

Exploratory Evaluation of Dry Ports in Northeast of Brazil

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Abstract

Develop a supply chain infrastructure is one of the most challenges faced by governments, trying to achieve an efficient logistic network. As an option to improve the congestion in seaports and reduction in transportation cost, dry ports have a key role to play in advancing port-hinterland connectivity. While many researches have been developed in Asian and European countries, studies about dry port are still in the early stage in Latin America. However, there are many issues to be discussed in these areas, with poor railways infrastructures, covered by bureaucratic customs processes in countries with economic and political instability, as happen in Brazil. To overcome the literature gap, this article presents a preliminary study about dry ports in northeast of Brazil, classifying the four logistic structures in that region and exploring, by two case studies, the main strategic issues related to Brazilian dry ports. This study provides a useful insight to policymakers, as well for dry port managers, shippers and costumers that use this logistic infrastructure as an alternative to become more competitive as well is a beginning for new research developments in this area.

Keywords

Dry port, Classification, Case study, SWOT analysis, Brazil.

1. Introduction

The massification of maritime transportation and the scale increases in vessel size are putting a huge pressure on seaports and their corresponding hinterland transport networks (Nguyen and Notteboom, 2018). With the growth of the world trade and containerized cargo transport, dry ports have played an important role in extending their services and providing continuous integration with the hinterland, helping to bring together all the stakeholders involved in the supply chain process (Haralambides and Gujar, 2012). However, most research was carried out in European and Asian countries that have a large container handling and developed railway infrastructure. In this way, a broad

approach applied in emerging economies may expand understanding of the barriers, opportunities and characteristics of dry ports in different contexts.

Among the main problems approached in the literature about dry ports are the location-allocation decision (Wang et al. 2017), (Komchornrit, 2017), (Wei and Sheng, 2017), (Nguyen and Notteboom, 2016), (Chang et al, 2015); the network between dry port, hinterland and seaport (Chen et al, 2018), (Tsao and Linh, 2018), (Kramberger et al, 2018), (Wei et al, 2017); the dry port performance (Jeevan et al, 2017), (Haralambides and Gujar, 2012), (Ng and Tongzou, 2010); evaluation about the transportation system (Qiu and Lam, 2018), (Lättilä et al. 2013); analysis of the viability of the dry port (Dadvar et al, 2011) and its environmental impact (Roso, 2007), (Muravev and Rakhmangulov, 2016). Despite the problems presented above, the discussion about dry ports in developing economies is still in the early stage and an exploratory analysis is necessary. In this way, this article will conduct a preliminary study about dry ports in Brazil, focusing in the northeast region, to answer two research questions, as follows:

RQ1. How could be classified the dry ports in northeast of Brazil?

RQ2. Which are the strengths, weaknesses, opportunities and threats of dry ports in northeast of Brazil?

By addressing the above questions, this study provides a useful insight to policymakers, in particular with respect to the development of dry ports in other Brazilian regions and the issues that should be improved, as well for dry port's managers, shippers and costumers that use this logistic infrastructure as an alternative to become more competitive. As a preliminary study, this study also works as a start to new developments and researches about Brazilian dry ports.

This article consists of seven sections and is structured as follows. The theories used to support the research are discussed in section 2, followed by the research methodology in section 3. Section 4 presents the results about the classification of dry ports in northeast of Brazil, followed by the case studies in section 5. The Section 6 presents the discussion and main features identified and section 7 the conclusions, bringing the limitations and directions to inspire the agenda for future studies.

2. Theoretical Background

2.1 Dry port development

A dry port was originally defined as an inland terminal to and from which shipping lines can issue their bills of lading (UNCTAD, 1982). Since then, many authors tried to define the concept, taxonomies, classification and the main issues related to dry ports in many countries. According to (Woxenius et al. 2004) and (Roso, 2007), dry port is based on a seaport directly connected by rail with inland intermodal terminals where shippers can leave and/or collect their goods in intermodal loading units as if directly at the seaport. Expanding this definition, (Roso et al. 2009) affirm that a dry port should be intermodal and ideally connect to one or more seaports using high capacity traffic modes, such as rail transport or barges. In another view, (Jaržemskis and Vasiliauskas, 2007) defined a dry port as a port situated in the hinterland servicing an industrial/commercial region connected with one or several ports by rail and/or road transport and is offering specialized services between the dry port and the transmarine destinations.

As an option to improve the congestion in seaports, delays in the supply chain, reduction in transportation cost and environmental impact, dry ports have a key role to play in advancing seaport-hinterland connectivity mitigating problems caused by constraints related to land and others that limit seaports' growth, coordinating the operation of the seaport supply chain and supporting regional economic development (Roso and Lumsden, 2010) and (Feng et al. 2013). Dry ports not only expand seaport hinterland areas and increase its cargo sources, but also simplify import and export procedures.

The main researches about dry ports were carried on in China and Europe, the centers of container transport in the world. In China this issue was approached by (Beresford et al. 2012), (Ka, 2011) and (Li et al. 2015); in India by (Haralambides and Gujar, 2012) and (Haralambides and Gujar, 2011); in Vietnam by (Nguyen and Notteboom, 2016) and (Nguyen and Notteboom, 2017). In Europe, the dry port development was analyzed in Spain by (Monios,

2011) and (González et al. 2012); in Italy by (Crainic et al. 2015) and in Sweden by (Roso, 2009). In American countries, the discussion was carried out by (Rahimi et al. 2008) and (Rodrigue and Notteboom, 2012) in the United States and in Brazil by (Padilha and Ng, 2012) and (Ng et al. 2013).

2.2 Dry port classification

It's a difficult mission to classified dry ports, considering the many services provided and the specificities of each country, which reflects at the logistics infrastructure. In this way, (Roso et al. 2009) classified the distance to seaport by long distance (> 500 Km), midrange (between 100-500 Km) and close dry port (< 100 Km). Until related to the location function, (Beresford et al., 2012) classified the China's dry port into three groups, namely seaport-based dry ports, city based dry ports and border dry ports. Until related to the location function, (Beresford et al. 2012) classified the China's dry ports into three groups, namely seaport-based, city based and border dry ports. Seaport-based refer to facilities which are sited near the seaports, offering yard and warehouse capacity support. The city-based is typically positioned within a larger logistics cluster city, offering a wider range of value-added logistics service. On the other hand, a border dry port refers to a dry port located in the border area, with the major function being as a transshipment center or custom clearance service.

Two concepts of the dry port development process was proposed by (Wilmsmeier et al. 2011) beginning with Inside-Out, whereby inland intermodal terminals seek greater integration with their sea ports, often driven by public body intervention. By contrast, Outside-In development is displayed by the conscious use of an inland node as a tool for seaport actors (whether port authorities or terminal operators) to expand their hinterland and capture discretionary cargo. In another view, (Notteboom and Rodrigue, 2009) proposed classify dry ports by the transport modes served, ranging from unimodal, when the dry port has access only by road, bimodal, when has access by rail and road, and trimodal, when has access by rail, road and barge.

2.3 Dry ports in Brazil

Initially called 'Depósitos Alfandegados Públicos' (Public Bonded Warehouses) and later 'Estação Aduaneira do Interior' (Inland Customs Station), dry ports were introduced in 1976 which authorized the implementation of customs clearance in secondary areas. However, the term 'Porto Seco' (dry port) was only adopted in 2002 (Padilha and Ng, 2012). In 2006, responding to the protracted legal disputes, was introduced the Provisional Measure 320, attempting to allowed dry ports to operate by means of licenses issued by the Federal Revenue, expanding the scope of dry ports to the Logistic and Industrial Customs Centre (CLIA) (Padilha and Ng, 2012), bur that provisional measure was considered unconstitutional and rejected by the Brazilian Senate (Ng et al. 2013).

According to (Ng et al. 2013), dry ports in Brazil are generally understood as bonded warehouses of public use where cargoes under customs control can be moved, stored and cleared, besides some additional services. Currently, Brazil has 32 dry ports and 24 CLIAs mainly located in the Southeast (29) and South (17) of the country. These macro regions concentrate the largest container terminals, especially Santos and Paranaguá, besides to be the only regions covered by the researches developed by (Padilha and Ng, 2012) and (Ng et al. 2013). Despite the concentration of cargo in these areas, in northeast of Brazil there are two large container seaports located in Salvador and Recife, the biggest states capitals in that region, and four dry ports, which offer additional services to the supply chain and were not considered in any research yet.

3. Tools and Methods

Discussions about dry ports in Brazil are scarce compared with European and Asian countries. In the last 20 years, only the researches developed by (Padilha and Ng, 2012) and (Ng et al. 2013) brought up the subject of dry ports in Brazil. Considering that there is little information available about this subject, apply an exploratory research is appropriate to enrich the discussion evolving this issue, helping to advance concepts that will support future researches (Eisenhardt, 1989), (Sarantakos, 2005).

To answer the first research question, the exploratory research allowed classify the four northeast dry ports following the definitions presented in Section 2. The northeast of Brazil region was selected in this article considering that there were no relevant researches developed in that region. The dry ports in northeast and their

hinterland are presented in Figure 1. All data was obtained through interviews, institutional web sites and Federal Revenue reports.

To answer the second research question, two case studies were conducted following a semi structured questionnaire in dry ports from northeast of Brazil. The interviews were carried on personally with six dry ports' managers during August, 2019, and had focused on their daily experiences and perceptions to enrich the discussion on the main factors that involve Brazilian dry ports, following a SWOT analysis. For business compliance, the dry ports analyzed in the case studies will be identified as dry ports A and B.

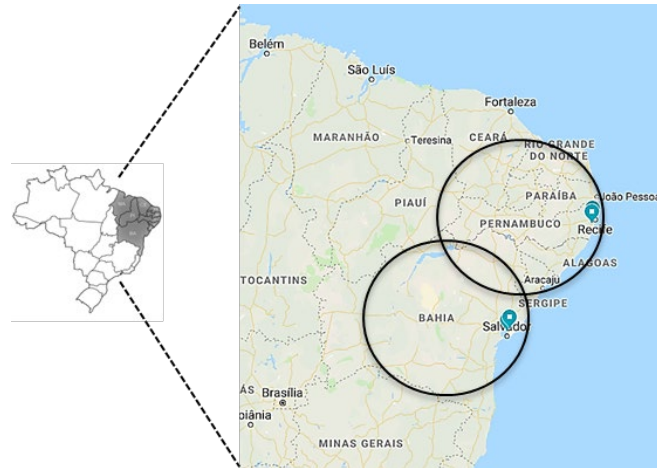


Figure 1. Dry ports and hinterland in northeast of Brazil

3.1 Dry port A

The case study in dry port A was carried on by three interviews with the Operational Manager, the Operational Supervisor and the Commercial Coordinator. Dry port A is located in the state of Pernambuco, between the Suape container seaport (22 km) and Recife downtown (29 km), the capital of the state. Classified as a close dry port and connected with container terminal only by road, dry port A has an average of 650 TEUs handled per month, utilizing 18% of its occupancy. Actually, dry port A works mainly with import cargo, about 98%, with products like tire, rubber, beverage and healthcare equipment.

3.2 Dry port B

The case study in dry port B was carried on by three interviews with the Operational Manager, the Customs Coordinator and the Commercial Manager. Dry Port B is also located in the state of Pernambuco, near to Suape container seaport (13 km) and Recife downtown (49 km), connected by road. Classified as a close dry port with 39.000 m² total area and a warehouse with 8.000 m², dry port B has a capacity of 1515 TEUs and an average handling of 460 TEUs per month, operating mainly import cargo, about 95% of total volume.

4. Classification of dry ports in northeast of Brazil

Following the definitions presented in Section 2, dry ports could be classified by the distance to the seaport in long distance, midrange and close distance; if the dry port is seaport based, city based or border based; by the transport mode as unimodal, bimodal and trimodal; and by the cargo flow as inside-out or outside-in. In this study, all dry ports in northeast presented similar characteristics. The four dry ports are classified as close dry ports, considering that they are less than 100 km far from the seaport. These logistics structure work as a support to the seaport, reducing the congestion and occupancy in the yard and transferring some customs process to dry port's areas. The information about the classification of dry ports in northeast of Brazil is summarized in Table 1.

Table 1. Classification of northeast dry ports

Location	Closest seaport	Distance to the seaport (Km)	Classification by distance			Dry port based on			Transport mode			Cargo flow	
			Long distance	Midrange	Close distance	Seaport based	City based	Border based	Unimodal	Bimodal	Trimodal	Inside-out	Outside-in
Salvador	Salvador	12			•	•			•				•
Simões Filho	Salvador	26			•	•			•				•
Cabo de Santo Agostinho	Suape	22			•	•			•				•
Ipojuca	Suape	13			•	•			•				•

Another characteristic of dry ports in northeast is the unimodal transport mode. With 15% participation in the transport matrix, and focused in movement iron and coal (approximately 80% of the total volume), Brazil has a low density of rail network compared to continental countries such as Canada, India, USA, China and even other developing countries in Latin America, such as Mexico and Argentina (ANTF, 2019). In the northeast, the reality is not different, what justify all dry ports be close distance and seaport based, considering that the main cities and the population are centered in the states capitals, as Recife and Salvador.

As in northeast there are no railways to hub the cargo in the hinterland and transport to the seaport in high capacity, the main advantages to use dry ports are the additional services and the customs special process. According to (Ng et al. 2013), dry ports in Brazil are generally understood as bonded warehouses of public use where cargoes under customs control can be moved, stored and cleared, besides some additional services. In addition to the possibility of removing goods from seaports earlier, when the cost of storing in dry ports is lower, imported goods can be stored for up to 120 days, which in seaport it would be 90 days, characteristic that stimulate the utilization of dry ports as outside-in, handling mainly import cargo.

5. Case studies

5.1 Dry port A

Dry port A is located between Suape seaport and Recife, the state capital. The managers interviewed believe that it's a strategic location, since the dry port is near the main customers and with a large area to operate. To be competitive in the northeast hinterland, dry port A works to offer personalized logistic solutions to the customers. In this way, its efforts concentrate to keep the process aligned with the clients, meeting the deadlines and understanding their necessities. This proximity and flexibility doesn't exist in the seaport due to the high volume of container handling. In the same way that this flexibility is strength, to manage the demand variation and comply the deadlines, which sometimes are determined by the Federal Revenue, are a weaknesses, if they can't fulfill the demand. This fact is hampered by the existing legislation and bureaucracy in customs processes, cause of friction with customers.

The bureaucracy was pointed as Weaknesses for the managers. In some states in Brazil, the revenue inspector imposes some difficulties and barriers that slow down the customs process, which results in lost customers which are looking for locations that enable agility in their processes (Ng et al. 2013). However, the managers pointed that the Federal Revenue has improved their process in recent years, especially in relation to inspectors, that apply the same rule to all players in the northeast supply chain, with no judgment variation.

Among the main reasons that led dry port A to locate near Recife was the possibility to handling special cargo. In the last 10 years, northeast region increased at rates higher than Brazil and many companies moved their facilities to there. In order to attend this demand, with a high added value, dry port A started to handle special cargo as open top containers and break bulk, utilizing its yard to accommodate the cargo. However, as Brazilian economy decelerated, the special cargo limited to 3% of the total volume handled. Despite the economic situation, the managers believe that detain the know how to operate special cargo, besides to offer additional services to the costumers, are a great opportunity for dry port A to become more competitive.

Brazil is passing through an unstable politic and economic environment. The dollar fluctuation rate impacts directly the trade balance and the operations in dry ports, mainly in northeast, that handle essentially import cargo. With a high dollar rate, fewer companies will import products in containers, which increase the competition between dry ports and seaport. In this scenario, the managers believe that the main threats to the dry port are changes in legislation, which can become more bureaucratic to the customers and entrance of new competitors as the seaport, that start to reduce storage rates to retain more containers in the recession environment.

5.2 Dry port B

For the managers in dry port B, the main strengths are the lower storage cost, compared to the seaport, the strategic location, near the 90% of the customers, besides the additional services and the custom warehouse, that offer logistic solutions targeted to customer needs. However, the managers believe that the lack of customers' knowledge about dry ports services and process is a weakness, mainly when their processes are barred by the customs bureaucracy. Besides that, use the dry port as service operator is include an additional player in the supply chain, what is considered by the managers a weakness, since some costumers believe that it can bring management problems and makes the customs process slow, adding more steps to them.

On the other hand, as an additional player in the supply chain with low handling volume, dry ports can offer more flexibility and proximity with the costumers to identify and fixed their operational problems. Some of the main additional services provided are weighing, cleaning and disinfection of cargo and vehicles, power supply for refrigerated trucks, fitting of seals, labeling, marking, placement of tax stamps on imported products, in compliance with your national legislation, cargo consolidation and deconsolidation for smaller volumes, repacking, palletizing and others.

As an outside-in dry port, 98% of the cargo handled is import. In this way, the managers highlighted the national and state economy as the main threats. As in dry port A, the expectation of increase volume in northeast was decelerated by the economic recession in the last years. Associated with the bureaucracy and the environment politic risks, fewer enterprises are coming to operate in Brazil, what reduce the import cargo and the dry port's activities. The main points of the SWOT analysis in the case studies are synthesized in Table 2.

Table 2. SWOT Analysis

SWOT Analysis	Dry port A	Dry Port B
Strengths	<ul style="list-style-type: none"> • Personalized logistics solutions; • Strategic location; • Operational efficiency. 	<ul style="list-style-type: none"> • Offer additional logistics services; • Customs warehouse; • Lower storage cost; • Strategic location.
Weaknesses	<ul style="list-style-type: none"> • Manage demand variation; • Bureaucratic processes. 	<ul style="list-style-type: none"> • Lack of customer knowledge of dry port services and processes; • Additional player in the logistics chain.
Opportunities	<ul style="list-style-type: none"> • Handling special cargo (over high, break bulk); • Offer additional services. 	<ul style="list-style-type: none"> • New logistics solutions that meet customer needs; • Large yard to storage container and break bulk; • Offer flexibility to the customers.
Threats	<ul style="list-style-type: none"> • Legislation changes; • New competitors; • Dollar fluctuation rate. 	<ul style="list-style-type: none"> • National and state economy.

6. Discussion

The results show similarities between the dry ports of the northeast region. All of them were classified as close dry port, seaport based, unimodal and outside-in oriented. These characteristics are explained by the functions that these logistic operators offer to the customers and the specificities of the Brazilian model of dry ports. As in Brazil there is no railway network to reduce the cost of logistic transportation to hinterland, most companies are located near the major consumer centers and seaports. In this way, dry ports in Brazil do not fit the definitions of (Woxenius et al.

2004) and (Roso, 2007), which consider dry ports as logistic structures directly connected by rail with inland intermodal terminals.

As each country has its specific logistics structure, disregarding the dry ports of developing countries because they are not connected by rail, as happen in Brazil, is a mistake. Brazilian dry ports offer important services to the country's supply chain that cannot be ignored, such as storage, consolidation, depot, maintenance of containers, track and trace, customs clearance (Roso, 2007). Hence, dry ports not only expand a seaport's hinterland areas and increase its cargo sources, but also simplify import and export procedures.

As was observed in the case studies, the dry ports in northeast of Brazil are specialized in offer additional and personalized logistic solutions for the customers, reducing bureaucratic processes and the occupancy in seaports. The smooth coordination between a seaport and its dry ports directly impacts the effective operation throughout the logistics supply chain. Driven by global economic integration and inland-oriented logistics services, the cooperation between seaports and their dry ports is getting increasingly close (Chen et al. 2018). However, in Brazil this scenario changes when the demand decrease and dry ports and seaports start to compete for storage cargo. This happens when the seaport occupancy are low, having capacity to storage import cargo, they reduce rates to retain more containers and increase their profits.

7. Conclusion

This article presented a preliminary study about dry ports in Brazil objecting to fulfill a literature gap in analyze this logistic structure in developing economies. To answer the *RQ1*, was realized an exploratory research in the four dry ports in northeast of Brazil to classify them following the definitions pointed in the theoretical background, trying to explain how is the currently dry port environment in that region. Results showed that all the logistic structures have similarities, been classified as close dry port, seaport based, unimodal and outside-in oriented.

The second step was identifying the main strategic issues about dry ports, by two case studies using a SWOT analysis to enrich the discussion about dry ports in Brazil. The discussion evidenced that Brazilian dry ports are directly influenced by the country's political and economic situation. With slow and bureaucratic processes, export and import cargo by container in Brazil, despite having a grown in the last years, is still a challenge. As an essentially commodity-exporter country, with high tax rate and an old inefficient logistic infrastructure, further researches about supply chain players must be develop and, this article, is the first step to provide useful insight about Brazilian dry ports.

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