



## **Moving beyond land and water: Understanding the development and spatial organization of inland ports**

Downloaded from: <https://research.chalmers.se>, 2026-04-04 14:15 UTC

Citation for the original published paper (version of record):

Witte, P., Wiegmans, B., Roso, V. et al (2020). Moving beyond land and water: Understanding the development and spatial organization of inland ports. *Journal of Transport Geography*, 84. <http://dx.doi.org/10.1016/j.jtrangeo.2020.102676>

N.B. When citing this work, cite the original published paper.



ELSEVIER

Contents lists available at ScienceDirect

## Journal of Transport Geography

journal homepage: [www.elsevier.com/locate/jtrangeo](http://www.elsevier.com/locate/jtrangeo)

## Critical review

## Moving beyond land and water: Understanding the development and spatial organization of inland ports

Patrick Witte<sup>a,\*</sup>, Bart Wiegmans<sup>b</sup>, Violeta Roso<sup>c</sup>, Peter V. Hall<sup>d</sup><sup>a</sup> Department of Human Geography and Planning, Utrecht University, the Netherlands<sup>b</sup> Department of Civil Engineering and Transport, Delft Technical University, the Netherlands<sup>c</sup> Division of Service Management and Logistics, Chalmers University of Technology, Sweden<sup>d</sup> Urban Studies Program, Simon Fraser University, Canada

## 1. Introduction

This Virtual Special Issue on understanding the development and spatial organization of inland ports aims at giving an up to date overview on the topic of inland port development in its different geographical and institutional contexts worldwide (see e.g. Ng et al., 2014). In the light of the recent scientometric analysis of port studies published in the Journal of Transport Geography since 1993 (see Ducruet et al., 2019), it is interesting to examine the development of inland ports as a specific object of study within wider port development debates. Inland ports have been a recurring topic of interest for the past twenty-five years or so, and in this time period a considerable amount of literature has been written, with Journal of Transport Geography being the main journal covering this ongoing debate (see Witte et al., 2019).

What is striking throughout most papers focusing on inland ports, however, is that even after more than two decades a recurring issue is the difficulty to grasp the different definitions, actors, functions, scale-levels and geographies that are of relevance (Rodrigue et al., 2010; Wiegmans et al., 2015). In particular, we have observed different ‘angles’ for studying inland ports, with an operational perspective being the most prominent (see e.g. Monios and Wilmsmeier, 2012). More recently, attention to the governance and management of inland ports, and the spatial, institutional and economic impacts of inland ports is also growing. In general, it can be stated that the literature on inland ports is rather scattered, with many different definitions floating around (see e.g. Notteboom et al., 2017 for an overview).

Of course, attempts have been made to conceptualize the evolution and development of inland ports. Key publications over the indicated time period are the early thoughts on satellite terminals by Slack (1999), the notion of port regionalization by Notteboom and Rodrigue (2005) and the directional development discussion started by Wilmsmeier et al. (2011), later refined by amongst others Bask et al. (2014) and Raimbault et al. (2015). A clear line running through these papers is the notion that inland ports are more than just merely an

extension of maritime ports. However, what is missing up to now, is a comprehensive understanding of the development, management, and spatial organization of inland ports, ranging from the global to the local scale, and paying attention to the importance of geographical context.

The aim of this Virtual Special Issue, titled ‘*Moving beyond land and water*’, therefore is to present an overview of different facets of inland port development, with a particular focus on the following interrelated levels which each imply particular focus areas: national/continental perspectives (with a focus on development and operations), regional perspective (with a focus on economic impacts and governance/jurisdictional arrangements) and local perspectives (with a focus on spatial organization and localized impacts). We aim to present the theoretical and empirical insights concerning inland ports through different time periods, in different geographical settings and by different analytical dimensions of inland ports.

## 1.1. Scope and structure of the virtual special issue

The Virtual Special Issue starts off with a literature review paper by Witte et al. (2019), titled ‘*A critical review on the evolution and development of inland port research*’, that is used for setting the scene of this special issue. How do we define inland port development? What kind of dimensions, characteristics and classifications do we distinguish? What kind of theories or conceptual frameworks are used to explain inland port development? How has this changed over time? A systematic literature review covering 80 international peer-reviewed academic journal papers on inland port development between 1992 and 2017 is used to reveal three stages of development within this time period.

The first stage runs roughly from the early 1990s until 2005 and can be summarized as ‘from port congestion to port regionalization’, with the previously mentioned papers by Slack (1999) and Notteboom and Rodrigue (2005) as the main milestones. This period is characterized by a focus on a globalization and supply chain perspective. The second stage runs from 2006 to 2011 and can be characterized as the diversification stage, beyond the concept of port regionalization, and focusing

\* Corresponding author.

E-mail addresses: [p.a.witte@uu.nl](mailto:p.a.witte@uu.nl) (P. Witte), [b.wiegmans@tudelft.nl](mailto:b.wiegmans@tudelft.nl) (B. Wiegmans), [violeta.roso@chalmers.se](mailto:violeta.roso@chalmers.se) (V. Roso), [pvhall@sfu.ca](mailto:pvhall@sfu.ca) (P.V. Hall).

amongst others on dry port development (e.g. [Roso et al., 2009](#)) as a specific ‘research track’ within this time period. The third phase runs from 2012 to 2017 and can be labelled as the contextualization stage, in which prime attention is focused on the directional development of inland ports within their specific local, regional and (inter-)national contexts. A key paper that is highlighting this new phase in inland port development is [Monios and Wilmsmeier \(2012\)](#).

As the literature review by [Witte et al. \(2019\)](#) runs up to and including 2017, it is interesting for this special issue to ask how the debate has developed since. Is inland port research developing into a stand-alone research area? How is inland port development taking shape in different geographical areas and contexts? The remaining papers that are included in this special issue can be seen as a reflection of the most recent stage of inland port research. Questions that are covered in the scope of these papers are: how do inland ports act in the chain of the wider network? How are inland ports embedded in the wider regional-economic context? And how have inland ports spatially/functionally evolved over time? The papers range from the local to the global perspective and highlight different operational, economic, spatial and institutional aspects of inland port development. They address inland ports in four distinct geographies; Europe-wide, Sweden, France and India.

The paper by [Tadic et al. \(2019\)](#), titled ‘*Selection of efficient types of intermodal terminals*’ studies inland intermodal terminals from an operational perspective. Starting from the notion that trends such as globalization, technological development, climate change, etc. all impact the complex demands we place on the logistics and transport sector, they argue for the crucial position of efficient inland intermodal terminals as one of the key intermodal transport sub-systems. The paper aims to define different types of inland intermodal terminals and develops an evaluation framework to assess and select efficient terminal types, based on a novel approach to multi-criteria decision-making. In studying real intermodal terminals in Europe, they arrive at the interesting conclusion that increased capacity does not necessarily lead to increased efficiency, and that especially ‘small’ inland road-rail hub terminals that mainly perform basic, supplementary and accompanying functions are instrumental assets in the development of transport networks, regionalization of ports and regional macro-economic development.

The paper by [Gonzalez-Aregall and Bergqvist \(2019\)](#), titled ‘*The role of dry ports in solving seaport disruptions: A Swedish case study*’, analyzes the effects of port labor disruptions on hinterland logistics, taking the case of the Swedish Port of Gothenburg’s container terminal as an example. A labor dispute in 2016–2017 led several companies to initiate mitigation strategies by moving their cargo operations from the seaport to hinterland locations and dry ports. Taking an infrastructural and economic perspective in studying the warehouse industry, they show that the traffic share of inland terminals was higher during and soon after the conflict, because the actors sought solutions to bypass the seaport. Doing so, this paper empirically illustrates what has been stated earlier that dry ports are significant actors and potential solutions to relieve pressure on maritime ports, not just in the case of labor disputes as is stated here, but potentially also in other cases of negative externalities or bottlenecks of maritime ports, such as traffic congestion, noise and air pollution or other unforeseen human-made or nature-based network disruptions.

The paper by [Gujar et al. \(2019\)](#), titled ‘*The impacts of major government initiatives on the development of dry ports: A case study of the direct port delivery scheme in India*’, studies inland ports from a governance perspective. The authors argue for the need to understand how governmental decisions impact the transformation of transportation systems, especially in the case of path disruptions of dry ports in India. The paper examines the implementation of the ‘direct port delivery (DPD) scheme’ that was developed by the Indian government in 2016 as a financial incentive to stimulate dry port development. The authors show that path disruptions in the development of dry ports occurred

due to changes in the strategic actions of market actors, because the port stakeholders created a joint counterforce against the government’s initiatives. The paper stresses the importance of institutional change in affecting dry port development practice, by showing that many dry ports have been developed more from bureaucratic rather than logistical considerations, leading to many (financially) unsustainable dry ports. This finding presents interesting food for thought concerning the role of major governmental policies in the transformation, or lack of transformation, of regional transportation systems.

The paper by [Raimbault \(2019\)](#), titled ‘*From regional planning to port regionalization and urban logistics. The inland port and the governance of logistics development in the Paris region*’, studies inland port development in France from an urban and regional planning perspective. The paper starts from the notion that large urban regions can be seen as the linking pin of regional, national and international flows and thus as the main logistics markets, concentrating warehouses, distribution centers, terminals, etc. Following this, it implies that inland ports – as part of the larger logistics systems of city regions – must be understood and governed taking into account their connections to the diverse logistical spaces at the metropolitan scale. However, the governance of inland ports within wider urban and regional governance arrangements of tentimes remains unclear. The paper thus analyses the inclusion of inland port spaces and institutions within metropolitan logistics strategies in the Paris region and concludes that inland port institutions have a unique position as one of the few policy tools for at the same time developing urban logistics sites, but also functioning as strategic assets for the metropolitan agenda of economic competitiveness.

## 1.2. Parallels and contrasts across the papers

A significant contribution that the papers included in this special issue brings to the academic debate, is that it comprehensively unites various geographical scale-levels and contexts with different sectoral foci for studying inland port development. First, most papers in one way or another position inland port development and operations in a national/continental perspective. For instance, [Tadic et al. \(2019\)](#) show the importance of small inland intermodal terminals in shaping the efficiency of wider national and continental transport networks and supply chains, and [Gujar et al. \(2019\)](#) show the impact of major transformational governmental policies at the national level on the actual spatial and functional evolution of dry ports in the whole country. Second, most papers put much emphasis not just on the development and operations of inland ports, but also on the economic impacts and governance/jurisdictional arrangements at the regional level. For instance, [Gonzalez-Aregall and Bergqvist \(2019\)](#) highlight the regional-economic ‘waterbed effect’ of a maritime port disruption on dry port operations in the hinterland, and [Witte et al. \(2019\)](#) show in their literature review an increasing focus on the roles of inland ports as components of regional transport and logistics systems, and the challenges that this imposes on the governance arrangements of inland ports. Third, increasing attention is also paid by most of the papers to the spatial organization and localized impacts of inland port development. This is most clearly shown through the contribution of [Raimbault \(2019\)](#) that analyses in-depth the challenges of inland port governance for the spatial organization of inland ports at the city-scale, including land use planning.

Taking the four analytical dimensions of inland ports (i.e. infrastructure, spatial structure, governance structure, economic structure) as outlined by [Witte et al. \(2017\)](#) as a frame of reference, there are also contrasts to be found between the papers. First, [Tadic et al. \(2019\)](#) take a dominant infrastructural perspective and put much focus on developing a novel and sophisticated model for optimization of inland port operations. Second, [Gonzalez-Aregall and Bergqvist](#) also start from infrastructure (i.e. changing inland port operations due to port disruptions), but then draw attention to the economic structure in terms of regional economic impacts and to the governance structure in terms of

the labor dispute that caused the infrastructure disruption in the first place. Third, [Gujar et al. \(2019\)](#) mainly stress the governance structure in terms of political and institutional challenges of inland port development by showing the almost surprising unwillingness of actors to follow government initiatives, even at the expense of more efficient operations (cf. [Maes et al., 2009](#), cited in [Witte et al., 2012](#)). Fourth, [Raimbault \(2019\)](#) has a dominant focus on the spatial structure in terms of the spatial and functional organization and management of metropolitan regions in accommodating logistics activities.

### 1.3. Future research directions

Although the set of papers included in this special issue presents a good overview of the current state of inland port research, there are plenty of conceptual, methodological and empirical questions that may inspire future research on this object of study. As suggested by [Witte et al. \(2019\)](#), the move away – or beyond – the port regionalization model opens up new directions for planning, management and governance of inland ports. In particular, specific localized, contextualized spatial development plans and institutionalization of inland ports governance could be studied further. This could be shaped in the following ways. First, as suggested by [Gonzalez-Aregall and Bergqvist \(2019\)](#), considerations for the effective and efficient design of inland ports within hinterland transport systems should not only be concerned with aspects such as cost efficiency and service quality, but should also consider risk-mitigation strategies. It could be studied how inland ports can be stimulated within hinterland logistics as a potential alternative for managing or even bypassing negative situations in maritime ports. Second, as suggested by [Gujar et al. \(2019\)](#), further research is needed to identify appropriate government initiatives for this potential future role of inland ports, especially on how inland ports can (re-)capture their logistical roles within the supply chain system. Furthermore, analysis of different possible governance approaches towards inland ports could deserve further research attention, especially in cases of major development programs such as the current China's Belt and Road Initiative. Priority should be on developing governance approaches that can trigger fundamental structural transformation to such transportation systems. Third, [Raimbault \(2019\)](#) suggests further comparative studies, for instance on urban regions where inland ports and maritime ports are managed by municipal or regional authorities, or by private companies. This would lead to more fully appreciating the localized and contextualized spatial embeddedness of inland ports.

### 1.4. Outlook and conclusion

The diversity of approaches to studying inland ports evident in this modest collection, mirrors in many respects their persistently multi-dimensional nature. In reductionist functional terms, inland ports are intermediary sites for the organization of global (or inter-regional) freight flows, but their intermediacy relates not only to these global flows; they are also implicated in national, regional and even metropolitan-scale distribution systems. In governance terms, while they

may be associated with a key or dominant actor (or 'owner'), these range from port authorities, to terminal operators, to national, regional, and local governments, but they also include private local and/or multinational firms. And despite the presence of a dominant actor, by their nature they tend to occupy intermediate or bridging spaces in administrative and jurisdictional systems. They are multi-modal, each with their own mode share and technical systems, and their immediate surroundings range from core urban to peripheral. Like the maritime ports they are bound up with, inland ports display important variation that makes them, if nothing else, an object of rich and ongoing study.

### References

- Bask, A., Roso, V., Hämäläinen, E., Andersson, D., 2014. Development of seaport – dry port dyads: two cases from Northern Europe. *J. Transp. Geogr.* 39, 85–95.
- Ducruet, C., Panahi, R., Ng, A., Jiang, C., Afenyo, M., 2019. Between geography and transport: a scientometric analysis of port studies. *J. Transp. Geogr.* 81, 102527 (in press).
- Gonzalez-Aregall, M., Bergqvist, R., 2019. The role of dry ports in solving seaport disruptions: a Swedish case study. *J. Transp. Geogr.* 80, 102499.
- Gujar, G., Ng, A., Notteboom, T., 2019. The impacts of major government initiatives on the development of dry ports: a case study of the direct port delivery scheme in India. *J. Transp. Geogr.* 80, 102498.
- Maes, J., van de Voorde, E., Vanelslander, T., 2009. Mapping bottlenecks in the Flemish logistics sector. *Eur. Transp. Conf.* 2009.
- Monios, J., Wilmsmeier, G., 2012. Giving a direction to port regionalisation. *Transp. Res. A* 46 (10), 1551–1561.
- Ng, A., Ducruet, C., Jacobs, W., Monios, J., Notteboom, T., Rodrigue, J., Slack, B., Tam, K., Wilmsmeier, G., 2014. Port geography at the crossroads with human geography: between flows and spaces. *J. Transp. Geogr.* 41, 84–96.
- Notteboom, T., Rodrigue, J., 2005. Port regionalization: towards a new phase in port development. *Marit. Policy Manag.* 32 (3), 297–313.
- Notteboom, T., Parola, F., Satta, G., Risitano, M., 2017. A taxonomy of logistics centres: overcoming conceptual ambiguity. *Transp. Rev.* 37 (3), 276–299.
- Raimbault, N., 2019. From regional planning to port regionalization and urban logistics. The inland port and the governance of logistics development in the Paris region. *J. Transp. Geogr.* 78, 205–213.
- Raimbault, N., Jacobs, W., van Dongen, F., 2015. Port regionalisation from a relational perspective: the rise of Venlo as Dutch international logistics hub. *Tijdschr. Econ. Soc. Geogr.* 107 (1), 16–32.
- Rodrigue, J.P., Debie, J., Fremont, A., Gouvernal, E., 2010. Functions and actors of inland ports: European and North American dynamics. *J. Transp. Geogr.* 18 (4), 519–529.
- Roso, V., Woxenius, J., Lumsden, K., 2009. The dry port concept: connecting container seaports with the hinterland. *J. Transp. Geogr.* 17 (5), 338–345.
- Slack, B., 1999. Satellite terminals: a local solution to hub congestion? *J. Transp. Geogr.* 7, 241–246.
- Tadic, S., Krstic, M., Brnjac, N., 2019. Selection of efficient types of inland intermodal terminals. *J. Transp. Geogr.* 78, 170–180.
- Wiegman, B., Witte, P., Spit, T., 2015. Characteristics of European inland ports: a statistical analysis of inland waterway port development in Dutch municipalities. *Transp. Res. A Policy Pract.* 78, 566–577.
- Wilmsmeier, G., Monios, J., Lambert, B., 2011. The directional development of intermodal freight corridors in relation to inland terminals. *J. Transp. Geogr.* 19 (6), 1379–1386.
- Witte, P., Wiegman, B., van Oort, F., Spit, T., 2012. Chokepoints in corridors: perspectives on bottlenecks in the European transport network. *Res. Transp. Bus. Manag.* 5, 57–66.
- Witte, P., Wiegman, B., Rodrigue, J., 2017. Competition or complementarity in Dutch inland port development: a case of overproximity? *J. Transp. Geogr.* 60, 80–88.
- Witte, P., Wiegman, B., Ng, A., 2019. A critical review on the evolution and development of inland port research. *J. Transp. Geogr.* 74, 53–61.