North Sea Baltic Connector of Regions
Interreg Baltic Sea Region programme 2014–2020

Review on stakeholders’ cooperation in supply chains

STATE OF THE ART report

Activity: WP 2, Activity 2.1.1

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Contents

List of Abbreviations

EU	European Union
HHM	Hafen Hamburg Marketing
ICOB	Investor Center Ost Brandenburg
ILiM	Institute of Logistics and Warehousing
NSB CoRe	North Sea – Baltic Connector of Regions

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1 General Background of Activity

2.1 Background of the Activity

This paper is an output for the activity 2.1.1 in NSB CoRe (North Sea Baltic Connector of Regions) project funded by BSR. The aim of the paper is to fulfill the needs to identify and analyze the bottlenecks hindering cooperation among participants within intermodal nodal points, as well as, corridors connecting them. Therefore, at first this paper defines and classify nodal points and corridors at conceptual level, which opens up an opportunity to study in little bit more detail which kinds of stakeholders's are involved in. Basically the idea is to see logistics and transportation as different networks merging in nodal points, and nodal points as different layers of different types of stakeholder and try to analyze the barriers hindering cooperation there.

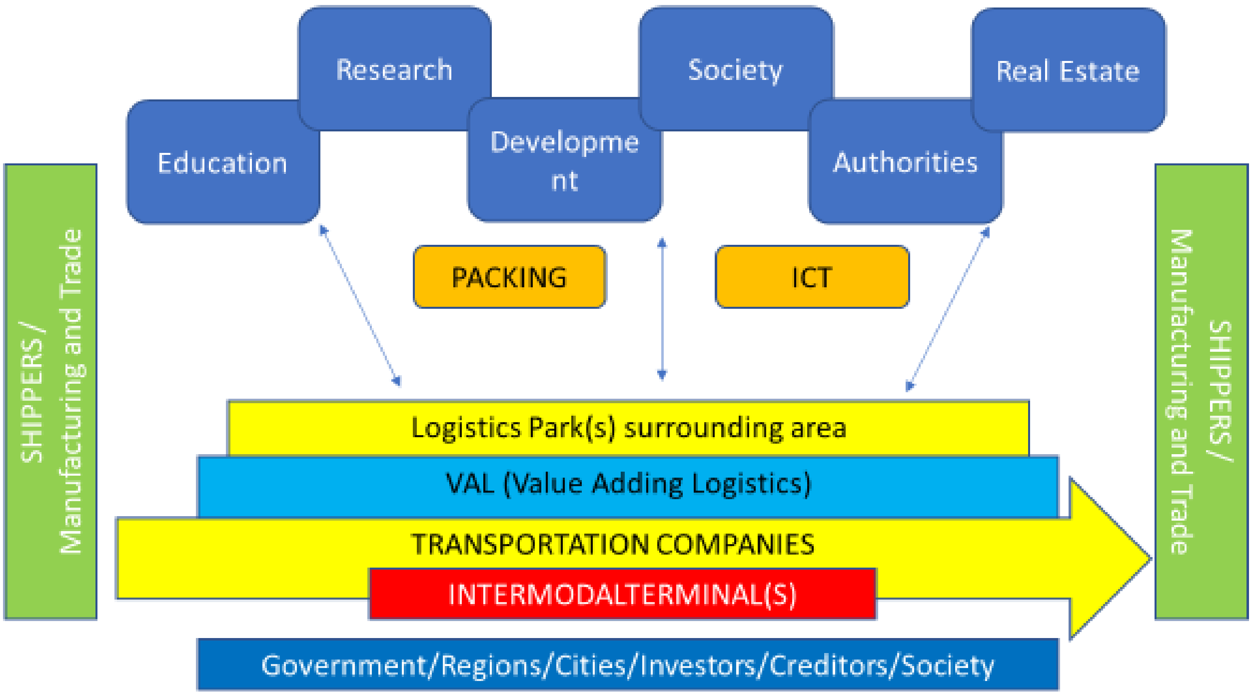


Figure 1 – Stakeholders around intermodal terminals

The analysis itself has been done together with ALICE (European Technology Platform in Logistics) team. ALICE has a special working group focusing on “hubs, corridors, and synchromodality”, which has a full match for the focus of this paper. ALICE has a clear vision towards Physical Internet, which will seamlessly integrate transport modes and stakeholders, and therefore, the ALICE Physical Internet Implementation Roadmap (2017) will answer the main questions of this study. Furthermore, the data used is mainly derived from SETRIS Project (2017), which has analyzed a great number of past and ongoing projects concerning the topic. Thus, this short summary has appendices, which describe mainly the results of this NSB CoRe activity 2.1.1. These appendices are abbreviations from the sources mentioned above put into a format which answers the target of this paper. Finally, there is also a short cut and separate summary from a study by Harris, Harris, and Wang (2015) which has a analyzed especially EU projects focusing on ICT systems in Intermodal hubs.

This study will focus on “hub and network” integration (through cooperation) which is stated as the first phase towards Physical Internet in the theme “corridors, hubs and synchromodality”. The following figure point out an overview towards PI vision.

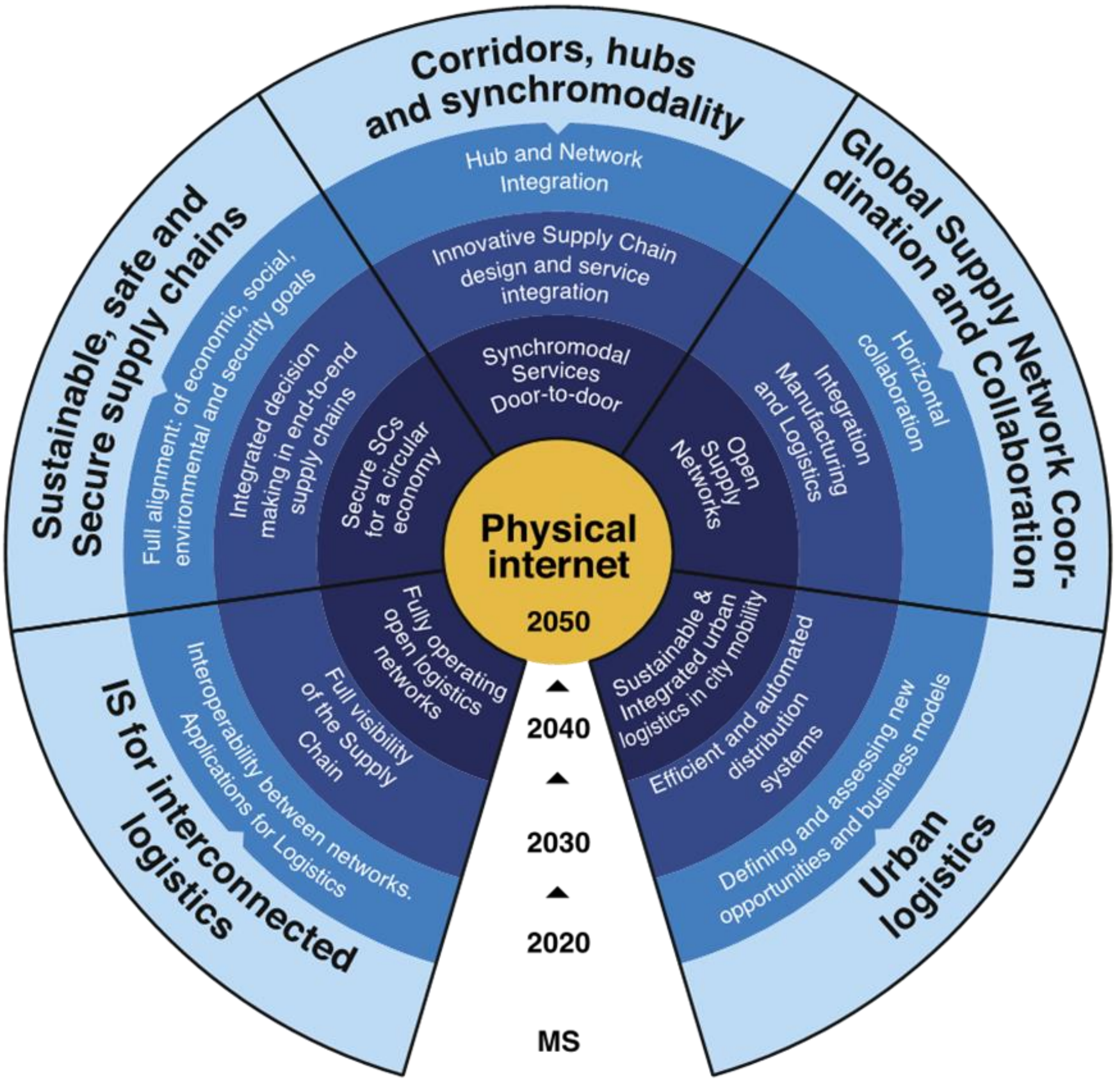


Figure 2 – Roadmap to Physical Internet (ALICE 2017)

2 Definition(s) and classification(s) of nodal points

The logistics center itself is a relatively new phenomenon (Meidute 2007) and it is also a new term (Nagel et al 2009). Lahtinen and Pulli (2012) understand the logistics center more as an area with logistics-intensive companies, which is difficult – or even not necessary - to define in detail. The German definition of the Freight Village ("GVZ – Güterverkehrszentrum" in German) is perhaps the best starting point for these purposes (GVZ-ORG.DE 2016). It states that a Freight Village could be defined based on the following criteria: 1) location of transport-intensive companies, logistics operators, as well as industrial and trading companies on the same industrial estate, 2) access to at least two transport modes, in particular to road and rail (intermodal terminal), and 3) management of the local freight village companies, which also initiate and facilitate cooperative activities. However, Rantala & Eckhardt (2011) found it valuable to classify different types of logistics centers in a way the following picture () describes. Logistics centers in categories C0 and C1 could be understood also as a “logistics miniclusters”, but without a management or governance function. Of course, there could be that kind of – typically a marketing function, but it is not included into classification.

Table 1 – Classification of logistics centers

Category	Title	Description
C0	**Logistics zone**	A zone along the main transport infrastructure formed by logistics concentration, areas and centres.
C1	**Logistics concentration**	A spontaneously formed compact group of logistics centres and areas with several management organizations, operators and industries.
C2	**Logistics area**	Organised area for logistics operations, freight village or business park, including several logistics centres, warehouses and terminals with logistics services. Several actors involved.
C3	**Logistics service centre**	Open logistics centre. One specific management, possibly several actors.
C4	**Logistics centre**	Closed logistics centre. Operations for specific trade or industrial companies’ needs.
C5	**Warehouse, Terminal**	Private warehouses and terminals, surface area under 10,000 m2.

Source: Eckhardt & Rantala 2011

Typically the number of centers decreases when the size of a center increases. It should be noted that this classification does not indicate the quality or significance of a center – for example, it does not mean that C1 would be better or worse than C2 because of the classification (Lahtinen & Pulli 2012). It seems that there are needs for different types of logistics nodes, and it is difficult to create a universal definition for a logistics center. Therefore, we suggest a classification model for different types of logistics centers. (C1/C2, supply chain perspective etc.) As its simplest form, “a logistics center is an area which carries transportation, warehousing and distribution intensive activities” (Lahtinen & Pulli 2012). Thus, most of our conclusions and suggestions are generated from a “logistics area” point of view. Mere technical classification based on features and size does not, indeed, indicate the importance of the centers and their different roles in the supply chain (Rodrigue & Notteboom 2008). It is also possible to evaluate different types of logistics centers based on the service concepts they have, business models, and networking, as suggested below. The "logistics center" expression itself can remain more of a general concept, the way it is also commonly used, but the classification model makes it possible for us to understand in greater detail different alternative logistics nodes and their development. Logistics nodal points are interesting concepts both for the businesses, as well as for societies. In fact, several impacts noted in the ALICE roadmaps would be true especially in and through intermodal transportation.

Expected impacts from the implementation of ALICE roadmaps proposed actions.

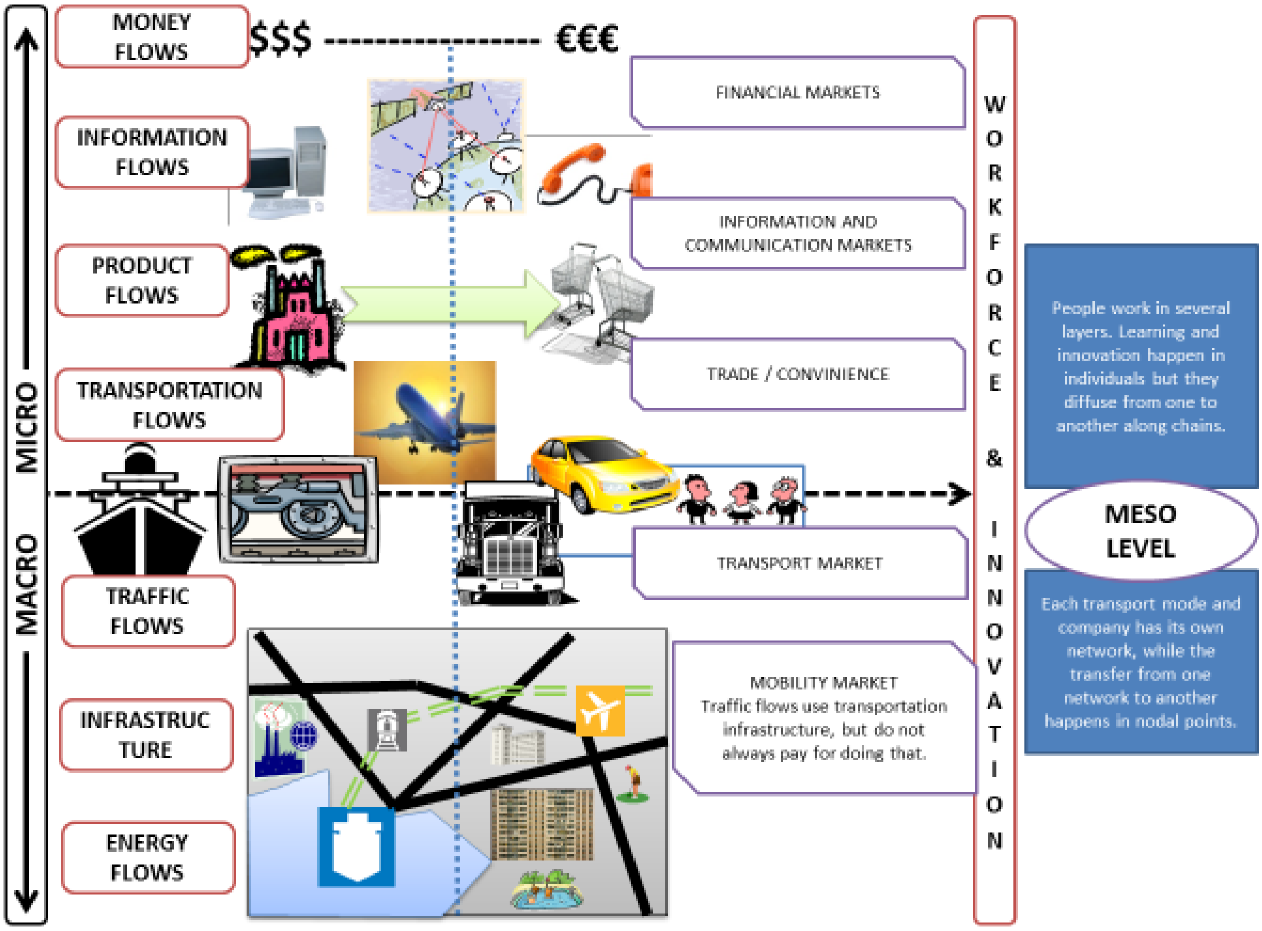
<table>
<tr><th></th><th>Primary Impacts</th><th>Secondary impacts</th></tr>
<tr><td>People</td><td>+ Increase customer satisfaction
+ Products availability
+ Secure societies</td><td rowspan="3">+ Load factors: weight and cube fill of vehicles
- Empty Running Kilometres
+ Volume flexibility (Time to +/- capacity)
+ % Synchromodal
+ Asset utilization
+ Supply Chain Visibility
+ Reliability of transport schedules
+ Perfect order fulfilment
+ Transport routes optimization (reducing Kms)
+ Transport actors using automatic data exchange
+ Cargo and logistics units integrated in the automatic data exchange
+ Upstream/Downstream Supply Chain Adaptability and Flexibility
+ Decoupling logistics intensity from GDP
- Waiting time in terminals
- Risk factor reduction
- End-to-end transportation time
- Travel distance to reach the market
- Lead times</td></tr>
<tr><td>Planet</td><td>- Energy consumption (kWh Logistics/GDP)
+ Renewable energy sources share
- CO2 Emissions</td></tr>
<tr><td>Profit</td><td>+ Return on assets and working capital
- Cargo lost to theft or damage
- Total supply chain costs</td></tr>
</table>

The importance of logistics nodal points on competitiveness is described in the following figure (when the discussion focus on logistics centers in its broad sense).

LOGISTICS PARKS ENHANCE OUR COMPETITIVENESS BY
1) ACTING AS NODAL POINT IN TRANSPORTATION SYSTEM - Companies have their own networks and each transportation mode has each own benefits. - Logistics hubs make it possible to combine all of them into efficient intermodal transportation system. - The importance of nodal points will increase in the Physical Internet – the transportation systems of the future.
2) ENABLING LOCAL SYNERGIES - Companies are interested in collaborating in transportation and other logistics activities - As well as, in other activies such as pooling resources (workforce, equipment, facilities) - And to organize joint purchasing
3) OTHER POSITIVE CUMULATIVE EFFECTS - Common learning, joint development activities - Creating new knowledge & innovations - Lobbying, availability of resources (employees etc.)

Source: Lahtinen (2016)

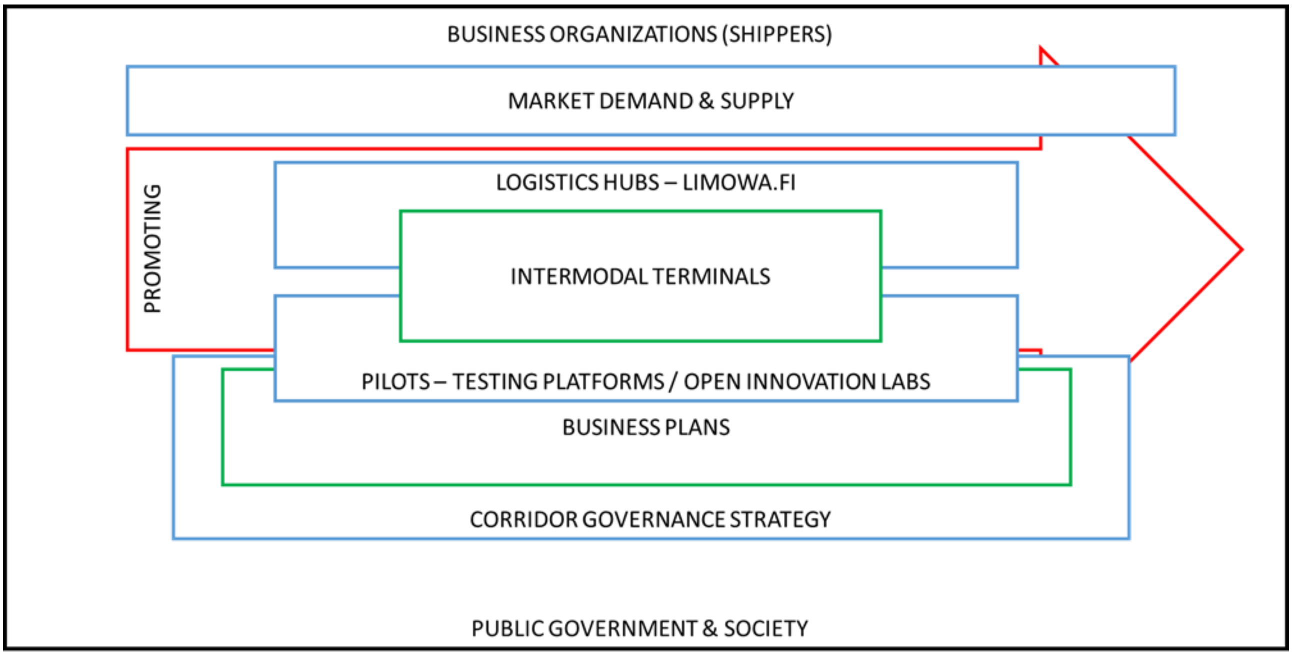
Lahtinen and Pulli (2012) have also described in detail the first perspective. Logistics centers – or freight villages – are important hubs in the transportation network. In general, logistics and supply chains could be seen as networks of different flows. Those flows, such as traffic, transportation, materials, information, and money flows, could be seen as different layers in the logistics system, and logistics centers could integrate these layers. Furthermore, in each layer, there are also networks of different operators, especially when we move forward from beyond infrastructure.



For example, hubs are located in places where different transportation modes (infrastructure) cross. While Lahtinen (2016) and the previous OR/Logistics literature have been focused more on the second point, this study evaluates these activities mostly from the third point of view. These are important additional dimensions to the transportation perspective: logistics centers create an opportunity to generate synergies among companies through collaboration (Pfohl and Gareis 2005), but to realize these synergies a management function is needed (Hesse 2004; Nobel 2004).

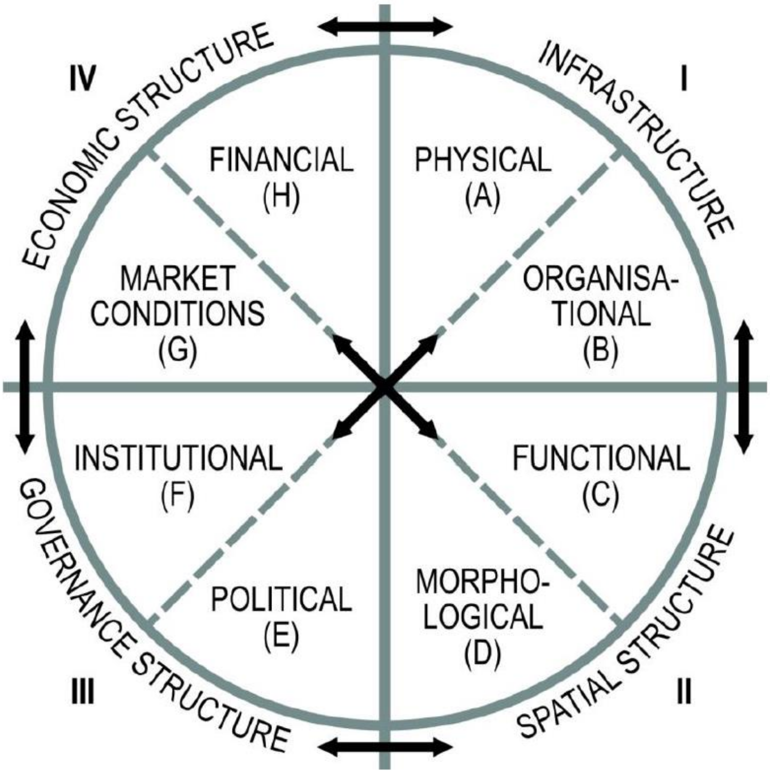
Nobel (2004?) has evaluated the management of freight villages in his dissertation. Viitanen and Launonen (2011) have evaluated and suggested the management of local ecosystems and hubs from innovation point of view in more general level. Winkler and Seebacher (2011) see management function that supports synergies among involved companies as being beneficial for all. Furthermore, Bolumole et al. (2015) have studied the governance of logistics hubs from a regional economic development point of view. It increases the importance of freight village management also from a societal point of view, but this perspective has nevertheless been excluded from this study. Finally, Corsaro & Cantu (2015) note that management of science and technology parks should take into account actors' heterogeneity and their potential consequences when building interorganizational collaboration and interdisciplinary teams. Therefore, in order to be successful, there should be a management function governing a nodal points, which makes cooperation among participants possible.

The heart of the logistics center and/or nodal point lie in its core, namely intermodal terminal. Whether we are speaking on logistics center, GVZ, Dry Port and so on, we will find that element. The following figure () points out several stakeholders (e.g shippers, government and society) around intermodal terminals. It could be understood also as several layers around the core of the nodal points i.e. intermodal terminals which includes also business models and governance strategy. In addition to separate transport modes, a nodal point could also successfully combine the other stakeholders and their needs.



3 Identifying and classifying bottlenecks

Witte & Wiegmans (2013) have created the following conceptual framework to classify different approaches when identifying and analyzing bottlenecks in intermodal transportation. We believe it as an important lens for taking several issues into account, namely, it is not only for intermodal terminals, but also for intermodal transportation, and therefore, also in this short literature review, we should keep in mind the crucial role of nodal points in intermodal corridors. This means, that we do not need to analyze only terminals themselves, but also taking into account how to link them into corridors.



Witte and Wiegmans (2013) classified the bottlenecks into two different categories, namely, technical and managerial ones. In the following table they show examples of their findings in a Dutch case study. The same classification will be used also in this study. It will help us to understand whether the barriers arise from technology or governance, and therefore, point out the potential solution which kinds or investments or actions are needed. Later below, when discussing particularly ICT systems, managerial bottlenecks and barriers are divided furtherly into “user” and “policy” related issues.

Technical	*Managerial*
Track length	Needless stops
Track capacity	Travel time
Train length	Circulation time
Security systems	Estimated Time of Arrival
Voltage systems	Knowledge of trains' priorities
Slot incompatibility	Traffic management
Free access to ports	Cross border slot reassignment
Connections to terminals	Language barriers engine's drivers

LIMOWA ASSOCIATION
EU Project: NSB CoRe (North Sea Baltic Connector of Regions)
WP2: Intermodal Transport
Action: 2.1: Logistics business requirements and networking needs
Task: 2.1.1: Analysis of past and ongoing projects & studies in terms of barriers of cooperation between the different transport modes and nodal points in different countries

Purpose: To identify and classify bottlenecks for implementing intermodal transport (Case: North Sea Baltic Sea Core Network Corridor)
If there is a proven/known solution available already, please also describe that.

Perspective	Type of bottleneck	Technical	Managerial
Infrastructure	Physical		
	Organizational		
Spatial Structure	Functional		
	Morphological		
Governance Structure	Political		
	Institutional		
Economic Structure	Market Conditions		
	Financial		

Please include links and references if possible.
Idea for the classification based on Witte & Wiegmans (2013)

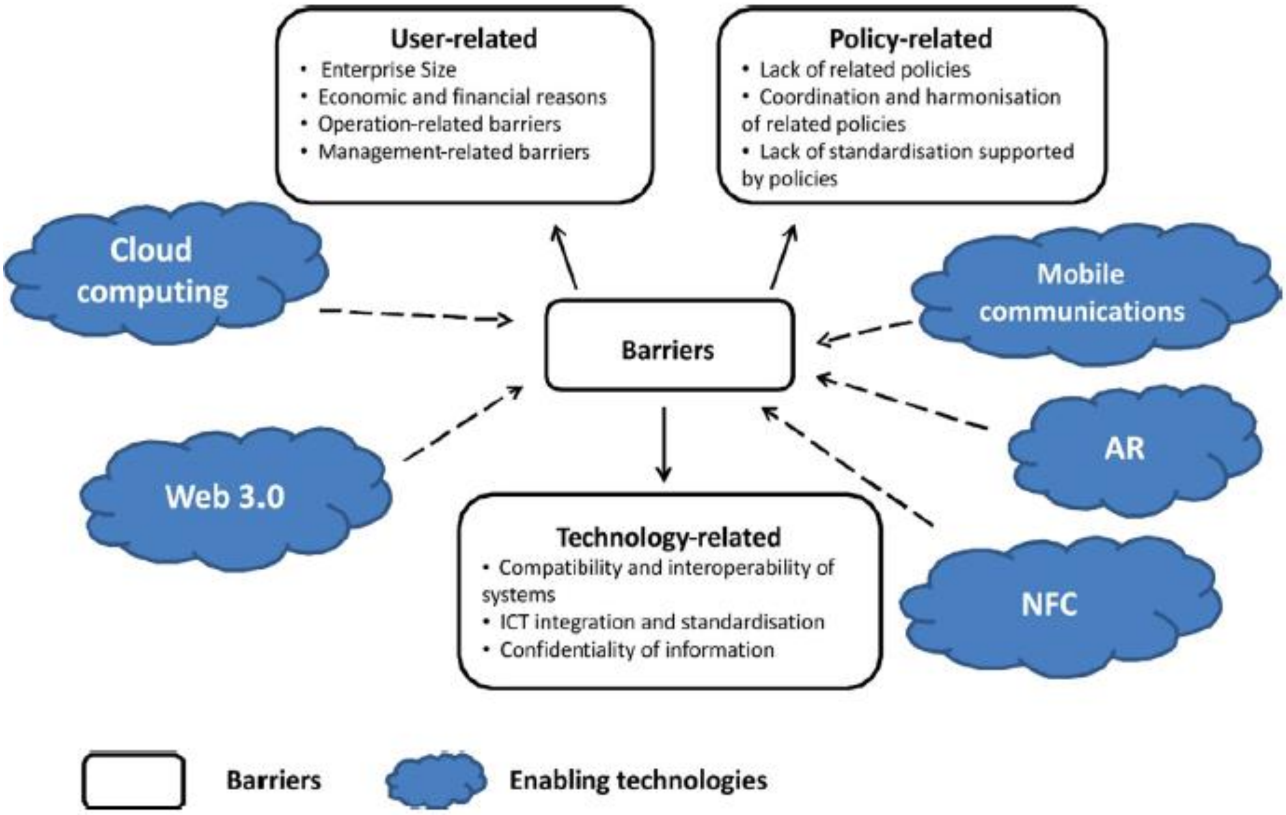
Forthcoming Output: Analysis of past and ongoing projects & studies in terms of barriers of cooperation between the different transport modes and nodal points in different countries
Description of the Output Review of past and ongoing European project results, in order to define the most suitable transport infrastructure, logistics services and schemes

Harris, Harris and Wang (2015) have gone through 33 EU FP Projects and did the following summary. ICT will have a big impact in operating intermodal terminals. However, the potential of ICT has not yet realized, because there have been several barriers causing slow adoption of technology.

A review of EU FP projects in ICT developments for multimodal transport (source: authors, based on TAP (2000)).

ICT application	Potential benefits	Exemplar EU FP projects
Freight resource management systems and applications	• Improved operational efficiency • Reduced empty runs through better route planning • Improved utilisation of transport infrastructure • Improved customer satisfaction • Reduced overall costs due to vehicle optimisation	1. Intra-company resource management system (COREM, 1996–1998, COREM (1996)) 2. Integrated route planning with mobile communication (SURFF, 1996–1998, SURFF (1996)) 3. Information exchange and freight resource management in multimodal transport (WELCOM, 1996–1996, WELCOM (1996)) 4. Telematics and software system to support expanding national and trans-European traffic planning needs (EUROPE-TRIS, 1996–1999, EUROPE-TRIS (1996)) 5. Automatic, optimal and intelligent warehouse- and (un-) loading system for small inland vessels (IWV, 2000–2001, IWV (2000)) 6. Telematics system for rail car asset management (F-MAN 2001–2004, F-MAN (2005)) 7. Maritime navigation and information services (MarNIS 2004–2008, MarNIS (2009)): port traffic management, maritime operation services and maritime information management
Terminal & Port information and communication systems and applications	• Reduced loading- and unloading time at intermodal terminal due to advanced terminal operation systems • Improved utilisation of intermodal terminal infrastructure • Improved, efficient interfaces between different modes at transhipment points for achieving seamless transfer of cargo • Reduced operation costs • Improved customer service and satisfaction	8. Cargo pre-notification system, Container identification & location system and Ferry reservation system (COREM, 1996–1998, COREM (1996)) 9. Automatic Equipment Identification for monitoring load units, vehicle and staff (INTERPORT, 1996–1998, INTERPORT(1996)) 10. Logistics Information & Communication System for intermodal cargo terminals (EUROSCOPE, 1996–1998, EUROSCOPE (1996)) 11. Information exchange between road freight transport and freight centre operators (SURFF, 1996–1998, SURFF (1996)) 12. ICT tools and services for easing the mandatory data supply and data delivery to improve the integration of ports into intermodal transport chains (IP, Intermodal Portal 2000–2001, IP (2000)) 13. Container Handling in Intermodal Nodes (CHINOS, 2006–2009, CHINOS (2009)) 14. Integrated ICT tools to support logistic and business operations in the port and dry port areas (SAIL, 2010–2014, SAIL (2010)) 15. Fully automated system for the distributed intermodal transport over a territory and for processing full trains in port to dry-port (MIT, 2011–2013, MIT (2011))
Freight and Fleet tracking and management systems and applications	• Enabling operators to monitor and manage the cargo and vehicle, as well as obtain up-to-date information • Improved utilisation of intermodal terminal infrastructure • Improved customer service through better communication and providing sufficient and real-time information regarding cargo and shipment • Improved security and safety procedures • Shorter lead time, resulting in a reduction in inventory	16. Intermodal Fleet and Cargo-Monitoring System (MULTITRACK, 1996–1998, MULTITRACK (1996)) 17. Cargo Supervision System (TRACAR, 1996–1998, TRACAR (1996)) 18. Tracking and tracing services (ParcelCall, 2000–2001, ParcelCall (2000)) 19. Integrated and global management system for door-to-door intermodal transport operations: transport chain monitoring system and freight transport monitoring systems (D2D, 2002–2005, D2D (2005)) 20. Integrated end-to-end system: goods tracking & tracing, freight identification, efficient transhipment at terminals and node, monitoring the transport of hazardous and perishable goods (M-TRADE 2005–2006, M-TRADE (2007)) 21. Intelligent cargo infrastructure (EURIDICE, 2008–2011, EURIDICE (2008)) 22. Intermodal global door-to-door container supply chain visibility (INTEGRITY, 2008–2011, INTEGRITY (2011)) 23. Global container chain management (SMART-CM, 2008–2011, SMART-CM (2011)) 24. Container security through visibility (CASSANDRA, 2011–2014, CASSANDRA (2011))
Integrated operational/ information exchange Platform/Portal/ Marketplace	• Electronic one-stop-shop marketplace for all parties along the multimodal chain, enabling them to provide bespoke services and accelerate data and information exchange between the participants • Allow the related authorities (e.g. customs and port authority) to interact with the operators and exchange information and transport-related documentation	25. E-commerce system: booking, scheduling, negotiation, brokerage, payment and invoicing data; connect intermodal users in short-sea-shipping (DOLPHINS, 2000–2001, DOLPHINS (2000)) 26. Integration of intelligent traffic management systems with the freight transport management systems operation, including intermodal freight transport (THEMIS, 2000–2004, THEMIS (2000)) 27. Integrated logistic networks and operational platform with inland navigation (ALSO DANUBE, 2000–2003, ALSO DANUBE (2000)) 28. Integrated Operational Platform accessible to the Small and Medium players (GIFTS, 2001–2004, GIFTS (2004)) 29. European Intelligent Transport System Framework Architecture (E-FRAME, 2008–2011, E-FRAME (2008)) 30. Generic system architecture for intermodal transport bringing together transport management, traffic and infrastructure management and administration (FREIGHTWISE 2006–2010, FREIGHTWISE (2006)) 31. Roadmap of an integrated many-to-many e-logistics system in Europe. (KOMODA 2008–2009, KOMODA (2009)) 32. e-Freight Framework to facilitate paperless information exchange among all EU freight transport stakeholders (e-FREIGHT 2010–2013, e-FREIGHT(2011)) 33. Support new intermodal logistics services: synchronise vehicle movements and logistics operations; adapt to changes through an intelligent cargo concept and develop an open freight management ecosystem (iCargo 2011–2015, iCargo (2011))

In general, they have found several barriers and slow adoption of ICT systems in developing intermodal terminals as classified into three categories, namely user-, policy- and technology-related barriers. In the user-related group, issues such as size of enterprise and economic reasons arise, while it could be stated, that several barriers both in policy- and technology-related barriers could be grouped into lack of standards or harmonization. As a next step, they suggested state-of-the-art solutions for overcoming these barriers.



It seems that these new technologies will be powerful for coping against barriers hindering the adoption of ICT in intermodal terminals before. This will be especially true with user- and policy-related barriers.

Current IT deployment for multimodal transport and future impact of technological trends.
Source: authors

Enabling ICTs Barriers	Cloud computing	Web3.0 and Social networking	Wireless/Mobile communication technologies and Internet of Things	Advances in interface technologies
(a) Current efforts in IT deployment				
User-related barriers	○	○	○○	n/a
Technology related barriers	○	○	○○○	n/a
Policy related barriers	○	n/a	○	n/a
(b) Impact of technological trends on barriers to ICT adoption				
User-related barriers	○○○	○○○	○○○	○○○
Technology related barriers	○○○	○○	○○○	○○
Policy related barriers	○○	○	○○	○

Key: ○○○ = Strong impact, ○○ = Medium impact, ○ = Weak impact.
n/a Denotes the technology is not deployed currently.

4 Cooperation among participants is needed

In their summary for developing logistics efficiency, transportation system and particularly enhancing intermodal transportation, Lahtinen & Pulli (2012) pointed out several layers and types in which way cooperation could happen. While different studies are using its own vocabulary, these findings derived from several practice oriented studies, will be a good summary also for this review: The barriers for intermodal transportation could be solved through cooperation. But it requires the understanding the structure of networked transportation and logistics system, and by enabling the cooperation among individual stakeholders in different layers and networks, the efficiency will increase and will benefit all users and service providers.

According to SETRIS (2017), the four surface transport ETPs (ERRAC, ERTRAC, Water*borne* and ALICE) recently produced a joint document highlighting the status and need for cooperation between them setting the basis for clustering of research and innovation. This is only a one example of cooperation needed between transport modes.

EFFICIENCY THROUGH COOPERATION TO IMPROVE LOGISTICS

COOPERATING PARTICIPANTS	GOAL OR RESULT
1) Cooperation between logistics centers	- Nobody can win alone – logistics system is a network - Differentiating centers worth pondering
2) Cooperation between companies	- Specializing in core competences, outsourcing, and globalization lead to the lengthening and fragmentation of supply chains. - Efficiency can be achieved and network risk managed through supply chain cooperation. - Cooperation also possible by industry or by region in clusters.
3) Cooperation between companies in a logistics area	- Companies in a logistics area may have a need for similar support functions or management of resources and capacity, e.g., due to seasonal fluctuations. - Companies can cooperate, i.e., through common purchases of goods and services and benefit from cooperation in many different ways. - Providing services needed in the area can also create new business opportunities.
4) Cooperation within logistics centers	- Representatives of several different organizations can operate behind the same gates or doors. - Cooperation is needed in order to achieve seamless processes and to manage entirely new kinds of organizational structures.
5) Cooperation between logistics educators/trainers and developers	- Logistics educators and development organizations play significant roles both in creating new competences and transferring them between different operators. - Many development organizations could benefit also from deepening their mutual cooperation, and may have a significant role in, e.g., promoting the kinds of clusters mentioned above.
6) Cooperation from the perspective of an individual	- Changes in organizational structures and processes mean greater demand for managing the big picture and cooperation skills. - There are weaknesses in these competence areas, and improving them can both benefit the current operations as well as create a foundation for common learning, adoption of new competence factors, and utilizing new innovations.

Lahtinen & Pulli (2012)

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5 APPENDICES

1 Input from ALICE (European Technology Platform on Logistics)

2 List of projects (based on SETRIS project)

The SETRIS Project brings together 5 Transport European Technology Platforms (ETPs) – road, rail, air, water and logistics – and a variety of their members. SETRIS aims to deliver a cohesive and coordinated approach to research and innovation strategies for all transport modes in Europe. The SETRIS consortium achieves a balanced representation of all transport modes as also included within the White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system". They bring a wide variety of industrial/ commercial involvement to the project, in turn assisting industry in preparation for on-going developments within roadmaps, implementation plans and future policy and strategy coming about from the White Paper. (SETRIS 2017)