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Identifying Governance Relationships Between Intermodal Terminals and Logistics Platforms

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ABSTRACT *Governance theory examines different ways of managing resources and relationships in order to achieve a desired outcome. This paper applies governance theory to intermodal terminals and logistics platforms, extending previous work on ownership to include different operational models. An inductive methodology is used to derive a typology of governance relationships from an analysis of the transport and logistics literature. The classification developed in this paper explores different kinds of integration that can help support growth of intermodal transport services. The understanding of transport governance is extended via three key relationships: first, between the logistics platform and the site tenants (therefore, encouraging consolidation and efficiencies that can boost rail services at the site); second, between the terminal operator and rail service provision (which can aid service planning and train loading factors); and third, between the inland site (either terminal, logistics platform or both) and port(s), (thus enabling better planning and efficiency of port rail shuttles).*

1. Introduction

Against a policy background in which governments seek to promote intermodal transport, particularly in Europe, intermodal terminals and logistics platforms have received significant public funding. Difficulties in securing traffic have been noted in the literature, and one way to address this has been the location of intermodal terminals and logistics platforms either near each other or as part of an integrated site. However, research has shown that this does not necessarily result in increased modal shift to rail. The motivation for this paper is the need to understand the relation between the intermodal terminal and the logistics platform. This will be done through the application of governance theory, which examines different ways of managing resources and relationships to achieve a desired outcome.

Port governance has been treated comprehensively in the literature; however, despite an extensive literature on the development and operation of intermodal terminals and logistics platforms, governance has rarely been addressed directly, although it has been touched upon as part of other discussions. As transport and logistics become more integrated and simultaneously more complex, relations

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between intermodal terminals and their often-related logistics platforms need to be addressed. Previous work on governance that addressed the relationship between the owner and operator will be extended to include the operational model, as the potential success of intermodal transport services relies on the logistics model of the clients and the relations with transport actors such as rail operators and port terminal operators.

The paper begins with a review of the literature on governance, before addressing applications of governance to ports, intermodal terminals and logistics. As governance theory has rarely been applied directly to intermodal terminals and logistics platforms, the large literature on intermodal transport and logistics will then be reviewed to establish the key topics with relevance for governance. The supply chain management literature, with its greater detail on governance and process integration, will prove particularly useful in this endeavour. The findings from this review are set out in Section 2 and are used to derive the research topics, which are presented in Section 3 together with an explanation of the inductive methodology. Section 4 analyses cases from the literature of different models of collaboration and integration. In Section 5, a governance typology is derived from this analysis, based on four elements: development and ownership, operational governance, internal operation model and external operation model. The typology is then discussed before considering the implications of these models for policy aims to encourage modal shift to intermodal transport. Section 7 concludes with suggestions on how to take these findings forward in new research.

2. Literature Review on Governance

2.1. *Definition and Previous Applications of Governance*

In the simplest terms, governance refers to an act or process of governing. While in the past, it has often been used interchangeably with government, in the last two decades, governance rather than government has become the preferred term. As power is devolved from governments to other bodies and representation of other interests is increased, official government institutions become only one part of the totality of the governance process (Jordan, Wurzel, & Zito, 2005). Governance then becomes a broader process of distributing authority and allocating resources, of managing relationships, behaviour or processes to achieve a desired outcome.

An understanding of governance cannot be separated from an appreciation of the role of institutions, although a full analysis of this topic lies beyond the scope of this paper.[1] Key elements of institutional analysis include a potential conflict between an organisation's legitimacy and its efficiency or agency (Meyer & Rowan, 1977; Monios & Lambert, 2013), difficulties in transferring a governance structure from one institutional setting to another (Meyer & Rowan, 1977; Ng & Pallis, 2010), the constant changing and re-making of institutions (Jessop, 2001), unclear responsibilities at each governance level (Meyer & Scott, 1983; Scott & Meyer, 1983) and the path-dependent trajectory of institutional development (Arthur, 1994; David, 1985; Martin, 2000). The state becomes "merely an institutional ensemble; it has only a set of institutional capacities and liabilities which mediate that power; the power of the state is the power of the social forces acting in and through the state" (Jessop, 1990; pp. 269–270). The state is elsewhere described as a "polymorphic institutional mosaic" (Brenner, 1999; p. 53), in which spatial scales are "perpetually redefined, contested and restruc-

tured in terms of their extent, content, relative importance and interrelations" (Swyngedouw, 1997; p. 141), "a series of open, discontinuous spaces constituted by the social relationships which stretch across them in a variety of ways" (Allen et al., 1998; p. 5).

In moving away from territorial political boundaries, an essential component of governance becomes its relational element. While political structures are ostensibly linked to territorial spaces (e.g. physical boundaries), their legitimacy and agency are relationally constructed, through the power of regional elites and industry players (Allen & Cochrane, 2007; MacLeod, 1997; Monios & Wilmsmeier, 2012b). Thus, governance becomes increasingly about working across boundaries, between government organisations, non-government organisations and individuals, as well as incorporating multiple scales of government (Hooghe & Marks, 2001; Marks, 1993). This process is linked partly to recent trends towards decentralisation and devolution (Peck, 2001; Rodríguez-Pose & Gill, 2003), which nonetheless are not necessarily an actual transfer of power, but more of a qualitative restructuring (Brenner, 2004), characterised as uneven processes of hollowing out (Rhodes, 1994) and filling in (Goodwin, Jones, & Jones, 2005; Jones, Goodwin, Jones, & Simpson, 2004) that can result in asymmetrical acting capacity.

As well as the changing role of political institutions, much governance literature considers process, asking questions about how power should be exercised, performance measured and outcomes regulated. This focus relates to the core of the difference between governance and government. It is not necessarily about the location of official responsibility but how a process is governed and an outcome achieved. These outcomes could include areas such as climate change, resource management, transport provision, accessibility and social inclusion. Effective governance can limit damage and protect social rights by regulating access to an environment, whether that be regulating access of mining companies to protect water quality or regulating car use to reduce local air pollution. Any political outcome can be debated in terms of which governance model will best achieve it, but the outcome itself must also be considered. Effective governance is not always measured by, for example, a measured reduction in an undesirable outcome such as pollution. Increasing representation of minority stakeholders can be a goal, as well as improved transparency and accountability.

2.2. *Port Governance*

While the role of multi-level governance has been explored in relation to shipping policy (Pallis, 2006; Roe, 2007, 2009; Verhoeven, 2009), the major application of governance theory in the maritime sector has been to port governance. As major engines for driving economies, control of ports is a significant lever for governments to manage trade and its attendant economic benefits. Over recent decades, a general trend has been observed for port management to move from the public to the private sector. Numerous studies have examined different models of port governance (e.g. Baird, 2000, 2002; Baltazar & Brooks, 2001; Brooks, 2004; Brooks & Cullinane, 2007; Brooks & Pallis, 2008; Cullinane & Song, 2002; Everett & Robinson, 1998; Ferrari & Musso, 2011; Hoffmann, 2001; Pallis & Syriopoulos, 2007; Verhoeven & Vanoutrive, 2012). The World Bank (2007) identified four models: the public service port, the private port, the tool port (a mixed model where private sector operators perform some of the operations but under the direction of public sector managers) and the landlord

port (the public sector retains ownership while the terminal management and operations are leased to private sector operators). While the landlord model has become increasingly common across the globe, implementation of port devolution policies has been observed to vary according to local conditions (e.g. Baird, 2002; Ng & Pallis, 2010; Wang, Ng, & Olivier, 2004; Wang & Slack, 2004).

It is not simply the initial devolution process that is relevant but the ongoing reform of port governance, entailing a focus on the various processes in which a port actor might engage. For example, the influence of shipping networks (Wilmsmeier & Notteboom, 2011), the role of the port authority in the cluster of associated businesses and services agglomerated around a port (Bichou & Gray, 2005; Hall, 2003; Hall & Jacobs, 2010; De Langen, 2004), the development of new competencies such as hinterland investment (Notteboom, de Langen, & Jacobs, 2013), port competition (Jacobs, 2007; Jacobs & Notteboom, 2011; Ng & Pallis, 2010; Sanchez & Wilmsmeier, 2010; Wang, Ng, Lam, & Fu, 2012) or the devolution of port governance from one level of government to another rather than from the public to the private sector (Debrie, Gouvernal, & Slack, 2007).

Advantages of greater private sector involvement in ports include increased efficiency and reduced cost to the public sector, while negative impacts include the loss or increased ambiguity of state control as well as the difficulties and risks involved in managing the tender process and subsequent monitoring (Baird, 2002). However, it has been found that governance decisions are not always related to port performance (Brooks & Pallis, 2008). Debrie, Lavaud-Letilleul, and Parola (2013) combined the institutional context (relationship between public and private actors and relative decision-making powers) with characteristics of the local market and societal and cultural factors impacting on motivations for public intervention. Such contextualisation is essential because applying a generic governance model in different local settings can lead to asymmetric results (Ng & Pallis, 2010). Bichou and Gray (2005) asserted that simple taxonomies are difficult because of the diversity of port functions (cf. Beresford, Gardner, Pettit, Naniopoulos, & Wooldridge, 2004; Sanchez & Wilmsmeier, 2010), and suggested that three elements are generally included: the role of public and private actors, the governance model and the scope of facilities, assets and services. This approach will underpin the current paper's attempt to expand simple terminal governance models with a strong operational component.

2.3. *Governance of Intermodal Terminals*

Operational issues arise from the nature of intermodal transport, as well as being derived from the development models and main functions of the site. The intermodal literature[2] focuses to a certain extent on the economic difficulties of developing rail shuttles, which include transport cost analysis (e.g. Arnold, Peeters, & Thomas, 2004; Ballis & Golias, 2002; Janic, 2007; Kim & Wee, 2011; Kreutzberger, 2008; Limbourg & Jourquin, 2009; Racunica & Wynter, 2005; Van Schijndel & Dinwoodie, 2000), the roles of the main actors (e.g. Runhaar & van der Heijden, 2005; Slack & Vogt, 2007; Van der Horst & de Langen, 2008) and the importance of aligning cargo requirements with intermodal service requirements (e.g. Eng-Larsson & Kohn, 2012; Woodburn, 2003, 2011). Also covered in the recent literature have been the institutional constraints on the intermodal freight system in general and site development in particular (Flämig & Hesse, 2011; Hesse & Rodrigue, 2004; Monios & Wang, 2013; Monios & Wilmsmeier, 2012b;

Ng & Cetin, 2012; Ng, Padilha, & Pallis, 2013; Notteboom & Rodrigue, 2005; Padilha & Ng, 2012; Rodrigue, 2006; Rodrigue, Debrie, Fremont, & Gouvernal, 2010; Rodrigue & Notteboom, 2009, 2010; Roso, 2008; Wilmsmeier, Monios, & Lambert, 2011).

Consolidating traffic to support intermodal corridors is essential, leading to the increasing focus of logistics platforms being considered as part of the transport designation. In the past, intermodal terminals have been the main focus of the literature, with logistics platforms being addressed separately in the logistics literature (see next section). Confusingly, in the transport literature in recent years, both functions have been covered interchangeably, without addressing the governance issue and how the two functions and physical spaces relate to each other.

While the last five years have seen an explosion of papers on intermodal transport and intermodal terminals, governance has rarely been addressed directly. This is partly because inland freight nodes tend to be smaller concerns than ports, with simpler governance structures and less government involvement. While landlord models are in evidence, government involvement is more likely in the start-up phase using public money to attract a private operator into the market, after which it is assumed that the site will be run by private operators with no further government involvement (although there are exceptions, as discussed in this paper).

Beresford, Pettit, Xu, and Williams (2012) applied the World Bank port governance model (public, tool, landlord and private) to dry ports, a useful approach for examining the relationship between the owner and operator. Beresford et al. (2012) also drew on the UN-ESCAP (2006) concentric model, in which the middle ring contains the container yard and container freight station, expanding out to a container depot, then the third ring is for logistics and finally an outer ring for related processing and industrial activities on the periphery of the area. Similarly, in the three-stage concentric model of Rodrigue et al. (2010), the intermodal terminal is at the centre of the activity, a larger ring includes any logistics activities that may or may not be part of the same site, and finally, a third level accounts for any wider retail and manufacturing activities in the hinterland that may be loosely related to the site.

Concentric representations can be misleading, as such a formulation suggests that the intermodal terminal is situated at the heart of a unified logistics platform. In reality, the terminal will be found at the edge of the site (Figure 1) and will primarily serve customers external to the logistics platform. Moreover, in most cases, the terminal(s) are separate to the logistics platform, perhaps placed next door to a large logistics platform (but still requiring entry and exit via a separate gate entailing appropriate security operations), a few miles away (thus requiring an additional road haul), or otherwise located in an area with several logistics operations of varying sizes, types and specialisations, which may or may not have requirements suitable for intermodal transport. Going wider still, Witte, Wiegmans, van Oort, and Spit (2014) developed a governance typology capturing potential spatial and institutional challenges between an inland port and the city where it is located.

2.4. *Governance in Supply Chain Management and Logistics*

Analysis of governance in the logistics literature derives from supply chain integration, a subset of which is logistics integration. Motivations for supply chain

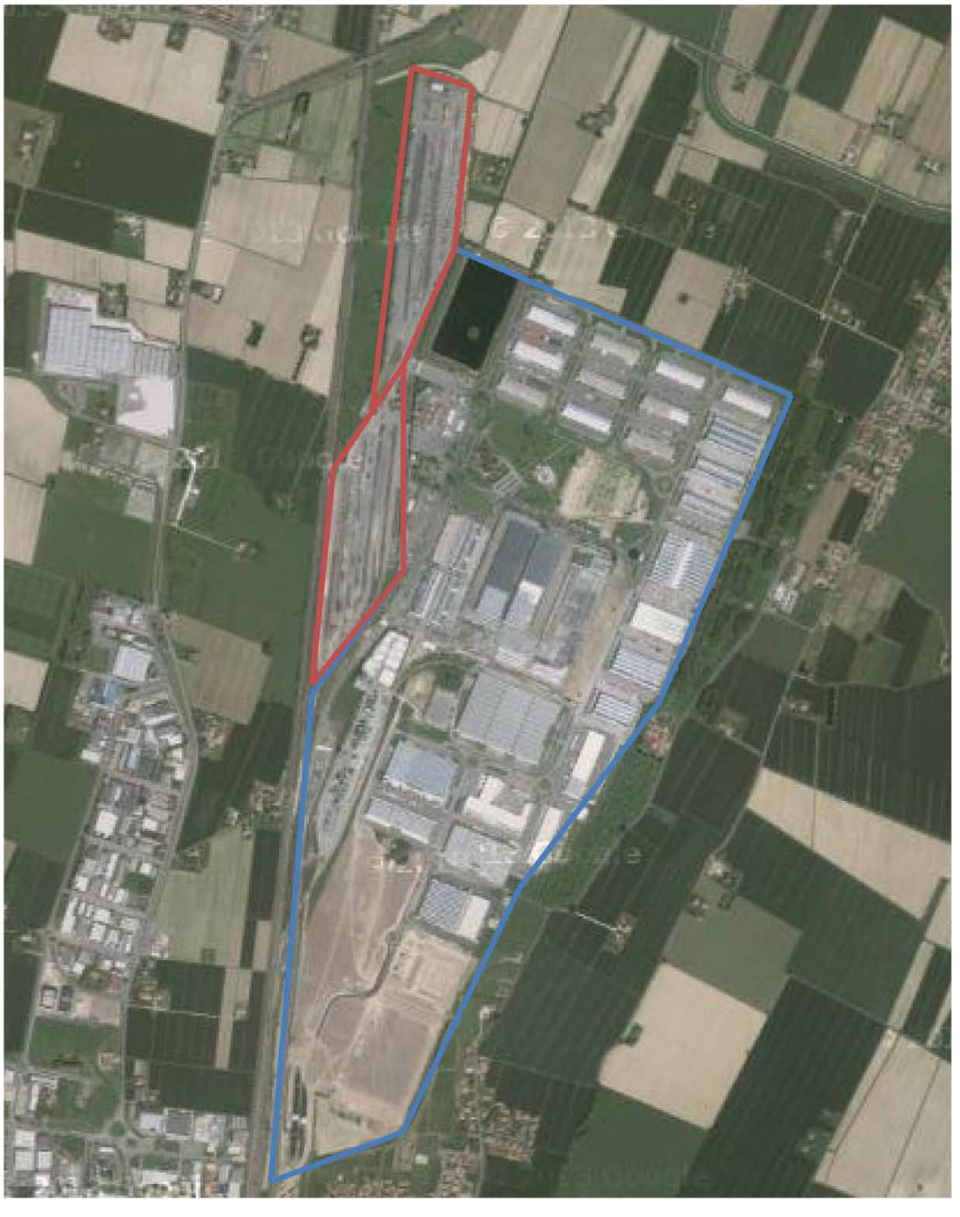

Figure 1. Aerial view of Bologna freight village, showing the logistics platform and two intermodal terminals embedded in the site.
Source: Imagery: Cnes/Spot Image, DigitalGlobe. Map data: Google.

integration include cost reduction through efficiency advances, resource complementarity, customer requirements, technology adoption, changes in supply chain partners and structure and competitive pressures. Potential challenges are lack of top management support, misaligned incentives, lack of trust, lack of information sharing, inconsistent performance measures and lack of joint decision-making (Cruijssen, Dullaert, & Fleuren, 2007; Fawcett, Magnan, & McCarter, 2008a, 2008b; Guan & Rehme, 2012; Min et al., 2005; Richey, Roath, Whipple, & Fawcett, 2010; Simatupang & Sridharan, 2002; Whipple & Frankel, 2000). One

important point is that internal integration is required as well as external. For example, integration of planning between the logistics and purchasing departments is necessary if the logistics department is attempting to integrate services with external organisations (Chen, Daugherty, & Roath, 2009; Gimenez & Ventura, 2005; Lambert, García-Dastugue, & Croxton, 2008; Stank, Keller, & Daugherty, 2001).

Governance models adopted stretch from a purely transaction- or market-based approach at one end to a fully integrated or hierarchical ownership model at the other (Golicic & Mentzer, 2006; Rinehart, Eckert, Handfield, Page, & Atkin, 2004). The former are governed by contracts of varying duration, regularly compared with the price and service offered by competitors, whereas integrated models can include an outright purchase or merger of one firm by another or the creation of a new organisation through a joint venture. In between these two extremes lie a variety of dynamic hybrid or relational models such as written contracts without equity involvement and minority stake agreements (Dussauge & Garrette, 1997; Halldorsson & Skjøtt-Larsen, 2006; Humphries, Towriss, & Wilding, 2007; Klint & Sjöberg, 2003; Parkhe, 1991; Rinehart et al., 2004; Schmoltzi & Wallenburg, 2011; Todeva & Knoke, 2005; Williamson, 1975). In addition to classifying such models according to equity stake, they can also be characterised by increasingly integrated services, from basic cooperation to coordinating business planning to strategic long-term process collaboration (Lambert, Emmelhainz, & Gardner, 1999; Spekman, Kamauff, & Myhr 1998; Whipple & Russell, 2007).

In transport, governance is about coordination of service requirements (as shown in previous sections), but in logistics and supply chain management, the focus is on firm creation (transaction costs, make vs. buy, internalise vs. market-based – for transaction cost economics, see Coase, 1937; Wilding & Humphries, 2006; Williamson, 1975, 1985) and resource utilisation (for more on the resource-based view, see Barney, 1991; Dyer & Singh, 1998; Hernández-Espallardo, Rodríguez-Orejuela, & Sánchez-Pérez, 2010; Lavie, 2006; Peters, Hofstetter, & Hoffmann, 2011; Schmoltzi & Wallenburg, 2011; Wernerfelt, 1984), leading eventually to a relational or network approach (Dyer & Singh, 1998; Pfohl & Buse, 2000; Skjoett-Larsen, 2000; Zacharia, Sanders, & Nix, 2011).

Bowersox, Daugherty, Dröge, Rogers, and Wardlow (1989) established a five-stage model of logistics integration, from single to repeated transactions, then partnerships, followed by third-party agreements and finally integrated service agreements. In this model, the partnership stage is when the shipper retains control of planning and management, while a third-party agreement is when the 3PL takes a more direct role in the relationship with a tailored service requiring information sharing, which increases the level of trust required. Finally, an integrated service agreement is where the entire logistics function or at least large parts of it have been outsourced to the 3PL. This will necessarily require a higher level of information integration possibly through joint ICT, and may also include additional value-added services as the inventory may in fact be stored at warehouses operated by the 3PL. Integration can even involve the placement of an 'organisational implant', which is when a representative from a 3PL is placed within the client organisation (Grawe, Daugherty, & Dant, 2012).

Thus, the key issues from logistics governance relate to internal and external resource and relationship management in terms of providing logistics services, and how integrated the logistics service provider is with the planning of the shipper.

3. Research Topics and Methodology

The governance models discussed in previous sections provide a useful beginning as they highlight the relation between the owner and operator and the separation of the transport function from the logistics function, as well as the role played by the trade-related activities at the periphery. They do not, however, disaggregate and identify the different kinds of relations between each level. The governance literature highlights the importance of working across boundaries and achieving cooperation among various interests and voices, and the supply chain literature explicitly requires consideration of internal and external integration processes.

These issues have been transformed into four research topics to be addressed:

(1) The development process, including the roles of the public and private sectors.
(2) The relation between the original developer and the eventual operator, including selling and leasing.
(3) The relationship between the transport and logistics functions, and other issues internal to the site.
(4) The site functions and operational model, including the relationships with clients and external stakeholders.

An inductive methodology is used to identify the key governance relationships from an analysis of the literature. While cases extant in the literature are discussed in this paper, the typology cannot be induced solely from an analysis of such cases, as many of the necessary features are not recorded in the case-study analyses. Indeed, one difficulty arising from the large literature on freight facilities in recent years is the many different frameworks under which they have been analysed, some focusing on location and transport costs, others on policy and planning issues and still others on rail operations.

It is, therefore, not possible simply to compare the four factors derived above by quantitative analysis of the totality of cases in the literature. Rather, these topics have been raised indirectly in discussions of issues relating to successful intermodal transport. Many of these issues derive from organisational complexity, conflicts in motivations between key stakeholders and changing governance forms between the development phase and the operational phase. This paper attempts to consolidate previous research and develop a research agenda by identifying the key relationships within one typology; future researchers can then focus on individual relationships that can aid the policy goal of increased modal shift to intermodal transport.

4. Case Analysis

4.1. *The Development Process*

The development of freight nodes has received much attention in the literature. The main issues to be addressed in this section are the role of government planning and funding, whether the developer is from the public or private sector and the eventual role of the site developer in transport and logistics operations. While governance has rarely been addressed directly, this section will reveal that it has been raised indirectly through discussions of the role of government

in supporting developments, the role of real estate developers and the use of public–private partnerships with varying levels of public involvement.

Inland freight nodes can be developed directly by government, although questions have been raised regarding the efficacy of public investment in terminals considering the difficulties of economically viable operation once the site is built (Gouvernal, Debrie, & Slack, 2005; Höltgen, 1996; Liedtke & Carillo Murillo, 2012; Proost et al., 2011). Table 1 lists examples of government-led developments, illustrating the variety of ways in which public sector actors can be involved in site development.

Fully public models are unusual and depend on the competencies of the public bodies in question. The risk is whether the site can then be leased or sold on to a private operator. Government involvement is more commonly achieved either as a PPP or through a concession not simply to operate a site, but to build it as well (Tsamboulas & Kapros, 2003).

Developments driven by the public sector due to motivations of regional development can run the risk of over-supply, while in North America, the private sector focus on profit tends to regulate this problem (Notteboom & Rodrigue, 2009; Rodrigue et al., 2010). On the other hand, public sector developments are more likely to adhere to planning strategies such as location in brownfield sites or economically undeveloped areas. Private sector developments, while technically also subject to the same planning approvals, often succeed in evading such restrictions (Hesse, 2004), partly due to a lack of institutional capacity to manage planning conflicts (Flämig & Hesse, 2011). Even where local planning rules apply, the lack of a coordinated regional approach can lead to sprawl of logistics platforms (Bowen, 2008; Dablanc & Ross, 2012), a lack of incentive to invest (Ng et al., 2013) or a split of scale economies across institutional jurisdictions (Notteboom & Rodrigue, 2009;

Table 1. Different models of government involvement in the development of freight facilities

Role of public sector in development process	Examples	Reference
Fully public	Falköping, Sweden (municipality)	Bergqvist (2008), Bergqvist et al. (2010), Wilmsmeier et al. (2011), Monios and Wilmsmeier (2012a)
	Verona, Italy (joint between town, province and chamber of commerce)	Monios (in press)
	Coslada, Spain (joint between national port body, four public port authorities and local government bodies)	Monios (2011)
Public–private partnership (PPP)	Bologna, Italy	Monios (in press)
One-off funding grant or land provision	Uiwang, Korea	Hanaoka and Regmi (2011)
	Jinhua, China	Monios and Wang (2013)
Award concession to build and operate (e.g. BOT, DBOT and BOOT)	Lat Krabang, Thailand	Hanaoka and Regmi (2011)

Van den Heuvel, de Langen, van Donselaar, & Fransoo, 2013; Wilmsmeier et al., 2011).

Private sector developments are more likely to be logistics platforms than intermodal terminals, and they are generally pursued by a real estate developer. This is more common in countries where the public sector traditionally has less direct involvement, such as the USA and the UK. For example, global company ProLogis, in conjunction with CenterPoint, developed the BNSF Logistics Park in Chicago, within the boundary of which was situated a large intermodal terminal developed by rail operator BNSF (Rodrigue et al., 2010). This model is becoming increasingly common in continental Europe, for instance, the Magna Park development in Germany studied by Hesse (2004).

Hesse (2004) showed how the real estate market for logistics has changed from one with high ownership levels, primarily local firms, few speculative developments, ten-year leases and a weak investment market to a situation with an increasing share of rental sites, international developers, speculative development, shorter leases of 3–5 years and a strong investment market for new developments. Average warehouse size is increasing in both the UK and the USA (Cidell, 2010; McKinnon, 2009), as is the tendency to agglomeration, with a trend towards companies choosing to locate their distribution centres within large logistics platforms (McKinnon, 2009).

Real estate and public sector developments may be grouped together as sites that are intended to be sold or leased to operators. Other sites are developed directly by the eventual operator for their own use (Table 2). In Europe, most rail networks were managed by the national government until recent times (Martí-Henneberg, 2013), thus terminals were developed both by private transport operators attached to the national network and by the national rail operators themselves. As shown in Table 2, these sites are now mostly owned and/or operated by private operators, or, in a liberalised EU environment, the vertically separated and quasi-private but still nationally owned rail operator.

Table 2. Intermodal terminals developed by the eventual operator

Developer	Example	Reference
Ex-national rail operator but now privatised	Various UK examples, for example, Freightliner Coatbridge	Monios and Wilmsmeier (2012b)
Vertically separated and quasi-private but still nationally owned rail operator	Various European examples, for example, IFB Muizen	Monios and Wilmsmeier (2012a)
Rail operator in countries where operations remain wholly or predominantly under state control	Several terminals developed by Concor, India	Ng and Gujar (2009a, 2009b) and Gangwar, Morris, Pandey, and Raghuram (2012)
Private rail operator	Joliet intermodal terminal Chicago developed by BNSF	Rodrigue et al. (2010)
Private port terminal operator	Venlo, the Netherlands, developed by ECT Rotterdam	Rodrigue and Notteboom (2009), Rodrigue et al. (2010), Veenstra et al. (2012) and Monios and Wilmsmeier (2012a)

In other countries, such as India, the rail operations remain wholly or predominantly under state control. In the USA, where rail is privately owned and operated on a model of vertical integration, intermodal terminals are developed and operated by the private rail companies. In addition to rail operators and 3PLs, the literature reveals that intermodal terminals can also be developed by port actors, whether port authorities or port terminal operators (see Section 4.4).

4.2. *Selling or Leasing the Site to an Operator*

The next aspect of the development and ownership question related to governance is to consider whether the site is then leased on the landlord model or sold to an operator. In sites developed by a real estate operator, the aim is to earn profit through selling or leasing either the entire site or individual plots. For sites developed by government, the decision of selling or leasing is tied to obtaining social benefits. This is first related to whether the site as a whole is being disposed of or only individual plots. A real estate developer is likely to lease or sell individual plots, whereas a public body is more likely to lease the entire site to an operator who will then manage the plots.

Assessment of the government role in operations is dependent to some degree on whether or not the government body in question has direct involvement in the site or just a shareholding (Table 3). In the fully public example of Verona in Section 4.1, the site is managed by an arm's length company established by the public shareholders, so they are not directly involved in day-to-day running. In other (rarer) cases, the public owner actually operates the site, at least on a supervisory 'tool port' basis. In others, the public body fully owns the site, but tenders the operation to a private operator on the landlord model.

An important consideration impacting on the lease or sell decision is the problem with the previous system that public sector stakeholders are trying to solve by investing in, owning or operating an inland freight node. In most cases, it is either economic development from supporting the logistics sector to provide jobs and economic activity in the region or seeking modal shift from road to rail to produce a reduction in negative externalities such as congestion or emissions. However, it is not possible to guarantee such outcomes simply by building an intermodal terminal or logistics platform. Many operational barriers need to be overcome for the site to be successful in developing intermodal traffic. That is why a governance typology must go beyond the simple issue of ownership; the operational model is an essential part of such classifications.

Table 3. Site management models of public sector actors

Type	Example	Reference
Arm's length company established by the public shareholders	Verona, Italy	Monios (in press)
Tool port model	Shijazhuang, China	Beresford et al. (2012)
Landlord model	Coslada, Spain	Monios (2011)
	Birgunj, Nepal	Hanaoka and Regmi (2011)

4.3. *Relationship Between the Intermodal Terminal and the Logistics Platform*

The relationship between ownership and operation of the intermodal terminal and logistics platform must now be considered (Table 4). In some cases, both sites may be operated by a single operator, which could produce synergies between the two, but this may produce conflict with the core competency of that single operator. For example, a rail operator operating a joint terminal and logistics platform would be different from a 3PL operating that same joint site. In practice, even where there is a nominally unified organisational structure encompassing both logistics platform and intermodal terminal, the operational reality is that the intermodal terminal and individual parts of the logistics platform will be operated by different organisations, often with part investment of the overall owner. The development process for such large projects is capital intensive and risky therefore a real estate developer, rail operator and a public authority are likely to be involved in a joint development, but the resulting project, once in operation, will be operated separately by the rail operator (terminal) and real estate developer (logistics platform).

A more realistic scenario is for the two sites to be operated separately, but with close operational relations, although this is difficult to capture in a typology. Venlo, the Netherlands (see Section 4.4 for more detail), is a good example of close relations between terminal and logistics, with the terminal operator holding a 50% stake in the logistics platform. Of the five Italian freight villages examined by Monios (in press), in all cases, the intermodal terminal was operated by a separate operator to the logistics platform; however, in most cases, the logistics platform operator had a high proportion of investment in that rail terminal operating company. Indeed, in most cases, the terminal operating company had been set up specifically to operate that terminal, with ownership from the logistics platform and a rail operator. These examples can be considered a demonstration of the 'organisational implant' concept discussed above (Grawe et al., 2012), which increases synergies by placing a representative of one organisation within the other. Further operational integration is possible in the container shunting operations between the terminal and the individual warehouses and distribution centres both within the logistics platform and in the surrounding area. This could be arranged by the shipper or freight forwarder or could be managed directly by the logistics platform operating company through a dedicated shunting

Table 4. Relations between intermodal terminal and logistics platform

Type	Example	Reference
Unified organisational structure	Xi'an, China	Beresford et al. (2012)
	BNSF Logistics Park Chicago	Rodrigue et al. (2010)
Separate operators	Bologna, Italy	Monios (in press)
Intermodal terminal operator holds a stake in the logistics platform	Venlo, the Netherlands	Rodrigue and Notteboom (2009); Rodrigue et al. (2010); Veenstra et al. (2012); Monios and Wilmsmeier (2012a)
Logistics platform operator holds a stake in the intermodal terminal	Verona, Italy	Monios (in press)

operation to serve site tenants and other nearby locations, thus increasing operational integration and lowering costs.

4.4. *Function of the Site and Operation Model*

The primary functions of intermodal terminals can be split into satellite terminal, transloading site and load centre (Rodrigue et al., 2010). Table 5 lists some examples from the literature.

A satellite terminal is generally considered as a terminal located close to a port (see also the close-range dry port model of Roso, Woxenius, & Lumsden, 2009) and used to overcome congestion by moving containers quickly out of the port area for processing at the inland location (Roso, 2008; Slack, 1999). There is, therefore, generally a high level of operational integration. By virtue of this need to move the container quickly out of the port, the close-range site will often fulfil administrative tasks, including but not limited to customs clearance. Thus, the valuable and congested port land is reserved for container handling functions and the close-range inland terminal can handle other aspects of the process. From a transport perspective, the short distance between the port and the satellite terminal means that the mode is more likely to be road, but rail or barge can also be used (e.g. the so-called 'container transferium' recently developed at Alblasserdam just outside the port of Rotterdam – van Schuylenburg & Borsodi, 2010). While a road-linked terminal would seem to ignore the main function which is to overcome congestion, such a model can reduce congestion inside the port by reducing the time each truck spends in the port on administrative matters.

A transloading centre is generally understood as primarily related to changing mode. This site could therefore, strictly speaking, be just the terminal with no services or storage nearby, but in practice, it would generally involve such services. Thus, while its primary function is interchange rather than servicing a local market, in practice, it would presumably do so in order to make the site economically feasible, which leads into the third main function, that of a load centre.

The load centre concept refers to a large intermodal terminal servicing a large region of production or consumption. It is probably the classic kind of inland node as it serves as a gateway to a large region and is more likely to be set within a specific logistics platform or in an area with high demand for such services. The load centre approach tends to fit well within the American inland port typology, which generally refers to a large site with a logistics platform located either nearby or as part of an integrated site.

Table 5. Functional models at intermodal terminals

Type	Example	Reference
Satellite terminal	Enfield, Sydney	Roso (2008)
	Beijing, China	Monios and Wang (2013)
Load centre	BNSF Chicago	Rodrigue et al. (2010)
	Rickenbacker Inland Port	Monios and Lambert (2013)
Transloading site	Mainhub, Antwerp	Macharis and Pekin (2009)
Extended gate	Venlo, the Netherlands	Rodrigue and Notteboom (2009), Rodrigue et al. (2010), Veenstra et al. (2012) and Monios and Wilmsmeier (2012a)

A fourth function or operational model is the extended gate, which relates all three of the above models, in particular, the satellite terminal and load centre. The extended gate concept is a 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 (Monios, 2011; Monios & Wilmsmeier, 2012a; Rodrigue & Notteboom, 2009; Roso et al., 2009; Van Klink, 1998; Veenstra, Zuidwijk, & van Asperen, 2012). At Venlo, the Netherlands, the intermodal terminal is set within a logistics platform and the operator of both the port terminal and the intermodal terminal also holds a 50% stake in the logistics platform. The extended gate concept entails various institutional barriers, but offers significant opportunity to improve the efficiencies of service planning and therefore improve the economic viability of intermodal port shuttles.

As with intermodal terminals, a logistics platform can be more or less developed. Some may be small, catering to local shippers and offering few services, while others may be large sites offering comprehensive value-added services, including hotels and restaurants. Different operational models can be identified at logistics platforms, as described in a comparison of Italian freight villages by Monios (in press). In the more common model, the site operator (a body set up and controlled by the owners) merely sells or leases individual plots to customers (e.g. Bologna). The tenants will be either individual shippers doing their logistics in-house or, in some cases, a site may have a majority of 3PLs as tenants (e.g. Marcianise). At Rivalta Scrivia, however, the operator of the logistics platform performs logistics operations for the tenants, producing a more integrated model. This model allows consolidation and feeds the intermodal terminal, with a result that at this site, the proportion of traffic at the intermodal terminal belonging to tenants of the logistics platform is far higher than at other freight villages (Monios, in press). This result suggests that this is a good model for supporting intermodal transport adoption, and should be captured in the governance typology.

Relations with external stakeholders along the intermodal corridor is the next issue to address. How does the intermodal terminal relate with rail operators and logistics providers organising company trains? How does the terminal operator interact with port authorities, port terminal operators or shipping lines in managing port shuttles? Intermodal corridor operations can be managed in different ways to lower transaction costs, such as contracts, joint ventures and integration through mergers and alliances (De Langen & Chouly, 2004; Ducruet & Van Der Horst, 2009; Panayides, 2002; Van der Horst & de Langen, 2008; Van der Horst & Van der Lugt, 2011, 2014). Moreover, since terminal volume is linked to traffic flows, the terminal operator requires a close relationship if not some level of integration with a rail operator to guarantee usage (Bergqvist, Falkemark, & Woxenius, 2010).

Some examples can be drawn from the literature of different levels of collaboration and integration in intermodal corridors, classified by whether the external actor is a rail or port actor (Table 6). The intermodal terminal operator may be independent from rail service operation; it may run rail services for any users or it may run rail services directly for the site tenants. Similarly, the operator of the logistics platform may do the logistics for site tenants (Rivalta Scrivia) or it may not. From a port perspective, there may be investment from a port authority or port terminal operator. Additionally, as shown in Table 6, the relation between the port and the inland terminal may be a highly integrated extended gate style of

Table 6. Levels of collaboration and integration in intermodal corridors

External actor	Type	Examples	Reference
Rail operators	Intermodal terminal operator is independent from rail service operation	Azuqueca, Spain	Monios (2011)
	Intermodal terminal operator runs rail services for any users	Freightliner, UK Delcatrans, Belgium	Monios and Wilmsmeier (2012a, 2012b) Monios and Wilmsmeier (2012a, 2012b)
	Intermodal terminal operator runs rail services directly for the site tenants	Venlo, the Netherlands Minto, Sydney	Rodrigue and Notteboom (2009), Rodrigue et al. (2010), Veenstra et al. (2012) and Monios and Wilmsmeier (2012a) Roso (2008)
Port authorities and terminal operators	Investment from port authority	Coslada, Spain Enfield, Sydney	Monios (2011) Roso (2008)
	Investment from port terminal operator	Hidalgo, Mexico Venlo, the Netherlands	Wilmsmeier, Monios, and Rodrigue (2015) Rodrigue and Notteboom (2009), Rodrigue et al. (2010), Veenstra et al. (2012) and Monios and Wilmsmeier (2012a)
	Port actors are directly involved in establishing intermodal services or corridors	Barcelona, Spain Alameda Corridor, USA Eurogate, Germany	Van den Berg, De Langen, and Costa (2012) Jacobs (2007), Rodrigue and Notteboom (2009) and Monios and Lambert (2013) Notteboom and Rodrigue (2009)

operation (Venlo) or it may not (the majority). Similarly, port actors can be directly involved in establishing intermodal services or corridors.

In order to pursue such strategies, port actors are required to alter their institutional capacity beyond their core competency of container handling and restructure their business models (Jacobs & Notteboom, 2011; Notteboom & Rodrigue, 2005; Notteboom et al., 2013; Sanchez & Wilmsmeier, 2010). It will mostly be large ports with the necessary resources that are likely to engage in such tactics, meaning that the levels of integration required for such aggressive hinterland control will be the exception rather than the norm. An important point to note is that the model of public involvement (as discussed in Section 4.1) may put restrictions on the operational model. For example, investment of public funds may be tied to an open-access requirement that may conflict with the business strategy of a port terminal operator seeking competitive advantage through better hinterland access.

5. Developing the Typology

The common elements of these different operational models can now be used to generate a governance typology (Table 7).

Table 7. Typology of governance relationships at intermodal terminals and logistics platforms

1	Developer of each part (terminal or logistics or both)	Some will be built to sell/lease on in order to get benefits (economic and social benefits for public sector, profit for real estate developer) Some will be built to operate themselves as part of a business strategy (although may have government investment or planning support)								
		Public sector (which level and type)	Real estate developer	Rail operator	3PL	Port authority	Port terminal operator	Shipping line	Independent	PPP	Other

2	Operator of each part (terminal or logistics or both)	Relation between owner and operator (of either terminal or logistics platform)				
		Operated directly by owner	Tool (operated directly but with some sub-contracting)	Operated through an arm's length company	Landlord (publicly owned but operated by private company under concession)	Leased	Other

3	Internal operation model (relation between terminal & logistics)	3a. Type of operator of each part (either terminal or logistics platform)							3b. Relation between operator of terminal and operator of logistics platform		
		Rail operator	3PL	Port authority	Port terminal operator	Shipping line	Independent	Other	Single operator	Mixed	Separate operators

4	External operation model (relation with clients & others)	4a. Relation between logistics platform and site tenants			4b. Relation between terminal and rail service providers			4c. Relation between either terminal or logistics platform and ports		
		Tenants do own or in-house logistics	Tenants are 3PLs doing logistics for various clients	Site operator does logistics for site tenants	Terminal operator is independent of rail service operators	Terminal operator runs rail services for all	Terminal operator runs rail services for site tenants	No relation with port	Port actor has invested partly or fully in site	Port actor involved in joint service operation

The first question is who are the various possible developers of a site: for example, government (what kind of government body and which scale), real estate developers, rail operators, 3PLs, port authorities, port terminal operators, shipping lines, independent operators and others. Each actor will have different motivations; for example, obtaining social and economic benefits (government), to sell the site or parts within it for profit (real estate developer), as part of an existing business (e.g. rail operator or 3PL) or for hinterland capture (e.g. port actors).

The second aspect is the relation between the owner and operator, drawing on previous uses of governance in the transport literature. This part of the typology covers whether the owner operates the site directly, at arm's length, through contracts or via a concession (landlord) or lease.

The third issue from the literature addresses the main function(s) of the site, in particular whether the site is an intermodal terminal or logistics platform or both. Part of this question includes the nature of the operator of each site (intermodal terminal and logistics platform) and the relation between them. This follows on from the development process (related to the original aim) and points the way towards more specific questions about the operational model.

The fourth issue concerns operations. Many detailed operational issues have been raised in the literature regarding the performance and economic viability of intermodal transport. The literature has pointed towards varying models of collaboration and integration as potential aids in this endeavour, so this section will classify the different models as part of the governance typology.

6. Discussion

As noted in Section 2.2, port governance studies have focused primarily on the relation between the owner (usually some level of government) and the operator (usually appointed by a tender process). By contrast, the key governance aspect of intermodal terminals and logistics platforms is related to operational characteristics. Operational types derive from the relation between the operator and the external actors (ports and rail operators), as well as the relation of the operator to the tenants, and, as reflected in the typology, the relation between the intermodal terminal and the logistics platform.

Therefore, the governance of ownership and operation (covering the landlord issue and tendering) is shown to be more important for ports than for inland sites, and forms only the first half of the typology. The ownership of an intermodal terminal or logistics platform matters primarily in terms of the desired outcome from the investment (social and economic benefits for the public sector actor or profit from selling the plots for a real estate developer). If the site is developed by an industry actor (rail operator, 3PL, port authority, port terminal, etc.) then, in addition to the profit motive, the development represents a long-term strategic decision to operate the site as part of their larger business.

The second half of the typology is based on the internal model (relation between the terminal and the logistics platform and who operates each) and the external model (relations with tenants, rail services and ports). These issues are relevant because, just as a port's success (both for itself and for its region) is related to the ability of the owner to negotiate a successful concessionaire that will attract shipping lines, the success of an intermodal terminal is related to many operational aspects such as establishing regular intermodal services, consolidating

flows to fill them, and reaching out to sea actors (ports and shipping lines) to embed the terminal in global flows.

In port governance, external relations are less relevant to the original lease decision as it is up to the private terminal operator to run the site in the most profitable way, and strategies have merged over recent decades so most terminals have links with shipping lines and with other terminals in the same global company. Intermodal terminals and logistics platforms are far smaller concerns, less likely to be part of a global or even national portfolio; as such, they exhibit a variety of relationships with rail operators, site users and ports. Therefore, the three kinds of external relations identified in the fourth section of the typology form the key distinctions, and lead towards future research on these models, underpinning as they do the ability to achieve successful intermodal services.

The governance typology aids identification of the relevant resources and relationships relating to each model, informing the policy background of supporting intermodal transport services. The recognition of the requirement for greater internal and external integration goes some way towards understanding why intermodal terminals do not always achieve the modal shift aims of government policy, despite often large amounts of public investment. The supply chain literature recognises that competition is increasingly between entire supply chains rather than individual firms, but this realisation is sometimes lacking in the transport literature, and especially absent from government decisions to fund intermodal terminals and logistics platforms in isolation from an analysis of their operational models.

The literature has shown that operational models are crucial in terms of whether an operator can succeed in developing intermodal services, based on the ability to cooperate, integrate, consolidate and plan. These are not just operational concerns but are in many instances derived from the governance model. Thus, the governance typology developed in this paper can help identify the different ways such integration can be pursued, and, more importantly, recognise when it is not.

7. Conclusion and Research Agenda

Operational difficulties preventing the economic feasibility of intermodal transport are well known and, while some discussions of the role of integration and collaboration have been raised in the literature, the relation between the owner, operator and operational models of freight nodes has been insufficiently addressed. This paper has applied lessons from the governance literature to intermodal terminals and logistics platforms in order to develop a typology that accounts for the importance of internal and external operational models in the success or otherwise of intermodal transport services.

Findings reveal the importance of understanding operational models that provide greater synergies not only between the users of the intermodal terminal and the logistics platform, but relations between the two sites and relations with external stakeholders such as transport providers and port actors. The goal of the typology is not to name or classify specific types, but to explore relationships. Classifying sites by ownership is the first step, but insufficient on its own. This paper has added another two layers derived from the supply chain literature, namely internal and external integration; this expansion is essential to the understanding and especially to the success of intermodal transport services, based on three key relationships; first, between the logistics platform and the

site tenants (therefore encouraging consolidation and efficiencies that can boost rail services at the site); second, between the terminal operator and rail service provision (which can aid service planning and train loading factors); and third, between the inland site (either terminal, logistics platform or both) and port(s), (thus enabling better planning and efficiency of port rail shuttles).

If policy goals of modal shift are to be achieved, intermodal transport can no longer be considered in isolation from logistics strategies. Thus, government money spent on intermodal infrastructure and operational subsidies must be aligned with an understanding of how intermodal flows are embedded within internal and external relationships, and with other logistics decisions. This expanded notion of transport governance can be taken forward in future research, in particular by a greater understanding of coordinating transport requirements with other logistics services.

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Notes

1. See Rodríguez-Pose (2013) for a recent overview of the institutional literature.
2. While intermodal transport includes container movements by both rail and barge, rail transport is by far the most common topic in the literature. The barge literature (e.g. Choong et al., 2002; Groothedde et al., 2005; Konings, 2007; Konings et al., 2013; Trip & Bontekoning, 2002) tends to focus on operations rather than on terminal development and governance issues.

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