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ORIGINAL PAPER

INTERMODAL LOGISTICS CENTRES AND FREIGHT CORRIDORS – CONCEPTS AND TRENDS

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ABSTRACT. **Background:** The development of international freight corridors, as the Trans European Network and new rail and inland shipping corridors in Asia and Africa, require efficient logistics centres along these corridors which serve as intermodal interfaces and provide a variety of different logistics service functions. The definition of the term logistics centre differs between countries and implies different functionalities. Locations are often selected randomly and business models are opportunity driven, especially in highly dynamic and less regulated new emerging economies. In particular Freight Villages as a special form of logistics centres have a high impact on regional development and serve as cargo generator for freight corridors. Consideration of general principles how to establish Freight Villages could improve the effectiveness of these logistics centres along freight corridors.

Methods: Based on a literature review a comprehensive and hierarchical definition of logistics centres will be discussed and applied. From experiences in the development of logistics centres in several countries, especially in Germany and Lithuania, challenges and concepts concerning regulatory framework, determination of location and business and financing models are discussed.

Results: Concerning the definition of logistics centres a hierarchical definition is applied which comprises different levels of logistics centres depending on the scope of the value adding and the functionality. As general principles for the development of Freight Villages the active role of the state, master planning, objective location finding, participation and co-operation of different stakeholders in the business model and a stepwise scheme for financing are introduced. Major trends for the future development of Freight Villages are the digitalization of supply chains, the application of new intermodal technologies and of innovative telematics systems, solutions for low emission and electro mobility, especially in connection with city logistics, and the collaboration of Freight Villages.

Key words: Logistics Centres, Freight Villages, Freight Corridors, Intermodal Transport, Multimodal Transport, Güterverkehrszentrum.

INTRODUCTION

Intermodal logistics centres play a decisive role as nodes in transport systems and supply chains. They not only enable temporary storage and buffering of cargo but also serve as centres for consolidation and distribution and as interfaces between long-distance and regional transport.

There is a wide variety of terms and definitions regarding the phenomena of logistics centres. In this paper a definition will be discussed which enables a hierarchical distinction between different types of logistics centres.

The emergence of intermodal logistics centres is closely connected with the introduction of overseas container shipping in the late 70's and 80's of the last century and happened first in the vicinity of large seaports. With the conception and implementation of long distance rail freight corridors we see a similar change in international transport networks today again, but primarily land-based this time. There are heavy investments into

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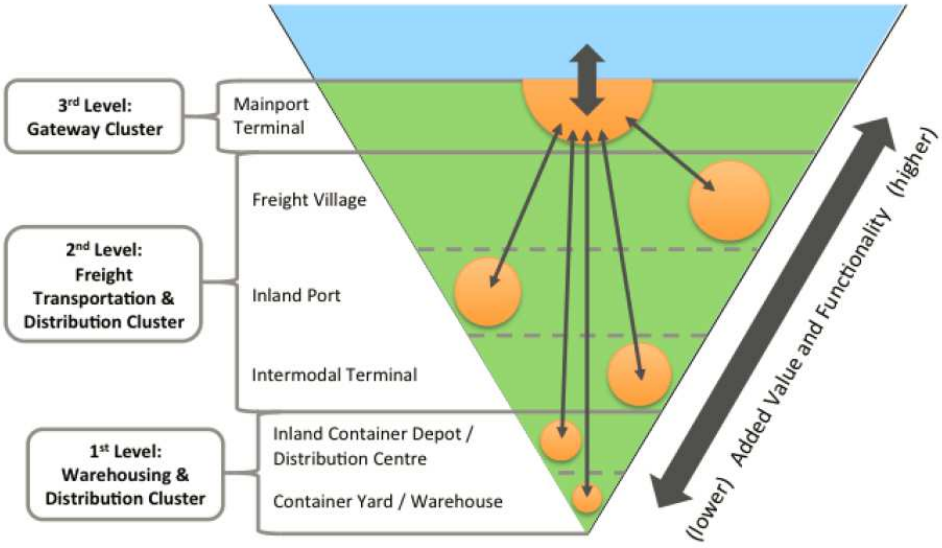
a TEN-T network of the European Union but also in new rail corridors between Europe and China and within the developing countries and in newly developed economies (the so called BRIC countries). Long distance rail freight corridors decrease transit times and costs considerably and thus extend markets and open new opportunities for regional industries. New routes will be opened and traffic patterns will change. Examples are the New Silk Road between China and Europe, the Baltic – Adriatic Corridor and the North Sea Baltic Corridor including Rail Baltica. So far the new rail corridors will play the role of a game changer nowadays.

Corridors need doors for entrance and exit. Intermodal logistics centres along these corridors fulfil this function. They can fulfil the functions as interfaces between modes and as cargo generators for the main haul. Possibilities and essential preconditions for this will be discussed in the course of this paper.

LOGISTICS CENTRES / FREIGHT VILLAGES – DEFINITIONS

There are numerous different terms and definitions describing the variety of logistics centres. Examples are Freight Village, Dry Port, Inland terminal, Logistics Node, Urban Distribution Centre, Intermodal Terminal, Transport – Logistics Centre, Public Logistics Centre, Intermodal Logistics Park, Multimodal Platform etc. etc.

A common or even standardized terminology does not exist. This diversity reflects the high dynamic of the logistics sector but also the immaturity of the research field and the semantic segmentation between different countries and regions. For instance the term Transport-Logistics Centres or just Logistics Centres is used by the European Association Europlatforms. Freight Village is used in the U.K., Güterverkehrszentrum (GVZ) in Germany, also translated as Freight Village. In France the term Platform Multimodales/ Logistiques prevail while in Italy the term Interporti and in Spain the term Ciudad Del Transporte are used.



Source: Higgins, et al., 2012

Fig. 1. Standardized Logistics Centre Hierarchy
Rys. 1. Ustandardyzowana hierarchia centrum logistycznego

Probably more important than the term used is the understanding of the functions of logistics centres and that they differ in their scope, functionality and size. For the purpose of this paper we follow the approach of Higgins, Ferguson and Kanaroglou [Higgins, et al., 2012] which bases on a comprehensive literature review, including the logistics centre hierarchy developed by Notteboom and Rodrigue [Notteboom & Rodrigue, 2009].

This hierarchy covers all types of logistics centres but differs in three levels depending on the added value and functionality. While the first level includes different types of stand-alone and company-run warehouses and distribution centres, the second level comprises more developed agglomerations of logistics companies like ports, intermodal terminals with logistics services and freight villages. The difference between the second level and the third level lies in the size and the scope of activities. Main sea ports are important gateway clusters and bundle cargo flows from several inland freight villages and inland ports and terminals. While the freight villages and inland ports and terminals play an important role in regional cargo consolidation and distribution, the seaports bundle these inland cargo flows for sea transport and overseas transportation. The definitions of Higgins, et al., [2012] and Notteboom & Rodrigue [2009] relate the gateway function to main sea ports primarily. But also main air hubs like Frankfurt (Main) or inland navigation / rail hubs like Duisburg offer this gateway function between long and short distance transport and include a large variety of logistics service providers and industrial parks for logistics companies. They also should be regarded as 3rd level gateway hubs.

THE FREIGHT VILLAGE CONCEPT AND ITS BENEFITS

A Freight Village (FV) is a specialized industrial estate wherein all kind of logistics companies settle. Public services and various auxiliary services for logistics companies are additional and important components of a FV. As a rule FV's also include an intermodal terminal which facilitates the integration between different modes of transport thus offering the choice and selection of the best possible cost and time effective transport chain for shippers.

FV's should be located
- near urban areas characterized by a huge number of industrial districts and/or a large population,
- near motorway and railway connections and/or waterway,
- in areas characterized by a big volume of traffic flows. (see also Galloni [2006].

This concept allows a spatial concentration of logistics companies thus enabling more economical public infrastructure investments, for the tenants a favourable infrastructure access and a friction free 24 hour operation. Usually located at the outskirts of big cities FVs offer the possibility to combine long distance intermodal transport, warehousing and regional distribution, resulting in a more efficient, multimodal transport and less congestion.

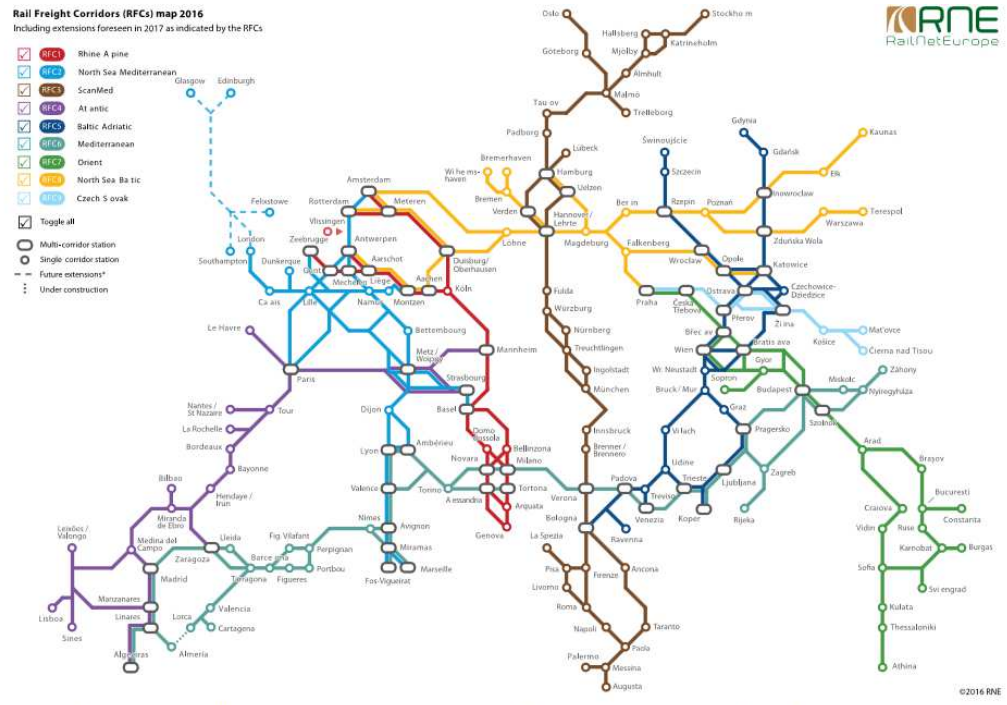
FVs can also be regarded as important hinterland nodes for main sea ports. There are good examples from the Netherlands were so-called districenters and dry ports function as bundling and distribution centres and as gateways to inland navigation in the hinterland of the port of Rotterdam. It is a win - win situation for the public and the private sector. The public benefits from higher taxes, employment, concentration of investments and less traffic in the cities. According to German experience on average one Euro invested by the public initiates four Euro private investments. In the FR Germany in 2010 there were 35 Freight villages which comprise in total 1,300 enterprises with 52,000 employees. [LUB ISL, 2010]. That are on average almost 1,500 employees per Freight Village. Traffic effect and ecological benefits result from the shift of traffic from the inner cities to the suburban FV. For instance, the transfer of nine logistics companies from the inner city of Berlin to a FV resulted in a reduction of inner city long distance traffic of about 870 trucks per day. (LUB ISL, 2010, p. 48) The private sector benefits from the availability of ready

to settle land plots, best infrastructure and auxiliary services and from synergetic effects with the neighbourhood.

Concerning the business model, public – private partnerships or less often private solutions are possible. In Germany all Freight Villages were developed by municipalities. The FV concept was developed first in Bremen and is now a success story in Europe. The concept gains more and more interest worldwide. In the EU 28 the European Association Europlatform has identified 280 Transport Logistics Centres (TLC) or Freight Villages. Four countries, namely Germany (35 FVs), Spain (33 FVs), France (26 FVs) and Italy (21 FVs), represent 47.9% of the total number of the TLC / FV identified and 62.1% of their gross surface. The average size of a Freight Village overall Europe is 108 ha . In Poland 6 TLC /FV have been identified, the largest being near Gdansk (Pomeranian L.C., 110 ha), near Katowice (Katowicka SSE Euroterminal Sławków, 140 ha) and near Poznan (CLIP Swarzędz Jasin, 10 ha terminal plus 80 ha Special Economic Zone). [Europlatforms, 2015]. Compared with the other countries and related to the number of inhabitants and freight tons carried Europlatform sees the biggest opportunities for further expansion of the FV concept in Poland, UK and Greece [Europlatforms, 2015].

FREIGHT CORRIDORS OPEN NEW CHANCES FOR FREIGHT VILLAGES AND VICE VERSA

In international transport networks the establishment of cross border Freight Corridors play an important role to remove infrastructure bottlenecks, to improve technical and organizational interoperability between national systems and to facilitate international trade and transport through shorter transit time at lower costs. Freight Villages and Freight Corridors could facilitate each other in their developments. Freight Villages benefit from better access to freight corridors and can offer new connections to new markets for their regional economies. Freight Corridors need access points and cargo which can be generated through Freight Villages.



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Source: Rail Net Europe, 2016

Fig. 2. Rail Freight Corridors in the European Union, Map 2016
Rys. 2. Korytarze transport kolejowego w Unii Europejskiej, Mapa 2016

Concerning the Rail Freight Corridors in Europe the EC follows a policy to strengthen the co-operation between rail infrastructure managers concerning infrastructure development and interoperable systems. Interoperability shall be promoted and intermodal terminals shall be integrated into the corridor management process. The TEN-T programme and the Connecting Europe Facility of the EU provide co-financing for necessary infrastructure investments.

From the map it becomes obvious that the rail freight corridors are a big chance for Freight Villages and for agglomerations located at these corridors to be connected throughout Europe. New markets for supplies and for products can be opened up. For the FV in Poznan the North Sea Baltic rail freight corridor (see RFC 8, picture 2) is of high potential. Regular train services to Rotterdam are already in place. In the future the FV in Poznan could be connected via Rail Baltica up to Tallinn in Estonia. The Rail Baltica is a 700 km double track electrified line with 1435 mm gauge, planned to be ready by 2020/2026. The first part of the line between the Polish/Lithuanian state border to the Rail Road Terminal and Logistics Park in Kaunas / Palemonas will be operational by 2020, according to recent plans. [RB Rail AS, 2017].

This is one example of how a network of FVs in Europe along rail freight corridors connections could be the backbone of a future intermodal network in Europe.

Rail freight corridor projects take place worldwide. Examples are:

- European Rail Freight Corridor No. 4 adding France, Spain and Portugal to the rest of Europe (see picture 2),
- (more than 4,300 km railway network, single or double track with 2 types of width European (1435 mm) and Iberian (1664 mm)) [RFC 4, 2012],
- Rail Corridor Addis Abeba – Port of Djibouti,
- (700 km railway; $ 4 bn; opened in 2016, freight trains 120 km/h) [Grey, 2016],
- North South Railway Project Riadh – Al Haditha (Border to Jordan),
- (2,400 km, $ 3.5 bn, trial operation started; freight trains up to 100 km/h) [Technology.com, 2017],
- Eastern Dedicated Freight Corridor in India between Dankuni near Kolkata in West Bengal to Ludhiana in Punjab,
- (1,839 km; $ 4,44 bn, to be completed in 2019,) [Railway Technology.com, 2017],
- New Silk Road Initiative of China which connects Northern China with Europe via Kazakhstan, Russia and Caucasus.

(presently 39 lines that connect 12 European cities with 16 Chinese cities; e.g. new train connection Bejing –London: 7,456 miles of railways, crossing Kazakhstan, Russia, Belarus, Poland, Germany, Belgium, France and the UK, 18 days journey. launched in 2017 [Webb, 2017]).

Along these rail freight corridors new opportunities emerge for setting up manufacturing but also logistics clusters, including Freight Villages.

CHALLENGES AND CONCEPTS FOR SETTING UP FREIGHT VILLAGES

In the following main challenges will be discussed and principles will be derived of how effective Logistics Centres / Freight Villages could be developed along freight corridors. The findings are empirical and result from practical experiences in more than 10 projects in 5 countries.

Active role of the state

The establishment of Freight Villages is a complex task. High investments into the public and private infrastructure are needed and there are long lasting and far reaching impacts on the regional economic and urban development as well as on the use of local resources and transport networks. The state shall therefore play an active role in initiating and supporting the development of Freight Villages. Best results have been achieved when the different interest groups work together in a kind of public private partnership. Lithuania may here serve as a good example where

the central government initiated a programme for Public Logistics Centres in Vilnius, Kaunas, Klaipeda and Siaulai. The Lithuanian Railways played a decisive role as a project owner in a first stage, later on the municipalities joined the projects. In an open tender procedure private investors are invited to buy or lease land plots and to invest into warehouses etc.

Master planning is needed

Very often warehouses and distribution centres are scattered more or less randomly along the highways and around the major cities. Land prices and land availability are the most important factors for these investment decisions. Existing infrastructure, accessibility and intermodal connections are of secondary importance. Because of a lack in spatial planning in many countries a structured development of areas for warehousing and distribution does not exist. Results are congestions in road infrastructure and suboptimal investments into public infrastructure.

On the other hand, intermodal inland terminals are usually owned and operated by railways which may have a master plan for their terminal development. But this is not connected to Freight Villages because railways have no primary interest in real estate development although they benefit from it.

To stimulate the use of multimodal transport and to promote a more coordinated development of logistics areas a concerted action of the stakeholders in a master planning process is required. Stakeholders are the state, municipalities, railways, ports and private property developers as well as logistics companies. The coordinated development of designated logistics areas with multimodal connectivity and with land available at reasonable prices will create a win-win-situation for all stakeholders.

Selecting the right location

Once the principal locations, e.g. according to districts or municipalities is decided in a master plan, the micro location needs to be defined. Multiple criteria from the viewpoints of different stakeholders need to be considered if the FV shall be a success in the future. Principal stakeholders are the FV developers, the private investors, the railways and the wider community. In a multi-criteria analysis the different criteria can be structured, weighed and then measured in a scoring model. Beside the set up costs and the operational logistics costs of a Freight Village other criteria need to be considered. After an evaluation the preferred location can be determined on an objective basis. We made good experiences with interdisciplinary groups of experts which assessed each criterion according to given indicators or other information and gave a score on a Likert scale 1 (very bad) to 5 (very good). (For Multi-Criteria Approach to Dry Port Location see also (Nguyen & Notteboom, (2016))).

Land availability

The availability of large real estates of 100 hectares or more at locations suitable for logistics is a key issue and very often a bottleneck Land plots are in different ownerships and owners have different interests with their properties. Public developers face the challenge to decide between available, but sub-optimum places and optimum but not available locations. In Germany the general construction law allows the municipality as public developers to establish a so-called development plan (B-Plan) where a certain area is determined and planned for use which is of a public interest. In this case private owners of land plots transfer their land to the public developer. They can sell or get compensated. In Lithuania such a legal provision did not exist, for which reason a special law for Public Logistics Centres was established.

Business and financing model

For the development of a Freight Village three principal business models can be recommended. First option is that the private or the public entity develops the FV with own capacities and on own account. Second option is that with other stakeholders a development company as a special purpose vehicle is founded to develop the FV. This is for instance

the case in the FV Vilnius. If own capacities or financing abilities are not sufficient a third planning or development company can be contracted, for instance in the form of a trusteeship.

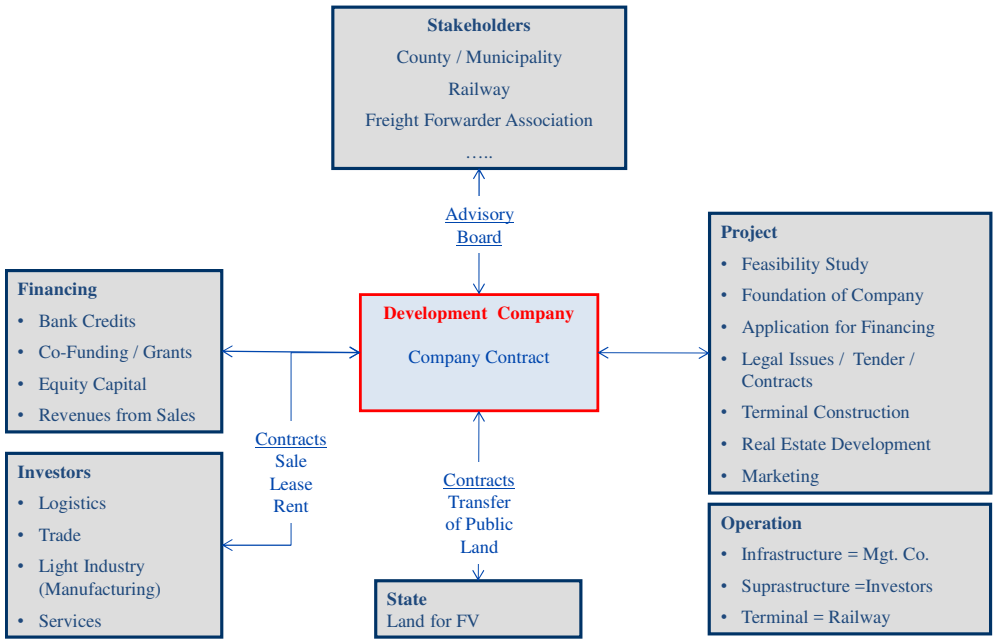

Fig. 3. Business Model for Development (Project) and Operation of a Freight Village
Rys. 3. Model biznesowy rozwoju i funkcjonowania wioski przewozów

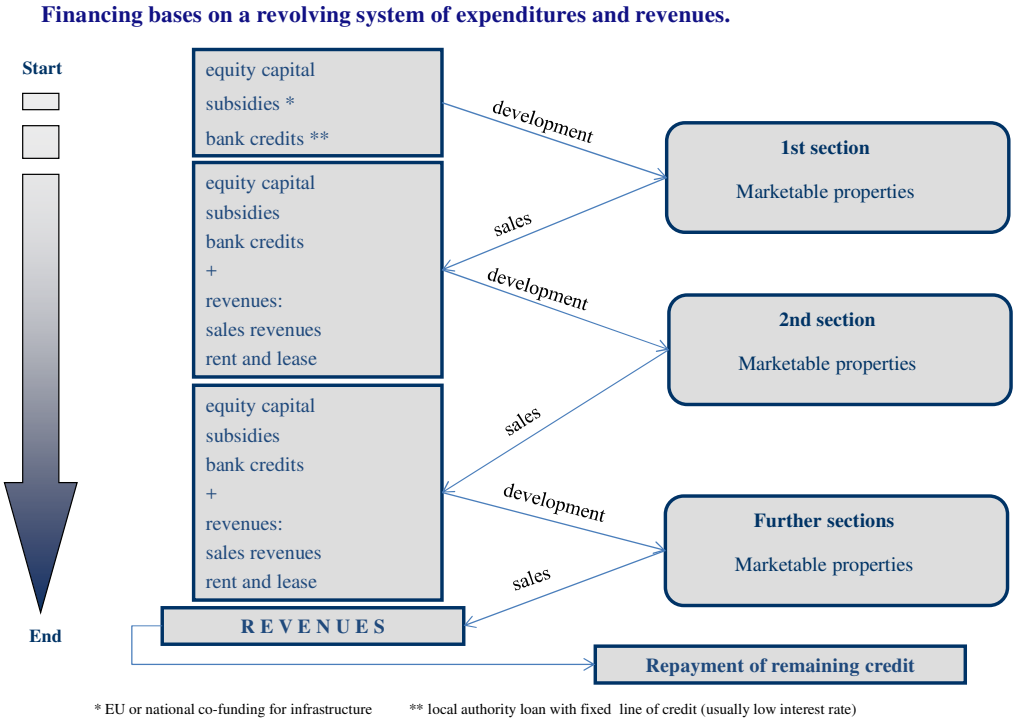

Fig. 4. Financing Scheme for a Freight Village Project
Rys. 4. Schemat finansowy projektu wioski przewozów

High public investments and financing costs can be limited through a revolving financing scheme. The development of the real estate in phases allows a stepwise approach. In a first phase the first land section can be developed and land plots can be sold. The revenues gained from these sales are invested into the development of the next section of the estate. This stepwise approach reduces risks, allows a lower credit line and lower financing costs.

In order to make best use of intermodal and other infrastructure facilities and to create synergy effects between the companies a careful selection and location process of investors is important. "Synergetic Neighbourhood" is realized best if companies which could co-operate in a supply chain are located in vicinity. For instance, around an intermodal container terminal, container depots, container freight station, repair shops and companies with container freight, like DHL or Schenker should be settled. For this reason FV developers, and here especially ports, tend to control settlements tightly and prefer to conclude long term lease contracts instead of selling the land plots.

FUTURE TRENDS AND NEW TECHNOLOGIES

The concentration of logistics companies in logistics centres promotes the application of new technologies. A FV management company can play an active role as promoter of new solutions. The possible co-operation between different companies and concentration of cargo flows allow lower investment costs through cost sharing between the users and better capacity utilization through economy of scale. New technologies in Freight Villages are:

Innovative horizontal loading technologies for non craneable trailers

Trans European rail corridors and Europe – Asian corridors will develop long distance continental cargo flows. This creates the opportunity for logistics centres to offer more train solutions for semitrailers. 95% of all semitrailers are not crane able. Innovative horizontal handling technologies will therefore play an important role in the future in long distance transport [Wagener, 2014].

Emission free city logistics and electro mobility

The environmental policy of large metropolitan areas calls for the wider application of low emission or even emission-free transport solutions. The development and application of 3.5 and 7.5 electro driven delivery vans and / or rail and barge shuttles between suburban Freight Villages and inner city logistics centres are current trends into that direction. A precondition for this is the establishment of an adequate infrastructure of electricity loading stations in FVs and in cities.

Freight exchange platforms

30 to 40% of all trips are empty trips. FV managing companies can help to balance empty trips as a neutral freight broker and by freight exchange platforms. (see for example (Interporto Bologna, 2013))

Security solutions

Automatic video surveillance, number plate recognition, gate in/gate-off control and authorised access, which monitors incoming and outgoing vehicles

For instance the INTERPASS system at Interporto Bologna allows companies to control and authorise the entering and exiting of their vehicles [Interporto Bologna, 2013].

Telematics solutions

GIS-based applications for real time traffic management allow optimum routing under current traffic situations. The challenge will be to develop solutions for traffic forecast and adjusted fleet planning. Also applications for delivery time, for parking places and for truck traffic and terminal operation will further increase productivity. Freight Villages can serve as pilot locations and test cases in this respect.

Digitalization and information platforms

Digital and comprehensive information on cargo and transport is a key issue for intermodal supply chains. Whereas in the past information platforms were focused on different ports and their communities only, now logistics information platforms play a decisive role in the intermodal markets and may create competitive advantages. An example is the information platform inland links where the information on facilities of 84 inland terminals and their intermodal services to / from Rotterdam are available and updated regularly [Port of Rotterdam, 2015]. Possible next steps are to extend the functionalities of these platforms to paperless transport information and to real time tracking of consignments. FVs and their terminals are well-advised to participate in these platforms in order to stay competitive.

Collaboration of Freight Villages

The implementation of new intermodal train concepts and new technologies would benefit largely from a collaboration of terminals and Freight Villages along freight corridors and within the Trans European network. This process is still in the beginning. European Associations and the EU corridor coordinators could play a promoting role in this.

SUMMARY AND CONCLUSION

Concerning the definition of logistics centres, a hierarchical definition which covers three levels of logistics centres depending on scope of the value added services and functionality proved to reflect best the interdependence of different types of logistics centres and can serve as an umbrella definition. Freight Villages form freight transportation and distribution clusters and have not only a high impact on regional development but also serve as cargo generators for freight corridors. In order to ensure a high effectiveness of Freight Villages as general principles for their development an active role of the state, master planning, objective location finding, participation and co-operation of different stakeholders in the business model and a stepwise scheme for financing are recommended. Existing Freight Villages face as major trends for the future development: digitalization of supply chains, the application of new intermodal technologies and of innovative telematics systems, solutions for low emission and electro mobility and the collaboration of Freight Villages in transportation networks.

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INTERMODALNE CENTRA LOGISTYCZNE I KORYTARZE TRANSPORTOWE – KONCEPCJE I TRENDY

STRESZCZENIE. **Wstęp:** Rozwój międzynarodowych korytarzy transportowych, typu Trans European Network oraz nowych korytarzy kolejowych i wewnątrzkrajowych w Azji i Afryce, wymaga istnienia efektywnych centrów logistycznych wzdłuż tych korytarzy, służących jako intermodalne interfejsy, dostarczające całej palety usług logistycznych. Definicja pojęcia centrum logistycznego jest różna w różnych krajach i obejmuje różne funkcjonalności. Lokalizacje są wybierane często przypadkowo i kształtowane przez działalność gospodarczą, szczególnie w dynamicznie i mniej uregulowanych dopiero powstających gospodarkach. Szczególnie koncepcja wioski transportowej jako typu centrum logistycznego ma duży wpływ na regionalny rozwój i służy jako generator ładunków dla korytarzy transportowych. Poznanie głównych zasad tworzenie i funkcjonowanie wiosek transportowych wpływa na efektywność centrów logistycznych zlokalizowanych wzdłuż korytarzy transportowych.
Metody: W oparciu o przegląd literatury, poddano dyskusji ogólną i hierarchiczną definicję centrów logistycznych. Przedyskutowano wybór lokalizacji, wyzwania i koncepcje zasad prawnych oraz biznesowy i finansowy model w oparciu o doświadczenia w rozwoju centrów logistycznych w kilku krajach, szczególnie w Niemczech oraz Litwie.
Wyniki i wnioski: Odnośnie definicji centrum logistycznego zastosowano hierarchiczną definicję, która obejmuje różnie poziomy centrum logistycznego w zależności o zakresu wartości dodanej oraz funkcjonalności. Ogólnymi zasadami rozwoju wiosek transportowych są: aktywna rola państwa, planowanie odgórne, obiektowe szukani lokalizacji, uczestnictwo i współpraca różnych współudziałowców w modelu biznesowym oraz schemat stopniowy finansowania. Podstawowymi trendami przyszłości rozwoju wiosek transportowych jest digitalizacja łańcuchów dostaw, zastosowanie nowych intermodalnych technologii oraz innowacyjnych telepatycznych systemów, rozwiązań o niskiej emisji oraz elektro-mobilnych, w szczególności w połączeniu z logistyką miejską oraz we współpracy z wioskami transportowymi.

Słowa kluczowe: centra logistyczne, wioski przewozowe, korytarze transportowe, transport intermodalny, transport multimodalny.

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INTERMODALE LOGISTIKZENTREN UND TRANSPORTKORRIDORE – KONZEPTE UND TRENDS

ZUSAMMENFASSUNG. Einleitung: Die Entwicklung von internationalen Transportkorridoren, wie z.B wie in Form des Trans European Network oder der europäischen Eisenbahnkorridore, und der neuen Transportkorridore in Asien und Afrika setzt das Vorhandensein von leistungsfähigen intermodalen Logistikzentren entlang dieser Korridore voraus. Diese fungieren als intermodale Schnittstellen und bieten eine breite Palette von logistischen Dienstleistungen sowie weitere Serviceleistungen an. Die Definition des Begriffs eines Logistikzentrums ist in verschiedenen Ländern unterschiedlich und umfasst unterschiedliche Funktionalitäten. In der Realität werden ihre Standorte oft zufällig, z.B. je nach Flächenverfügbarkeit, ausgewählt, insbesondere in den sich dynamisch entwickelnden, weniger geregelten und sich gerade etablierenden Volkswirtschaften. Besonders das Konzept eines Güterverkehrszentrums (Freight Village) als eine Kategorie von Logistikzentren übt einen positiven Einfluss auf die regionalwirtschaftliche Entwicklung aus und generiert Ladungen die betreffenden Transportkorridore. Eine Masterplanung ist notwendig, um die optimale Standortwahl und die bedarfsgerechte Ausgestaltung der Funktionalitäten eines Güterverkehrszentrums sicherzustellen.
Methoden: Anhand einer Fachliteraturrecherche wurde die allgemeine und hierarchische Definition von Logistikzentren einer eingehenden Analyse unterzogen. Anhand der Erfahrungen beim Aufbau von Logistikzentren, die in einigen Ländern, insbesondere in Deutschland und Litauen, gesammelt wurden werden werden Methoden zur Standortwahl, Probleme der Rahmenbedingungen sowie Lösungen für das Geschäfts- und Finanzierungsmodell vorgestellt.
Ergebnisse und Fazit: In Bezug auf die Definition „Logistikzentrum“ wird eine differenzierte, hierarchische Definition, die verschiedene Ebenen eines Logistikzentrums in Abhängigkeit von dessen Wertschöpfung und Funktionalität umfasst, angewendet. Als allgemeine Prinzipien für die Entwicklung und den Betrieb von Güterverkehrszentren werden vorgestellt: eine aktive Rolle des Staates, umfassende Masterplanung, objektive Auswahl des jeweiligen Standortes, Einbeziehung und Zusammenarbeit von unterschiedlichen Interessenspartnern am Geschäftsmodell und ein phasenweises Schema für die Finanzierung von Güterverkehrszentren. Grundlegenden Trends bei der zukünftigen Entwicklung der Güterverkehrszentren sind: Digitalisierung von Lieferketten, Anwendung von neuen intermodalen Technologien und innovativen telematischen Systemen, sowie Low Emission - Lösungen und elektro-mobile Lösungen, insbesondere im Zusammenhang mit der Stadtlogistik, und die zukünftig stärkere Kooperation zwischen Güterverkehrszentrenn.

Codewörter: Logistikzentren, Güterverkehrszentren, Transportkorridore, intermodaler Transport, multimodaler Transport

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