Comparative Case Studies in Dry Port Development

Ziakas Anastasios[1], Boile Maria[2]

University of Piraeus
Email: anastasisziak@gmail.com
[2]University of Piraeus and Hellenic Institute of Transport
Email: boile@unipi.gr

Abstract

According to the UNCTAD Review of Maritime Transport for 2020, containerized trade continues to increase, albeit at a slower pace in recent years, and ports worldwide are handling over 810 million TEUs. Maritime ports, as key nodes in global logistics networks, often struggle to accommodate the increased flow of cargo. Dry ports/Freight villages present a viable option to cope with capacity constraints at seaports. They may contribute in decreasing congestion at port and terminal gates, reducing costs and saving time for shippers, improving the level of service and increasing satisfaction of consumers and service users due to improved functionality of supply chains. This paper presents comparative case studies of dry port development. Different types of development policies are observed worldwide including exclusively public or private investments as well as Public-Private Partnerships (PPP). Considering the different development models, case studies from Europe, USA and Asia are presented, providing information about capacity, connectivity and number and type of tenants, stakeholders and shareholders. Special attention is given to the type of investment.

Keywords: *freight village, dry port, facility location, public private partnerships, logistics, port*

Περίληψη

Το διεθνές εμπόριο χαρακτηρίζεται αφενός από την τάση μοναδοποίησης των φορτίων και, αφετέρου, από την ολοένα και αυξανόμενη ζήτηση για μεταφορά αγαθών. Σύμφωνα με στοιχεία του UNCTAD για το 2020, τα λιμάνια παγκοσμίως διαχειρίζονται περίπου 810 εκατομμύρια TEUs το χρόνο και αποτελούν κρίσιμους κόμβους στις παγκόσμιες εφοδιαστικές αλυσίδες. Η διαχείριση των αυξημένων ροών αποτελεί πρόκληση για πολλά λιμάνια, τα οποία συχνά δεν επιτυγχάνουν τον αποτελεσματικό χειρισμό τους. Μια πιθανή λύση σε αυτό το πρόβλημα αποτελεί η δημιουργία "dry ports/freight villages", με στόχο τη μείωση της κυκλοφοριακής συμφόρησης στα λιμάνια και τους λιμενικούς σταθμούς διαχείρισης εμπορευματοκιβωτίων, τη μείωση του κόστους και του χρόνου εξυπηρέτησης, καθώς και την παροχή υψηλότερου επιπέδου υπηρεσιών, γενικότερα. Παγκοσμίως, παρατηρούνται διαφορετικές πολιτικές επένδυσης στις συγκεκριμένες εγκαταστάσεις, με εμπλοκή του δημόσιου ή του ιδιωτικού τομέα, ή συμπράξεων αυτών. Σκοπός της παρούσας έρευνας είναι να επικεντρωθεί κυρίως σε μελέτες περίπτωσης που φέρουν τον τίτλο της σύμπραξης δημοσίου-ιδιωτικού τομέα αλλά και η

σύγκριση αυτών με επενδύσεις αποκλειστικά δημοσίου ή ιδιωτικού, σε Ευρώπη, ΗΠΑ και Ασία. Εξετάζονται και αναλύονται στοιχεία όπως η διασυνδεσιμότητα και η προσβασιμότητα στις εγκαταστάσεις αυτές, ο τύπος και ο ρόλος των μετόχων και των εμπλεκομένων φορέων, καθώς και το προφίλ των χρηστών των εγκαταστάσεων και των υπηρεσιών που προσφέρονται.

***Λέξεις-κλειδιά**: εμπορευματικά κέντρα, dry port, εφοδιαστική αλυσίδα, πρόβλημα επιλογής θέσης, λιμάνια, σύμπραξη δημοσίου-ιδιωτικού τομέα*

1. Introduction

Containerized cargo flows have increased significantly over the last few years especially after the financial crisis of 2008 due to several reasons, including advances in relevant technology and changes in shipper and consumer needs and preferences. Globalization almost eliminated the barriers in terms of trade and transactions around the world. Shippers and receivers are not only part of local and regional supply chains, but they have a strong impact in global trade, while carriers cater to their needs, seeking to optimize their services while reducing costs and increasing revenues. Container shipping companies have been ordering mega containerships with a capacity of over 24,000 TEU to achieve scale efficiencies, a trend that has major impacts in the structure of liner shipping networks, and port and terminal characteristics. Many ports are required to accommodate a larger number of containers within a shorter time window, which places a stress on their capacity and increases the need for new technology implementation, or capacity expansion. Capacity limitations along with a lack of space for expansion often result in congestion in the terminal yards and gates. Furthermore, apart from the above, seaports must deal with the implications of trade imbalance. The rate of imports, especially in western Europe and the US, exceeds by far the rate of exports. For example, import-export imbalance in early 2021 in the port of Los Angeles hit a 4:1 ratio, which had several implications in terms of management of operations and handling of equipment shortages. It is thus crucial for seaports to become more flexible, and steadier at the same time, to cope with these imbalances.

Dry ports offer a viable solution to such problems, with notable benefits to the maritime supply chains and the hinterlands they serve. Dry ports are inland intermodal terminals directly connected to a seaport by various modes of transport, which support the transhipment of sea cargo to inland destinations. They contribute to the minimization of port congestion while generating new job opportunities, directly or indirectly. Furthermore, they contribute to reducing carbon footprint and supporting regional development of their surrounding local areas, through intermodalism and transport network development. A dry port can adopt the role of a seaport in terms of several functionalities and services. Their development and implementation is a result of economic integration, from companies such as logistics providers, real estate developers, container shipping companies etc, and can provide maritime ports the ability to handle efficiently increased amounts of cargo. Such inland facilities usually offer rail and road services as well as inland waterways transport where possible. Consumers, nowadays, require a safe, speedy, reliable, and low-cost delivery of goods which make the cooperation between seaports and dry ports more obligatory than ever before. In order to achieve that, many port authorities extended their portfolio through investments in inland facilities. However, the presence of private industry in such investments is more than obvious, especially in the US and in some cases in north-western Europe. A modern large scale freight facility development must include both private and public sector involvement and support, to create a sustainable project with a competitive advantage.

Dry ports have gained prominence in researchers' agenda during the last decade. Many researchers have focused on dry ports' main characteristics and services offered. For the purpose of this paper, a pool with different freight facilities, including dry ports, from around the world has been developed and reviewed, with a selected number of them presented herein. Development policies in various regions (Europe, USA, Asia) are examined, underlining the role of public-private partnerships and the contribution of each sector to the development and operation of the facilities. The aim of the research is to demonstrate the role of PPPs in large-scale freight facilities development initiatives. Public and private sector cooperation may assist in a better streamlining the allocation of resources, risks, and rewards in large scale freight facility development projects. Furthermore, by implementing PPPs, inland ports may attract more tenants to operate in their area while collaborations with significant seaports are further enhanced. For each one of the selected cases reviewed in this paper, the physical characteristics such as capacity and area coverage, will be described. In addition, the kind of investment as well as the current developer and operator will be noted followed by the services/functions offered and the tenants which operate in the terminal. Special attention will be given to the stakeholders and shareholders of each facility. Finally, the comparative analysis will conclude on the role of each sector before, after and during the development of an inland freight facility.

In the remainder of the paper, the typology and the main characteristics of dry ports reinforce the theoretical background that precedes the analysis of the cases. Section 2 presents pertinent literature. Section 3 gives definitions, characteristics, and functions of dry ports, while Section 4 presents the case studies. Section 5 summarizes the outcome of the comparative analysis and conclusions of the research.

2. Literature Review

Following a systematic literature review, pertinent literature has been selected and analysed as presented herein. The aim of this analysis is to examine dry port/inland terminal/inland port/freight village development and implementation, taking also a regional perspective by considering different cases in Europe, Asia and the US.

The volume of international trade and freight transport worldwide has witnessed fast growth in recent decades. Specifically, according to the 2020 UNCTAD Review of Maritime Transport, last year the European ports handled over 810 million TEUs. Li et al. (2011) noted that these increased flows pass through seaports to the hinterland, creating congestion in a port's gateways as well as delays in customs clearance. Furthermore, maritime terminals are often suffering the lack of space for potential expansion. Many researchers, such as Othman et al. (2016), have noted that a container seaport is incomplete without inland freight facilities. Monios (2011) noted the importance of vertical integration, either forward or backward, in the supply chain and underlined that the role of ports has changed from a monopoly to a nodal point in the logistics chains. Ports need to be more active in extending or even maintaining their hinterlands.

Roso (2007), Khaslavskaya and Roso (2019) and Boile et al. (2013) observed that dry ports have become a solution to increase seaport productivity due to the movement of containers via high capacity means to and from seaports to achieve an effective supply chain solution in the hinterland as well as in the entire transport chain. Haralambides and Gujar (2011) characterized dry ports as inland equivalents of maritime terminals. Several definitions for dry ports have been reported by different authors such as Li et al. (2011), Rodrigue and Notteboom (2012), which provide different aspects of their concept. This paper focuses on the definition given by

Leveque and Roso (2002). According to this, *"A dry port is an inland intermodal terminal directly connected to seaport with capacity transport mean where customers can leave/pick up their standardised units as if directly to a seaport"*. However, not all inland facilities should be mentioned as "dry ports". Roso et al. (2009) investigated the elements of a dry port in comparison with other inland terminals. *"Inland terminal can be categorised as a dry port if there is a scheduled rail connection to a seaport and custom services, as well as other container operations"*. Boile and Theofanis (2017) also provided an extended typology matrix of inland facilities, including dry ports. Furthermore, through quantitative or qualitative analysis it is demonstrated that the implementation of such facilities could lead to a better environmental, social, economic and logistics impact. These positive impacts are analysed by many authors, including Li et al. (2009), Jeevan and Roso (2019), Zeng et al. (2013), Tadić (2020), Henttu and Hilmola (2011), Boile et al., (2008) Boile et al. (2011).

Othman et al. (2016) noted that logistics and multimodal transportation systems have become the pillar of the future maritime industry. Boile and Theofanis (2017) note that many studies worldwide indicate that freight consolidation and synergies achieved through collaboration, reduce logistics costs, which may be a strong incentive for companies to relocate in a freight village. According to Wang et al. (2016), the choice of a chain rather than a port becomes more critical for liner shipping companies, logistics service providers and shippers. Consequently, the intermodal transport of cargoes is required. The actors involved are shipping companies, logistics providers, terminal operators, port authorities, governments etc. Dry ports are an important node of modern supply chains as they handle a big share of cargo flows. Some of these supply chain actors also take part in the development and management of dry ports. Different methods and policies are used for such development which define the kind of investment.

As mentioned above, dry ports development can be characterized by different kind of investments which often depend on the local, regional, and national government. For instance, according to Ng and Gujar (2009), dry ports in India (and to a large extent in Asia in general), are mainly developed by CONCOR (Container Corporation of India). Haralambides and Gujar (2011) noted that CONCOR proposed "*to let private investors handle, on contract or under franchise, all transport of containers and cargo by road between the satellite CFSs[3] and the rail-fed ICDs[4], and between ICDs/CFSs and shippers' premises"*. Bask, Roso et al. (2014) present cases of dry ports in Kouvola, Finland and Hallsberg, Sweden where the public sector played a major role in their development via cooperation with private investors. In the same spirit, Korovyakovsky and Panova (2011) and Rodrigue at al. (2010) examined several Russian and European cases respectively, most of them distinguished by Public Private Partnership (PPP) and landlord model. In PPPs, the public sector is usually involved during the development phase, while the private sector is responsible for inland terminal's operation and management. The landlord model includes ownership by the state and operation from other private investors or port authorities (Monios 2011). In the US, according to Rodrigue et al. (2010) and Wilmsmeier et al. (2011) the government has traditionally taken little action. Rail operators and real estate developers play a key role in dry port investments. In terms of PPP, Pavona and Hilmola (2015) mentioned that there are plenty of stakeholders who are interested in dry ports projects, most of them are usually vertically integrated into the supply chain.

[3] Container Freight Stations-CFS

[4] Inland Container Depots-ICD

This paper presents a comparative study of dry port developments at a European and global level. The research has been focused on case studies from Europe, Asia and the US, with relevance to maritime logistics activities. After an analysis of the existing typology and definitions as well as the main characteristics and services of an inland terminal/dry port, the paper examines the development policy, the management structure and concludes with the assessment of the presented cases underlining the interest of transport providers, financial institutions, local and regional authorities in dry port development.

3. Dry Ports-Definitions, Characteristics, and Typical Functions

Markets worldwide are oriented towards better connectivity to make the whole supply chain more efficient. Dry ports contribute to the improvement of seaport operational efficiency. Their main characteristics and typical functions are analysed below. It is worth noting that there is plethora of definitions of freight facilities, often noted in the literature as inland terminals; dry ports; inland ports; inland hubs; inland logistics centres; freight villages; inland clearance depots; inland container depots; inland freight centres; inland freight terminals. A description of some of these types of facilities and some of their distinct characteristics is given by Boile et al. (2008), as summarized in Table 1.

Table 1: *Typology Matrix*

Type of Freight Facility	Typical Features and Characteristics
Freight Village	A clearly demarcated and actively managed location, within which both multimodal freight transfer facilities and industrial activities are situated, along with commercial and/or worker support services.
Community Integrated Freight Village (CIFV)	A freight village containing community-oriented commercial activities.
Logistics Center Freight Village (LCFV)	A freight village not containing community-oriented commercial activities.
Freight Terminal	A freight terminal is a location where loading, unloading, and intermodal transfer of shipments take place.
Intermodal Industrial Parks	Intermodal industrial parks differ from freight villages in that they have no commercial activities or workers support services incorporated into the facilities.
Multimodal Industrial Parks	Multimodal industrial parks have access to multiple modes to support industrial activities, but no connections between these modes through dedicated freight transfer facilities.
Industrial Parks	Industrial parks differ from intermodal and multimodal industrial parks in that they lack the key features of dedicated freight transfer facilities and multimodal access.
Urban Distribution Centers	Urban distribution centers offer means of reducing truck traffic in congested urban areas through cooperation and coordination among various stakeholders.

In this paper, the definition of a dry port given in Leveque and Roso (2002) is adopted; "*A dry port is an inland intermodal terminal directly connected to a seaport with high capacity transport means where customers can leave/pick up their standardized units as if directly to the seaport"*. Subsequently, intermodality is more than a requirement as it is essential to transform a piece of land to a dry port.

Despite the range of definitions, dry ports must be characterized by three very important elements to confirm their role and title as parts of the supply chain and hinterland transportation systems. Intermodal connectivity and the easy, speedy shift from road to rail and vice versa are the base upon which the concept of inland ports is built. Furthermore, a dry port must be well-connected with at least one seaport to ensure its economic/financial sustainability. Finally, the operator of the inland facility is responsible to organize a group of operations and logistics activities. Shippers are looking for certainty and professionalism while receivers are looking for reliable and speedy delivery of their goods, a fact that pushes the operator to one specific direction; to design and organize activities that offer value.

The services offered by an inland terminal depend on its size but there are some core activities that are taking place in every dry port. Most of them provide storage and depot space for containers and goods as well as warehousing services. In addition, in order to save valuable time from shippers most dry ports are responsible for customs clearance services, packing/unpacking operations and distribution. Bigger inland terminals often try to gain competitive advantage in global supply chains, by following Porter's differentiation strategy. So, they offer a variable of services, the so called "added-value services". Labelling, power supply, manuals, maintenance of containers, track and trace, empty container depot, insurance of stored goods, advising services, cargo storage of reefer containers are well known such services.

In this research work, the main objective and motivation is to examine the role of public and private sector in dry port development initiatives. Thanks to the prementioned researchers, freight villages/dry ports/inland ports development is separated in categories. Nevertheless, each region has its own development strategies/policies. For instance, in the US, the development by private sector, mainly by rail operators and real estate developers, is very widespread. On the other hand, in many Asian countries, because of the political environment, the public sector plays a principal role in such investments and in the management of facilities. Special attention is given to the public-private partnerships (PPP) where the Special Purpose Vehicles (SPV) or Special Purpose Entities (SPE) are introduced. In PPPs, common share of responsibility, risk financing, losses and profits are observed as all members are concerned about reaching the set goals. The collaborating organizations, usually, create a new vehicle, which is responsible to build, operate and maintain the infrastructure. A SPV often signs the contract with the government (Haralambides and Gujar (2011)). The reason of its creation is to control and spread the risk of the investment, as SPVs minimize the risk of each involved entity. The landlord model differs in key elements, such as control of risk and the level of interest by both public and private sector actors.

4. Development of Case Studies

In this section, case studies from Europe, Asia and the US are presented. Two major criteria have been considered for the selection of those cases. Firstly, the research is oriented in providing a description of a variety of good cases with different profiles, including different

size, geographical characteristics, type of development, capacity, as well as modes of transport operating in the facility. Secondly, pertinent cases have been selected based on the publicly available information, to a level of detail that enables a thorough description of the facility. Some examples of public and private sector developments are presented first and, subsequently, cases developed based on PPPs are described in a chronological order of their development, demonstrating the prominence of this model. For each freight facility, the year its operation started, the size of the facility, capacity, functions, connected modes of transport along with information on governance, developer, operator, tenants, stakeholders, shareholders, and company structure (where feasible), are reported.

4.1 Lat Krabang ICD, Asia (1995)

In Asia, the development strategy differs from the European and the US one. Inland terminal and other investments, in general, are seriously based on public sector's influence. Another key feature is that the capacity of such inland facilities is usually much bigger than in Europe. It is widely known that containers start their journey to European markets mainly from Asia, where the manufacturing part takes place. So, supply chains, in order to achieve scale efficiencies, need to be flexible, and that is achieved through the implementation of dry ports with no capacity issues. Lat Krabang, occupies 80 hectares of land, able to provide cargo consolidation, distribution, warehousing, customs clearance, empty container storage services and Chassis storage facilities with a capacity of 1.7 million TEUs per year. This Inland Container Depot (ICD) is publicly owned, operated by State Railway of Thailand (SRT) which is the only shareholder, and whose development is a result of STR and Module Operators joint venture. The ICD offers a two-modal connectivity (rail to road and vice versa), with some important cargo carriers renting its space such as Evergreen, Hanjin and NYK. However, there is interest by CMA CGM and ONE, whose fame and prestige as ocean carriers are also well known.

4.2 Hutchison Ports Venlo, Netherlands (1982)

In contrast with the case of Lat Krabang ICD, Hutchison Ports Venlo belongs to a private investor. The facility is offering great accessibility. It can be reached by the core rail and road network and can also provide barge services via inland waterways. The terminal is operated by Hutchison Ports. In an area of 9 hectares, the terminal has storage space for 5,400 TEUs from rail and 1,900 TEUs from barge. Unfortunately, no further information about total handling capacity is available. Additional services are offered; Road, shuttle, barge operations; customs clearance; consolidation/deconsolidation; and empty containers storage. Many tenants operate under its roof including ECT, Keyrail, D.B. Schenker, DELTA (APM), Home (HPH). Among its stakeholders and shareholders, European Container Terminal, APL Logistics and Betutweroute (Keyrail) have significant presence. Venlo dry port is characterised by significant strengths, keeping an important competitive advantage because of its location in a close distance to the German border. It serves different markets in different hinterlands. Venlo's dry port is depicted in Figure 1. Its great connectivity allows the cooperation with main European ports such as Rotterdam and Antwerp.

Figure 1: *Hutchison Ports Venlo*

4.3 BNSF Logistics Park Chicago, USA (2002)

In case of inland terminals developed in the US, the private sector has been the major investor. The BNSF Logistics Park Chicago constitutes one of the biggest in the country with a capacity around 3 million TEUs per year in an area of 2630 hectares. For its development Burlington Nothern, Inc. and Santa Fe Pacific Corporation worked together, however, its operation is assigned to BNSF Rail Operator. This inland facility belongs to totally private investments and represents the most typical American model. The logistics park, apart from other services such as parking, restaurants etc., provide FTZ (Free Trade Zone), trans-modal load centre and import logistics rail-truck-rail. Its notable connectivity with rail/road allows important franchises to operate into its space as tenants. Walmart, DSC Logistics, Maersk Logistics, American Honda Motor Company; American Isuzu Motors; American Suzuki Motor; Ford Motor Company/UPS Logistics; Hyundai Motor America; KIA Motors America; Mitsubishi Motor Sales; Nissan North America, and Subaru of America, Major 'big-box' retailers, 3PLs, Georgia-Pacific, Pacific Asian supply chains are brands which increase the prestige of the terminal. Among its shareholders, Prologis, CenterPoint, and BNSF have significant impact despite the fact that some of them did not contribute to its development. Figure 2 shows an aerial photo of part of the land occupied by the facility, focusing on the rail and road connections.

Figure 2: *BNSF Logistics Park Chicago*

4.4 CenterPoint Intermodal Center Elwood-Joilet, USA (2010)

With its rather large area of 2590 hectares, CenterPoint Intermodal Center Elwood-Joilet can handle 3 million TEUs per year offering warehousing, distribution, and container depot services as well as rail-served facilities and land sales or leasing. CenterPoint is responsible for both operation and development. However, during the first stage of its construction CenterPoint had a different name, Capital and Regional Properties Corporation. It also follows the typical American model as a fully private business. The terminal is well-connected with a reliable rail/road network, attracting important tenants such as Acres Truck Parking, Adrian Carriers, BNSF Railway, Central States Trucking Co., Clearwater Paper, cmi, ConGlobal industries, ContainerPort Group, C R England, CTDI, CYPRESS Medical Products, DeLco, DSC Logistics and supply chain management, GAVILON, Georgia-Pacific, GERTSEN INTERSTATE SYSTEMS Inc, THE HOME Depot, International Transload Logistics, J.B. Hunt, LAFARGE, MARS, MSC, Midwest warehouse & distribution system, NEOVIA, NFI, Odyssey, Partners Warehouse, PRAIRIE Material, PRIMESOURCE, RMC, RoadOne Intermodal Logistics, SaddleCreek Logistics Services, SAMSUNG, SATURN, Stepan, UNION PACIFIC, VULCAN Material co., WALMART, XPOLogistics, ZE, unis. CenterPoint is the only one shareholder, making good use of facility's management. In terms of stakeholders, Union Pacific Joilet Intermodal Terminal, BNSF Chicago, Norfolk Southern Railway, CSX, NAIHiffman have serious interest in its sustainability and efficiency.

4.5 Interporto Bologna, Italy (1971)

Interporto Bologna is the first presented case from the European continent with public-private partnership being the philosophy of its development. Different organizations, in terms of ownership and services offered, cooperated and most of them hold their part in the Interporto Bologna SpA. The dry port in Bologna territory occupies 410 hectares of land, able to handle 300,000 TEUs per year, which makes it a strong competitor in global markets. It provides a range of services, including handling, storage management, container repair, transhipment, shuttle services, customs clearance, fumigation, management of dangerous goods, agency services, handling, and surveillance of ADR containers. Interporto Bologna can be approached by rail or road which facilitate many important brands to place their operation in the terminal's area, like Ferrari, Maserati, Lamborghini, Ducati, Barilla, Parmareggio, Ima and GD. As mentioned above, Interporto Bologna belongs to many shareholders' portfolio. More specifically; Comune di Bologna 35.10%, Provincia di Bologna 17.56%, Camera di Commercio di Bologna 5.90%, Trenitalia S.p.A 1.49%, Praoil Oleodotti Italiani SPA 2.26%, Fi.Bo.SSPA 2.48%, A.B.S.E.A. 1.49%, L'Operosa S.c.a.r.l. 1.10%, Cassa di Risparmio in Bologna SPA 4.10%, EM.RO Popolare SPA 2.68%, Dexia Crediop SPA 1.13%,,, Banca Nazionale del, Lavoro Partecipazioni SPA 2.08%, Sanpaolo IMI SPA 2.31%, Banca Monte dei Paschi di Siena SPA 1.68%, Unicredito Italiano SPA 8.12%, Banca Popolare di Verona E Novara s.c.a.r.l 1.43%, Le Assicurazioni D'Italia SPA 1.69%, Gruppo Societa' Artigiano s.r.l 1.43%, Associazione Industriali di Bologna 5.04%, Interporto Bologna SpA 0.94%. Furthermore, 3PLs companies, logistics operators, MTOs freight forwarders, shipping agents, road transport companies and couriers, ecommerce operators and rail intermodal transport operators are involved. The company structure of the Special Purpose Vehicle (SPV) is depicted in the following chart (Figure 3).

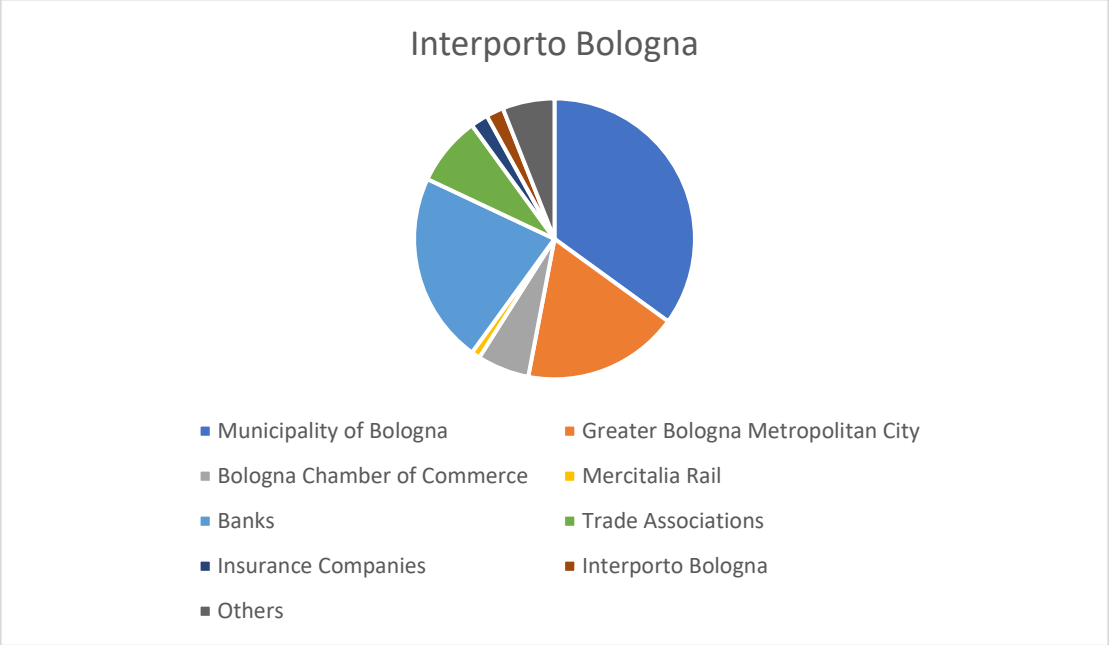

Figure 3: *Interporto Bologna Company Structure*

4.6 Riyadh Dry Port, Asia (1982)

In contrast with Lat Krabang ICD, the public-private partnership stands out, in a facility in Asia, where this method is not widespread. Riyadh Dry Port is placed in a 92 hectares piece of land, with the ability to handle annually 1 million TEUs. Saudi Port Authority was the key-player for the development part while the operation is managed by BAAS International Group and Saudi Railways Organization. To satisfy users' expectations, the terminal offers services such as transhipment, refrigerated storage, customs clearance, maintenance of containers, road haulage and forwarding while many tenants like CMA CGM and BIG operate in it. As mentioned, dry ports are only a part of the supply chain and the cooperation of different parts is more than required. So, Sea Port of Eastern Province and Damman Sea Port are among the stakeholders despite the fact that they may not have direct financial interests. In Figure 4, an aerial photo of the terminal is shown, indicating its size in relation to the surrounding area.

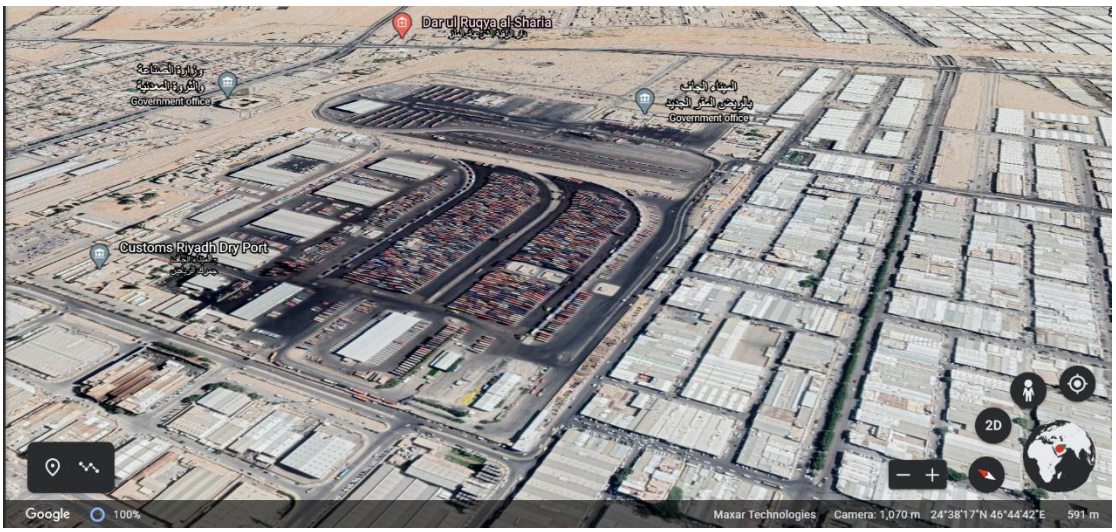

Figure 4: *Riyadh Dry Port*

4.7 Dry Port Madrid in Coslada, Spain (2001)

Different public owned organizations cooperated in its development. Specifically, Spanish Ministry of Development, Municipalities of Madrid and Coslada, Spanish Port Authority and Spanish National Rail Operator joined their forces and created the SPV named "Puerto Seco de Madrid". However, the recent trend of vertical integration by pioneering container shipping companies, led COSCO to take advantage of the situation and sign a contract to operate the terminal. So, Conte Rail, a subsidiary of COSCO, is responsible for the services offered by the dry port. In a space of 14 hectares, by having the ability and equipment to handle 64,165 TEUs per year and the rail/road accessibility available, the Dry Port Madrid in Coslada constitutes a node for the ports of Barcelona, Valencia, Bilbao, and Algeciras which are some of the main shareholders holding a 10.2 % each. Madrid Regional Government also holds the biggest part of 25% as well as Entidad Publica Empesarial de Suelo and Coslada Local Counsil with 13.08% and 10.92% respectively. The dry port provides all the core services such as customs clearance, rail services, road transport services, empty container depot, container cleaning and repair and warehousing. Except for users, investors and residents, the most important stakeholders of the project are COSCO Shipping Co. and Continental Rail. The tenants operating right into the area of the dry port include: ACL, MRW, PEPSICO, TDN, EL CORTE INGLES CEDIAL, IVECO, DECOEXSA, DOCKS LOGISTICS, SADECO, TRANSPORTES CEREZUELA, CTT EXPRESS, BIMBO, AGILITY, DHL FREIGHT, DIPLOMATIC SUPPLY, TOLDOS MONITA, ENVIALIA, SUPERMERCADOS COVIRAN, SENDING, EVOLA GROUP, CECAUTO, GEWISS IBERICA, ADI GLOBAL DISTRIBUTION, VOITH, RHENUS, CARRIES TRANSICOLD, ALVACO, CORREOS EXPRESS, FERROLI, NTL TRANS, TRANSNATUR.

4.8 Rickenbacker Intermodal Terminal (Columbus, OH), USA (2008)

Rickenbacker Intermodal Terminal has been planned and developed by Columbia Regional Airport Authority, Duke Realty Corporation and Capitol Square Ltd. while the operation part is assigned to Rickenbacker International Airport and Norfolk Southern Corporation. Based in the state of Ohio, the terminal handles 260,000 TEUs per year, in a land of 70.8 hectares (in its

initial phase), especially due to its excellent connectivity with road, rail and air corridors. It also provides users with all type of services such as storage, warehousing, Free Trade Zone, distribution and manufacturing, interchange of shipping containers between trains and trucks as well as the presence of double-stack rail cars directly from the Port of Norfolk, Virginia. It is argued that not only the terminal offers a great variety of functions in terms of number, but it serves the users with the proper way which attracts a plethora of corporations willing to utilize its infrastructure (tenants). Goodyear, Amazon, Anheuser-Busch Owens & Minor, Crate and Barrel Lasership, RGLP, American Showa, BASF, Hyperlogistics, FedEx, UPS, Kalitta Air, Atlas/Polar Air Cargo and Evergreen International Airlines, Exel/DHL Global Logistics, Expeditors International, Freight Expediters, Hellman Worldwide, Kintetsu, HA Logistics, Polar Air Cargo, Kalitta Air and Nippon Express, Commodity Logistics and ODW Logistics operate in Rickenbacker Intermodal Terminal. Unfortunately, information on shareholders and company structure is not available, however, among the stakeholders, Norfolk Southern and Heartland have a primary role.

4.9 Savannah-Appalachial Regional Port, USA (2018)

Following the Rickenbacker development philosophy, Appalachial Regional Port have been developed by the partnership of private and public sector. The terminal has been run by Georgia Ports Authority, while its development/construction is a result of the State of Georgia, Murray County, Georgia Ports Authority and CSX Transportation joint-venture. The inland port handles approximately 50,000 TEUs per year in an area of 17 hectares and its major function is transloading import logistics. It can be characterized as a satellite terminal. According to Rodrigue and Notteboom (2012), a satellite terminal is close to a port facility but at the periphery of its metropolitan area. A satellite terminal operates as load centre for local or regional markets. As most of its kind in the US, rail/road network constitutes a milestone and permits to different tenants like CSX Transportation, TCW Inc., Averitt Express having their own space in the terminal's area. Furthermore, shareholders and stakeholders are in the same group following the same direction to achieve revenues either financial or socioeconomic. Savannah Port Authority, Savannah Economic Development Authority, Duke Realty, CSX Railway and NS Railway have mutual interests with the operators. The difference of this inland facility, in comparison with the other ones in the US, is that its size, and possibly its governance, do not allow for a large number of tenants.

4.10 East West Terminal, Hungary (2022)

East West Terminal is placed in a strategic position, as Hungary is bordered by several countries in Central Europe and the facility will serve as a gateway of the New Silk Road. This terminal is in an early phase of development. East West Terminal occupies a 125 hectares piece of land and is able to handle 1 million TEUs per year, as well as, to offer a variety of different functions to its users. Container transfer from rail to truck, 5G Access, semi-trailer transhipment, loading/unloading containers, empty container storage, 24/7 customs clearance, moving and storing of dangerous goods, distribution, software access, truck parking are planned to be available. In this case, the development is a result of public-private partnership while responsible for the operation is a SPV named "East West Intermodal Logistics Service Private Company". Because of its well-placed area, it provides notable accessibility via rail and road. Important companies, like CAMCO Technologies, have already expressed interest and signed contracts to operate their business in the terminal's infrastructure, despite the fact that it will open its gates in early 2022. Until the time this paper is written, there are two main shareholders; 50% belongs to Greennovatik Energetikai Fejleszto Limited Liability Company; and 50% to

Trusty Business Management Private Limited Company. However, the Hungarian government has contributed with capital to this investment and has its own interests. Some of them could be the new job opportunities that will be offered to the unemployed population or the taxes.

The analysis of the selected cases from the three regions is based on recently updated data and its purpose is to provide a better understanding of the freight facilities' development initiatives as well as to present the private sector's involvement in their development.

During their early implementations, large scale freight facilities were developed mainly as either public or private initiatives. On the one hand, private sector is looking for new business opportunities with the scope to maximize profit by contributing to smoother and more effective supply chain activities while, historically, has been a better "entrepreneur"/operator than public authorities. On the other hand, public sector seeks to better accommodate increasing freight flows and deal with the increasing truck traffic, especially in urban areas; promote a more rational use of available land; and increase social benefit. In early schemes, the presence of both private and public sector had been obvious, with public being responsible especially for the initiation and the development phase while private gaining higher shares once the facilities were established, which is clearly depicted in the analysis of the selected cases.

PPP schemes seek to exploit the expertise of each involved party, to share authority and responsibility and optimally meet well defined objectives in large scale freight facility development initiatives. They have been applied for many decades as the previous review indicates. "Interporto Bologna" was established in 1971 and a SPV was created to manage the terminal; Riyadh Dry Port was established in 1982 with important connections with Sea Port of Eastern Province and Damman Sea Port. Subsequently, Dry Port Madrid in Coslada in 2001, Rickenbacker Intermodal Terminal in 2008 as well as Savannah-Appalachial Regional Port in 2018 are more recent projects where PPPs implementation facilitate the cooperation with major seaports. In Madrid, the development started as a public initiative due to the plethora of different public bodies involved including Spanish Port Authority as well as in case of Savannah where Georgia Port Authority also operates the terminal. In both cases, the Port Authorities are involved from the early stages of their development. It is worth mentioning that Dry Port Madrid in Coslada is a node for the ports of Barcelona, Valencia, Bilbao, and Algeciras verifying the results derived from the analysis. All parties involved in a PPP are concerned with mitigating the risk and planning facilities for long-term efficiency. The last case presented, the East West Terminal in Hungary, is due to open its gates in 2022. Both public and private bodies are responsible for its development. Different tenants have already expressed their interest to operate in the terminal while the facility will serve as a gateway for the New Silk Road with significant economic advantages.

PPPs in large scale freight facility funding and development have been the preferred mechanism in many cases for over 30 years. Actors involved in the process may have different interests and objectives. However, large scale freight facility development better facilitates supply chain operations by promoting the strengths of both parts, public and private. The principal outcome of such model is the offering of flexibility. The presented cases from the three regions show that there is strong potential for PPPs in funding inland freight facilities, including dry ports, with the involvement and collaboration of Port Authorities, 3PL companies and relevant transportation providers. The coexistence of both public and private sector creates a steadier environment by absorbing to a greater extent the possible ups and downs.

In the last Section, the conclusions gained from the research are summarized, offering documented information about PPP in dry port development and underlining the need to include them, in a dynamic way, across the whole supply chain.

5. Conclusions

This paper sought to provide a comparative analysis of selected dry port cases with a global geographical coverage. The authors described the current situation in global trade and strengthened concisely the theoretical background by providing a typology table and presenting an outline of the main services offered and characteristics of inland facilities. Subsequently, inland ports located in Europe, the US and Asia were presented. Special attention was given in their development strategy.

Different development policies in the three regions were noted. In Europe, public-private partnerships are more widespread with significant involvement of Port Authorities. By implementing PPPs, both parts control the risk of the investment and, at the same time, they focus on the services they are responsible for. For instance, a Port Authority and a rail operator collaborated to develop a dry port. After the construction completion, Port Authority is responsible for management while the rail operator has the control of the terminal's operation. On the other hand, inland ports in the US show the important role of the private sector, represented mainly by rail operators or real estate developers. Another important key feature is the size, with freight villages in the US typically occupying many more hectares of land than in Europe. The number of tenants, as it derives from the analysis, shows how competitive they are in global markets. In Europe and the US, the public sector participation in large scale freight facility development is stronger during the initiation and development phase, and rather limited in general. In several Asian cases, the public sector involvement tends to be stronger, with several facilities with notable size and capacity fully developed and operated by the public sector, because of the government policies in many Asian countries. When competition is encouraged, plenty of private investors, such as container shipping companies, follow a vertical integration. To achieve that, in most cases, the flexibility of the public sector facilitates the whole procedure, creating a win-win situation. Hence, the global competitive environment triggers opportunities for both sectors.

Nevertheless, the public and the private sector have different objectives to achieve. The public sector requires regional development through new job opportunities and financial benefits to the state and region. The private sector's principal objectives are mainly oriented in revenues, functionality of the terminal and satisfied users as well as increased market share. Public-private partnership empowers the coexistence and balance of these interests.

Modern supply chains and global trade in combination with the increased flows of cargo make dry ports implementation mandatory in many cases, as they improve port hinterland connectivity and further support interaction among carriers, manufacturers, shippers and receivers. This paper reviewed development policies, showing that freight facilities, including dry ports, can be implemented through PPPs as a funding mechanism, even in today's competitive environment where private sector's share increases rapidly, a fact that removes barriers and facilitates stakeholders and investors. Transport providers, financial institutions, local and regional authorities should be perceived as equal players in a competition game. By investing in dry ports, involved stakeholders could gain significant advantages and strengthen

their position and that is what an innovative development policy like PPP promotes. This paper constitutes a preliminary investigation of good practices in freight facility development, which may provide a good reference for further research and provide some insights in new facility development.

References

Bask A., Roso V., Andersson D., Hämäläinen E., (2014), Development of seaport–dry port dyads: two cases from Northern Europe, *Journal of Transport Geography*, 39, 85-95

Boile M., Theofanis S., Mann H., Betak J., Sdoukopoulos E. (2013) "Freight Facility Location Analysis to Support Port Related Activity – Economic and Transportation Drivers and Factors Affecting Site Selection", Proceedings of the International Association of Maritime Economists (IAME) Annual Conference 2013, 3 – 5 July, Marseille, France.

Boile M., Theofanis S., Ozbay K., (2011) Feasibility of freight villages in the NYMTC Region. Rutgers, The State University of New Jersey, Center for Advanced Infrastructure and Transportation. Report submitted to the New York Metropolitan Transportation Council.

Boile M., Theofanis S., Strauss-Wieder (2008*),* Feasibility of freight villages in the NYMTC region: Task 3. Rutgers Centre for Advanced Infrastructure and Logistics, Freight and Maritime Program. Piscataway, NJ

Haralambides H., Gujar G., (2011), The Indian dry ports sector, pricing policies and opportunities for public-private partnerships, *Research in Transportation Economics*, 33, 51-58

Henttu V., Hilmola O., (2011), Financial and environmental impacts of hypothetical Finnish dry port structure, *Research in Transportation Economics*, 33, 35-41

Jeevan J., Roso V., (2019), Exploring seaport - dry ports dyadic integration to meet the increase in container vessels size, *Journal of Shipping and Trade,* 4:8

Khaslavskaya A., Roso V., (2019), Outcome-Driven Supply Chain Perspective on Dry Ports, *MDPI*, Sustainability 2019

Korovyakovsky E., Panova Y., (2011), Dynamics of Russian dry ports, *Research in Transportation Economics*, 33, 25-34

Leveque, P., Roso, V., 2002. Dry Port concept for seaport inland access with intermodal solutions. Master thesis. Department of Logistics and Transportation, Chalmers University of Technology.

Li F., Shi X., Hu H., (2011), Location Selection of Dry Port Based on AP Clustering - the Case of Southwest China, *Journal of System and Management Sciences*, Vol.1 No.5, 79-88

Monios J., (2011), The role of inland terminal development in the hinterland access strategies of Spanish ports, *Research in Transportation Economics*, 33, 59-66

Ng K., Gujar G., (2009), The spatial characteristics of inland transport hubs: Evidences from Southern India, *Journal of Transport Geography*, 17, 346-356

Othman M., Jeevan J., Rizal S., (2016), The Malaysian Intermodal Terminal System: The Implication on the Malaysian Maritime Cluster, *International Journal of e-Navigation and Maritime Economy*, 4, 046-061

Panova Y., Hilmola O., (2015), Justification and evaluation of dry port investments in Russia, *Research in Transportation Economics*, 51, 61-70

Review of Maritime Transport, *UNCTAD Final Report*, November 2020

Rodrigue J, Notteboom T., (2012), Dry ports in European and North American intermodal rail systems: Two of a kind? , *Research in Transportation Business & Management*, 5, 4-15

Rodrigue J., Debrie J., Fremont A., Gouvernal E., (2010), Functions and actors of inland ports: European and North American dynamics, *Journal of Transport Geography*, 18, 519-529

Roso V., (2007), Evaluation of the dry port concept from an environmental perspective: A note, *Transportation Research Part D*, 12, 523-527

Roso V., Woxenius J., Lumsden K., (2009), The dry port concept: connecting container seaports with the hinterland, *Journal of Transport Geography*, 17, 338-345

Tadi´c S., Krsti´c M, Roso V., and Brnjac N., (2020), Dry Port Terminal Location Selection by Applying the Hybrid Grey MCDM Model, *MDPI*,6983

Tsamboulas D., Kapros S., (2003), Freight village evaluation under uncertainty with public and private financing, *Transport Policy*, 10, 141-156

Wang G., Zeng Q., Li K., Yang J., (2016), Port connectivity in a logistic network: The case of Bohai Bay, China, *Transportation Research*, Part E, 95,341-354

Wilmsmeier G., Monios J., Lambert B., (2011), The directional development of intermodal freight corridors in relation to inland terminals, *Journal of Transport Geography*, 19, 1379-1386

Zeng Q., Maloni M., Paul J., Yang Z., (2013), Dry Port Development in China: Motivations, Challenges, and Opportunities, *Transportation Journal*, Vol. 52, No. 2, 234-263