site was developed through a $68.5m partnership between Norfolk Southern and the Columbus Regional Airport Authority (with $30.4m coming from a SAFETEA-LU earmark). The terminal is located within the logistics park, named the Rickenbacker

Inland Port. This integration of a rail terminal with a logistics park was the first time NS had done so (Rodrigue, 2010). The total site covers 1,576 acres. In addition to the common-user terminal, customers can have direct rail connections to private warehouses.

This terminal currently has three trains in and three out per day, and is about to start one from Columbus to Virginia. There are also two trains from the east coast to Chicago that get merged into one here, and a domestic train each way to Chicago. The terminal is currently doing 500 lifts per day, but it could do double the current lifts. Unlike many inland ports in the United States, 95% of its traffic is international, coming from the port. Furthermore, as the aim of the connection is mainly maritime access, the trains will be made up primarily of cars that take 20ft, 40ft and 45ft boxes, rather than 53ft domestic boxes (Boyd, 2010), which is also attractive because the US network is currently experiencing a shortage of 53ft well cars for double-stack operation.

While much government attention is focused on the infrastructure for the trunk haul, every single container needs to come from a warehouse. Each warehouse may only be contributing a handful of containers a day or week to the terminal, so a large amount of warehousing space is required to feed the terminal and make the rail operations economically viable. A large purpose-built site like Rickenbacker, with a good amount of greenfield space for future development, can help to attract companies like 3PLs to locate in one area, thus reducing the road haul and increasing the attraction for intermodal transport. One interviewee noted that his firm built a new warehouse at the Rickenbacker site early on in the process because it was felt that the new rail connection with east coast ports would be "one of the most important developments for trade in Columbus since the interstate." Smaller terminals on the route are being planned at Prichard, WV and Roanoke, VA, but funding is still being sourced before work can begin at these sites. This is particularly important for shippers in West Virginia who are currently more than 1130 miles from the nearest intermodal terminal, resulting in additional costs estimated at around $450-650 per container (RTI, 2003).

7.3.4 Recent development of intermodal corridors in the USA

The famous Alameda Corridor was the first major PPP intermodal corridor in the United States, opening in 2002 at a total cost of $2.43bn, split between $1,160m revenue bonds, $400m federal loan (the first of its kind), $394m from the ports of Los Angeles and Long Beach, $347m MTA grants and $130m from other sources

(Goodwin, 2010). The ports are directly involved in the project, as they are the financial guarantors of the corridor and will lose money if the route is not used and incurs losses (Jacobs, 2007; Callahan et al., 2010).

The Heartland Corridor was the first multi-state PPP intermodal project, and it can be viewed as a major influence on subsequent developments of large multi-state intermodal corridor projects. CSX's National Gateway is a PPP that also joins Norfolk with Ohio (via a different route), involving 61 double-stack clearances, the construction or expansion of six intermodal terminals and will cost $842m (McCrary, 2010), including $98m in funding from the first TIGER programme. Norfolk Southern has proposed a number of projects along what they call the Crescent Corridor, a 1,400 mile stretch running between New Orleans and New York. They are aiming to develop a PPP to cover the estimated cost of $2.5bn. The project involves 13 states, 11 new or expanded terminals and 300 miles of new track. In February 2010 the project was awarded $105m in TIGER I grants through an application from Pennsylvania DOT and in August 2010 six states submitted applications under the TIGER II programme totalling $109.2m, although none were successful.

One key result from these corridor developments will be to transform Ohio into an intermodal hub for the US, with both eastern railroads having major intermodal terminals there. This will allow some traffic to bypass Chicago, thus redrawing the map of intermodal transport in the country.

7.4 Analysing the case study

The use of a thematic matrix was established in the methodology chapter, based on the literature review. All the data were reviewed and relevant information for each of the six factors, divided into 27 sub-factors, was entered into the matrix. The data collection, primarily through interviews but supplemented with document analysis, was guided by these factors, thus while the analysis proceeds by induction, a strict grounded theory approach is not followed here. Rather, the analysis is guided by pre-defined factors. The sub-factors, in addition to blank "other" rows within each section, produce a fine level of detail that allows key themes to emerge.

Flyvbjerg (2006) reminds us that "case studies . . . can neither be briefly recounted nor summarised in a few main results. The case story is itself the result" (p.238). In this chapter the case study has been presented in a narrative form, and it is essential not to be overly reductive by focusing only on the tabulated summaries of key evidence for the

research question. The overall aim of this thesis is to understand the process, to learn how port regionalisation strategies occur in practice. The sub-factors in the analysis matrix are there to structure the findings but the overall research question is to learn about how the process takes place, therefore the above narrative has explored those issues with rich detail on actual practice.

Table 7-2 sets out the thematic matrix with the relevant data noted against each factor. The table is followed by a discussion of these findings.

Table 7-2. Applying the thematic matrix

Factor	No.	Sub-factor	Data
1: The reasons for the collective action problem	1	Unequal distribution of costs and benefits	Public spending is controlled by each state, but, from a corridor perspective, the benefits accrue to more than one state. It is therefore difficult to coordinate such a project where one state may have to spend more because a lot of the rail line is in their state, while another state may receive a disproportionate benefit. From a private point of view, the costs of investing in an upgraded line would bring benefits for users but not enough revenue for the operator to cover the investment.
	2	Lack of resources or willingness to invest	As in 1 and 4, there was no willingness to invest on the part of the two Class I railroads. Interviewees did not directly state the reasons, but it may be because benefits of doing so were not clear, either from the perspective of economic feasibility of the new traffic, or as a competitive act against the other operator. In the public sector, sufficient financial resources were not available within each state to develop their own rail infrastructure, as a corridor perspective was required. This is related to the following sections on scales of governance. Lack of knowledge of rail in the public sector was also noted by both private and public interviewees, as this is not the traditional purview of DOTs in the United States.
	3	Strategic considerations	As in 4, two major rail operators serve the area. There was no need for one firm to capture a market as a competition mechanism because both firms knew that a large investment was required therefore the result was inertia.
	4	Lack of a dominant firm	The area is served by two Class I railroads, Norfolk Southern and CSX.
	5	Risk-averse behaviour/short-term focus	Related to 1-4, there was no incentive to take a long-term view of the payback for the required investment to upgrade this line. Due to the rationalisation of the Class I rail network in previous decades, the focus is now on high capacity lines rather than peripheral routes. The requirement to provide regular dividends to shareholders was noted by one railroad as a constraint on long-term investment.
	6	Other	According to the regional body and the commissioned studies, there was a lack of understanding in the public sector (i.e. the state DOTs) of the importance of regional access to global markets. This was highlighted in the interviews as an important part of the need for a regional focus rather than a state focus.

2: Infrastructure for collective action 1: the roles, scales and institutional presence of public organisations	7	At which level are institutional presences scaled	Roles were well defined at local, state and federal level, and institutional thickness was strongest at state level. State DOTs were and remain the primary conduit for infrastructure planning and investment.
	8	Confused sovereignty, multiple authorities and funding sources	Sovereignty was not confused as roles were well defined (see 7). The problem was that the primary scale was the state level, which lacked ability to act. Other funding sources were known (e.g. federal earmark) but there was no clear process of how to obtain this funding, which therefore required much informal networking. However, for the states to lobby effectively in Washington, it was first necessary to achieve a unified project vision at the local and state level. This was driven primarily by the regional body ARC, supported by some key stakeholders such as a political champion in the person of a WV state senator.
	9	Constant changing and re-making of institutions	This was not observed during the project as institutions remained stable. After the project, the changing of federal funding for transport projects has altered the institutional setting. While organisations remain the same, the institutional setting (in the sense of the rules of the game) has changed, and now multi-state PPPs have become a key way to acquire funding for transport infrastructure.
	10	Limited government organisations due to political designs can mean that delivery of government policies may be "hobbled"	Political design of transport agencies means that they don't have a great deal of power for direct intervention. However, their roles are clear therefore new stakeholder groups are able to facilitate their own actions. Moreover, the limited state role allows freedom of action for other groups to access funding directly without involvement in planning bureaucracy.
	11	Conflict between legitimacy and efficiency	As in 10, the state level of transport governance is the most legitimate scale, but it has limited ability to promote intermodal transport or direct investment there. Conversely, the less legitimate state body ARC was able to use informal networking to promote the project and turn it into a coherent vision that could be lobbied at federal level. Thus a conflict between legitimacy and efficiency (agency is perhaps a better term here) has been observed.
	12	Other	

3: Infrastructure for collective action 2: how the system works	13	The rules of the game	As in 8, the rules of the game were known, thus the limited infrastructure for collective action was known, but it was very limited. The rules were that state DOTs controlled infrastructure spending and that rail was predominantly a private sector area therefore money would not be directed there. Thus the rules of the game had led to the collective action problem.
	14	The current equilibrium outcome, i.e. a shared understanding of how the system works	Initially there was not a well-defined infrastructure. Both the rules (see 13), and the understanding of this system by actors, led to an impasse where no actor was prepared to invest. The shared understanding was that it was up to the private sector to invest, and state DOTs would not invest because benefits to each state were not clear. Therefore a political champion was particularly important at the early stages to connect the stakeholders with funding opportunities, thus attempting to alter the shared understanding of how the system works.
	15	Innovation may be stifled by inappropriate formal structures	As in 8, 10 and 11, the structure of transport governance prevented investment in this area. It is not clear from the data that innovation was "stifled"; it is perhaps safer to infer that, as in 13 and 14, actors understood the status quo and were not incentivised to change the current system. However, there is no evidence in this case that innovation had been tried and stifled by the current structure of transport governance.
	16	Monitoring may become primarily ceremonial and related to the formal structure rather than to the real activities of the organisations	The monitoring of public agencies or the institutional setting did not come up directly in the interviews. Indirectly, however, the structure of the state DOTs, whereby their funding is based on their state transport plans and strategies rather than a regional approach, could be interpreted as a "ceremonial" monitoring that focuses on the status quo rather than a deeper analysis of issues for regional shippers that were not being addressed. In particular, state funding is focused primarily on highways as rail is a private business, therefore the "real activities" of the DOTs could be defined as ensuring market access and good transport connections, which were not being monitored in a system that did not monitor rail because it was not a public responsibility to do so.
	17	Other	The multi-state concept of this project was replicated in other projects seeking federal funds, thus a well-defined infrastructure for collective action can now be observed. It is difficult to assess to what degree this project influenced subsequent projects or in particular the new direction of federal transport funding. A clear trend can be observed, which was discussed with interviewees during the research trip, as the second round of TIGER programme applications were being assessed while interviews were being conducted in the USA during September 2010. However, clear relations between the two phenomena are difficult to identify.

4: The kinds of interaction among (public and private) organisations and institutional presences	18	What actions were taken	Market studies were conducted on behalf of the regional body ARC to identify options. A steering group was established by the ARC with regular meetings, involving both the public and private sectors. In particular, the early involvement of the private sector railroad operator was essential. Regular promotion was used to convince relevant people of the benefits of the project. A high level of interaction was noted by interviewees as being of central importance. Once a coherent project vision had been established, the project was then lobbied for at federal level for congressional funds.
	19	Informal collaboration and influence	As noted above, the regional development agency ARC was able to build informal networks, and as discussed in the notes above regarding formal structures of transport governance and their relation to the lack of an infrastructure for collective action, it was that very lack of agency in the system that both necessitated informal networking but also allowed it to succeed. A political champion was particularly important at the early stages to connect the stakeholders with funding opportunities. It is difficult to map such a process objectively as it is reliant on the interview statements which may not describe the reality accurately, therefore caution must be exercised here. However, the informal nature of the process was raised by many respondents.
	20	Other	The informal networking has to an extent been institutionalised in the current TIGER grants, which are application-based, and rely, therefore, on bottom-up consortia approaches based on PPPs.
5: A common sense of purpose and shared agenda	21	Stakeholders established agreement upon the priority and message necessary to complete the task	Regular steering group meetings were held to establish a joint vision to enable the promotion of the project in different contexts. Essential to this vision was agreement on a multi-state corridor approach, which was based on recognition by all stakeholders of the shared benefit in allocating the funds to specific locations. The group developed common presentation and branding materials that contributed to the coherent project vision and the involvement of a political champion helped to drive this project at federal level.
	22	Link between establishing the vision and achieving the outcomes	Many interviewees noted that many meetings were required to establish the vision, and many local presentation and discussion sessions took place. It was noted that without this work, the project would not have progressed to federal level.
	23	Other	

6: The role of leader firms	24	Institutional entrepreneurs benchmarking their own institutional equilibrium against new ideas	It was difficult to establish this factor definitively based on interview responses, and it also relates to 26 which is based more on observed actions. It could be said that the rail operator that got involved in the project (as opposed to their competitor who declined) was trying new ideas to alter their institutional equilibrium, but how far this process was actually understood or planned strategically is difficult to map. This factor could be studied better by action research, thus is perhaps not suitable to this framework.
	25	Use their own resources	Norfolk Southern was involved from early on in the project. It contributed funding and staff time and was noted in the interviews with other actors as being flexible with changing project plans.
	26	Leads to reactive moves by other firms	Other firms followed afterwards in similar multi-state corridor projects, most notably CSX's National Gateway (CSX had declined to take part in the Heartland Corridor).
	27	Other	States are now looking at other related investment along the corridor for intermodal terminal access.

In this case, state rescaling issues were not particularly active, as roles and responsibilities were well defined at all levels. MacLeod (2001) advised that it is necessary to identify at which scale institutional thickness is strongest; in this case it is clearly the state level, as evidenced by the state DOTs. However, a regional impetus was needed to draw states together, which began with a relatively weak regional organisation (ARC) drawing together stronger individual organisations, such as state DOTs and the privately-owned railroad Norfolk Southern. The research identified a lack of motivation on behalf of the railroads to challenge the current situation, requiring the promotion by the ARC and others of a greater understanding of the role of regional access to global markets.

While a trend towards devolution has been noted in many areas of the world (Rodríguez-Pose & Gill, 2003), states in the USA have long been the primary level of institutional presence with regard to transport (Haynes et al., 2005). Findings in this research on the importance of regional cohesion in devolved governance systems can thus be of relevance to other contexts.

From an institutional perspective, the notable feature of the existing system was the clear roles for existing organisations within their institutional setting. However, the reason behind this clarity was that public organisations occupied a small role with little influence over the railroad sector. Railroad development is for the most part planned and funded by the private sector, which in this case had little impetus for potentially risky investment. Therefore as a well-defined infrastructure for collective action did not exist, informal arrangements, brand development, political championing and congressional earmarks were required to bring the two sectors together and highlight the potential for both private and public benefits.

Since this project, the institutional setting has been altered by developing more transparent funding systems, based on a clear bidding process for pre-determined funding sources. In doing so, organisational arrangements such as PPPs have been encouraged to develop, demonstrating that a well-defined infrastructure for collective action did not exist before the project, but has since been developed. Interestingly, a move away from congressional earmarks towards a discretionary system means that

legislators will potentially have less influence over strategic planning, as such a system would depend on ad hoc bids (see Moe, 1990). On the other hand, if multiple private and public sector partners are required to form consortia in order to attract federal money, greater strategic cohesion across larger areas becomes more likely than via the usual state-by-state approach.

While the project was started by the regional development agency, once stakeholders were involved the project developed its own identity. Regular meetings, promotional events and a political champion were particularly relevant in the early stages. Vital for the successful development of such multi-partner, or indeed multi-region or multi-state projects is the agreement among stakeholders that the investment will benefit all locations along the corridor (McCalla, 2009). In order for the public and private funds to be blended, a new framework of agreements had to be developed, ensuring that funds were spent in certain ways.

As noted earlier, institutional thickness relates to the institutional environment, while hinterland access regimes refer to specific projects. The aim of this theoretical framework is to draw both approaches together, therefore some indicators relate to the overall system, while others relate to the role of actors within this institutional setting.

The current institutional setting is constituted by the roles, power and influence of public and private organisations, in their various manifestations, through such areas as planning, policy, operations and the marketplace. While there is a general government policy in favour of intermodal transport, in the USA planning for intermodal freight does not normally include direct intervention, as it is the private sector that owns and operates rail infrastructure and services. Therefore while planners desire to remain informed of any issues to which they can contribute some assistance, it is not their role to intervene and they do not possess sufficient instruments to influence the situation.

Nevertheless, private sector actors can find it difficult to make investments in transport infrastructure, therefore they depend to a significant extent on public sector support through the planning system. Although when public funding is used to support an infrastructure project, questions of infrastructure ownership are raised, which is one reason why the private sector has traditionally been wary of accepting public money. Private organisations will generally do what is most profitable, responding to

operational requirements or signals from the market. This approach often produces a lack of long-term investment due to shareholder pressure. However, a public organisation with little institutional presence, such as the ARC, has the flexibility to draw together policy-led planning departments and profit-seeking private operators in order to fulfil the aims of local shippers who feel that neither the policy and planning arenas, nor the operations and market focus of the private sector, are likely to address their problems if the current institutional setting is not altered.

Therefore the way the institutional environment has been altered in this instance is to provide access to public money for private operators to bring forward their operational requirements, rather than enforcing a planned system of infrastructure investment from the top down. The role for this money is to enable large consortia to come together where public and private benefits can be clearly identified among all the parties. This is not necessarily to say that the TIGER programme should replace funding through transportation legislation, and, indeed, there is an important conversation to be had on that issue, but its influence will be felt in future plans.

One key aspect of the Heartland Corridor project was that the private sector rail operator was brought into the project first, before it was taken further to lobby for public money. Prior to this project, much resistance was found in the private sector towards government involvement, and the sectors were not integrated in the sense of long-term strategic planning. The achievement of the ARC to build institutional capacity through stakeholder groups involving the private operator along with shippers, thus forming a shared agenda, was extremely important.

In the United States, institutional presence in terms of transport governance is scaled mostly at the state level, while the regional body does not have much actual power of action. However, it managed to create agency through informal networking. Furthermore, taking a corridor approach across jurisdictions was essential to the success of the Heartland Corridor. In the USA, vertical integration in the rail industry makes investment planning by the rail operator much easier, because they have control over the operations in relation to the infrastructure investment. Thus they knew that if a certain amount of money is spent, a certain amount of revenue is likely to result from shippers in these regions. By contrast, in Sweden, for example (see pilot study), the inland

terminal that is being developed has not been able to access the demand for their services, despite evidence that the demand exists. The crucial point about investing in intermodal infrastructure is that demand can be consolidated on key routes to create economies of scale and allow operators to bid on this consolidated traffic, rather than many small flows that could not support such expensive infrastructure and services. The Heartland Corridor demonstrates how taking an integrated corridor approach can overcome these problems.

New developments in transport funding from the federal government in the USA are also interesting, because they suggest the influence of the Heartland project, and how a reconciliation can be achieved between top-down planning approaches and bottom-up market-led approaches, as justified in the funding applications by consortia of public and private actors. Therefore path-dependant transport chains can be disrupted by peripheral regions through the coordination of public and private bodies. The success of multi-state PPPs can lead to governance reform in the way transport planning and public investment are restructured to attract private interest, and bring forward large rail infrastructure projects that otherwise would not be pursued.

As noted by Coulson and Ferrario (2007), it is important not to conflate correlation and causation when a successful project and a strong institutional environment are observed. Therefore, while it is not possible to claim that this project caused a change in policy, a clear trend may be observed from federal loans (e.g. the Alameda Corridor) to grants (through earmarks, as in the Heartland Corridor) to competitive bids (the TIGER grants). In addition, two major multi-state corridor projects have since commenced, based partly on PPPs and federal funding through the TIGER programme. Therefore another trend may be observed, towards multi-state projects. Thus governance of transport infrastructure development has moved towards a reconciliation between top-down planning approaches and market-driven private sector development.

The literature suggested a conflict between legitimacy and efficiency and a limitation of political organisations due to their design, both of which were confirmed in the findings (although agency may be a more accurate term than efficiency in this context). These issues account for the high incidence of policy churn, lack of agency and, sometimes, lack of communication between the public and private sectors. The role

of informal networking was found to be important as it can overcome institutional inertia, although it is difficult to capture this process, and harder still to attempt to institute it in another setting through policy action.

The framework developed in this chapter represents an attempt to bring together analyses of individual projects and institutional settings, reconciling institutional economics and institutional approaches from economic geography. Being drawn from a vast institutional literature, it is fairly broad at this stage; it requires application in more cases, therefore, in order to test it further and improve its relevance and explanatory power. These issues will be discussed further in the conclusion chapter.

7.5 Conclusion: the role of collective action problem resolution in port regionalisation

Before discussing the relevance for port regionalisation, some findings can be drawn from the specific case analysis. A trend in federal funding from loans to grants to competitive bids has been identified, as well as the potential relevance of the TIGER funding grants in other contexts, in which the PPP approach required in TIGER applications may be a way to reconcile bottom-up and top-down approaches to transport planning and funding. The need for a more strategic approach in the UK was discussed in part two of the thesis, and the potential applicability of a similar scheme there will be considered as a future research topic in the conclusions chapter. Findings from this research on the importance of regional cohesion (informal or otherwise) in devolved governance systems can also be of relevance to other contexts.

This chapter can also build on part one of the thesis, which compared a number of inland terminal case studies. The Rickenbacker inland terminal could be added as another inland-driven case study, in this case being able to develop good relations with the port, as part of the larger corridor project, thereby reflecting the benefits of port involvement from the beginning, as well as the benefits of taking a corridor approach. By contrast, one of the western railroads interviewed complained that they do not use the Alameda Corridor as much as they otherwise would because they do not have sufficient terminal space nearby to marshal trains. Therefore that project becomes a case of a port authority integrating inland to the extent of building the rail infrastructure, but

without the operational integration displayed in the Venlo case where the port terminal operator also operates the rail link with the inland terminal. So this chapter has provided additional cases to develop the classifications from part one of the thesis further.

Considering the role of collective action problem resolution in port regionalisation, this chapter has shown that conflicts between legitimacy and efficiency or agency and a limitation of political organisations due to their design may account for the high incidence of policy churn, lack of agency and, sometimes, lack of communication between the public and private sectors. Thus institutional design constrains integration between maritime and inland transport systems, suggesting that port regionalisation processes will face challenges developing in the way that the concept assumes. This part of the research goes some way towards describing how "national, regional and/or local authorities try to direct this process" (Notteboom & Rodrigue, 2005; p.306), and explaining how "a lack of clear insights into market dynamics could lead to wishful thinking by local governments" (p.307). It is the way public organisations are designed that limits their capacity to engage successfully in such situations; when they do, the conflict between legitimacy and agency limits their effectiveness.

This part of the thesis also highlights the importance of scale. In all situations, it is important to identify at which level transport governance is scaled, and how public and private organisations interact within and around these scales. In this case, a regional body utilised informal networking to overcome the inertia at state level, where transport governance is scaled in the USA. Comparisons can be drawn with part two, where national funding exists to promote intermodal transport, but the funding scheme is ad hoc rather than strategic. So the results from this case study analysis demonstrate that when discussing the role of the public sector in port regionalisation, it is first necessary to understand the roles and powers of public bodies in that particular country or region, before forecasts can be made of how private freight stakeholders may act.

Similarly, the case study analysis revealed the importance of leader firms, yet these firms are reluctant to act without the infrastructure for collective action being clearly defined. So again, when predicting or explaining the likely path of regionalisation processes in a particular country or region, these aspects must be understood. In this case, there were two competing rail operators. In the case of the UK retail sector in part

two, there were a number of retailers competing, but only one large enough to fill a train; as the other retailers would also prefer a private train rather than a shared service, this prevents them exploring rail in more seriousness.

More cases are required to validate these suggestions, but the details of how a case works in practice can raise issues about the extent to which port regionalisation can actually happen and what is required for it to happen. The case elucidates good reasons why ports may experience challenges in controlling or capturing hinterlands through the strategies of integration that the port regionalisation concept suggests.

Institutional design constrains, or at least challenges, such regionalisation processes of integration from occurring, therefore in future research greater disaggregation of port regionalisation possibilities could be pursued along the lines of institutional models of ports and other stakeholders, particularly public sector planners and funders. Legitimacy and agency are a problem for these organisations and if an infrastructure for collective action is not in place (and it is usually predominantly a *public* infrastructure for collective action), then private firms will not act, thus hampering any attempts at port regionalisation and keeping the maritime and inland spaces separate.

Therefore for port regionalisation to happen in a region (at least in terms of intermodal transport which is the limited focus of this research), it will depend on the institutional setting and relative constraints on action, including design of public organisations and the conflict between legitimacy and agency. The institutional setting, as well as the institutional agency of actors in the rail sector, will require further classification, with evidence in each case, and cannot be assumed to be the norm. Port regionalisation can only be declared a phase in port development if it can be shown to what extent ports are integrating with these inland developments, which will be different in each region.

8. Discussion of results

8.1. Introduction

Each of the three research questions was answered at the end of each of the appropriate chapters. This chapter will bring these findings together. An addition to the port regionalisation concept will then be proposed and discussed, before further theoretical discussion and a final conclusion.

8.2 Discussing the results

The aim of this thesis was to understand the role of intermodal transport in port regionalisation by examining three questions in detail. The findings are summarised in Table 8-1.

Table 8-1. Summary of key findings from the thesis

Question	Findings
1	**RQ 1: How can different strategies of inland terminal development influence port regionalisation processes?**
	• Ports can develop inland terminals • Differences exist between those developed by port authorities and those developed by port terminal operators • Differences exist between those developed by ports and those developed by inland actors • Integration with ports is difficult, which challenges regionalisation
2	**RQ 2: How can logistics integration and inland freight circulation influence port regionalisation processes?**
	• Operational issues prevent port-inland integration and thus challenge regionalisation • Lack of integration of market players challenges regionalisation • Centralised spatial development of inland markets challenges regionalisation • It remains difficult to solve operational issues through policy
3	**RQ 3: How can collective action problems influence port regionalisation processes?**
	• Public agencies face a conflict between legitimacy and efficiency or agency • Infrastructure for collective action is normally public, and without it private actors are hesitant to take risks, but it is not easy to develop this infrastructure • Inappropriate institutional structure can limit port-inland integration, which challenges regionalisation
Relevance for port regionalisation	• It is not easy to maintain the commercial and institutional conditions required for port regionalisation strategies to succeed • The implication is that port regionalisation may be the exception rather than the norm

It was not known at the outset whether findings from any of these parts would be able to be used to induce new theory. The primary goal of case study research is to extend understanding through deep analysis of the specifics of the case, which in this thesis meant understanding *how* port regionalisation works in practice. However, new theory does not always result from such a process.

Parts two and three of the thesis highlighted conflicts between maritime and inland actors, a lack of integration, institutional barriers, and the importance of understanding the specificity of market structure (part two) and limitations of political design (part three), both of which limit the extent to which port regionalisation processes can occur. It is not clear at this stage how to incorporate these into the port regionalisation concept, other than to underline that assumptions of integration of corridors are perhaps overstated. The concluding chapter will consider how this avenue of research can be taken further in future work.

Part one showed that Venlo is the only case of port regionalisation among all the "consciously implemented" inland terminals under study. This is not to say that others do not exist, but that in many cases where ports are supposedly integrating inland, the case study analysis has revealed that they are not. Similarly, in parts two and three of the thesis, this is not to say that ports cannot or are not integrating with inland freight logistics markets and/or through solving collective action problems, serving as facilitators in inland development (even where they cannot necessarily capture traffic, as correctly stated by Notteboom & Rodrigue, 2005), but that very real barriers prevent port regionalisation taking place, and these will be context-dependent, thus challenging the ability to capture them in a single concept.

It seems unclear whether it can be stated definitively that there is such a phase of port development occurring, when it seems more a *possibility* that can only take place under a number of favourable conditions, which cannot be assumed to be the standard case. As Rodrigue et al. (2010) noted about inland terminals, "the inland port is only an option for inland freight distribution that is more suitable as long as a set of favourable commercial conditions are maintained" (p.2). Similarly, it might be said that port regionalisation can only happen as long as a set of favourable commercial and institutional conditions is maintained. The findings from the cases presented in this

thesis suggest that it is not easy to maintain such conditions, implying that port regionalisation may be the exception rather than the norm, only one possible pathway in port system evolution. Thus a hypothesis for future research may be that there are more factors preventing a port integrating inland than supporting it.

Just as with "dry ports", the notion that ports are consciously capturing hinterlands through spatial development is not clear. This thesis does not contain enough data to answer this question definitively, but it suggests that perhaps the port regionalisation concept is insufficiently tested or proven as yet.

As this thesis is a qualitative exploration, rather than an experimental proof or disproof of the port regionalisation concept, it can serve as a framework for further analysis, disaggregation, identification and classification of port regionalisation processes, in particular the factors that enable or constrain them. Future researchers can use this framework to add more evidence of different regionalisation processes so that a more precise understanding may be gained of the circumstances under which port regionalisation processes can occur and are occurring, and where they are blocked by other strategies that can also be observed, as they have been in the cases examined in this thesis.

As discussed in the methodology chapter, it is not possible to generalise statistically from these case study findings. The aim of this thesis is to generalise analytically, that is, to generalise to theoretical propositions. In this thesis, the aim is to expand the regionalisation concept to improve its explanation of these observed phenomena. The following section will consider the findings in the light of previous theory, in order to develop an explanation and conceptualisation of the observed port-inland division.

8.3 Giving a direction to port regionalisation

It was shown in the literature review that a trend may be observed towards using inland terminals to enlarge the hinterland of the seaport (van Klink & van den Berg, 1998), supported by the integration of logistics services within the transport chain. Increasingly relevant is the recognition that the port's position has changed from a monopoly to a dynamic interlinkage and a subsystem in the logistics chain (Robinson, 2002). Ports are required to drive, as well as react to, developments in both land and

water dimensions. While the economic theory of the firm examines different methods used to coordinate or control these relationships in order to reduce transaction costs (Coase, 1937), geography studies how these strategies differ across spaces and scales. Therefore to discuss the findings from this thesis, insights derived from the theory of the firm will be combined with spatial development theory.

The aim is to build on the "main street" concept outlined by Taaffe et al. (1963), whereby "since certain centres will grow at the expense of the others, the result will be a set of high-priority linkages among the largest" (p.505). However, the relations between nodes that create priority corridors are changing. Whereas in the past these corridors were more static, due primarily to the geographical or political entry barriers represented by port location, this view of ports is no longer valid (Robinson, 2002; Bichou & Gray, 2005). Notteboom and Rodrigue (2005) have characterised inland terminals as active nodes in shaping the transport chain. These corridors are now based to a greater degree on strategies of vertical cooperation than they are on the location of physical infrastructure, due to already horizontally-integrated globalised operators seeking new methods of cost reduction and hinterland capture.

In order to supply a directional focus absent in the model of Taaffe et al. (1963), this thesis borrows from the terminology of industrial organisation, which identifies backward and forward vertical integration, depending on which level of the chain owns the other levels. For example, a manufacturer buying a distributor would be an example of forward integration, whereas a manufacturer buying the supplier of its raw material would be backward integration. However, the focus of this research is on the *development* of the sites rather than their eventual ownership or operation. Therefore in practice what are being analysed are strategies of cooperation rather than actual integration through ownership, and so the directional focus applied will be based on whether control of the relationship is based on the landward or seaward side. A distinction is proposed between two types of development: Inside-Out (land-driven, e.g. public bodies, rail operators) and Outside-In (sea-driven, e.g. port authorities, terminal operators).[10]

[10] This directional model was developed in conjunction with supervisor Dr Gordon Wilmsmeier and published in Wilmsmeier et al. (2011).

The case studies exhibited the relevance of understanding the direction of development in Taaffe's "main street" concept for the case of inland terminal development. The role of the public sector in facilitating and driving development from the inside out creates new opportunities in linking ports to inland terminals. The pilot study showed that the Swedish system takes on the risk for the private sector in order to accelerate development that might otherwise take many years. The disadvantage is that, as noted in the pilot study, there remains a danger of numerous municipalities pursuing projects that, through destructive competition, become unviable, and even a single terminal in an area may not be economically sustainable if market demand (or willingness to use the terminal) has not been estimated accurately. Even if the demand is known to exist, there will often be operational reasons why these businesses will not use the rail connection. The risk of such public sector optimism bias was raised by Notteboom and Rodrigue (2005) as one danger of port regionalisation processes.

Similarly, in the case of Mouscron/Lille and Muizen, the inland terminals were originally developed using public money (either from regional organisations or through the publicly-owned national rail operator), but are now operated either by a private operator (Delcatrans taking over an unprofitable site at Mouscron/Lille), or Belgian Railways which, while still publicly owned, is operating in a deregulated market and is now vertically separated from the rail operations. It must also be remembered that most rail operators in Europe, while operating in a liberalised environment, remain subsidiaries of nationally-owned rail operators (Notteboom, 2008).

Spain provides an excellent example of both kinds of development. Outside-In is followed as a business strategy by port authorities seeking to access an inland market. The Inside-Out model is being followed by regional authorities seeking to bring development to a region. It was noted in the literature review that other research has revealed problems with developments driven by local or regional bodies because they are not always the most efficient from a transport point of view. The priority of securing hinterlands for the ports was joined with the inland priority of providing a high capacity link for local and regional shippers, as well as the economic development aims of the local and regional authorities.

Venlo is a case of Outside-In development, driven by the private port terminal operator. In terms of port development, it can be viewed as an example that fits the regionalisation concept because of its integration of operations. Ports can use a variety of mechanisms to coordinate the hinterland transport chain and thus reduce transaction costs (de Langen & Chouly, 2004; Van der Horst & de Langen, 2008; Van der Horst & Van der Lugt, 2009), but full integration is rare, and thus stands out as an innovative development. Venlo represents the kind of hinterland access strategy that many ports and inland locations would like to copy, but many institutional, operational and legal difficulties prevent its achievement (Veenstra et al., 2012). From an operational point of view, even beyond issues of ownership, the closed loop, run between the port and the inland location with full visibility of containers through PCS and the direction of such movement by the staff at the inland location, provides opportunities for higher efficiency than is possible under other arrangements, where individual rail operators struggle to achieve these efficiencies with separate streams of traffic.

Freight villages in Italy are very much an example of Inside-Out development, as their logistics/warehouse/freight village activities are land-focused. The case study analysis showed that the freight village concept is good for logistics but has had very little success integrating with ports. Indeed, even getting rail traffic at all is not easy due to the road-dominated and fragmented Italian logistics system, and some freight villages have very large intermodal terminals with very low rail traffic. An evocative comment by one interviewee was that "rail does not exist in Italy."

The Inside-Out model tends to be publicly driven, as a means to attract investment and development to a region, particularly since a key role of the public sector in infrastructure development is to bring in private sector investment. However, in this kind of operation benefits for the private investor are sometimes small therefore it is difficult to attract them. Developing such infrastructure allows container flows to be bundled on high capacity links such that private operators can then bid on this consolidated traffic. Therefore by creating an infrastructure corridor that was not there before, it removes a barrier to entry (in the form of a large upfront investment) that had kept private operators out of the market. However, this model tends to involve different companies working together in strategies of low integration, whereas Outside-In

generally involves greater cooperation since it aims to increase access and/or efficiency in a more mature marketplace, rather than generating something from nothing.

However, the model is complicated, because while Outside-In can be generalised as a privately-driven enterprise to protect or develop business for an existing company, such companies may be publicly owned. So ECT in the Netherlands is a private company integrating inland, while in Spain it is the publicly-owned port authorities which, nonetheless, act as profit-making companies. Adding examples from part three of the thesis, the Alameda Corridor represents an Outside-In strategy of a port authority integrating inland (although only to the extent of the infrastructure corridor rather than the inland terminals), while the Rickenbacker inland terminal is an Inside-Out strategy, developed by rail operator Norfolk Southern, which, nonetheless, has good relations with the port of Virginia through the larger Heartland Corridor project.

Even with Outside-In development, inland organisations remain heavily involved. While, for example, the port authority or terminal operator may be considered to drive the process and thus the direction, in reality they will be forming partnerships with inland operators or terminals, rail services, logistics providers and other actors. So in the case of Spain, the ports only have a minority shareholding and it is really the inland terminal operators who direct operations, despite the process being driven initially and marketed heavily from the seaward side. Likewise, in the Netherlands, ECT has integrated inland to manage their container flows, but they work in partnership with a logistics company to operate that aspect of the inland site. Thus ports still retain a focus on their core business, and their cooperation strategies relating to hinterland access do not cause them to lose sight of this fact.

Another aim of the directional development distinction is to help reveal the reality behind whether inland terminals are really being used by ports as extended gates or "dry ports" in the sense of being "consciously implemented" (Roso et al., 2009; p.344). The case studies show that rail terminals remain independent in most cases, even in Outside-In development, with the exception being Venlo. Ports thus do not need to be involved in the operation of inland sites in order to reap the benefits of hinterland access. They simply need to put the development together in conjunction with a terminal developer. Thus, despite the recurrence of vertical integration as a theme in the literature, the case

studies illustrate the difficulties involved in attempting such a process. Moreover, the Roso et al. (2009) "dry port" model (ICD + freight village + extended gate: see discussion in chapter 5) is extremely difficult to develop because extended gate functionality requires strong port involvement, if not full integration.

A conflict may be identified between two groupings: on one hand the Outside-in, extended gate, port-driven, "consciously implemented" concepts and on the other, the Inside-out, load centre, public-sector driven concepts. A clear conflict can be observed between land and port aims, between Inside-Out and Outside-In strategies. Yet this is not the entire story, as Inside-Out development can lead to close integration with ports, but generally only where ports are forced to reciprocate this relationship due to operational requirements. This can be seen in the way the successful port traffic of Rivalta Scrivia contrasts with the unsuccessful port shuttles of Marcianise, despite the latter being cheaper than the current system.

An additional aspect of the directional distinction applied above is to what extent the cooperation strategy followed during development impacts upon the potential integration of partners once the site is operational. In most of the cases above, the rail operator manages container flows, regardless of the terminal development situation. Findings from the current research indicate that most sites act as independent rail terminals once they are developed, rather than being controlled by the ports. Share ownership of these inland terminals represents a way for ports to remain informed and to protect their interests, which relates back to the point of Moglia and Sanguineri (2003) about port authorities having a seat on the Board of private companies carrying out commercial activities within their ports. For instance, in Spain all three sites are marketed by the ports, suggesting that the ports are directly involved in them, but they are all common-user facilities run by independent organisations, in none of which does a port own the majority shareholding. However, as has been noted, the controlling share in the operator (not owner) of Coslada is a seaport terminal operator.

The next aspect to consider is integration with ports. In Spain, public port authorities are involved in inland terminal development, yet despite their heavy marketing of this involvement, in none of these sites do the port authorities own a majority shareholding or direct the operations. By contrast, ECT is a private port terminal operator actively

integrated with the inland site, thus representing perhaps the only genuine case of port regionalisation of the above examples. While in all the cases above, a port actor is involved to some degree, the results in part one reflect the difficulty for a port authority (and to a lesser extent a port terminal operator) to exert influence beyond the port's perimeter (de Langen, 2008; Moglia & Sanginieri, 2003). The underlying theme is that port actors want improved inland access to further their business aims, but they can rarely be said to be driving these developments, even in the cases of Outside-In development. In most cases, the port actor is a partner in someone else's plan. Similarly, with the exception of Venlo, all inland terminals in the above sample are independent from the port.

Rather than exerting influence on the ports, the inland terminals are generally aiming to make themselves more attractive destinations by seeking some kind of partnership with key ports in their bids to improve their transport links through corridor development projects. While relations between inland nodes and shipping lines will remain of vital importance in arranging routes for carrier haulage, the ability of the inland site to exert power on the port remains limited by the operational considerations of the port actors.

Recently, Ng and Cetin (2012) and Padilha and Ng (2012) have suggested that the regionalisation concept has limited application in developing countries. Ng and Cetin (2012) concluded that Inside-Out development is the common model in developing countries, as opposed to Outside-In in developed countries. The cases presented in this thesis show that Inside-Out development is also common in developed countries.

Port actors can be motivated (or perhaps even forced) to integrate inland to overcome operational issues such as congestion (e.g. Rotterdam or even better the ports of Los Angeles and Long Beach in the Alameda Corridor example discussed in part three), whereas strategic involvement is less successful (e.g. Spain). Inside-Out strategies for logistics poles do not always align with operational or strategic aims of port actors. The potential exists for closer relations between transport and supply chain functions (e.g. Venlo). However, the "co-location" of such services is more the focus of the regional economic development agencies or land-focused logistics actors. It may be

that the need for better container management will drive a closer relation between these two functions, as has been shown in the Venlo example.

8.4 Location splitting and spatial discontinuity

Returning to spatial theory, this section will consider the spatial discontinuity represented by inland terminal development. Cullinane and Wilmsmeier (2011) suggested that this strategy may be a way for ports to extend their life cycle, based on the product life cycle of development, introduction, growth, maturity and decline. As noted in the literature review, other writers have discussed the port's declining influence in the transport chain. However, a strategy of location splitting can only be successful if the transport links between the port and its subsidiary locations are of significant enough quality to allow for a sufficient level of throughput. To increase the efficiency of these links further requires some level of integration of operations, independent of whether the development is Inside-Out or Outside-In. Achieving this quality of linkage is challenged by the fact that all nodes in the chain compete for their market share, thus the levels of integration and cooperation in each instance will be context-dependent. In particular, the geographic location of ports, while no longer guaranteeing a captive hinterland, nevertheless provides a concentration of flows unequalled by inland gateways.

Since the port represents a physical and functional link between logistic and transport networks, they will need to meet certain requirements in the future, influenced by a number of restrictions and external drivers (Cullinane and Wilmsmeier, 2011). Among others, these include capacity restrictions within the port area, capacity restrictions in the seaport access and the related environmental challenges, and increasing competition in the hinterland due to other ports extending their area of influence.

The conceptualisation presented in this thesis underlines the necessity for decision makers to develop a clear understanding of the complexity of port development; such knowledge can potentially reduce risks and allow decision makers to see port development in the context of wider impacts on other systems. Ports with spatial development constraints are required to pursue a strategy of spatial discontinuation to

remain competitive, but they often need inland partners to drive development. Conversely, many inland actors drive a development and seek interest with a port, which is not always forthcoming due to a misalignment of objectives.

One question that arises is where the convergence of Inside-Out and Outside-In development requires regulation, particularly as market liberalisation tends to result in increasing concentration as companies merge to achieve economies of scale and thus market power (e.g. shipping lines and port terminal operators). Government responses to the horizontal integration represented by liner conferences have received much attention over the last decades; will vertical integration be the next area for consideration of potential policy intervention? Even if they are nominally common-user terminals, will increasing vertical integration result in some transport corridors becoming increasingly separate? Are hidden costs, such as administration or lack of information, channelling shippers into particular transport corridors which may not be the most efficient?

While the current findings cannot be statistically generalised to state objectively that vertical integration between ports and inland terminals is not the dominant model, the issues raised in the interviews and the industry perception suggested from them is that integration between ports and inland terminals is difficult and uncommon. According to interviewees, inland terminals are being run as profit centres to make money in their own right, rather than as cost centres to support the rest of the business by capturing the market, or to fulfil government strategies if public sector driven (e.g. modal shift or job creation). Graham's (1998) description of inland distribution as "characterized by relatively low investment, high operating expenses, little scale incentive to collective operation and a considerable level of unremunerated activity requiring cross payment out of sea freight" (p.135) remains accurate. Ideals of integration with ports and leaving the container at an inland terminal "as if directly to a seaport" (Roso et al., 2009; p.341) are only possible if a number of difficult obstacles have been overcome, therefore integrated transport chains with lower transaction costs and increased efficiency are not yet the norm and may not be for some time.

Inside-Out development is likely to be the most dominant because port actors do not generally have the institutional capacity to drive developments far beyond their

perimeter. This is particularly the case for port authorities (generally working on a public mandate from the city or region), but even private port terminal operators are generally working to a core competency and the institutional structure (as represented by the board of directors who report to the shareholders) is unlikely to be suited to the requirements relating to purchasing land and dealing with the regulatory and other issues of developing a subsidiary in the hinterland. Short-range satellite terminals for overspill functions can be feasible, but load centres hundreds of miles away are not generally compatible with the aims of the port. This finding supports Notteboom and Rodrigue's (2005) contention that "the port itself is not the chief motivator for and instigator of regionalization" (p.306).

Therefore the question becomes not only how can a port actor drive Outside-In development but how can it induce the kind of Inside-Out development that suits its aims. This formulation highlights the importance of territorial and relational issues surrounding the agency of different organisations, which is derived from a multiplicity of institutional factors (Monios & Wilmsmeier, 2012). More use of theory from institutional and economic geography could be useful here, just as findings from the institutional analysis can feed back into other areas of geography. These possibilities will be considered in the concluding chapter.

8.5 Conclusion: expanding the regionalisation concept

An inland intermodal terminal can provide port access to a region that suffers from poor accessibility to ports, fulfilling aims of both the inland region and the port. Consolidation of flows to provide economies of scale, decreased transport costs through access to main routes and increased frequency of services providing flexible options are all desirable for shippers in inland regions, while the port benefits from increased traffic along this corridor. While the port does have an interest in improving hinterland links, this aim can be achieved in different ways.

Notteboom and Rodrigue (2005) stated that regionalisation "is characterised by strong functional interdependency and even joint development of a specific load centre and (selected) multimodal logistics platforms in its hinterland" (p.300), and they went on to remark that "the implementation of regional load centre networking strategies can

vary from informal programs of coordination to advanced forms of strategic partnerships through strategic alliances, (cross-)participation, joint ventures or even mergers and acquisitions" (p.307). This account does not clarify who drives the development of the strong interdependencies that lead to port regionalisation. As the case studies reveal, the direction of development and the drivers, whether public, private or in combination, have a significant impact on the level of created interdependencies, which particularly materialise in the level of logistics integration.

The distinction drawn by Rodrigue et al. (2010) between the transport and supply chain functions of an inland node can be widened further, based on evidence presented in the case studies in this thesis. Even in instances where port-inland integration is desired the actuality is difficult and only focused on the transport function, whereas the logistics and supply chain functions are more likely to be the interest of regional and public development bodies. Whether these two functions can be integrated is a question for further research. Even the success of the Venlo example requires further legal and practical barriers to be overcome before its potential can be reached.

Logistics practice remains fragmented among a variety of actors. As one indicative example, how can inland distribution be coordinated and rationalised among a network of load centres when carriers require empty containers to be returned immediately to ports, adding movements and expense to the overall transport cost? Such operational arrangements can affect the viability of transport corridors and inland terminals and thus constrain the strategies of ports and other transport actors. However, institutional structures, in terms of ownership, regulation and development of transport services such as carrier, merchant or "terminal" haulage can make it difficult to resolve these operational limitations.

Traditional ports and port systems are under pressure to find new solutions to cope with competition, capacity constraints and the requirements of logistics and supply chain management. These various strategies are often grouped under the umbrella term of regionalisation. The comparison in this thesis of various concepts on how inland terminals and the connecting corridors are planned, controlled, owned and operated have shown that location splitting is frequently driven Inside-Out. The operational role in Outside-In relations has been shown to have greater likelihood of success than

strategic developments, whereas Inside-Out development has been revealed to be the dominant kind.

A potential conflict exists between the strategies of ports and inland actors, such that development remains risky, and a number of institutional issues can prevent developments achieving their operational potential, even if a market is in existence. Thus the role of policy and planning in driving such developments must be questioned, and a focus on logistics integration, visibility of cargo flows and information management comes to the foreground in the future of port development theory.

Port devolution and the deregulation of transport services have opened wider possibilities for the private sector, public sector and varying forms of cooperation between the two. Land use and transport planning require integrated approaches across local, regional and national boundaries to be able proactively to influence and direct port development in this type of spatially discontinuous system. As with the discussion on development in part one, the operational discussion in part two highlighted the difficulty of making intermodal transport feasible in Europe. Many terminals had their development subsidised by the public sector, and many operators still receive public funds. Indeed, terminals rely on rail traffic for their existence, and as many rail operators in Europe continue to receive subsidies from their national governments, this subsidy indirectly supports the small terminals that continue to exist. It is unclear how many small intermodal terminals might fail if the rail operators using them were to lose their subsidies. Some interviewees noted the existence of previous inland terminals developed with public money that had since failed. Therefore a recognition in industry of the risk of public development can be identified. What is needed now is for public bodies such as local and regional planning authorities, as well as national bodies who tend to provide the funding, to recognise the seriousness of this issue and strive to improve the integration of their transport planning with industry needs, whether that be market demand or operational requirements. Part three of the thesis highlighted the difficulties of managing such institutional relationships across spaces and scales. In particular, the importance of informal regional cohesion across devolved governance spaces was demonstrated, a finding that can be applied to the European context, where subsidies can be local, regional, national or supranational (i.e. the European Union).

Sixteen years ago, Höltgen (1996) raised concerns with the proliferation of freight terminals that were not part of a strategic plan, and these issues persist. More recently, Bergqvist and Wilmsmeier (2009) noted that inland terminals are being developed on an ad hoc basis and this development could threaten their efficiency and hence potential for modal shift. They suggested that government policy could be required to enable a planned system of inland terminals in ideal locations linked by high quality transport infrastructure. The requirement for any facility that benefits from such legislation would be that they remain a common-user facility, and publish a transparent pricing structure.

Woxenius and Bärthel (2008) discussed the idea that terminals could be considered infrastructure rather than operations, thus placing them within the government's sphere of influence, which would make it simpler for them to be implemented through government subsidy and then operated by the private sector. Ng and Gujar (2009a&b) discussed different measures taken by the Indian government to direct inland terminal development, some resulting in artificial transport chains that would not otherwise exist. On the other hand, non-intervention has been questioned as well. Rahimi et al. (2008) noted that "there is now increasing recognition, from non-planners and the private sector alike, that the 'free market' approach to logistics channel formation is not going to work efficiently in the future, especially in large metropolitan areas" (pp.363-4).

Part three of the thesis identified a potential resolution, through a funding scheme that requires bidders to be public bodies, while favouring bids that come from joint public-private consortia. Conflicts between legitimacy and agency can lead to policy churn, but it was shown how a reconciliation between top-down planning approaches and market-driven private sector development can go some way towards overcoming the problems identified in parts one and two of this thesis.

Relating the findings back to traditional spatial theory of port development leads to a question: what is port development? First, physical, as evidenced by most of the earlier models: infrastructure, superstructure and spatial development. This stream of models leads towards location splitting as spatial discontinuity. The aim of this strategy is to support the core business of port throughput.

Second, port development may be considered from operational and strategic perspectives. These are the aspects sought by the regionalisation concept, which focuses

on relations between the port and the hinterland, through a variety of interdependent relationships. These can only work if accompanied by a move beyond the same aim of supporting the port's core business. While the port regionalisation concept does discuss this break from the traditional understanding of the port's role, it does not elaborate sufficiently on how it is done, in particular which actors direct the process and from which direction.

A trend may be observed, beginning with the port's core business of container throughput, and developing towards hinterland actions and investments (either physical or operational/strategic) with an aim of supporting this core business. As can be seen from the case studies in this thesis, these developments struggle to succeed if they are viewed merely in this supporting role. Greater integration with the supply chain requirements of the cargo inside the containers is required, even if this integration relates only to the visibility of the cargo in the supply chain, so that more efficient movements may be scheduled within the port's operational hinterland links (e.g. Venlo). This will be the next challenge for ports.

In order to succeed in an increasingly competitive environment, ports can only achieve the required efficiencies in their hinterland links if they no longer make a clear distinction between core and supporting activities. Therefore the emerging stage in port development theory must understand relations between port authorities, port terminal operators, inland terminal operators (including the transport link between the two) and logistics providers who can provide visibility of the supply chain requirements of the cargo in the boxes. Cargo movement and container movement must be aligned more closely, and the direction of vertical control and the drivers of these developments can help reveal these relationships and linkages.

9. Conclusion

9.1 Research summary

The aim of this thesis was to understand the role of intermodal transport in port regionalisation. It was shown in the literature review that the concept was based on three aspects, but that each was insufficiently disaggregated, so the concept offered little explanation of who drives regionalisation processes and how it is done. Each of these three aspects formed the basis for the research questions to be answered in this thesis:

1. How can different strategies of inland terminal development influence port regionalisation processes?
2. How can logistics integration and inland freight circulation influence port regionalisation processes?
3. How can collective action problems influence port regionalisation processes?

A literature review on each of these topics established the key features to be addressed, which formed the structure for data collection and analysis in each part.

The methodology chapter set out the justification for choosing a case study methodology, explained the site selection and the analytical process to be followed when collecting and analysing data relating to each research question. This research process was then tested through a pilot study in chapter 4, after which some modifications were made to the interview questions and approach. Each of the three research questions was treated in its own chapter, by presenting the case studies and then analysing them through thematic matrices that were developed according to the factors derived from the literature.

The findings were presented at the end of chapters 5, 6 and 7. Chapter 8 discussed these findings within the context of the port regionalisation concept, and proposed a directional model to expand the conceptualisation of port regionalisation processes. An extended inductive discussion was then offered, covering policy and spatial theory.

This chapter will consider the contributions of the research and reflect on the methodology and limitations of the thesis, concluding with suggested avenues for further research.

9.2 Contributions to the literature

Part one showed that ports can actively develop inland terminals, and differences exist between those developed by port authorities and those developed by port terminal operators. In the cases studied, the most successful model was the port terminal operator, and a suggested explanation was that this is because it was directly involved in operating the inland terminal. The port authority is rarely in a position to do this, thus limiting the potential for successful inland terminal developments by port authorities. As the port regionalisation concept focuses primarily on the port authority, it devotes insufficient attention to the role of the port terminal operator, which, as noted by Slack and Wang (2002), must be considered an essential part of a new spatial model of port geography.

Findings showed that differences can be observed between inland terminals developed by ports and those developed by inland actors. A broad conceptual division (Inside-Out and Outside-In) reflecting the drivers and direction has been proposed to capture these differences. This model is not exhaustive, but it is a shorthand way of highlighting the broad divisions in strategy that have been observed. Thus the port regionalisation concept has been extended in this way, providing greater explanatory power through disaggregation. A discussion of location splitting and spatial discontinuity further underpinned this theoretical contribution, suggesting that the integration of maritime and land systems has not yet occurred to the extent sometimes assumed in theory.

The final conceptual contribution from part one was the finding that the "dry port" concept proposed by Roso et al. (2009) is not met by the sites called themselves "dry ports". The only site in this thesis that fits the definition (Venlo) is already known as an extended gate concept. Understanding of the extended gate and freight village concepts has also been bolstered by this research, although the multiple-case design in part one was necessarily based on simple case studies; more detailed single-case examinations of

these sites may result in deeper understanding of these conceptualisations. The importance of separating transport and logistics functions when classifying inland terminals, an approach drawn from the literature (Rodrigue et al., 2010), has been strengthened by the findings in this thesis, as it was shown that even in sites where an intermodal terminal is embedded within a larger logistics park, the two functions remain separate.

Other conclusions from the field work in part one were related, from a practical point of view, to the development, operation and port integration of inland intermodal terminals. The case findings suggest that integration with ports is difficult and consequently rare. Suggestions of integration with ports and leaving the container at an inland terminal "as if directly to a seaport" (Roso et al., 2009; p.341) can only be possible if a number of difficult obstacles have been overcome, therefore integrated transport chains with lower transaction costs and increased efficiency are not yet the norm and may not be for some time.

Part two contributed to the literature through obtaining access to high calibre interviewees to explore a topic that has not previously been addressed: how the use of intermodal transport fits into retail logistics. As large retailers are the primary drivers of intermodal transport in the UK, lessons can be learned for promoting intermodal transport across the UK and comparable contexts, such as Europe, where similar operational issues prevail. The findings reveal serious barriers to further growth and an ongoing subsidy that may be removed at any point. These findings question to what extent government policy can drive intermodal transport when there are many market and operational issues relating to inland freight circulation over which the government has no control. This highlights the importance of covering all facets of port regionalisation and leads into part three which focuses more on the public sector.

By examining the role of logistics integration and inland freight circulation in port regionalisation, part two of the thesis has shown how operational constraints and spatial development of markets can limit the development of intermodal transport, thus challenging the success of inland terminals and rail corridors to ports. In particular, the economic feasibility of these links can be threatened by operational limitations and industry inertia. Even with ongoing government subsidy, it remains difficult to compete

with incumbent road hauliers. There is little evidence of major inland market players having any interest in collaboration with ports. International and domestic intermodal systems remain separate in many instances. This is as much the case in the UK and Europe as in the United States, which leads into the final case study that formed the basis of part three.

In part three, an interdisciplinary theoretical model was developed from the literature, attempting to unite institutional economics and economic geography. The framework for institutional analysis represents a contribution to the theoretical literature, and the application of the model in this research enabled reflections that can be addressed in other contexts, and the model strengthened and refined further in order to analyse legitimacy and agency from different perspectives (see below). The high calibre of the interviewees in this part of the thesis furnished high quality data which underscores the relevance of the findings. The literature suggested a conflict between legitimacy and efficiency or agency and a limitation of political organisations due to their design, both of which were confirmed in the findings. These issues account for the high incidence of policy churn, lack of agency and, sometimes, lack of communication between the public and private sectors. The role of informal networking was found to be important, as it can overcome institutional inertia, although it is difficult to capture this process, and harder still to attempt to institute it in another setting through policy action. Another contribution was an understanding of solving a collective action problem across spaces (different states) and scales (local, regional and federal). While a trend towards devolution has been noted in many areas of the world (Rodríguez-Pose & Gill, 2003), states in the USA have long been the primary level of institutional presence with regard to transport (Haynes et al., 2005), therefore findings in this research on the importance of regional cohesion in devolved governance systems can thus be of relevance to other contexts.

Returning to the overall aim of the thesis, which was to critique and expand the port regionalisation concept, it has been argued in this thesis that while there is certainly a greater focus on inland aspects of port development, the concept does not explain these developments fully. The direction model (from part one) serves to highlight that regionalisation covers different processes which often conflict, and further, operational

issues (from part two) mean that maritime and inland systems remain quite separate much of the time, thus perhaps vindicating the criticism of Rimmer and Comtois (2009) that port development studies have focused too much on inland aspects. Part three added institutional theory to port regionalisation to highlight conflicts between legitimacy and agency, and revealed that institutional design can prevent port-inland integration, contributing even more to the continued separation between maritime and inland transport systems; the institutional setting in any given case must be understood before it can be predicted how port regionalisation processes might unfold.

While additional cases are required to advance the theory further, the cases in this thesis elucidate reasons why ports may not be controlling or capturing hinterlands through the strategies of integration that the port regionalisation concept suggests. The thesis also argues for greater disaggregation of the factors that challenge or enable port regionalisation processes, comparing the institutional models of ports and other stakeholders, particularly public sector planners. It may be more accurate to state that port regionalisation can only occur as long as a set of favourable commercial and institutional conditions are maintained. The findings from the cases presented in this thesis suggest that it is not easy to assure such conditions, implying that port regionalisation may be the exception rather than the norm.

9.3 Reflections on the methodology

The choice of a qualitative case study methodology, including the limitations and challenges of this choice, was explained in detail in the methodology chapter. This section will reflect on the issues encountered in producing the thesis, the challenge of capturing the rich detail, the "thick description" of cases in their specificity, while simultaneously deriving objective conclusions from unique real-life phenomena.

Summarising the key findings from a case study analysis in a table can seem overly reductive, and some research methods writers caution against such an approach (e.g. Flyvbjerg, 2006). In this thesis, a combination of narratives and matrices has been employed in an attempt to provide balance, as recommended by Miles & Huberman (1994). It has retained the rich detail of the interviews, while highlighting key data on which conclusions have been drawn. This enables readers to follow the research process

and draw their own conclusions on the internal validity of the process, as well as the external validity, or degree to which the findings are transferable to other cases (Seale, 1999; LeCompte & Goetz, 1982).

The multiple-case design applied in part one of the thesis proved useful to the research aims, allowing a disaggregation of different models of inland terminal development. While such a design is limited by the lack of detail in each site, as opposed to the detailed single-case designs followed in parts two and three, it was suitable for the limited aims of the first research question. A framework for inland terminal classification has been developed, and can now be expanded with further cases, or even with a survey approach based on the key indicators developed in this research. This potential will be considered at the end of this chapter.

Part two followed a single-case design, but was presented via an issue-based structure rather than a narrative. This decision was related to the inclusion of multiple units of analysis embedded within the single case. Rather than applying a cross-case synthesis between individual cases (e.g. retailers), the goal was to examine the phenomenon of intermodal transport in the UK, and an issue-based structure was the most efficient way in which to address the research question. Thus a progression has been followed in this thesis, from a number of simple cases in part one, to a single case with many units in part two, to a detailed single case in part three.

Like part two, part three followed a single-case design, but it was presented in a narrative structure, followed by matrix analysis based on six key factors derived from the literature. This part of the thesis was the most explicitly theoretical, and while the framework proved useful to capture the key data relating to these factors (with the use of many sub-factors), it was found in the current application that the framework tends to highlight positive trends such as identifying the drivers for institutional change. The framework could be refined in future work to take care to identify negative trends as well; for example, locating potential sources of resistance.

The literature identified the potential conflict between legitimacy and agency, and this trade-off can be observed in the case study through the importance of informal networking as opposed to the formal institutional thicknesses scaled at state level which can often be ineffective due to the way they are designed (Moe, 1990). However,

according to the interviews, the actors were acting rationally in their own interest, which would seem to fit with the NIE approach that retains a generally neoclassical view of the rational actor, despite leaving behind some limiting assumptions such as perfect information and costless transactions. Or is it simply that the framework derived from the NIE literature obscures non-rational actions? It was noted in the literature review that Groenewegen and de Jong (2008) found that NIE models were unable to capture the complexity of political power play and social and cognitive learning among actors. The difficulties encountered in the methodology adopted in part three support those findings. While some elements of these processes were uncovered through interviews, there is a limit to the efficacy of the interview as a data collection method. Similarly, Aoki's (2007) discussion of a shared understanding on how the game is played is another issue that can be subject to response bias.

Response bias was also suspected in some cases (mostly in parts one and two), where the subject exaggerates the ability or capacity of their business, and it can sometimes turn into something of a public relations experience, with glossy brochures extolling the quality of the business, rather than frank discussions of difficulties and limitations. When writing the case studies it was necessary to triangulate the interview data with desktop research to create as objective a picture as possible, based on the aims of the research. Some conflicting data were obtained in terms of throughput or amounts of investment. Triangulating interview data with action research could produce a better result (Näslund, 2002), but action research would normally focus only on one organisation, thus missing the bigger picture; it would also be at risk of observer bias. This could, however, be a possibility for future research.

Particular areas to develop in future work are attempts to capture the subtleties of actor behaviour which presents as rational in the interviews but may not always be so, as well as elucidating both positive and negative influences on institutional transformation. As discussed in the methodology chapter, these methodological difficulties arise from the nature of the theoretical issues themselves.

Reflecting on the overall objective of the research, the discovery of so many barriers to port regionalisation was not an expectation. As the theory has been so influential and subject to very limited criticism, the goal of this thesis was only to disaggregate the

concept to improve identification and classification of different strategies. That is why the qualitative case study methodology was adopted. However, now that the results have provided reasons why port regionalisation may be the exception rather than the norm, the appropriate methodology to take these findings further may be a quantitative study of ports to identify to what extent these processes of inland integration are indeed happening. It could begin with a more refined classification and structuring of the different processes, along the lines of those raised in this study, before moving on to a survey methodology. Such a methodology was not considered at the start of this study as it was not thought that the port regionalisation concept needed to be proven or disproven, but merely disaggregated. The final section of this chapter covering suggestions for future research will consider these issues.

9.4 Limitations of the research

Structuring the thesis in three parts implies the drawback of less depth in each part, but it was essential in order to cover all three aspects of the port regionalisation concept. This limitation was mitigated by the interrelation between the three parts. All three relate to different aspects of intermodal transport development: the terminal, the market and operational issues facing users and the institutional aspects of corridor development. Additionally, the analysis became more detailed as the thesis progressed, so part three developed a detailed theoretical framework that contributes not only to the port regionalisation concept, but also to theoretical discussion in other disciplines.

Generalising from case studies can be problematic, and this was discussed in the methodology chapter. In the analysis, it was made clear that the main goal is analytical generalisation, moving inductively from the case to the theory, and that additional cases will be required to continue this line of theoretical enquiry and strengthen the reliability of the explanations offered in this thesis. On the other hand, one of the strengths of this thesis is the access to high calibre interviewees, particularly in parts two and three. Therefore the case study methodology based on semi-structured interviews offered the opportunity to capture valuable industry knowledge that would not have been possible through a different research design. Thus it was also noted that one aim of case study research is "thick description" (Stake, 1995), such that the case narrative "is itself the

result" (Flyvbjerg, 2006; p.238). It was demonstrated in the literature review that the port regionalisation concept is insufficiently disaggregated and that detailed case description was required to explore the theory in more detail. It was only through this process that the thesis was able to elucidate reasons why ports may not be controlling or capturing hinterlands through the strategies of integration that the port regionalisation concept suggests.

Following Seale's (1999) recommendation that the researcher is "seeking for evidence within a fallibilistic framework that at no point claims ultimate truth, but regards claims as always subject to possible revision by new evidence" (p.52), it is recognised that additional cases are required, thus it is not possible to draw firm, final or definitive conclusions on the dominant strategies of port development from the contents of this thesis alone. Indeed, it was noted in the introduction that this thesis does not aim to develop a comprehensive theory that would enable explanation and prediction of port development. Rather, the qualitative analysis in this thesis presents a more multidimensional view, offering new insights into port development theory and indicating challenges in a variety of contexts.

9.5 Suggestions for future research

During the course of this research, many papers have been published on inland terminals, inland ports and dry ports, from both theoretical and applied perspectives, including some case study approaches. However, when this research began in 2009, few case studies on inland terminals were to be found in the literature. Thus one aim of this thesis was to add case studies to the literature, not only exploring the conceptualisation of inland terminals, but also providing detailed evidence of the process and, in so doing, to increase understanding of the qualitative aspects of site development and operation that were missing from the literature. In particular, the intention was to highlight the difficulties in attracting intermodal traffic, against the policy background in Europe to promote modal shift from road to rail.

Additional case studies of inland terminals could take these findings further, in particular adding to, critiquing and expanding the directional development concept proposed in this thesis to classify different inland terminal developments by whether

they are port-driven or inland-driven. A survey methodology could be useful to measure how many inland terminals have any port investment or involvement in operations, although, as noted in the methodology chapter, obtaining good quality data from a survey methodology is difficult. A large-scale collaboration between researchers in different countries or regions could potentially manage such a project through local knowledge, contacts and site visits.

While the port regionalisation concept suggests that increasing integration with inland actors is the current phase of port development, this thesis has highlighted many reasons that prevent these processes happening. The findings from the cases presented in this thesis suggest that it is not easy to maintain the conditions for successful port regionalisation, implying that port regionalisation may be the exception rather than the norm, only one possible pathway in port system evolution. Thus a hypothesis for future research may be that there are more factors preventing a port integrating inland than supporting it. This topic would be difficult to research because visiting many ports and speaking to the many people involved in such large organisations is not practical, yet a survey methodology may not be able to capture enough information either. That is why the present research followed a case study methodology. However, in the discussion on whether the phenomenon of port regionalisation is actually occurring, it is difficult to make firm statements without more data.

It is not to say that regionalisation is not happening in some cases, but the case studies have shown examples of very real barriers to this process. Therefore, when regionalisation is discussed it should be classified more explicitly around such categories, identifying where and under what situations a port regionalisation process is taking place and where it is not. Before it can truly be formalised as a stage of port development, a quantitative study might be required of how many ports are actually integrating with any activities inland. This topic could be approached via a descriptive survey to map current behaviour, or, to understand the decision process in more depth, through the application of a methodology such as fuzzy AHP (analytical hierarchy process). An AHP could be developed using data collected from a survey of ports on key attributes of inland integration. AHP can be used as a decision tool to rank criteria

and has been applied to topics such as a hierarchy of performance measures and port selection (Lirn et al., 2004).

If a quantitative study on the prevalence of port regionalisation strategies is not possible, a detailed single-case study on one port with many interviews or utilising action research (as discussed in section 9.3) could be valuable, to capture a full understanding of how ports plan for inland terminals and intermodal corridors. While the port perspective would have been valuable for this thesis, the topic was too large to cover adequately, thus in this research the focus was primarily on the inland aspects.

Another interesting topic is the role of logistics. The cases in part one cannot show clearly the role of logistics in inland terminals. It may be that logistics tends to be more important for those sites developed by public bodies, as the aim is to support businesses, but further research is required. A frequency count would be useful to determine the prevalence of integrated logistics sites compared with simple intermodal terminals but, more importantly, the relationship between operators of either part and also the use of intermodal transport by shippers located at the site would also be interesting.

From a methodological perspective, the institutional analysis in part three of this thesis has been identified as a fruitful avenue for further research, and represents a topic likely to be central to transport geography over the next decade. The theoretical framework developed in this thesis can be explored in further contexts, improved and advanced to strengthen its explanatory power. Furthermore, the interdisciplinary nature of this research is an agenda that should be taken forward, to explore greater resources in other areas of geography, notably economic and political geography, utilising theoretical approaches to scales and spaces that can inform transport geography further. Additionally, the discipline of logistics could benefit from cross-disciplinary approaches making use of institutional theory from geography. Furthermore, it will be challenging to capture the subtleties of actor behaviour which presents as rational in the interviews but may not always be so, as well as elucidating both positive and negative influences on institutional transformation.

Institutional issues are important and not sufficiently understood, although, as noted in regard to the study of inland terminals and dry ports, a number of papers have been published on this emerging topic during the course of this research. Institutional design

prevents port regionalisation processes of integration from occurring, therefore in future research greater disaggregation of port regionalisation possibilities could be pursued along the lines of institutional models of ports and other stakeholders, particularly public sector planners and funders. Legitimacy and agency are a problem for these organisations and if an infrastructure for collective action is not in place (and it is usually predominantly a *public* infrastructure for collective action), then private firms will not act, thus hampering any attempts at port regionalisation and keeping the maritime and inland spaces separate.

More use of theory from institutional and economic geography could benefit this enquiry, just as findings from the institutional analysis can feed back into other areas of geography. Brenner (1998) proposed a contradiction between fixity and motion in the circulation of capital, "between capital's necessary dependence on territory or place and its space-annihilating tendencies" (p.459). Therefore, any spatial fix must be temporary. Brenner's definition of this process is worth quoting at length:

> The forms of territorialisation for capital are always scaled within historically specific, multitiered territorial-organisational arrangements. The resultant scale configurations, or "scalar fixes" (Smith, 1995), simultaneously circumscribe the social relations of capital within determinate, if intensely contested, geographical boundaries and hierarchise them within relatively structured, if highly uneven and asymmetrical, patterns of sociospatial interdependence (p.464).

Brenner noted that each temporary scalar fix must be approached in terms of its formation, stabilisation and eventual rupture. However, the role of the state is to attempt to maintain these equilibria, and to this end it "deploys a wide range of geographically specific policies differentially oriented towards cities, industrial districts, regions, growth poles, peripheries, 'underdeveloped' zones, rural areas, and so forth" (p.470). These are the policies of intermodal transport development influencing the spatial and institutional processes touched upon in this thesis.

What Brenner calls temporary *scalar* fixes are instantiated in political formulations across scales such as countries, regions and cities, which are themselves based on temporary *spatial* fixes whose fluid boundaries and thus authority are derived from both territorial and relational aspects. However, the attempts by states at any scale to harness

global capital flows through the proxy of container flows result in spatial fixes such as ports and intermodal terminals. These physical spaces then exert a decades-long legacy impact on the structure of logistics and transport systems, while the temporary scalar and spatial fixes just described change around them.

The state's aim is to harness the power of capital to achieve its own aims through various combinations of privatisation, public–private partnerships, deregulation and subsidies, however, "the state is denied the power to control the flow of those resources which are nevertheless indispensable for the exercise of state power" (Offe, 1994; p.120). A number of theoretical approaches to such attempts by the state at harnessing capital flows for economic development have been developed in the economic geography literature, and it is argued here that transport geography can make use of such theoretical insights, as they are relevant to the development of major infrastructure projects such as ports and intermodal terminals. As well as the utility of such approaches, tying spatial and institutional models of port development into the wider debate may provide a firmer theoretical grounding for the concepts discussed in this thesis.

Taking the findings from this thesis forward by way of such institutional theory can develop a research agenda whereby new developments in transport geography can both learn from, and contribute to, current discussions within geography, which is particularly relevant in the context of recent calls for a more qualitative, interdisciplinary and higher-profile transport geography (Hall, 2010).

10. References

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Appendix 1. Interview schedules

A1.1 Introduction

This appendix provides details of all interviews undertaken for this research. Table A1-1 summarises the number of interviews conducted for each part of the thesis.

Table A1-1. Number of interviews conducted for this thesis

Part	Group	No. of meetings	No. of people
1	Inland terminals	19	27
2	General freight stakeholders - UK	9	9*
	Retail intermodal logistics	11	12
3	General freight stakeholders - USA	25	35
	Heartland corridor	10	15
	Total	74	98*

* Attendances at the FTA round table discussion with around 20 members have only been counted as one interviewee each in order not to unbalance the count

The following sections will include only the number of interviews and organisation type. All other details have been removed for reasons of confidentiality, but have been retained by the author.

A1.2 Part one: Europe

In most cases two staff were interviewed, usually the manager of the intermodal terminal or freight village and a member of operational staff, depending on the size of the terminal. Other opportunistic discussions with staff were also possible in some instances.

Table A1-2. List of interviews for part one

No.	Organisation type	No. of interviewees
1	Municipality	1
2	University	1
3	Regional planning authority	1
4	Inland terminal	1
5	Inland terminal	2
6	Port	1
7	Inland terminal	2
8	National port governing body	1
9	Port terminal operator	1
10	Inland terminal	3
11	Inland terminal	1
12	Inland terminal	1
13	Port authority	1
14	Inland terminal	1
15	Inland terminal	2
16	Importer	1
17	Inland terminal	2
18	Inland terminal	2
19	Inland terminal	2
Total		**27**

A1.3 Part two: UK

A1.3.1 Overview

For part two, the interviewees were divided into two groups. The first group were general freight stakeholders to discuss freight movements, distribution issues and intermodal transport in the UK. These included transport operators and regional transport planners and industry association representatives. Annual attendance at the Scottish Supply Chain Forum (a round table discussion with freight operators, major shippers, etc. organised by the Freight Transport Association) was also extremely beneficial. This round of interviews was conducted in the first year of the PhD, in 2010, as a general round of data gathering on intermodal transport in the UK. Some of these interviewees were interviewed again later with a specific focus on retail intermodal logistics.

The second group were the specific interviewees involved in retail intermodal logistics.

A1.3.2 General freight stakeholders

Table A1-3. List of interviews for part two: general freight stakeholders

No.	Organisation type	No. of interviewees
1	3PL	1
2	Rail operator	1
3	Rail operator	1
4	Association	Group*
5	Port operator	1
6	Industry association	Group*
7	Regional transport partnership	1
8	Industry association	1
9	Industry association	Group*
Total		**9**

* Round table discussion of freight stakeholders organised by the FTA, including major freight operators, shipping lines, major shippers, transport planners and association representatives.

A1.3.3 Retail intermodal logistics

Table A1-4. List of interviews for part two: retail intermodal logistics

No.	Organisation type	No. of interviewees
1	Rail operator†	1
2	Retailer*	1
3	3PL	2
4	Wholesaler	1
5	3PL†	1
6	Retailer‡	1
7	3PL	1
8	Retailer	1
9	Rail operator†	1
10	Retailer‡	1
11	Retailer*	1
Total		**12**

* As this subject was interviewed earlier in what became quite a lengthy total duration of the study, he was interviewed again to follow up and confirm the accuracy of earlier statements.

† Those marked with this symbol were interviewed previously as part of a general freight stakeholder study on intermodal transport, and then interviewed again specifically for the retail intermodal logistics study. Fortunately this was possible with a few interviewees with whom good relationships have been established through other work at the university.

‡ This symbol designates two interviewees from the same retailer interviewed separately.

A1.4 Part three: USA

A1.4.1 Overview

In part three of the thesis, interviewees were divided into two groups. The first were general freight stakeholders to obtain a picture of freight movements and issues in the USA as well as new directions in freight policy. The second group were those directly involved in the Heartland Corridor project.

A1.4.2 General freight stakeholders

Table A1-5. List of interviews for part three: general freight stakeholders

No.	Organisation type	No. of interviewees
1	Federal DOT	1
2	Federal DOT	2
3	Association	1
4	Federal DOT	2
5	Federal DOT	1
6	Research institute	1
7	University	1
8	State DOT	4
9	Research/consultancy	1
10	Rail operator	2
11	Rail operator	1
12	Rail operator	1
13	Rail operator	2
14	Rail operator	1
15	University	1
16	University	2
17	Port authority	1
18	Airfreight operator	1

19	Rail operator	1
20	University	1
21	Construction authority	2
22	Port authority	1
23	Transportation authority	1
24	Rail operator	2
25	Port authority	1
Total		**35**

A1.4.3 Heartland Corridor

Table A1-6. List of interviews for part three: Heartland corridor

No.	Organisation type	No. of interviewees
1	Regional development agency	1
2	Port authority	1
3	Rail operator	1
4	Research institute/State senate	1
5	State DOT	1
6	State DOT	2
7	3PL	1
8	Rail operator	2
9	Shipper	2
10	Chamber of commerce Private consultant State DOT	1 1 1
Total		**15**

Appendix 2. Interview questions

A2.1 Introduction

The methodology chapter discussed the interviews in more detail. A number of different aims were pursued in the interviews therefore different questions were used for each group of interviewees. These are reproduced below.

A2.2 Part one: inland container terminal site visits

A2.2.1 Overview

Each site visit was arranged with a key member of personnel, but in most cases other personnel were also on hand to discuss the issues. The questions were designed to elicit primarily factual information but expert opinions were also of value to elucidate key issues.

The questions for the pilot study were shorter and more general as the aim was to understand the process better and adapt the interview questions for the actual cases to the setting. For the actual cases, it can be seen that the number of questions was expanded and the structure improved to capture the key data.

A2.2.2 Pilot study

Development

1. Describe the site development process.
2. How did you determine the feasibility of the facility before implementation?

Operations

3. General description of the site ownership and operations: e.g. annual throughput, rail operations, truck operations, site management.
4. How do you measure performance? E.g. throughput, profit, revenue, turnaround time, new business attracted.
5. How do users offset the additional transhipment cost of using the inland terminal?
6. How will you develop the rail terminal into a site that will offer more services? Do you think this will attract more business?
7. Is competition with other terminals an issue?

Role of the port

8. Describe your collaboration with the port.
9. Does the port have a problem with losing storage or other revenue to the inland terminal?

Government policy

10. Did you receive government funding?
    a. What kind?
    b. How much?
    c. What were the criteria to be eligible for the grant?
11. Do you think government policy or regulation is required to prevent wasteful competition between terminals or do you think the market will find the best solution?

General

12. What other issues are relevant?

A2.2.3 Actual cases

Implementation and planning

1. Key details of the site:
    a. owner
    b. operator
    c. date opened
    d. size (m^2)
    e. capacity (TEU)
    f. current throughput (TEU)
    g. throughput from each port (TEU)
    h. current rail services
    i. mixture of import vs export containers (%)
2. Who were the main organisations involved in developing the site?
3. What process was followed to get the development approved or to secure public funding?
4. What was the investment breakdown? Private, public, grants, etc.
5. Was the location of your site in relation to other facilities relevant to this process?

Operation

6. Which rail operators run services to your terminal?
7. Do you have any involvement in the rail services, e.g. booking slots, consolidating small flows, scheduling services, attracting customers?
8. Why do customers use your terminal? (e.g. cost, services, environment, time, etc.)
9. Do you attract the business of smaller customers or only large ones who can fill trains?
10. Do you have a freight village (or similar) attached to the site? What is the relation between the container terminal and the freight village? i.e. is it one big site or are they run separately?
11. What proportion of your containers are stripped/stuffed onsite (or nearby)?

Relation of terminal to sea ports

12. Which terminals/ports do you compete with for port traffic to this hinterland?
13. Is it better for inland terminals to be more vertically integrated (either with the sea port or the rail services) or to be independent?
14. Do you deal with the port authority or an individual terminal operator within the port?
15. What methods of cooperation do you use for service development? E.g. joint venture, full integration, contracts. What are the pros and cons of this arrangement?
16. Has your connection with the sea port(s) helped them to overcome problems that they were having? E.g. road congestion, handling speed, use of port land, etc.?
17. Has your terminal improved the repositioning of empty containers in the system?

A2.3 Part two: retail intermodal logistics

A2.3.1 Overview

The first set of questions is general, for use with any freight stakeholders. They are designed to be tailored to the situation.

The second set of interviews was conducted later in the project, therefore they are more targeted, building on what was learned earlier from the broader questions. It was designed to be used primarily with retailers and 3PLs but the key operational issues will also be relevant for rail operators.

A2.3.2 General freight stakeholders

Overview

1. Overview of freight terminals, traffic and current services.
2. Development plans for terminals, shuttles, general business, etc.
3. General operations: who runs trains, sells slots, manages flows, consolidates flows, deals with customers, etc.? Third-party, own, mixed.
4. Collaboration: horizontal and vertical.

Intermodal freight transport

5. What are the barriers to intermodal freight?
6. Does the current infrastructure restrict business?
7. Where are the opportunities for growth?
8. Have you had success with shuttles for large customers? Do you think there is room for more growth in this sector? What is the potential for getting them to locate in/near intermodal terminals?
9. How does this compare to attracting the business of smaller customers? Where is the potential here? How to consolidate smaller flows?
10. Are containers stripped onsite (e.g. in a freight village) or do customers take them to their own warehousing facilities?

Relation with ports

11. Relation between port and inland terminals: port authority, port terminal, inland terminals, rail operators, shipping lines, other.
12. Do you have issues with container repositioning?

Developing intermodal freight transport

13. What is the best way to develop intermodal transport? Who should lead? Rail operator, inland terminal operator, 3PL, port authority/terminal, joint venture, government?
14. What is the role of government policy and funding?
    a. Overall.
    b. Specifically relating to your development/business.
15. How can it be improved?

A2.3.3 Retail intermodal logistics

1. Distribution:
    a. Inbound: UK suppliers, imports through ports. Who manages this, main flows, relevant issues such as factory gate pricing, consolidation centres, etc.
    b. Outbound: NDC to DC to store. Who manages the logistics, main flows, relevant issues such as DC location, picking stock vs direct supply to store, role of NI in relation to Scotland, etc.
2. Current use of intermodal transport
3. Future changes
4. Pros and cons of locating DCs at these kinds of sites (rather than road-based):
    a. Inland rail (e.g. Daventry)
    b. Port-centric (e.g. Teesport)
    c. Continental hub (e.g. Zeebrugge)
5. Role of the following on current distribution patterns:
    a. Economies of scale at large sites (vs more smaller DCs)
    b. Ease of managing the operation as a whole (vs a more decentralised approach)
    c. To fit in with larger transport chains (e.g. deep sea shipping lines and feeder patterns)
6. Role of government policy, planning and funding in driving intermodal transport?
7. Infrastructure issues in the UK: ports, rail, road. E.g. gauge, capacity at terminals and on network.
8. Technology: key drivers of new technology adoption, tracking, barcodes, RFID, etc.
9. Integration and collaboration: horizontal and vertical
10. Other operational issues preventing intermodal growth: e.g. pallet-wide containers, reefers, double-deck trucks, need for low wagons, role of last mile to DC or store, etc.

A2.4 Part three: Heartland Corridor

A2.4.1 Overview

Two sets of questions were used for the third part of the thesis: one for general freight stakeholders and one specifically for those related to the Heartland Corridor. The first group of interviews was used for different organisations, from federal planners to inland terminals to rail operators and shippers. Therefore the same broad template used for general stakeholders in part two was used here, and it was tailored to each situation and developed in more detail where possible. The second set of questions, designed specifically for the Heartland Corridor, was based on the key factors from the literature review.

A2.4.2 General freight stakeholders

Overview

1. Overview of freight terminals, traffic and current services.
2. Development plans for terminals, shuttles, general business, etc.
3. General operations: who runs trains, sells slots, manages flows, consolidates flows, deals with customers, etc.? Third-party, own, mixed.
4. Collaboration: horizontal and vertical.

Intermodal freight transport

5. What are the barriers to intermodal freight?
6. Does the current infrastructure restrict business?
7. Where are the opportunities for growth?
8. Have you had success with shuttles for large customers? Do you think there is room for more growth in this sector? What is the potential for getting them to locate in/near intermodal terminals?
9. How does this compare to attracting the business of smaller customers? Where is the potential here? How to consolidate smaller flows?
10. Are containers stripped onsite (e.g. in a freight village) or do customers take them to their own warehousing facilities?

Relation with ports

11. Relation between port and inland terminals: port authority, port terminal, inland terminals, rail operators, shipping lines, other.
12. Do you have issues with container repositioning?

Developing intermodal freight transport

13. What is the best way to develop intermodal transport? Who should lead? Rail operator, inland terminal operator, 3PL, port authority/terminal, joint venture, government?
14. What is the role of government policy and funding?
    a. Overall.
    b. Specifically relating to your development/business.
15. How can it be improved?

A2.4.3 Heartland Intermodal Corridor

The reasons for the collective action problem

1. What were the problems?
2. What were the reasons for these problems?
3. Who were/are the main actors?
4. What was needed?

Infrastructure for collective action

5. What is the role of government? Policy, planning, funding, governance scales?
6. What ability do public organisations have to act in the freight industry?
7. How has it changed or is it changing?

Interaction among (public and private) organisations and institutional presences

8. What actions were taken and by whom?
9. Informal collaboration and influence
10. Public vs private actors?
11. What happened after?
12. What is different now?