Development of dry ports in Småland, Sweden
Comparing the cases of Nässjö and Vaggeryd

Master’s thesis within: International Logistics and Supply chain management
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Jönköping: May 2012
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Jönköping International Business School, May 2012

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Frans Wilhelm Gerard Haak
Master Thesis in Logistics and Supply Chain Management

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Tutor: Susanne Hertz
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Abstract

Problem: Due to several changes in the market, economy, industry and the environment there was an increasing trend in emerging dry ports/inland terminals throughout Sweden. A dry port is still a young term in the transportation field gaining more popularity and attention. The gap in literature was found that the dynamics of dry port evolution is not yet explored. Thus, the development of the layout, services offered and involved actors of dry ports in Småland, Sweden have to be studied.

Purpose: The purpose for this report seeks to reveal how dry ports have evolved from establishment, in the area around Jönköping, and to discover in what form the dry ports can operate and compete. The study was based on the dynamics of three elements: layout, value added services and networks.

Theory: In the theoretical research the dry port concept is described. Due to the variety of descriptions, authors formed a definition for the thesis to clarify the content. Further, the literature analysis contained the characteristics, classifications and reasons of development as well as involved actors, advantages and disadvantages, location, layout, design and performance measurements.

Method: The case study method was chosen to cover the identified gap. This qualitative study with semi-structured interviews conducted face-to-face and by telephone was accomplished with fourteen experts. If the authors faced problems regarding phone interviewees, open questions were prepared and sent to the respondent via email. The data gathering phase was followed by the analysis after which the conclusions were drawn.

Conclusion: The thesis proves that the development of dry ports is affected by a large number of internal and external factors. Terminals need to execute a thorough analysis of the market and the location in which they plan to operate. Therefore, the market has to be analysed continuously in order to keep improving their networks and value added services. Furthermore, the layout has to be adjusted for the changes and measurements have to be performed in order to increase the efficiency.
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<th>Description</th>
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<tr>
<td>AB</td>
<td>Limited (ltd)</td>
</tr>
<tr>
<td>CILTUK</td>
<td>The Chartered Institute of Logistics and Transport (UK)</td>
</tr>
<tr>
<td>e.g.</td>
<td>For example</td>
</tr>
<tr>
<td>ESCAP</td>
<td>Economic and Social Commission for Asia and the Pacific</td>
</tr>
<tr>
<td>et al.</td>
<td>And others (et alii)</td>
</tr>
<tr>
<td>ICT</td>
<td>Information communication technology</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>JIT</td>
<td>Just In Time</td>
</tr>
<tr>
<td>KTU</td>
<td>Kaunas Technical University</td>
</tr>
<tr>
<td>LP</td>
<td>Svensk LogistikPartner AB</td>
</tr>
<tr>
<td>NNAB</td>
<td>Nässjö Näringsliv AB</td>
</tr>
<tr>
<td>p.</td>
<td>Page</td>
</tr>
<tr>
<td>PoG</td>
<td>Port of Gothenburg</td>
</tr>
<tr>
<td>PoH</td>
<td>Port of Helsingborg</td>
</tr>
<tr>
<td>SC</td>
<td>Supply chain</td>
</tr>
<tr>
<td>SEK</td>
<td>Swedish Kronor</td>
</tr>
<tr>
<td>TEU</td>
<td>Twenty-foot equivalent unit (6,1 m)</td>
</tr>
<tr>
<td>TFK</td>
<td>Transport Research Institute (Trafikforskning AB)</td>
</tr>
<tr>
<td>UNCTAD</td>
<td>United Nations Conference on Trade and Development</td>
</tr>
<tr>
<td>VA</td>
<td>Value added</td>
</tr>
<tr>
<td>VLC</td>
<td>Vaggeryd Logistic Center</td>
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1 Introduction

The use of containers to transport goods is increasing every year (Korovyakovsky & Panova, 2011). This means that more ships are crossing the oceans to serve their customers all over the world. The usage of larger ships allows reducing the price of the transportation; therefore, a seaport has a high level of inbound traffic to serve a ship. However, increasing size of the ships raises the shortage of capacity in the seaport. Ships have the highest capacity, of all transport modes, as they can deliver up to 13,000 TEUs at once (Wittskog, 2011). Such a ship equals 160 trains (capacity of 80 TEU per train) or 4,300 trucks (three TEU each). Raising demand for door-to-door transport with a single bill of lading, which usually requires intermodal transportation, and increasing containerisation boost the need for new logistical firms and services (Jarzemskis & Vasiliauskas, 2007; UNCTAD, 1991; Coyle, Bardi & Novack, 2000). Hence, new services of dry ports are likely to become more important.

According to Jarzemskis and Vasiliauskas (2007) the European ports are mostly located in cities, implicating a limitation of space. The result of increasing traffic and increasing size of containerships is that the ports have to handle more goods and containers, at the same time, which fills up the capacity of a port. These trends challenge the European seaports. Hence, in this region, dry ports are started to be seen as an opportunity instead of a treat, due to the ability to reduce road traffic and to gain other advantages. As Frost (2010, p. 2) states: ‘Ports can therefore increase their capacity by establishing a close dry port in their immediate hinterland or at the outer fringes of the city’.

Sweden is one of the largest economies in Northern Europe. According to Trading Economics (2012) ‘historically, from 1993 until 2011, Sweden's average quarterly GDP Growth was 0.70 percent’. The increase of GDP (appendix 1) is an indicator of economic growth; therefore, the need for transportation enlarges every year as well. From the year 2000 the freight volumes as well as the market share increased (Bärthel, Östlund & Flodén, 2011). Therefore, the amount of TEU’s handled in the Swedish ports has increased from 277,797 (2009 Q1) to 370,157 in the same period of 2011 (Eurostat, 2012a,b). This is a steady increase of 33% in two years.

A more recent driver of the logistics sector and dry ports in particular are the changing regulations and interests regarding the environment in the European Union (Van Klink & Van den Berg, 1998; European commission, 2011). This factor together with changes in the market influenced infrastructural improvements in Sweden. The road transport in this region is still more popular in comparison to rail, which lost market share for fifty years. However, the improvements in the sector were started in the 1970’s, when the intermodal terminal infrastructure in Sweden was established. At the beginning about 40 different road-rail terminals were founded (Almotairi, Flodén, Stefansson & Woxenius, 2011). Despite of previous, Swedish Rail Administration, expectations the market became stagnant (Bärthel et al., 2011). Hence, this made transport companies focusing on larger volumes and longer distances, thus, many original terminals were closed.

However, the interest in dry ports regained, in addition to the previously mentioned motives, due to the following reasons: first, the port of Gothenburg changed its strategy to serve the hinterland, by implementing an intermodal network, second the fees for infrastructure were reduced, and third, the deregulation of the rail freight market was com-
pleted. For instance, in Småland, new intermodal terminals were opened as a reaction to changes in the market; thus improving the infrastructure in the region and the logistical sector. The recovery of the industry of Småland was also stimulated by the investments in railway infrastructure (Portrait of the Regions, 2003). Furthermore, large enterprises have opened new warehouses in the district to serve the Scandinavian market (Hultén, 2011).

1.1 Problem statement

The theoretical literature regarding the dry port concept is extensive. However, there is a gap in the theory about the development of dry ports, their provided services and progress in collaboration. Hence, to perform the study, it is practical to base it on concrete examples; therefore, Sweden with its strong economy and increasing logistic region of Småland was chosen.

To start with, a dry port needs a suitable location with good infrastructural connection and space to extend their operations (Rodrigue, Debrie, Fermont & Gouvernal, 2010). The location needs to have an economic significance that is related to the logistical activities. Hence, it becomes interesting to analyse the importance of the location as a dry port needs to make strategic decisions according to this factor as well as ownership structure and the market (Rodrigue, Comotois & Slack, 2009). Consequently, the specifics of the region may influence not only the flow of goods, but also services provided, network of partners and the layout.

Next, the layout is specific to the location of a dry port and there is no universal pattern for an optimal design. Roso, Woxenius and Olandersson (2006) argue that the design depends of several factors; the local conditions, volumes of traffic, and requirements of the market. These facts form the question what are the similarities and differences between the layouts of different dry ports; also, to explore if the layout changed over time and why.

Further, the range of activities performed and services offered by dry ports is very broad (UNCTAD, 1991). They may vary due to several reasons: to start with, location and size of dry port, as well as knowledge possessed, moreover, the most important factor are the customers’ needs. A recent trend for dry ports is to develop physically and to increase their value added (VA) activities, such as packaging, storage, labelling; yet the trend is to outsource most of these services to sub-contractors, meanwhile giving their customers the freedom to choose (Chandrakant, 2011). It becomes evident; the services are influenced by the region and market tendencies. Hence, VA is a considerable part of the competitive advantage of a dry port.

Moreover, due to high costs of transportation in a supply chain (SC), the coordination of the transport network is of the utmost importance (Almotairi, Flodén, Stefansson & Woxenius, 2011). The high level of integration with different actors is needed not only for establishing a transportation network, but also to keep it efficient. Further, the trend to develop collaboration between different actors is stimulated by environmental responsiveness as well. Together the actors, in whole SC, are responsible for the status of the transportation system: they are aware of the image of transportation (Bergqvist, 2007). Therefore, the perspectives and goals of different involved actors are considered in the thesis. Dry ports involve such actors in its network as the (local) government, seaports, terminal operators, rail and road operators, shippers, forwarders and the society in some extent.
The described trends provide the guideline for the adopted research questions which are described in the purpose of this thesis.

1.2 Thesis purpose

The main purpose of this report has explanatory goal; to reveal how dry ports have evolved in the area around Jönköping. The thesis seeks to discover in what form the dry ports can operate and be competitive. The following questions are the building blocks of this research:

- How and why the layout of a dry port changed over time?
- How the value added services that are most requested in the region of Småland, Sweden changed from the beginning of enterprise?
- How the relations with the most important actors changed during the different phases of dry port life time?

In order to cover these questions a literature analysis will be done. The challenges, to establish and develop a dry port, mentioned in the previous section introduce the need for creating an insight in the subject for future dry ports as well as related organisations, which have an interest in intermodal transport or dry port development. To perform this task, two cases were analysed and compared with the literature, using the proper methods. The next chapter presents the concept of the dry port and the variable elements related to a specific case.
2 Literature review

This chapter explains the theory of the dry port concept including definition, characteristics and their functions as well as how to classify the dry ports. Furthermore the advantages and limitations of using dry ports are discussed. The location, design and layout of a dry port will be motioned in this chapter as well as evaluation of a dry port.

2.1 Defining the dry port concept

There is not a single definition that has been agreed on by the academic world. Hence, the mostly used definition identifies a dry port as an inland intermodal terminal directly connected to one of more seaports (Figure 2.1), with a high capacity transport option, most likely rail, where customers can collect or drop off their containers as if they are in a seaport (Roso, Woxenius & Lumsden, 2009). The explanation of this definition is that a dry port is an external site that takes over functions of a seaport; therefore it needs a direct connection with the seaport with a high capacity mode of transport.

Zimmer (1996) has defined dry ports as not just a configuration of pavement and railroad tracks, but as an organisation of services that are integrated with a physical plant to meet the demands of the market (cited in Roso et al., 2009). He explains that a dry port is not only a physical place where shipments are handled, but it also meets the need of the market by providing extra services. Academics, linked to the Economic and Social Commission for Asia and the Pacific (ESCAP, 2010, p. 2) proposed the following definition of a dry port.

‘A dry port provides services for the handling and temporary storage of containers, general and/or bulk cargoes that enters or leaves the dry port by any mode of transport such as road, railways, inland waterways or airports. Full customs-related services and other related services such as essential inspections for cargo export and import, whenever possible, should be put place in a dry port’.

A dry port is an inland terminal with a direct link to a maritime port (Cezar-Gabriel, 2010). This definition is very simple referring to two basic components of a dry port; a container terminal and a direct link to the seaport, mostly done by rail. The following definition of the concept is from the United Nations Conference on Trade and Development (UNCTAD, 1991, p. 2).
‘Dry ports are specific sites to which imports and exports can be consigned for inspection by customs and which can be specified as the origin or destination of goods in transit accompanied by documentation such as the combined transport bill of lading or multi-modal transport document’

Furthermore, a dry port is located inland, at a distance from seaports. Hence, they serve regions with an intermodal terminal offering value added services and a consolidation point for shipments that require different modes of transport (Harrison, McCray, Henk & Prozzi, 2002). Rahimi, Asef-Vaziri and Harrison (2008) give a definition which state dry ports as clusters of logistics and distributions centres located on a main transportation line. Consequently, a dry port is normally located at a distance from a seaport and established to enhance international trade by providing multi modal transportation and value added services. This concept is known as a ‘satellite inland port’, based on the hub and spoke system.

Overall the definitions of the dry port concept are quite similar (appendix 2). The definition that is used in this thesis is a combination of several definitions:

A dry port is an inland intermodal terminal, with a direct rail link to one or more seaports which supplies services that are similar to the ones of a seaport.

Hence, dry ports are very similar to inland terminals. To research the similarity and differences the next paragraph will discuss the inland terminal comprehensively.

2.2 Inland terminals, inland ports & inland clearance depots

Over time different names have been given to an inland terminal. According to Wiegmans, Masurel and Nijkamp (1999) a terminal is a location where goods can be changed to another form of transport. Furthermore, at this point goods are stored or distributed, collected and exchanged; the handling can transpire between the same or different modes of transport.

Notteboom and Rodrigue (2009) discuss the lack of consistency in the terminology regarding the inland terminal concept. They claim that there are three main types of intermodal terminals, which have different requirements to location and equipment. The first type is called seaport terminals. They provide a connection between the sea transportation and the inland systems. This type has the highest level of traffic and requires the largest amount of space and investments. The next type is the rail terminals. They start or end the inland intermodal chain at a port terminal and may connect different terminals by rail or road. The requirements for rail terminals are as demanding as for the seaport terminals; however, a rail terminal is located in a less congested site. The final type of terminals is a distribution centre, offering different value added services, supported by trucking firms. The main services are warehousing, cross docking and transloading maritime container into truckloads or in native containers. Thus, rail terminal and distribution centre definitions are similar to the definition of a dry port mentioned in the previous chapter.

According to Rodrigue, Debrille, Fermont and Gouvernal (2010) inland port is the correct term for an inland terminal because of the function, ownership and the facilities that can differ in size. The main three criteria for an inland port are containerisation, a direct link with a seaport and economies of scale. However, Monios (2011) argues that the
term inland port refers to inland waterway port, especially in Europe, due to the large amount of rivers and canals. Furthermore, he states that the inland ports in the US are larger than those in Europe; therefore, using the term inland port to classify all the worlds’ inland terminals is wrong.

An inland clearance depot (ICD) is a terminal with a special focus on the customs clearance of the shipments at an inland location (Monios, 2011; Garnwa, Beresfold & Petitt, 2009). This location can also be positioned in a landlocked county, because they do not have seaports. According to Ingram (1992) the sea borders are relocated to an ICD, where the goods enter or exit the country (cited in Garnwa et al., 2009).

To conclude this sub-heading the authors can state that there are large similarities between the different terms describing the dry port concept and terminology. In the next part the development of the dry port concept will be presented.

2.3 Development of dry ports

According to Rosa and Roscelli (2009) the first dry ports where established as a solution for the space limitations; a seaport moves several activities to an inland location. Hence, a dry port is created in the process where containers can be dropped off, picked up or stored. Thus, developing a dry port can create a competitive advantage for a seaport. With the increased containerisation of the international trade, which started after the Second World War, the focus of dry ports or inland terminals has shifted from a passive role in the supply chain to an active role; integrating with other actors in the SC (Rodrigue & Notteboom, 2009). The increased relationships between the seaports and dry ports were significant. Following this change the supply chains and logistical networks are seeking new areas to gain profit and add value to the customer. However, they still need to maintain the operational benefits of a dry port.

Thus, Swedish dry port infrastructure has faced lot of changes from the first formations of intermodal terminals to nowadays. Today a real estate company called Jernhusen AB owns thirteen terminals, of which seven are intermodal terminals operated by different companies (Jernhusen, 2011). Moreover, there are plans to establish new dry ports in Sweden by different municipalities and Jernhusen AB. ‘The terminals have, in theory, always been open to all intermodal operators, but as CargoNet and its predecessors operated all the terminals, the new entrants often felt discriminated against’ (Almotairi et al., 2011, p.19). Yet there is an increasing trend for dry ports to collaborate with different intermodal operators, such as Danish ISS TraffCare, Norwegian Baneservice.

In addition, in the literature a trend can be seen that countries and governments are investing in dry ports, infrastructure and communication network. According to Do, Nam and Le (2011, p. 8-9) ‘countries should continue to invest in upgrading roads, modernising ports and constructing dry ports as well as the provision of sufficient cargo/container handling equipment and the streamlining of clearance procedures’.

According to ESCAP (2010) report, the development of dry ports has three major spear points:
- Making the development of dry ports a priority in a country.
- Addressing the opportunities and treats that face the developing dry ports.
- Institutionalising advance of these dry ports at nation-wide level.
The most steps of development require comprehensive analysis and close collaboration with other actors in the supply chain (SC).

2.4 Actors involved with dry port services

There are several actors involved in the concept of a dry port, as mentioned in the problem statement. In table 2.1 these actors are presented, their key processes and main benefits are shown. Furthermore, examples are provided for each type of actor in the table to make it easier to understand the main players of Swedish transportation industry.

Table 2.1 Actors involved in dry port concept (adjusted from Almotairi et al., 2011)

<table>
<thead>
<tr>
<th>Actor category</th>
<th>Key processes</th>
<th>Benefits</th>
<th>Examples of actors in Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shipper</td>
<td>Order the transportation process</td>
<td>Is able to deliver goods efficient to customer</td>
<td>Manufacturers, (e.g. Volvo), retailers (e.g. IKEA)</td>
</tr>
<tr>
<td>Forwarder</td>
<td>Coordinates the total transportation process</td>
<td>Efficient transport over long distances</td>
<td>DB Schenker, Aditro AB</td>
</tr>
<tr>
<td>Shipping line</td>
<td>Transports containers between seaports</td>
<td>Increased capacity for a seaport</td>
<td>Maersk, Nedlloyd</td>
</tr>
<tr>
<td>Seaport</td>
<td>Tranship between different modes of transport</td>
<td>Increased throughput</td>
<td>Port of Gothenburg, Port of Helsingburg</td>
</tr>
<tr>
<td>Intermodal operator</td>
<td>Designs, markets and coordinate the total rail transport service</td>
<td>Efficient transportation from seaport to final customer</td>
<td>GreenCargo AB, CargoNet AB, Van Dieren</td>
</tr>
<tr>
<td>Rail carrier</td>
<td>Operates cargo-trains.</td>
<td>Increased efficiency (less handling time)</td>
<td>Hector rail AB, CFL Cargo AB (Midcargo)</td>
</tr>
<tr>
<td>Dry port/inland terminal operator</td>
<td>Owns dry port, manages the handling</td>
<td>Enables their existence</td>
<td>PGF Tåg AB, Transab AB</td>
</tr>
<tr>
<td>Road carrier</td>
<td>Transport the containers by road to final customer</td>
<td>Single pick-up or deliver point, increased efficiency (less idle time)</td>
<td>Local trucking firms</td>
</tr>
<tr>
<td>(Local) government; society</td>
<td>Initiative taker in development</td>
<td>Development of industries</td>
<td>Municipality, Jernhusen AB</td>
</tr>
<tr>
<td>Society</td>
<td>-</td>
<td>Increased employment</td>
<td>Community</td>
</tr>
</tbody>
</table>

For instance, the government has the largest influence because they can subsidise the project if they are interested in creating jobs, reducing traffic, the air pollution or if they want to boost the local industry. Districts seeking to compete globally have to perform better and to improve their position in order to become attractive places to work and invest (Bergqvist, 2007). Furthermore, different users have the economy of scale to reduce their costs. However, trucking firms will see a decrease in the amount of kilometres, but they can increase the quantity of containers that they transport to and from the dry port.
Rodrigue et al. (2009) state that the transportation industry is integrating in networks linked to several local and regional industries. Furthermore, the authors state that implementing networks is a result of different strategies to enhance the competitiveness advantage of the actors in the network. Almotairi et al. (2011, p. 16) present a similar idea ‘the real future competition will not be between seaports and individual transport carriers per se, but between a handful of total logistics chains’. Hence, together the actors mentioned in the table make it possible to operate and develop a dry port.

2.5 Dry port characteristics

According to the literature review, there are three fundamental characteristics of a dry port: connecting different transport modes, daily rail connection, and value added services (table 2.2).

Table 2.2 Fundamental dry port characteristics (own illustration)

<table>
<thead>
<tr>
<th>Fundamental dry port characteristics</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>An intermodal terminal</td>
<td>Cezar-Gabriel, 2010 ; Roso et al., 2009 ; Rahimi et al., 2008</td>
</tr>
<tr>
<td>Connected directly with the port terminal (a high capacity corridor)</td>
<td>Jarzemskis &amp; Vasiliauskas 2007; Roso et al., 2009; Korovyakovksy &amp; Panova 2011; Rahimi et al., 2008; Roso &amp; Lumsdensen, 2010</td>
</tr>
<tr>
<td>Provides supportive logistics activities</td>
<td>UNCTAD, 1991; Rahimi et al., 2008; Roso et al., 2009; Roso &amp; Lumsdensen 2010</td>
</tr>
</tbody>
</table>

The thesis focuses at the third characteristic; therefore, just this characteristic is explored further. The comprehensive part of activities provided in a dry port seeks to satisfy and fulfill clients’ needs and to increase competitive advantage. These VA activities increase value of the goods during processing, consolidation or distribution process (Rahimi et al., 2008). Authors also indicate VA activities as packing, testing, refining, assembling, sorting, and dividing shipments for local deliveries as well as consolidate several shipments into a single, efficient, shipment. Customs clearance, stuffing, stripping, storing empty and load containers, in addition to, repair services of containers and different modes of transport should be available at a dry port with full services (Roso et al., 2009). Korovyakovksy and Panova (2011) expand the list of value added services by mentioning tracking, road haulage, and transport security activities provided in dry ports. The different functions a dry port can perform are noted in table 2.3.

Further, the smart solutions can be offered as ‘efficient and cost-effective managerial decisions’, when all necessary operations are performed for one customer. This requires alignment of all involved actors, ICT (information communication technology) infrastructure, and collective planning (Van Woensel, 2012). Hence, door-to-door as well as truck and trace services can be indicated as smart services. In addition services need an integrated package (Notteboom & Winkelmans, 2001).
Table 2.3 Basic functions and activities of the dry port (own illustration)

<table>
<thead>
<tr>
<th>Functions of dry ports</th>
<th>Description</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation functions</td>
<td>Cargo-handling function such as consolidation, deconsolidation, loading, unloading, and reloading. Releasing to the customs just before the merchandise leaves the dry port.</td>
<td>Rahimi et al. 2008 Roso &amp; Lumsden, 2010 UNCTAD, 1991 ESCAP, 2010</td>
</tr>
<tr>
<td>Container depots</td>
<td>Storing surplus containers, acting as an empty containers supply point and maintenance and repairing containers under contract.</td>
<td>Rahimi et al. 2008 UNCTAD, 1991</td>
</tr>
<tr>
<td>International port functions</td>
<td>Customs inspection and clearance performed at dry port location. Safety/security procedures have to be taken into account.</td>
<td>Rahimi et al., 2008 Roso &amp; Lumsden, 2010 ESCAP, 2010</td>
</tr>
<tr>
<td>Information technology functions and communication</td>
<td>Freight management requires information system linking customs with seaports, customers and service providers.</td>
<td>UNCTAD, 1991 ESCAP, 2010</td>
</tr>
<tr>
<td>Other functions</td>
<td>Freight forwarding, immigration related services, repairing vehicles, fumigation, documentation, billing and cash collection, customers and drivers facilities.</td>
<td>UNCTAD, 1991 Rahimi et al. 2008 ESCAP, 2010</td>
</tr>
</tbody>
</table>

Most of activities and functions performed by a dry port require a high knowledge level and vast investments for equipment and machinery. Therefore, some dry ports outsource services to third parties to reduce costs (Chandrakant, 2011). Dry ports seek to be located close to main highways, railways and even airports. There is a trend to allocate dry ports in an area which has potential to be developed as an industrial zone or production centre (ESCAP, 2010). Even so, the important goal for success is to be equipped with reasonable numbers of cargo handling machinery, since, according to Roso et al. (2009), UNCTAD (1991) and ESCAP (2010), Rodrigue et al. (2009) terminal capacity depends on a function of terminal surface, stacking height, number of docks, with number and type of machinery. Handling equipment and systems used in a dry port: lifting equipment, portage equipment, equipment needed for other VA services. Facilities for efficient handling of containers and other cargoes are rubber-tired or rail-mounted gantry cranes, quay or yard cranes, reach stackers, tractor-trailer system, tug masters. The main used equipments are presented in figure 2.2.
By knowing the main characteristics of a dry port, they can be classified into specific groups. The following paragraph discusses the different ways to sort dry ports. Classifying makes it easier to evaluate the dry ports, because their specifications are not always the same.

### 2.6 Classification of dry ports

One way to categorise dry ports is based on the distance to the seaport and the function of the dry port (Roso et al. 2009; Do et al. 2011). The three categories are identified: distant, midrange and close dry ports. The *distant dry port* is the traditional dry port, located more than 500 km away from the seaport (Van Klink & Van den Berg, 1998). The main reason to use a distant dry port is to reduce the costs. Hence, the distance and quantity of goods transported make it feasible. Further, the *midrange dry port* is located within the distance that is covered by road transport (Roso et al., 2009). They serve as a consolidation point, and offer several other services including customs clearance and administration. Moreover, a midrange dry port serves as a storage buffer in order to free capacity in the seaport. To continue, *close dry ports* are located just outside the city where the seaport is located (Roso et al., 2009). Their main functions are consolidation and relieving traffic on the city streets and at the seaport, conducting customs clearance. Also these terminals act as the ‘front door’ of a seaport, the place where the shipper will pick up or drop off containers.

The second way to categorise the dry ports is based on a modified ‘product lifecycle’ (Harrison et al., 2002). The idea behind this method is that over the lifetime of a dry port the productivity will grow slowly at first and when the dry port is successful, it will grow faster towards a more stable process. The different stages a dry port can be in are: preparation, establishment, expansion, stabilisation and decline/innovation. Rodrigue et al. (2009) adapted this model. Authors use the same stages; however, the phases are named using synonyms. Figure 2.3 clarifies the evolution process of dry ports.
Figure 2.3 The inland terminal life cycle (Rodrigue et al., 2009).

According Harrison et al. (2002) and Rodrigue et al. (2009) the preparation (planning) phase is the first stage of the development that makes the proposal operational. This phase can have a long time span, because it is critical to establish the foundation of the dry port thoroughly to have an effective relationship with the different partners. The second phase, named establishment (setting), is after the dry port becomes operational and the first orders are coming in. It is important to become well known and earn a good reputation for the dry port to attract more investors, in order to develop the dry port in an efficient and ecological way. The third phase is the expansion (growth) of the established dry port in which new modal elements might be included. The fourth phase is the stabilisation (maturity) in which the dry port becomes firmly established in the market. At this level the dry port has reached its maximum capacity or it will reach its maximum capacity soon. Hence, the local community are now benefiting of the presence of the dry port. The last phase is the decline/innovation. Here the dry port either innovates, to keep their business or to keep growing. Otherwise, the dry port starts to decline.

Besides that, dry ports might be classified according to size, means of access and value added services (Cezar-Gabriel, 2010; Wiegmans et al., 1999; Almotairi et al., 2011). The first criterion proposed allows classifying dry ports into four categories from small to medium, large or even mega ones. Dry ports are compared according to their capacity (TEU handled in the terminal usually per year). The second criterion allows sorting dry ports in terms of layout of the facility and the infrastructure around it. As mentioned in the report of United Nations ESCAP (2010) dry ports can be differentiated between rail-based and road-based. In the report the main advantage for the road-based dry port is an effective consolidation and distribution of cargoes in land-locked countries and increasing freight load aspects (mainly for return trips) for trucking firms. The third parameter suggested by Cezar-Gabriel (2010) is extra value added services the dry port can provide. In this way dry ports can be seen as having minimum amount of VA activities or with great variety of different services. They can be pointed to specific products (e.g. frozen, refrigerated, perishable, fragile or dangerous goods) and specific activities (containers maintenance, containers stuffing or stripping, handling and storing). Thus, different VA services might be understood as competitive advantage over dry ports in nearby locations. Moreover, the Port of Gothenburg has generated a grading system (one to five stars, comparing geographical location, services range, safety and security and the condition of the area, buildings and equipment) based on similar criteria (Port of
Gothenburg, 2012). The primary goals of this grading system are to support the marketing operations of the port of Gothenburg, to create a distinction between the different rail terminals. However, this system also has the ability to influence the development of dry ports as they seek to gain a better evaluation.

2.7 Advantages of dry ports

In this paragraph the advantages of implementing a dry port are discussed. The advantages are divided over the actors: shippers, rail and road operators, the government (city, province or country), seaport, and the community.

The main advantage for the shippers (in this thesis they are defined as a company that sends their shipment from point A to point B) is that a dry port increases the efficiency; therefore, it will reduce the costs of transportation of a shipment (UNCTAD, 1991). The main way how a dry port reduces the cost is by consolidating the shipments and therefore utilising the economies of scale. Moreover, the usage of this concept improves the access to the seaports (Roso, 2010). According to Morash (1999) a successful dry port reduces the transportation related waste, which adds cost instead of value. Likewise, Harrison et al. (2002) states that dry ports are starting to attract attention of organisations, because the concept provides a way to improve transportation-related costs of supply chains.

There are gains for the rail and road operators working together with the dry port (Roso, 2010). Starting with the rail operators, they have access to the economies of scale which reduces the fixed cost per container; moreover, their market share increases. Moving on the road operators, they spend less time on the congested roads and in a seaport terminal. Therefore, the time they use on one shipment decreases; thus, they can handle more shipments in the same time.

Further, the most significant benefits for the government are the ability of the dry port to reduce the road congestion in the area of the seaport (Roso, 2008; Henttu, 2011; Rahimi et al., 2008; Trainaviciute, 2009; Nosorowka, 2010). Hence, the truck traffic from and to the seaport will decrease, since the containers/cargo are loaded directly from the ship onto a train for the next step of the transportation. Consequently, a direct positive result is the decrease in pollution.

The first positive input for the seaports is that it enables a seaport to serve a larger hinterland. Hence, a dry port can also be located in landlocked countries (ESCAP, 2010). The second benefit is the increased throughput of containers which enables a seaport to serve more ships without physical expansion (Notteboom & Winkelmans, 2001; UNCTAD, 1991). Thirdly a dry port can be used, according to Henttu (2011), to balance out the stress (congestion in terminals).

To conclude this paragraph, the main advantage of local community is the increase in the amount of jobs in the area, since establishing a dry port can increase the local economy, attract new distribution and manufacturing industries to the region (Rahimi, 2008). Furthermore, local businesses have easier access to the global market, because the dry port and the seaport are gateways for the world.
2.8 Disadvantages for dry ports

The dry port concept does not only have advantages, but it also has few limitations. The first disadvantage is that the complexity of the transport system increases (Henttu, 2011). To give an example, the times that a shipment has to be handled may sometimes increase. Furthermore navigation of the containers becomes more complicated, when more dry ports get involved in the shipment. These limitations may be understood as examples of organisational boundaries.

An example of a practical restraint for opening a dry port is that the initial costs are very high, therefore, implementing dry port is expensive (Henttu, 2011; Do et al., 2011; Rodrigue et al., 2009). The question arises who is going to pay for the establishment of the dry port. Besides that, the railways do not reach every city; moreover, in Europe they are already crowded with passenger transport. Further, Bärthel et al. (2011) indicate the problem considering modern electric locomotives in Sweden. The lack of cooperation and a common goal for rail companies and intermodal operators, to establish sustainable transportation system, therefore, the right investments are still a problem.

To sum up, the rail infrastructure is an important factor in selecting the location of a dry port. Further, the selection of the location will be discussed as well as the most optimal way to organise the layout of a dry port.

2.9 Location, design and layout

The method for determining the optimum location of a dry port is given by Rahimi et al. (2008). A range of characteristics are grouped in three areas that influence the location analysis: first, there is the site selection, secondly, the elements required to operate a dry port, and finally, the VA services, for the distribution functions, offered by the dry port.

The critical requirement for the site selection is if there is enough demand for intermodal freight transportation and a local supply of a carrier service (Rahimi et al., 2008). Besides that, there has to be a good basis for community relationships and finally enough public and private capital to fund the development. To continue, there has to be the needed physical infrastructure to operate a dry port successfully. In addition, the suppliers and customers need to be in the proximity. Further, the political and tax climate need to be supporting to the implementation of a dry port. The last part of selecting the right site is the VA services, of the dry port, which has meet the demand of the customers.

Furthermore, there are different ways to establish a dry port. The first method can be compared with a push-strategy. In this method the seaport has a need for establishing a dry port to ensure the competitive advantage. Hence, the seaport will try to find a suitable location with the requirements listed in the previous paragraph (Rosa & Roscelli, 2009). The other method can be linked to the pull strategy, as a location uses different marketing tools to promote itself. In addition, the design of the dry port needs to be based on the expected volume (Younis, Kamar & Attya, 2010).

To conclude, there is no optimal design and layout for a dry port, because the layout depends on the specific site, services offered and on the amount of traffic that a dry port handles. However, some main rules still exist. To start, a dry port has a rail siding con-
Container yard, container freight station, gate complex, boundary wall, roads, pavements, repair and maintenance, office buildings, tracks should be connected on both sides to the main rail line, and public facilities (UNCTAD, 1991; Rodrigue et al., 2009). As an example, a dry port that handles at least two trains a day should have a separate container yard to increase cranes productivity as well as to create a buffer for traffic fluctuations, and to store the containers safely. When a dry port has a separate container yard the flow for the containers needs to be regulated in a way that the operations go smoothly, e.g. enforcing one-way traffic in the dry port that goes in a circle. The tracks should be joined at both ends to the main rail line to facilitate two-way entry and departure of the trains. Furthermore, there should be enough space for the equipment to manoeuvre (UNCTAD, 1991).

‘While establishing a Dry Port, the choice of location makes an important impact on future performance, especially, considering that it is an intermodal terminal, having rail connection with the port. The intermodal transportation can be attractive for the shippers when the overall expenses are the same or smaller than the ones of road transport’ (Trainaviciute, 2009, p. 34).

2.10 Performance measurements

According to Harrington (1991, p. 164) ‘If you cannot measure it, you cannot control it. If you cannot control it, you cannot manage it. If you cannot manage it, you cannot improve it’. The activities have to be analysed systematically and compared with an old data to make improvements seeking overall performance of the company and meeting customer’s needs better. Terminal customers (as well as their handling orders) are tending to be attracted to the dry port by using the equipment more efficient than others and having experienced staff (Cezar-Gabriel, 2010). Performance indicators are used in order to move terminals to standardised processes for collecting and evaluating data on the performance of dry ports (Kumar Shukla, Garg & Agarwal, 2011). Performance assessment has to be understood as an important strategic tool which also helps to accomplish the objectives required for fulfilling a firm’s mission and strategy.

The criteria for the evaluation of performance of dry port have to be chosen thoughtfully. Main rules for good measures are that they have to be quantitative, easy to understand for everyone in the company and they have to encompass outputs as well as inputs (Coyle, 2003, cited in Jensen, 2011). A firm is likely to focus measurements on financial data such as return on investment or sales, turnover, capital return, price variances, sales per employee, productivity and profit per unit production (Kumar Shukla et al., 2011). Efficient process supervision requires not only financial measurements. There is also a need to collect information about the operational performance (UNCTAD, 1991), and to measure the offered value (Trainaviciute, 2009). Almost all companies seek to evaluate effectiveness and efficiency to improve their activities. Other important categories usually measured are: time, quality, cost and efficiency (Kallio, Saarinen, Tinnila & Vepsalainen, 2000). The most appropriate criteria and indicators for dry port evaluation are given in table 2.4.
Table 2.4 Criterions and indicators used to evaluate dry port performance (Wiegmans, Van der Hoest & Notteboom, 2008; UNCTAD, 1991; Cezar-Gabriel, 2010, own illustration)

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transhipment cost</td>
<td>Handling cost/TEU, storage cost/TEU</td>
</tr>
<tr>
<td>Speed (Container handling time)</td>
<td>TEU/crane/hour</td>
</tr>
<tr>
<td>Reliability</td>
<td>Number of false handlings (handling of empty containers)</td>
</tr>
<tr>
<td>Flexibility</td>
<td>-</td>
</tr>
<tr>
<td>Capacity</td>
<td>Maximum capacity/year</td>
</tr>
<tr>
<td>Terminal productivity</td>
<td>Moves per hour</td>
</tr>
<tr>
<td>Cost efficiency</td>
<td>Out-of-pocket and time costs of port calls and cargo handling</td>
</tr>
<tr>
<td>Storage of containers in the yard</td>
<td>TEU/day</td>
</tr>
<tr>
<td>Throughput</td>
<td>TEU handled a day/week/month</td>
</tr>
<tr>
<td>Average storage time of goods</td>
<td>-</td>
</tr>
</tbody>
</table>

Better customer service might begin with improvements in VA services for customers: lower cost of the transport, faster unit transportation to and from the seaports, lower storage rates, speedy improvements for customer clearance (Wiegmans et al., 2008; ESCAP, 2010; Younis et al., 2010; Roso et al., 2010). Moreover, the list might be extended by such activities as having operating hours that accommodate needs of most of their users, efficient loading and unloading (minimisation of re-handling), and transhipments of containers. Besides that, port security, safety and environmental profile of the port have to be evaluated, yard capacity and utilisation have to be improved and maximised. Organisational structure of a dry port has to facilitate operations efficiently. All those above may determine the attractiveness of a dry port and influence its development.

Further, following the trends for just in time and supply chain management in the company is not enough to evaluate performance. Therefore, SC performance has to be estimated. According to Bergqvist (2007) it is worth to measure the level of consolidation of different modes of transport and harmonisation with the environment. Most authors indicate that the assessments have to be performed by different actors taking into consideration the entire network of a dry port. Though, due to scope of the thesis this issue will not be addressed deeper.

The main conclusion after completing the literature analysis is: there are multiple elements included in the dry port concept which are highly connected. Those essentials are developing over the dry ports’ life time. Implementing the dry ports, such elements as involved actors and role in the SC have to be considered. In the setting stage, location and the market analysis have to be accomplished, the optional layout design created. Further in the life cycle, continuous improvements have to be made in order to compete and increase efficiency and effectiveness. The functions performed by the dry ports require a high level of knowledge and investments for equipment, which have to be supported over the time. Thus, such elements as possibility to expand, direct connections with associated actors, intermodal transportation and value added services are the main characteristics needed to gain competitive advantage (Rahimi et al. 2008).
3 Methodology

This section of the thesis discusses the methods and approaches used to gather and analyse the raw data from and about the dry ports. Moreover, the contact companies chosen for the study are introduced as well as the framework of the study is presented.

According to Bryman (2008) methodology is used to uncover the assumptions and practices that are common in these methods. Author defines a method as an instrument of data collection and analysis. In this thesis, the following steps were taken before the analysis was made: the information regarding methodology was collected by using different library sources and internet-based databases; further, the collected data was analysed and the most appropriate methods and tools were selected. The literature framework helped to decide which methods have to be used and provided the framework of the study. The analysis part was used to evaluate the results gathered, to generalise them and to gain comprehensive understanding.

In order to determine to what extent the dry ports in Småland have been developing and to establish which steps the dry ports took to reach their current level, the following objectives were identified. The objects of this study were the representatives of dry port operators and other actors.

The objectives of the study were:

- Define the changes in layout of the dry ports in Småland and the triggers for those alterations;
- Assess the variation of services offered by the dry ports over time and identify what value added services fulfil the need of the current customers;
- Uncover the typical network of a dry port: who are the most important actors and in what way, did the relationship change over time.

In order to reach the objectives appropriate methods have to be chosen. These are presented in the following paragraphs, starting with the research approach in the next sub-heading.

3.1 Research approach

There have been two major traditions of research in social sciences according to Williamson, Bow, Burstein, Drake and Harvey et al. (2002). Starting with the positivist in which researchers used methods in social sciences that are proven in natural sciences (e.g. using statistical research which has been developed for natural sciences). The other method is interpretive. During a research with this method the gathered information was stretched. The authors state that researchers need an understanding of these methods in order to conduct their study effectively.

Furthermore, there are two approaches of doing research; the deductive and the inductive method (Seth & Zinkhan, 1991; Zikmund, 2000; Williamson et al., 2002). The deductive method uses a general fact, known to be true, to develop a theory in order draw conclusions regarding a hypothesis (Seth et al., 2000). On the contraire, the inductive method takes specific observations to collect data and to develop, after the analyses, a general theory (Johnson & Duberley, 2000; Williamson et al., 2002). Thus, the induc-
tive method, which is interpretive in nature, matches this research since it is relying on empirical findings from data collection, at the researched companies, and on current theories to fill the gap in theory.

### 3.2 Methods used

To conduct a study, there are two basic methods possible. To start with, the traditional empirical *quantitative* method usually has the form of a questionnaire in which the respondents receive fixed questions to answer. However, quantitative methods are not adjusted to explain personal behaviour, attitude or estimation. On the other hand, the *qualitative* method is adapted to include explanation of personal factors (KTU e-learning technology center, 2008?). The main differences between these two models are presented in table 3.1.

Table 3.1 Qualitative and quantitative model (adjusted from Unterhauser, 2006)

<table>
<thead>
<tr>
<th></th>
<th>Qualitative study</th>
<th>Quantitative study</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal</strong></td>
<td>Gain qualitative comprehension about substantial reasons and motives</td>
<td>Assess data and spread the results for the whole population</td>
</tr>
<tr>
<td><strong>Scope</strong></td>
<td>Small non presentable cases number</td>
<td>Large amount of presentable cases</td>
</tr>
<tr>
<td><strong>Data gathering</strong></td>
<td>Non structural, qualitative</td>
<td>Structural, quantitative</td>
</tr>
<tr>
<td><strong>Data analysis</strong></td>
<td>Non statistical, analytical or conceptual generalisation</td>
<td>Statistical generalisation</td>
</tr>
</tbody>
</table>

Qualitative method notices and assesses more small nuances. According to Pranulis (2007) quantitative method often does not show those differences, which are easily found when using a qualitative method. Furthermore, it is thought that qualitative type of study is gaining more popularity, because of the need to do contextual work. This method generates descriptive data: ‘people’s own written or spoken words and observable behaviour’ (Taylor & Bogdan, 1998, p. 5). Williamson et al. (2002) emphasise the importance of descriptive data. According to Babbie (2004) there is a need to observe the market and the behaviour of different actors in order to gain accurate knowledge. This method was seen as the most appropriate to gain the needed insight for the thesis.

According to Taylor and Bogdan (1998) in-depth interviewing is a qualitative analysis tool that involves conducting an intensive, usually face-to-face or telephone conversation (table 3.2). This allows a deeper insight of a small number of respondents. Considering the time frame and goals the *semi-structured* interview method was chosen to obtain the information. The interview method might be classified into three types: unstructured, semi-structured, and structured. Williamson et al. (2002) mention that in an unstructured interview, the previous answer generates the next question. With a structured interview the interviewees are all given the same pre-established questions. However, a semi-structured interview has pre-determined questions, but the interviewers are free to follow up on an answer.
Table 3.2 Interview types used during the case study (Sekaran, 2003, own illustration)

<table>
<thead>
<tr>
<th>Interview type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face-to-face</td>
<td>Questions can be adapted, doubts clarified; Possibilities to ensure that respondents are understood properly; Non-verbal clues can be picked (e.g. unconscious body language).</td>
<td>Geographical limitations; Vast resources needed; Hard to evaluate interviewer biases; Hard to secure the anonymity of respondents.</td>
</tr>
<tr>
<td>Telephone</td>
<td>Short time period is needed to reach different people; Might eliminate discomfort to face interviewer; Facilitate personal information disclosing.</td>
<td>Respondent may easily refuse participate in the study; Not possible to gather nonverbal information;</td>
</tr>
</tbody>
</table>

To accomplish the study, the network of actors was analysed. Further paragraphs present the study resources and the way the intensive analysis for individual units were completed.

### 3.3 Case study

According to Williamson et al. (2002) a case study can be used to reach various objectives. Starting, describing a hypothesis, development of a theory and finally, testing a theory as described by Cavaye in 1996 (cited by Williamson et al., 2002). Furthermore, the authors state that a case study can be used to generate an assumption or to explore dimensions where current knowledge is limited. Regarding the problem statement of this thesis, the objective was to gain new insights in an area where current knowledge, about the development of dry ports, is limited. The scope of this research was determined to only two cases and a limited amount of respondents (appendix 3) as proposed by Gummesson (2000). The addressed experts are introduced in the sub-chapter **Data collection.**

There are two important types of a case study (Gummesson, 2000). The first one tries to form **general conclusions** from a selected number of cases. The other type has the goal to reach a **specific conclusion** for one case, because the history of that specific case is of great interest. The author argues that one of the main pros to use a case study is that this method can **generate theory** and **initiate changes.** With the given time-frame, this method was used to generate a respective conclusion and to improve overall understanding of the thesis subject. Therefore, the limitations of the case study were considered in advance.

### 3.4 Limitations of the study

To start with, some limitations are based on the time frame and the scope of this study. This case study can be identified as a cross-sectional: completed by a respondent at a given point in time (Rindfleisch, Malter, Ganesan & Moorman, 2008). In comparison, the longitudinal study contains repeated cross-sectional studies, which would have demand extra investments in terms of time and money.
Furthermore, Taylor and Bogdan (1998) state, that the interview method has time constraints as interviews are dependent on the participants. They need to free up time for the meeting or a telephone conversation. As it was mentioned before, the usage of a telephone to conduct interview excludes the opportunity to gather non-verbal information. Moreover, the trust issue is always a problem. Furthermore, the actual actions are not necessary equal to the answers given as well as the sensitive or unfavourable data might be concealed. Besides that, the language barriers might bring misunderstandings as none of the participants or the interviewers is a native English speaker.

The main limitations of this case study were being excluded by using the following methods. Firstly, selecting the proper case and understanding the translating dynamics of the situation correctly as indicated by Sekaran (2003) and Williamson et al. (2002). The selection required a thorough consideration of the interview questions, amount of cases needed and appropriate methods to analyse the data.

To minimise the chance of refusing participation in the study, for telephone or face-to-face interviews, thesis authors used Sekaran (2003) suggestions. The interviewees were called ahead of time to request their contribution towards the survey. During the initial telephone contact the subject of questions and an approximate idea of how long the interview would last were given. Moreover, a mutually convenient time was arranged. However, the authors still faced a problem when trying to conduct telephone interviews with some related actors. The time of the interviewees was limited; hence, the authors were convinced to send open questions via email for some respondents. It was agreed upon the possibility to call, and get deeper explanation regarding their answers, only if some uncertainties occurred.

3.5 Case study design

In this thesis the authors used techniques appropriate for qualitative methods. Thus, a holistic approach was used to evaluate settings and people (reviewed as a group). Thesis authors interacted with the information in a natural and unobtrusive manner and it was tried to understand respondents using their own frame of reference, humanistic (Taylor & Bogdan, 1998). The case study appeals to ethics, law principles, and appreciates experts’ goodwill, avoid using any kind of pressure, to secure that the data is used in a thoughtful manner. Moreover, all the participants were informed about the goals of the study and were asked to answer all the questions thoughtfully by skipping those which cannot be answered due to confidential constraints.

In order to achieve the study objectives the authors used the framework of Peppard (2001) as a basis, however, instead of a longitudinal a cross-sectional case study was used (figure 3.1). Furthermore, before analysing all available data, the information was gathered from different sources.
Figure 3.1 Case study design (adjusted from Peppard, 2001).

For the first step data collection different qualitative questions were prepared in close relationship with the scientific literature analysis. The semi-structured interviews were prepared using Unterhauser (2006) and Pranulis (2007) their recommendations. Second, the analysis was made of the case studies in consideration to the data from previous studies made about companies from Småland’s logistics industry in order to concretise and compare the results. Third, the cases were described and analysed considering the gathered data from the involved actors, the explanations were made as well as similarities and differences revealed.

### 3.6 Data collection

The authors had decided to use a case study; therefore, two dry ports were identified in the Jönköping area to be the focus of the in-depth, contextual analysis. The respondents were selected after researching which area in Sweden has potential for a dry port. The Jönköping, Nässjö and Vaggeryd triangle occupies a split third place in the list of the most important logistical areas in Sweden (Hultén, 2011). The author also states that this triangle is on the rise from 2005 (8th place) to the third place in 2011. Furthermore, the midrange dry ports in Nässjö and Vaggeryd had been the subject in previous studies and documentation (which gave wider understanding for the study). Thus, the cases were chosen as purposeful samplings. Following, most of involved actors, as well as ports of Gothenburg (PoG) and Helsingborg (PoH), were contacted using a snowball effect (Pauwels & Matthyssen, 2004). Hence, the initial companies provided contact details for other associated actors.

The cases have a limited amount of main networking actors involved in the daily operations. Thus, much to regret of the authors, there were a few companies who could not participate in this study. Some of them regarded the information as confidential, others forwent due to time constraints or other reasons. The companies that the authors were trying to contact, but not succeeded, were CargoNet, Nässjö Näringsliv AB, Intercontainer Scandinavia, Van Dieren, Jernhusen AB, and Schenker Logistics AB. In the table 3.3 the methods used for different interviewed actors are presented, summarising the interview guidelines.
Table 3.3 Methods used for different actors (own illustration)

<table>
<thead>
<tr>
<th>Actors (interview guideline)</th>
<th>Method</th>
<th>Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>The dry ports <em>(appendix 4)</em></td>
<td>Semi-structured interview</td>
<td>Establishment; Development; Value added services.</td>
</tr>
<tr>
<td>Port of Gothenburg <em>(appendix 5)</em>; Port of Helsingborg <em>(appendix 6)</em></td>
<td>Semi-structured interview and open questions</td>
<td>Reasons to integrate; Level of integration; Perspectives for using dry ports.</td>
</tr>
<tr>
<td>Associated actors <em>(appendix 7)</em></td>
<td>Semi-structured interview and open questions</td>
<td>Reasons to collaborate; Benefits of dry ports; Insight in the development</td>
</tr>
</tbody>
</table>

The case companies and PoG were interviewed face-to-face, the related actors, including the PoH, were contacted by phone or via email, because it included several contacts from different locations. The interview guidelines are presented in the appendices as indicated in the table. Thesis authors accessed 20 companies and contacted even more people in order to reach the right persons with the needed knowledge. Eventually, authors accomplished the study with aid of 14 experts from 14 companies (table 3.4).

Table 3.4 Persons contacted for the study (own illustration)

<table>
<thead>
<tr>
<th>Company</th>
<th>Category</th>
<th>Expert</th>
<th>Position</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vaggeryds Kombiterminal</td>
<td>Dry port</td>
<td>Carl-Gunnar Karlsson</td>
<td>Näringslivsråd enterprise director</td>
<td>2012-03-16</td>
</tr>
<tr>
<td>PGF Tåg AB</td>
<td>Terminal operator</td>
<td>Henning Berggren</td>
<td>Marketing director</td>
<td></td>
</tr>
<tr>
<td>Höglandets terminal</td>
<td>Dry port</td>
<td>Anders Wittskog</td>
<td>Sales manager</td>
<td>2012-04-05</td>
</tr>
<tr>
<td>Transab AB</td>
<td>Terminal operator</td>
<td>Rune Petersson</td>
<td>Logistics manager</td>
<td></td>
</tr>
<tr>
<td>Logpoint AB</td>
<td>Municipal organisation</td>
<td>Sofia Runn</td>
<td>Marketing communicator</td>
<td>2012-05-10</td>
</tr>
<tr>
<td>Port of Gothenburg</td>
<td>Seaport</td>
<td>Stig-Göran Thorén</td>
<td>Senior Manager Business Development</td>
<td>2012-05-08</td>
</tr>
<tr>
<td>APM Terminals</td>
<td>Terminal</td>
<td>Hans Gutsch</td>
<td>Key account Manager</td>
<td>2012-05-08</td>
</tr>
<tr>
<td>Port of Helsingborg</td>
<td>Seaport</td>
<td>Oskar Jonsson</td>
<td>VD assistant</td>
<td>2012-04-17</td>
</tr>
<tr>
<td>Hector rail</td>
<td>Rail carrier</td>
<td>Jonas Swartling</td>
<td>Commercial manager</td>
<td>2012-04-02</td>
</tr>
<tr>
<td>Green Cargo</td>
<td>Intermodal operator</td>
<td>David Larsson</td>
<td>Logistics developer of Production</td>
<td>2012-05-02</td>
</tr>
<tr>
<td>Trafikverket</td>
<td>Transport authority</td>
<td>Lennart Andersson</td>
<td>Regional manager south Sweden</td>
<td>2012-04-11</td>
</tr>
</tbody>
</table>
Table 3.4 continued

<table>
<thead>
<tr>
<th>Company</th>
<th>Category</th>
<th>Expert</th>
<th>Position</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Svensk Logistikpartner AB</td>
<td>Carrier</td>
<td>Dennis Johansson</td>
<td>Director</td>
<td>2012-04-02</td>
</tr>
<tr>
<td>Waggeryds Cell AB</td>
<td>Shipper</td>
<td>Jessica Fredriksson</td>
<td>Logistics coordinator</td>
<td>2012-04-04</td>
</tr>
<tr>
<td>Trafikforskning AB</td>
<td>Transport research</td>
<td>Maria Mustonen</td>
<td>Researcher</td>
<td>2012-04-23</td>
</tr>
</tbody>
</table>

The meeting including the presentation and site visit of Vaggeryds Kombiterminal with PGF AB lasted two hours. The Nässjö dry port representative gave a comprehensive interview for one and a half hour. During the study both terminal operators were eager to help and answered several e-mails giving additional data for the thesis. The one hour long interview with PoG gave needed insights and a wider understanding. The PoH and related actors were contacted by telephone. For most of them the open questions were sent by e-mail; when the need occurred, thesis authors contacted them for a short (5 to 20 minutes) conversation to ascertain the findings from the questions.

3.7 Validity and reliability

A thesis is usually argued on the method used to perform the study. A criticism that frequently returns is that a case study lacks the statistical data and has only one point of view (Gummesson, 2000; Rindfleisch at al., 2008); thus, a lack validity and reliability.

To start with, validity is the extent to which the method provides the right answer; therefore, it is not only relative to the tools used, it relates also the type of data collected and the context of a study (Gabor & Gabor, 2010). Pauwels and Matthyssens (2004) argue that validity is supported by four columns, which need to be addressed: theoretical sampling, triangulation, pattern-matching logic, and analytical generalisation. Theoretical sampling relates to the combined selection of cases to generate valid outcome of the study. Thus two dry ports and multiple associated actors were selected for this thesis; multiple data sources were combined in order to exploit triangulation approach. Further, the outcomes of the cases were compared to each other and relevant literature.

‘The goal of reliability is to minimise the errors and biases in a study’ (Yin, 2003, p. 37). Thus, a guideline how to accomplish a study was created, besides that the method of the study was found to be well documented. The thesis authors have adopted and adjusted the case study design of Peppard (2001) to make sure this thesis meets the demands for both, validity and reliability. Hence, this study is based on the findings of several semi-structured interviews and open questions with the goal to compare different ideas and to uncover correspondences.

To sum up the methodology chapter, interpretive inductive information analysis was used to evaluate the study in order to cover the gap in the literature about the dynamics of dry ports evolution. A qualitative case study method was chosen. Semi-structured, face-to-face interviews were conducted with case companies and a few actors; open questions were sent to other companies due to emerged obstacles thought. Besides, the limitations were considered in advance and narrowed with appropriate tools. Further, the validity was increased by purposefully chosen cases and considerable amount of related actors. Thus, triangulation approach was used.
4 Empirical part

The following chapter offers the gathered data of the two studied cases. Starting at the dry ports and continuing with network of associated companies. The establishment, services, location, and layout are also being described shortly.

4.1 Vaggeryds Kombiterminal

The dry port located between Vaggeryd and Skillingaryd, about 40 kilometres from Jönköping, is called Vaggeryds Kombiterminal. The terminal is linked to the port of Gothenburg with a direct rail shuttle. The rail shuttle is operated by Intercontainer Scandinavia AB and connects Vaggeryds Kombiterminal 6 times a week to the port (Port of Gothenburg, 2012). Vaggeryd’s dry port is located in the hinterland (200 kilometres) of the port. According to Mr Berggren this fact limits the effective market, but the terminal has the potential to eliminate this problem by operating a new rail shuttle, thus, serving a new market.

Vaggeryds Kombiterminal is the first Swedish dry port that has been integrated, in June 2010, with the PoG. The terminal is presented as the hub of operations for Vaggeryd Logistic Center - VLC (Vaggeryd logistics center, 2012). The capacity and services offered are increasing and expanding since the beginning. Moreover, this dry port is the first Swedish terminal that took over customs clearance for imported goods by giving reliable, integrated services with the PoG (Port of Gothenburg, 2012; CILTUK, 2010).

4.1.1 Dry port establishment and development

The main reason of the establishment of this dry port was the need, of the port of Gothenburg, for inland terminals (as competitive advantage). At the same time, the municipality of Vaggeryd gained interest in the business concept. Together with the municipality and Trafikverket (Swedish Transport Administration) PGF created a suitable site for the terminal. Howbeit, Mr Berggren mentioned that the height difference in the selected area was less than 2 metres throughout the site. The good soil condition (25 metres deep sand layer) was an important reason to select this location. Also, the importance of the logistical sector and the excellent infrastructure in the area were significant. Consequently it was relatively cheap and excellent site to build the terminal. For example, the costs in another area to make a similar terminal would be 3 to 5 times higher. The main investors in the project were the municipality and European Union Commission.

The terminal was completed in 6 months from October 2009 to April 2010 when the first train arrived. In June 2010 the new rail port was officially opened. According to Mr Karlsson the time frame from the planning until the setup of the rail terminal in Vaggeryd was less than 2 years.

Howbeit, there are several limitations for the development of a dry port at this site. First of all, the rail system is not electrified and the switches are not automatically controlled. Furthermore, a double track to Värnamo is possible, but not yet completed. This limits the amount of traffic that goes to the dry port.

4.1.2 Vaggeryds Kombiterminal’s layout and competitive advantages

At the present, Vaggeryds Kombiterminal’s layout is a 1,600 metres oblong shape with two 650 metres long tracks on the same side to load and unload a train. According to Mr
Thorén (personal communication, 2012-05-08) of PoG this layout is the ‘master picture of a rail port’. The northern track was extended in order to facilitate more and larger trains. Furthermore, the terminal has a 150 metres track (inside of the terminal) which is used for maintenance purposes of rail wagons. The overall capacity of the site is 10 trains a day and possibilities to stack about 1,500 TEUs at the current site. The amount of TEUs handled by the Vaggeryds Kombiterminal has increased constantly, even though that the world’s economy was in a recession (from 43,680 TEU in 2009 to 55,116 TEU in 2011).

According to Mr Berggren (personal communication, 2012-03-16) the ‘possibility to expand the terminal and to add value added services like reparation of container/trailer, fumigation of containers, customs, storage of loaded containers, load/unload of containers, depot of containers for the shipping companies’ are the main strong points the company has. The dry port can also offer warehouse activities, including RFID tracking, in combination with the terminal business. The services, already offered or being developed, are requested by customers. Vaggeryds Kombiterminal was the first Swedish terminal to take over the customs clearance; therefore, the terminal was encircled by an electric and alarmed fence. The fence was built by the order of the Swedish customs agency to protect the shipments that have not been cleared by customs yet, besides it gives safety and security benefits for the terminal itself. Furthermore, there is a possibility for PGF to offer ‘extra’ value adding services to the ocean liners, rail carriers, trucking firms, for example the maintenance of their containers, wagons, and trailers. These services are currently under construction.

The terminal and the offered VA services in Vaggeryd is still in development, therefore, PGF does not measure its performance yet. Nevertheless, the customer satisfaction is still very important.

4.1.3 The dry port operator

The terminal is operated by PGF Tåg AB (Vaggeryd logistics center, 2012). However, the site is completely owned by the municipality of Vaggeryd. The mother company PGF AB consists of three companies; Logistic AB, Trans AB, and Tåg AB. The initial company was founded in 1997 and owns the warehouse hotel in Vaggeryd and the trailer business.

Mr Berggren indicated that PGF AB takes responsibility for ‘selling the product’; therefore they handle the promotion of the dry port. Further, they have a lot of contacts regarding road transports, ocean, and air freights; hence, the operator takes care of the customers by introducing them to such companies if additional services are needed.

4.2 Höglandets Terminal AB

Höglandets Terminal was established in 2004 to the north of Nässjö (about 40 kilometres away from Jönköping) in the Gamlarp area, close to the main railway line between Stockholm and Malmö. The terminal has a regular train shuttle that transports 30 TEUs at the same time, to and from the port of Gothenburg. Besides that, the terminal has a shuttle to Herne in the Ruhr area of Germany (Transab, 2012; Van Dieren, 2012; Port of Gothenburg, 2012; A. Wittskog, 2012-04-05).

The dry port concept includes the transportation of goods produced in Asia to the final consumers in Sweden by different modes of transport. Transab AB buys services from
GreenCargo AB and the same train from PoG is shared between Höglandets Terminal and Torsvik Kombiterminal (for IKEA).

4.2.1 Establishment and development of the terminal

The dry port has an operating history of nearly a decade: the planning stage started in 2001, the terminal started working in the end of 2004. According to Mr Wittskog the municipality of Nässjö has a good network (the academic community, local industries and the local government) which contributed to the establishment of the dry port in Nässjö. The importance of the logistical sector in the area of Jönköping and Nässjö was also a stimulating factor. Furthermore, the convenient location next to the main railway-line, which makes the travelling time to Copenhagen, Stockholm and Gothenburg just over two hours, is beneficial. Another point that helped to establish the dry port in Nässjö is the easy road access to the site. The costs of implementing the dry port where spilt between the municipality, European Union, the Swedish Rail Administration and Posten.

4.2.2 Höglandets Terminal's layout and competitive advantages

The layout of Höglandets Terminal is rectangular with two tracks (650 metres), on both sides of the terminal. Moreover, the container storage area is located in the centre of the site. The dry port has the ability to handle maximum 3,000 TEUs at one time. The dimensions of the site are 650 metres by 80 metres. The tracks indicated by the numbers 11 and 12, in the figure 4.1, are suitable to handle electric trains. The terminal can only be reached by road from the south-side, which has a fence and lockable gates. In addition the terminal is guarded by cameras and there are frequent patrols of security guards.

![Figure 4.1](image)

Transab AB owns a small warehouse in Torsvik (to reload goods) and large warehouse close to the Höglandets Terminal. This enables dry port operator to allocate the storage of containers in the most suitable place, increasing the quality of services and ability to adapt to the customer needs.

Today, the dry port offers a wide variety of value added services varying from loading/unloading to tailor-made Smart services and door-to-door solutions. If the demand is considerable and volumes for new services are high enough the company seeks to provide the requested services themselves. However, if the services are not frequently
demanded, Transab AB outsources those activities. For instance customs clearance is outsourced, as it is expensive to do in-house: thus, the prices for the customers would increase more than customers are willing to pay. To have customs clearance the designated area has to be fenced and data support, which keeps track of the location of the products, is needed.

Since, the Nässjö terminal operates nearly a decade, by now they seek to increase the level of collaboration and value of smart solutions offered. Mr Wittskog sees a great advantage for the terminal as Transab AB delivers the units directly to the client’s warehouse as most dry ports only take care of loading and unloading of containers. Besides comfort to the customer, this enables ‘extreme truck and trace’ over a longer distance. It is to declare, that the company always seeks to suggest new solutions for its customers. Besides that, the services are integrated and closely adapted by the customers.

To increase customer satisfaction and profitability the terminal needs to increase the efficiency. Höglądets Terminal has identified the amount of non-value adding movements of their reach stackers by measuring the performance of their equipment (e.g. fuel consumption, number of lifts). Now the terminal uses a tug master to deliver the trailer to the reach stacker, which improved the efficiency. Continuing, Mr Wittskog mentioned that the terminal adjusts the opening hours to the customers and the train schedules, therefore, flexibility, and the reliability are parts of the customer satisfaction. Hence, a dry port needs to measure the satisfaction of its customers.

4.2.3 Operator of Höglądets Terminal

The current owner of the terminal is a real-estate company, completely state-owned (Jernhusen, 2012). According to Mr Wittskog Jernhusen AB has the ability and resources to improve the terminal by connecting the tracks to the main railway line on both sides, that the cargo trains can use the terminal without having to reverse out of the terminal.

The dry port is operated by Transab AB which was founded in 1968 out of two trucking firms. During 2003 and 2004 the company was working together with Nässjö to develop the Höglądets Terminal (Transab, 2012). Moreover, Transab AB collaborates with several organisations, throughout Sweden, in order to improve the services, reach the lowest possible cost and to share the benefits of the transportation logistics network with those who want to cooperate. The company acquires the aid of other organisations in non-core competences; together those companies create a network.

4.3 Network of the dry port

In this sub-chapter, the information gathered of actors related or having any kind of partnership with the case study companies is presented. These actors help to gain clearer understanding about the development by the dry ports.

Mr Berggren and Mr Wittskog identify the need for networking and collaboration which begins with the planning stage and is improved during whole lifecycle. Mrs Mustonen (personal communication 2012-04-23) stated, that a dry port ‘can be the missing link that makes an efficient transport chain possible’. Further, the network of actors working together with dry ports is analysed.
The dry port network presented above identifies how the actors are related to the dry port. In addition, the map of the individual actors of the cases is presented in appendix 8. In the analysed cases the seaports of Gothenburg and Helsingborg, customers (IKEA, Jysk, Rusta AB, Waggeryd Cell AB), rail hauliers (Hector Rail AB), intermodal freight forwards (InterContainer Scandinavia AB, GreenCargo, Van Dieren AB), and road hauliers (Svensk LogistikPartner AB) are linked directly to the core competence of the dry port. Continuing the municipalities, supporting organisations (VLC, Logpoint AB), research institutions (universities, Trafikforskning AB), Swedish transport Administration and the local advertising companies (Nässjö Näringsliv AB) provide support to the dry ports and gather information in order to improve the whole transportation network.

The importance of logistics is increasing for every company, thus, better and more advanced solutions are needed. The way to reach this goal is to cooperate with several partners, which could decrease the price, improve the quality level, and share the experience and knowledge. The experts point out the increasing need for networking in the logistics sector has to be seen as an opportunity instead of a treat.

4.3.1 Municipalities, transport authorities and research institutions

There are lot of companies providing input in order to increase efficiency of the transportation system in Sweden. To start with, all regions seek to increase their economy. Municipalities as Vaggeryd and Nässjö are promoting the area using the dry port as a unique selling point, therefore, attracting new enterprises and improving the infrastructure. Further, logistic centres as VLC, Nässjö logistics centre or Logpoint AB may be established in order to attract new players into the site and to ease the municipality’s task.

Next, research institutions help to understand the market and its situation, accomplish researches, offer suggestions for interested parties. For instance, Trafikforskning AB (TFK) is an independent transport research institute. TFK has a large network based in the private and public sectors in Sweden and other parts of Europe. (Transport Research Institute, 2012). TFK researches the transportation areas in order to improve transport system, transport planning, infrastructure issues, environment, and economics. Vaggeryds Kombiterminal is participating in research projects regarding the rail port system and midrange dry ports. The company does not give general recommendations for a dry port; hence, every dry port is unique with specific problems. Besides that, TFK researches the external environment, for instance, political decisions regarding the infrastructure. Mrs Mustonen (personal commutation, 2012-04-23) mentions: ‘there are some bottlenecks in the rail transportation system that can stop the development of the
dry port system, and it is a political decision which infrastructure investments the government will make in the future’. The investments identified by TFK relate to the Swedish governments and the Swedish Transport Administration.

Thus, organisations as the transport administration carry out tactical decisions and support improvements. For example, the Swedish government has a great interest in the national infrastructure and in the efficient flow of goods (Trafikverket AB, 2012). Therefore, it has established the Trafikverket (Swedish Transport Administration). Trafikverket supports the establishment with good connections between the dry ports and the state owned rail and road network, since the future potential of the concept in relation with the intermodal transportation was identified. They cannot engage in a partnership with a single dry port. However, ‘Trafikverket has to give some dry ports priority because we can’t build connections and put a lot of investments in order to meet all wishes from the surrounding market’ (L. Andersson, personal communication, 2012).

4.3.2 The seaports

The port of Gothenburg is the largest harbour in Scandinavia (Port of Gothenburg, 2012). Last year the harbour handled 887,000 TEUs. The main reason for this is the ability to serve the largest vessels and the strategic location to reach Scandinavia and the Baltic’s. In comparison, the Port of Helsingborg is the second seaport in Sweden, which handles more than 7 million tonnes of goods (300,000 TEUs) each year (Port of Helsingborg, 2012). Both seaports have excellent rail and road infrastructure and are networking with the analysed dry ports. Due to the easy access and the location of the seaports, the volumes of shipments going through the ports tend to increase.

Three main reasons were identified to use dry port services for PoH, as a dry port gives possibilities for seaports to increase volumes ‘without interfering city areas’, next, it gives ‘a greater catchment area’ for the seaport and the last, it ‘contribute to more environmental friendly transport’ (O. Jonsson, personal communication, 2012-04-17). In addition, the extensive terminal network does not only increase the traffic it also raises the attractiveness of the seaport (S-G Thorén, personal communication, 2012-05-08).

As a result of the increasing trade, new solutions for handling the growing volumes in Sweden have to be found. The container terminal of the PoG is operated by APM Terminals, who has the needed knowledge. APM terminals invest in the ICT system, which still needs to be improved in order to enable the SCs to work more efficient (S-G. Thorén & H. Gutsch, personal communication, 2012-05-08).

4.3.3 Shippers, carriers and intermodal operators

Many shippers, rail and road carriers, and intermodal operators are involved in the network of the studied dry ports. Of each an example is provided.

First, shippers initiate the transportation process. An example of a shipper, contacted by the authors, is the paper mill Waggeryd Cell AB. This company produces large quantities of paper and pulp. To transport these goods the company turned to Vaggeryds Kombiterminal. Since, using a dry port means less treatment of the pulp (e.g. better wrapping quality), moreover, loading becomes more efficient: ‘it takes just 10 minutes to load a container compared to about 25 minutes for a normal truck’ (J. Fredriksson, personal communication, 2012-04-04). Therefore, it is an advantage to have the dry port close to the mill.
Second, rail carrier *Hector rail AB* provides the line-haul traction between the different locations of dry ports and seaports, having the core competence ‘*driving the train*’ (Hector rail AB, 2012). Furthermore, *Hector rail AB* has the ambition to be the best in class in their role as supplier, by understanding the needs of their customers, generating cost efficient solutions and focusing on the quality of their services. *Hector rail AB* provides the rail traction between Herne and Nässjö (New rail shuttle service, 2009) and is currently working on the establishment of a partnership with *PGF Tåg AB* (J. Swartling, personal communications 2012-04-02).

Third, *Svensk LogistikPartner AB (LP)* is a road carrier for freight forwarders, shipping lines and other actors, which offer services in an independent and neutral way. (Svensk LogistikPartner AB, 2012). Moreover, the services offered by *LP* are distribution to all cities in Sweden, intermodal transportation to and from main the ports in Sweden as well as daily services to other countries in Scandinavia.

Fourth, *Green Cargo AB* is an intermodal operator that works together with four dry ports in Småland (Alvesta, Jönköping, Nässjö and Älmhult). The official website states that the company offers efficient green logistics to their customers through ecological friendly services (Green Cargo AB, 2012). Mr Larsson mentioned that *Green Cargo AB* initiated the partnerships with intermodal terminals, because their customers are located close to them.

### 4.3.4 Vaggeryds Kombiterminal’s relations

The transportation network in Sweden can be divided into smaller networks and chains. To understand this statement better, first, an example of Vaggeryd’s dry port will be presented. Customers might be shippers; retailers, manufacturers, and industrial companies who initiate the process of transportation. *Waggeryd Cell AB* started a partnership with the dry port of Vaggeryd as it gave the possibility for the manufacturer to outsource some decisions. In addition, the road carrier (*LP*), together with *InterContainer Scandinavia AB*, *CFL Cargo AB* and *PGF Tåg AB*, offers intermodal transportation to and from the *port of Gothenburg*. In this collaboration *PGF Tåg AB* operates the terminal; *CFL Cargo AB* provides the rail traction. *InterContainer Scandinavia AB*, which works as an agent to manage the domestic flows in Sweden, provides the contact with the *port of Gothenburg*.

Mr Berggren explains that most partnerships are still under process: ‘as we need more services we like to build up those with strong partners who can provide the services wanted’. For instance, *PGF Tåg AB* initiated the negotiation to establish of a partnership with *Hector rail AB*, since terminal operator is determined to set up a rail shuttle to Dortmund, German Ruhr area. The importance to collaborate with universities and research institutions is realised as well. For example, Vaggeryd’s terminal already has cooperation with transport research institute *Trafikforskning AB*.

In addition, the relation between *Trafikverket* and *Vaggeryds Kombiterminal* relates to the connection of the terminal with the surrounding infrastructure. Dry ports, which are connected first to the main infrastructure, gain a competitive advantage over other dry ports in the region. Mr Thorén (*PoG*) mentioned that *Trafikverket* has plans to electrify the rail line to Vaggeryd. In addition, Mr Karlsson indicated, that the dry port is proposed to be one of four central terminals as ‘the Swedish government regard the Terminal as national interest due to its strategic location in the south of Sweden’. Hence, this
would mean increasing support and investments. However, the long discussion time, to reach a solution (electrification of the line), identified in the literature, was confirmed by Mr Berggren.

The municipality of Vaggeryd is responsible for the marketing of VLC, which is the brand name of the site. Mr Karlsson states that ‘Vaggeryd Kombiterminal is owned by the Municipality of Vaggeryd and is operated by PGF on contract basis. The business in the terminal is advertised by PGF’. Therefore, both parties have a common interest in promoting the terminal, participating in different business networks and visiting conferences to establish new relations.

4.3.5 Networks and relations of the Nässjö terminal

Comparing, Transab AB has a network of companies all over Sweden. They are collaborating in order to improve services, acquire the lowest possible costs and to share the benefits, the network may reach. Transab AB has relations with local politicians in the area as well as with some educational institutions (Jönköping International Business School, Chalmers University).

As an initiative of the municipality, to analyse logistical opportunities, and to promote the area, Nässjö Näringsliv AB (NNAB) was established. The organisation created the foundation (planning) of the terminal and, currently, it provides the marketing solution for the terminal, since they have excellent marketing tools to promote the terminal, even though they just have general knowledge about the services.

Höglandets terminal AB is a part of the supply chain for companies as Rusta and Jysk. According to the Göteborgs Hamn report (2006), a warehouse located near to the Höglandets terminal is a cost efficient and environmental friendly decision allowing cost savings as well as operational freedom and enhanced flexibility.

Furthermore, Transab AB cooperates with companies such as Green cargo, CargoNet, Van Dieren, Schenker, several train hauliers. For instance, Hector rail AB provides the rail traction between Herne and Höglandets terminal (New rail shuttle service, 2009). Besides that, the major player in the network, PoG, cooperates and discusses with Höglandets Terminal, providing significant information at conferences and meetings. Sometimes the collaboration for Nässjö terminal is a one-time solution, sometimes they are long term relations.

To sum up, both dry ports have extensive networks, consisting of different companies and institutions, in order to create a unique selling point, which appeals to current and new customers, as well as to improve their services, infrastructure and design. This requires efficient communication between the different actors, however, the ICT system is not integrated and currently the actors rely on traditional communication methods, mostly a fax. Thus, the current method is time consuming and costly. To improve the network, information exchange about the terminal and the business situation between the companies is required.
This chapter debates the main similarities and differences between the two studied dry ports and the relevant theory. The main areas of importance are the location, establishment, development of layout, equipment and service, as well as the meaning of measurements.

5.1 Process of dry port evolution

Considering the empirical part the tendency for dry ports’ evolution was ascertained. To facilitate the understanding of the analysis, thesis authors composed table 5.1, based on Rodrigue et al. (2009) their ideas about the dry port life cycle, to indicate different phases passed during the development of analysed dry ports in Småland, Sweden.

Table 5.1 Phases of dry port’s life cycle (own illustration)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Activities performed during the phase</th>
<th>Vaggeryds Kombiterminal</th>
<th>Höglandets Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning</td>
<td>Market studies (clarify opportunities, threats); Support search (pulling investors, attracting potential customers)</td>
<td>Vaggeryd logistic site and customer analysis; Enlisted investors; Selecting potential partners.</td>
<td>Nässjö region analysis; Meeting potential customers; Find the investors and interested parties.</td>
</tr>
<tr>
<td>Setting</td>
<td>Constructing facilities; Attract customers; Become well known; Gain a good reputation.</td>
<td>Terminal construction; Acquiring equipment; Contracts signed with first clients; Unit storage appointed.</td>
<td>Creating the dry port; Acquiring equipment; Agreements with different customers &amp; actors; Prepared units storage.</td>
</tr>
<tr>
<td>Growth</td>
<td>Identify potential in the market; Increase traffic; Find and attract new customers; Generate value adding services.</td>
<td>Improvements in value added services; Design improvements; Negotiations with new hauliers; Ideas for new rail shuttles (Germany).</td>
<td>Collaboration with other companies; Development of new better services (smart solutions); Optimising business.</td>
</tr>
</tbody>
</table>

As shown in the table, the first two stages (planning and setting) are similar for both dry ports, however, considering the gathered information, the thesis authors identified, that Vaggeryds Kombiterminal is in the beginning of the growth phase while the Nässjö dry port is closer to the end of the stage. Further analysis will be based on these findings.

5.2 Analysing dry ports location

A successful dry port fits in a complex system were maintenance is guaranteed, proper law and regulations are implemented, and needed infrastructure is available (Roso & Lumsden, 2010). Besides, Gooley (1998) indicates that the local market needs to have the demand for a dry port (cited in Rahimi et al., 2008). Evaluate the suitability of location and carry out an external analyses are part of the planning stage (Rodrigue et al. 2009). Thus, a location is composed of a combination of factors. The intermodal infrastructure takes advantage of the physical factors and the available market at the location to serve the global, regional and local markets (Rodrigue et al. 2009; Rahimi et al., 2008; UNCATD, 1991; Trainaviciute, 2009).
In line with the theory, both of the locations studied in the thesis have a good connection with the intermodal infrastructure, the geographical features and market of their site. Småland is centrally located in Sweden; therefore, it can serve major markets in Scandinavia and Baltic’s. In addition, both are located in an area with an extensive logistical sector (Bergqvist et al., 2008). Vaggeryd serves the south part of the region and Nässjö more to the north, as indicated by the circles in the figure 5.1. However, there are four terminals in the area (Nässjö, Vaggeryd, Torsvik and Jönköping). Thus, the main idea perceived during the study is that the market has to be divided, between the dry ports by specialising mostly.

This geographical location has another disadvantage as well, since the cases are located too close to the PoG (200 kilometres) which limits the available market. Höglandets Terminal reduced problem by opening line to Ruhr area in Germany. Similarly, the Vaggeryds terminal attempts to open the shuttle line to Dortmund (Ruhr).

The available infrastructure is similar for both terminals; however, they have considerable differences as well. Thesis authors assessed the location of both dry ports. The results are presented in table 5.2. The location elements were evaluated and given either A(very good) or B(good) in order to compare their location suitability.

Table 5.2 Evaluation of Locations (own illustration)

<table>
<thead>
<tr>
<th>Location</th>
<th>Vaggeryd</th>
<th>Nässjö</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail infrastructure</td>
<td>B</td>
<td>A</td>
</tr>
<tr>
<td>Road infrastructure</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Communication</td>
<td>B</td>
<td>B</td>
</tr>
<tr>
<td>Logistical sector</td>
<td>B</td>
<td>B</td>
</tr>
</tbody>
</table>
The authors considered that the dry port in Nässjö has a better rail infrastructure; as, having more rail operators within reach (rail operators’ infrastructure is illustrated in the appendix 10). However, high density of passenger traffic for the main railway line may be seen as a problem (Roso et al., 2008), which is a reality for Nässjö, since, the railway line Malmö to Stockholm is vital for the terminal. Further, Vaggeryd’s terminal has specific problem, identified in the literature review by Bärthel et al. (2011), about the electrification; the line from Värnamo is not yet electrified, meanwhile, Höglandets Terminal is suitable to handle electric trains. Second, the road infrastructure was considered to be better for Vaggeryd. Hence, the E4 highway passes Vaggeryds Kombiterminal and highway 40 passes Höglandets Terminal. The E4 is the main highway in Sweden and is less than 1 kilometre from the Vaggeryds Kombiterminal and 24 kilometres away from Nässjö.

Next, the necessity of ICT for whole SC is indicated by Trainaviciute (2009); however both cases have same problems with communication connections. For example there is no common technology to integrate the entire network, thus, all involved actors, are using different systems (e.g. excel and fax or phone to communicate) which is hard to improve quickly. However, PoG, in specific APM Terminals, are working on an interface to connect the different systems.

Last, the logistical area around the dry ports is quite similar as the dry ports are only 40 km away from each other. Vaggeryd Kombiterminal has a manufacturing company (for outbound transport); in the case of Nässjö the most important shippers are large retailing companies. However, Roso et al. (2008) identifies, that new industries are attracted to the site due to improved existing rail terminal infrastructure as well as area, growing as the hub. The idea is seen in both studied cases; municipalities expect the growth for the region and increasing volumes for the dry ports. On the other hand, there is a high level of competition between different logistical areas; hence, for instance, Logpoint AB, VLC and Nässjö logistics Centre try to attract the same companies.

To conclude, ‘location is the most important factor for a dry port’ (O. Jonsson, personal communication, 2012-04-17). Thus, both the literature and the studied cases indicate the importance of this selection. Following, the establishment of the dry ports is interpreted.

5.3 Interpreting the establishment

According to Do et al. (2011, p. 1) ‘to establish a good transportation system is not easy. It depends on many conditions such as the nation’s economy, policy, requirements and geographical features’. To start with, the pre-establishment phase will be presented with the activities performed during this phase of the dry port life cycle, named planning following the external analysis.

5.3.1 External analysis

After the need for having the dry port occurs in a specific site, the opportunities, and threats need to be considered. The authors decided to study key perspectives in the market considering main influencing factors. The analysis of literature (Almotairi et al. 2011, Van Klink & Van den Berg, 1998, Rodrigue et al. 2009, Bärthel et al. 2011, Barrett, 1998) and personal communications is presented in appendix 9. Table 5.3 presents summary of opportunities and threats for dry ports in Sweden.
Table 5.3 Macro environment influences for dry ports (own illustration)

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Threats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political/legal</td>
<td>Kyoto Protocol (environment); Taxation on fossil fuels; Road congestion measures; Shifting focus.</td>
</tr>
<tr>
<td>Economical</td>
<td>Globalisation; Exchange rates; Increasing trade.</td>
</tr>
<tr>
<td>Social</td>
<td>Increasing population; Education; Environmental awareness.</td>
</tr>
<tr>
<td>Technological</td>
<td>IT systems; Development of new equipment.</td>
</tr>
</tbody>
</table>

The external analysis helps to form a circumstantial picture of the market which influences dry ports and to understand the changes that occurred in the market during the life time of the cases analysed. The external analysis is usually carried out in the planning stage.

5.3.2 Pre-establishment phase

Rahimi et al. (2008), Roso et al. (2009), Bärthel et al. (2011), Harrison et al. (2002), and other authors indicate that regarding the establishment of a dry port, there are areas which have to be considered (appendix 11). The most important factor is the market demand and the analysis of it. Furthermore, the needed knowledge, available knowledge, as well as the required rail, road, and communication infrastructure has to be assessed.

Table 5.4 Important factors considered before establishment (own illustration)

<table>
<thead>
<tr>
<th>Areas to consider</th>
<th>Vaggeryds Kombiterminal</th>
<th>Höglendets Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market and demand analysis</td>
<td>Performed by PGF by researching if there was a need for a rail service in the area; The demand from PoG was ascertained</td>
<td>Cooperation with PoG to analyse the potential market in the region; Both, market demand and promotion strategies were used</td>
</tr>
<tr>
<td>Required Infrastructure</td>
<td>Direct railway line, E4 highway; Identifying needed improvements</td>
<td>Direct railway line, highway 40; Bottlenecks were identified</td>
</tr>
<tr>
<td>Knowledge</td>
<td>PGF has the knowledge to operate the terminal, municipality knows the area</td>
<td>Nässjö’ municipality cooperates with Transab AB to gain the needed knowledge</td>
</tr>
</tbody>
</table>

Table 5.4 indicates that both dry ports were analysing the market and the demand for a terminal located in the specific area (these factors represent social and economical influences that face the business idea). The seminars arranged by PoG helped to identify the market demand, meet potential clients, and create communication networks. The main retailing companies at the Nässjö site were identified as main shippers. However, a push strategy was used as well to advertise the company. H. Berggren (personal com-
munication, 2012-03-16) stated that ‘as long as the price is lower than ordinary truck loads and the transit time is equal, the market is positive to rail services’. Vaggeryd found a great advantage, the paper manufacturer (Waggeryd Cell AB) which gave a possibility to fill outgoing trains. In case of Höglandets Terminal they had to consider a way to avoid empty trains by establishing collaboration with other partners as the terminal had not enough outbound transport. Hence, the decision was found to transport IKEA’s products, manufactured in Falköping, to fill the train going back to the seaport.

Further, the infrastructure for both terminals was considered and areas, requiring improvements, were identified. Moreover, in both cases the municipalities do not know how to run a rail port, hence, specialised companies were needed. Considering the cases, at both sites, the companies specialised in operating of a dry port (PGF Tåg AB and Transab AB) where involved in the establishment. Together with municipally and other involved actors they established dry ports, designed to have a practical layout. Thus, both operators were involved in the project stage and shared their knowledge to establish and later to manage the dry port.

### 5.3.3 Establishment phase

The establishment is part of the setting stage in the life cycle of dry port (Harrisson et al., 2002; Rodrigue et al., 2009). The strategy that should be used relies on the specific factors of the location, the physical site and the involved actors, municipality support, logistical and industrial sectors in the area. The establishment of the cases are presented in the table 5.5.

Table 5.5 Terminals establishment (own illustration)

<table>
<thead>
<tr>
<th></th>
<th>Vaggeryd</th>
<th>Nässjö</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prehistory</strong></td>
<td>Started terminal in different place on a small scale with only a track of 150 metres to operate in 2008. The dry port was only 500 square metres</td>
<td>Small terminal in different site as a test project to transport unloaded/loaded swap bodies for Hemköp in southern Sweden. Duration of the project was approximately 1 year</td>
</tr>
<tr>
<td><strong>Establishment</strong></td>
<td>A project of PGF, Municipality (who suggested the idea) and the Swedish Transport administration (Trafikverket).</td>
<td>A joined afford of the municipality (project owners) and Transab AB (business development) who established the terminal company in 2004</td>
</tr>
<tr>
<td></td>
<td>The time frame form the planning until the setup of the rail terminal was less than 2 years</td>
<td>Planning stage started in 2001. It took nearly 3 years to start working</td>
</tr>
<tr>
<td></td>
<td>Inaugurated as a dry port in June 2010</td>
<td>Terminal Established in 2004 (not officially inaugurated as a dry port)</td>
</tr>
<tr>
<td><strong>Cost</strong></td>
<td>62 million SEK</td>
<td>58 million SEK</td>
</tr>
<tr>
<td></td>
<td>Investors: municipality other Swedish organisations and European Union commission</td>
<td>Costs where spilt between the municipality, European Union, the Swedish Rail Administration and Posten</td>
</tr>
</tbody>
</table>
Roso et al. (2009) mention that by investing and cooperating with dry ports a seaport can locate itself in the hinterland. The cases do not have a seaport as an investor during the establishment. However, the authors have ascertained the non-financial contribution from PoG. The table makes it clear that both midrange dry ports were established in a similar, practical manner. Hence, both were established by multiple actors who split the costs. As identified in the literature splitting cost between private and public sectors is common (Younis et al., 2010, Trainaviciute, 2009). Furthermore, Harrison et al. (2002) indicate that the planning of a dry port is a long process, for instance, cases analysed needed two to three years to establish the dry ports.

The trend, not identified by the literature, was determined. Both locations had a previous terminal in the area, as well as the case of Torsvik (indicated by R. Petersson, Logpoint AB). Hence, this allows gaining knowledge about the concept and marketing demand in the area. If the demand significant enough, an investments are made to construct larger terminal with better infrastructure. After the establishment of a dry port the market may change over time, therefore, the dry ports need to keep developing their business and services.

5.4 Development of analysed dry ports

‘Different things can be problematic for different dry ports. It is hard to give general recommendations without analysing the goods flows and working methods in each case. A big question for each terminal is how to plan the terminal both physically and regarding the working flows so that you can avoid unnecessary handling of goods’ (M. Mustonen, personal communication, 2012-04-23).

5.4.1 Layout

For creating an efficient and effective process the dry ports need to consider the design carefully at the establishment and during the on-going improvements (development), when testing the efficiency of the site. To start with, the design of the dry port needs to be based on the expected volume (Younis et al. 2010). Next, regarding the layout there has to be a designated location to store loaded and empty containers (Roso & Lumsden 2010). Further, the main elements of an inland terminal were mentioned in the theoretical research. The container yard has to be close to the rail, terminal has to be large enough for daily operations; moreover such facilities as gates, walls/fences, roads, pavements, office buildings are required. The comparison of the terminal sites (including the work area and the tracks) is presented in figure 5.2.

<table>
<thead>
<tr>
<th>Vaggeryds Kombiterminal</th>
<th>Höglandets Terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oblong 1,600x80</td>
<td>Rectangle 650x80</td>
</tr>
</tbody>
</table>

Figure 5.2 Studied dry ports design (own illustration).

Having oblong terminal reduces the efficiency. Hence, PGF seeks to implement a track in the centre of the dry port in order to make the site more square and efficient (cur-
rently only an idea). However, the real development is on the north-side of the terminal where the track is extended to 650 metres (which was 400 metres before). During the expansion in Vaggeryd some improvements were made: there were investments in building a road, a bridge, and a roundabout, in order to increase the flow of traffic to the dry port. There are no traffic lights and no congestion on the access roads.

In contraire, the Höglandets Terminal has rail access at both sides of terminal; however, there are still some plans to improve Höglandets Terminal. According to literature the tracks should be joined at both ends to the main rail line to facilitate two-way entry and departure of the trains (UNCTAD, 1991), which is a goal for Nässjö dry port. Furthermore, the cases have the ability to expand physically, since the site has used all of the available space. Roso & Lumden (2010) indicate the investments, and cooperation of public and private organisations is needed. In the studied cases public organisations have invested in the physical infrastructure. The operating companies, privately owned, invested in the required equipment.

5.4.2 Required equipment

Moreover, in close relation to the layout the equipment has to be selected. Trainaviciute, (2009) argues that the right equipment is a major part in the efficiency of a dry port. Therefore the author mentions that a dry port requires modern equipment. In addition, it has to match the flow of goods and services provided. Roso & Lumsden (2010, p 207) declare, that ‘all of the dry ports are equipped with reach stackers for handling containers of different weights. In addition, some also have gantry cranes or forklifts for empty containers’.

In line with the literature, the Vaggeryd Kombiterminal uses two reach stackers to unload and load the trains and trucks. They have plans to buy tug master when the trailer services will start. Further, the terminal uses a 10 ton forklift truck for handling empty 20’ containers and for stuffing containers with wood products. In comparison, at present, the Nässjö terminal handles containers and trailers at the site by using three reach stackers and one tugmaster. The tug master is used to reduce the amount of kilometres the reach stackers have to make.

To sum up, the layout depends on the specific site, services offered and traffic flow as presented in literature also mentioned by the experts. Regardless of the different location of the sites some similarities were identified. For instance, a rectangular shape is more efficient, allows reducing empty kilometres for equipment. Moreover, the main idea in the market regarding the best design is to join the tracks at both ends to the main rail line. However, the electric wires (for electric trains) cannot cover the complete length of the terminal as the wires hinder the usage of handling equipment (e.g. reach stacker). Further, attention is paid to make the access easy for road and rail carriers, equipment. The increasing security level (especially for customs) is also important. The gear used by the dry ports counterpart the suggestions in theory.

5.5 Competitive advantages

‘Capabilities, combined with value-added services, allow businesses to compete more effectively’ (Harrison et al. 2002 p.1). The competitive advantages of the two studied dry ports are being compared with the theory in this sub-chapter. These include the im-
provements of the value added services over time, and the performance measurements of the dry ports in order to improve their practices.

5.5.1 Value added services

Since, the cases are located quite close (200-300km) to the seaport, they seek to improve their services in order to fulfil their clients’ needs. The services offered can generate several benefits; maintaining a buffer, increasing the efficiency, reducing the costs and connecting transport modes. Table 5.6 is made in order to clarify the differences and similarities between the activities of two dry ports. In addition, similar services were presented in literature analysis (table 2.3).

Table 5.6 The services of the cases (own illustration)

<table>
<thead>
<tr>
<th>Vaggeryds Kombiterminal Services offered</th>
<th>Starting year</th>
<th>Höglandets Terminal Services offered</th>
<th>Starting year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse services</td>
<td>2006</td>
<td>Loading, unloading, reloading</td>
<td>2004</td>
</tr>
<tr>
<td>Packing, sorting, assembling</td>
<td>2008</td>
<td>Warehousing</td>
<td>2004</td>
</tr>
<tr>
<td>Storage of loaded containers</td>
<td>2008</td>
<td>Stripping, stuffing</td>
<td>2004</td>
</tr>
<tr>
<td>Truck and trace at warehouse</td>
<td>2009</td>
<td>Containers storage</td>
<td>2004</td>
</tr>
<tr>
<td>Load, unload, reload units</td>
<td>2010</td>
<td>Consolidation of shipments</td>
<td>2004</td>
</tr>
<tr>
<td>Stripping, stuffing goods</td>
<td>2010</td>
<td>Smart business solutions</td>
<td>2004</td>
</tr>
<tr>
<td>Fumigation of containers</td>
<td>2010</td>
<td>Truck and trace</td>
<td>2005</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Freight management (IT) system</td>
<td>2005</td>
</tr>
</tbody>
</table>

Depot of empty containers
Repair and maintenance of containers and trailers
Freight management (IT) system
Truck and trace at rail terminal

Integrated solutions based on collaboration with other companies

Services that terminals are working on

Outsourced services

<table>
<thead>
<tr>
<th>Vaggeryds Kombiterminal</th>
<th>Customs clearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fumigation of containers</td>
<td>Controls clearance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Höglandets Terminal</th>
<th>Import/export documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Door-to-door services &amp; smart business solutions</td>
</tr>
</tbody>
</table>

The services of Vaggeryds Kombiterminal and Höglandets Terminal, presented in the table, form an integrated package of services as mentioned by Notteboom and Winklemans (2001). In both cases the services offered were requested by the customers, which correspond to Roso et al. (2009), Roso and Lumsden (2010) ideas. Mostly, if the demand is enough, the services are considered to be done in-house, otherwise, they are outsourced. This is in line with the statement of Chandrakant (2011) that a dry port operator outsources services to specialise. Moreover, both dry ports outsource customs clearance. In the case of Vaggeryd due to problems with the process and issues for the needed knowledge, at Höglandets Terminal in order to reduce the price for services.

‘The logistics revolution had allowed a better management of cargo flows with low inventory costs, reliable delivery time and distribution (the so-called ‘just-in-time’, or JIT) ’ (Chandrakant, 2011, p. 184). Therefore, a trend is that JIT solutions are getting more popular with intermodal carriers. This trend makes storage redundant. Hence, the needed warehouse space is diminishing, as well as the needed terminal storage space.
Consequently, the trend for integrated and tailored solutions is growing in the market. This can be illustrated by the example of IKEA (Göteborgs Hamn, 2006). Their representative stated that the need for customised and more adapted solutions for individual customers will increase and become a success factor for most terminals and rail operators. In addition, Roso and Lumsden (2010) state that VA services must reach the doorstep of the customer and decrease the response time. Therefore, Höglandets Terminal has developed their Smart business solutions, which they already offer to Jysk and IKEA. Mr. Berggren mentioned that this type of VA services will be available at Vaggeryds Kombiterminal in the future as well.

Thus, the differences in the VA services, currently, offered at the cases can be explained with help of the dry port life cycle. As identified before both dry ports are in the growth stage, increasing traffic and generating VA services are the actions the companies are concentrating on. Cases examined by Trainaviciute (2009) follow the same trends in development of services as Höglandets terminal and Vaggeryds Kombiterminal. Eriksson and Rosenberg (2009) indicate that several important aspects increase value for the customers. Those are price, security, reliability, flexibility, and environmental sustainability. However, during the case study it was revealed that the last indicator adds value as long as it does not increase the price. Hence, the reliability and the cost of the shipment are seen as the most important ones.

5.5.2 Measurements

The dry ports can only improve their efficiency by measuring the performance. Trainaviciute (2009) identifies that key measurements are quality requirements for several areas, which need to be reviewed on a regular basis. In the case of a dry port the performance assessment allows to consider if the site, communication technology (ICT) and equipment (e.g. tug masters, reach stackers) are efficient or in need of improvements (Jarzemskis & Vasiliauskas, 2007; Richardson, 1999 cited in Rahimi et al., 2008). In the frame of literature several measurements were presented (table 2.4).

Of the studied cases only Höglandets Terminal implements measurements to monitor the processes (equipment performance, customer satisfaction). Vaggeryds Kombiterminal has not implemented measurements; hence the dry port is still developing. However PGF has identified the importance of the customer satisfaction. Not performance measuring is a treat to the complete abilities of the terminal.

However, not only internal factors influence the performance measurement but also external factors. One of the drivers of the performance measurement is the rating system, of PoG, that seeks to classify the terminals. Almotairi et al. (2011) mention the importance of the grading system for dry ports; hence the system has the ability to improve their services. PoG uses four criteria as stated on their website to grade the dry ports in Sweden. Mr Thorén evaluates the status of the dry ports during a meeting on site. Furthermore, he stated that currently Vaggeryds Kombiterminal and Höglandets terminal would have the same rating (4 to 4,5 stars). To improve the competitiveness dry ports usually seek to be classified higher by the PoG by improving the services, safety and security.

In conclusion both the academic world and cases identify that without performance measurements the services of a dry port cannot be improved. ‘The operation at container terminals becomes a vital issue for measurement of terminal performance. It de-
pends mainly on the design and layout of the container terminal’ (Younis et al., 2010, p. 6). The measurements relate to the development (life cycle) of a dry port (Harrison et al. 2002). In addition, without the measurements the competitive advantage of a dry port may reduce by stagnation of the VA services.

5.6 Benefits for different actors to use dry ports

The literature regarding the benefits of dry ports is extensive. According to Trainaviciute (2009), Roso et al. (2008 & 2009), Rahimi et al. (2008), Do et al. (2011) a dry port can initiate several benefits, such as environmental (reducing congestion, emissions), economical (reduce costs, increased property value, better use of capacity, improved communications), social (attract new companies, create jobs,) governmental (increased tax income). Thus, different actors gain several benefits by working together with a dry port (e.g. costs savings, improved throughput, flexibility, reducing the carbon footprint, increased economic activity). The figure below indicates a short summary of the benefits given in literature.

<table>
<thead>
<tr>
<th>BENEFITS</th>
<th>Freight forwarders</th>
<th>Shippers</th>
<th>Port Authority</th>
<th>Society</th>
<th>Road operators</th>
<th>Rail operators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance between road and rail transport</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Shorter waiting time in port</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduce road congestion</td>
<td>+</td>
<td></td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prevention from increase in environment pollution</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Strengthening the sea ports role in transport chains</td>
<td></td>
<td></td>
<td></td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create jobs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+</td>
</tr>
</tbody>
</table>

Figure 5.3 The advantages that different actors can gain from the dry port (Trainaviciute, 2009).

The benefits identified in the figure 5.3 were closely confirmed by the case study. To start with, in line with theory, the most important advantage for the customer is flexibility. In addition, to flexibility cost savings and environmental benefits are major profits for the shippers. Further, pros for a carrier to work with a dry port are that the customers get a better, cheaper product and the control over the shipment increases. Furthermore, there is no need to wait in congestions close to a seaport.

Besides that, road hauliers collaborate with dry ports in order to satisfy their clients. However, for instance, Hector rail AB sees dry ports only as terminals (regular customers) and has no strategic collaboration with them. Continuing, Mr Larsson of Green Cargo AB states, regarding the benefits for an intermodal operator: ‘where there are terminals we do not have to start and operate a terminal ourselves’. As indicated by the performed study some actors see the relationship with a dry port different because of the companies’ core strategies.

Furthermore, Vaggeryd and Nässjö dry ports might be considered as medium sized (according throughput); regardless of their size they have the ability to influence the competitiveness of a seaport as being connected to a convenient distribution area may in-
crease seaport competitiveness. For instance, the PoG uses its extensive network of dry ports (rail ports) as a competitive advantage when negotiating with large shipping firms.

Besides, local government initiate development of industries in the area (e.g. attracting new enterprises for outbound transport), which also increase the amount of jobs. Therefore, the local government is a supporting and stimulating factor for a dry port. Moreover, the benefits for the municipality include increased economic activities, investments, employment opportunities and a growth in population (C.-G. Karlsson, M. Mustonen).

The advantages for different actors approve the significance of dry ports and the need for such transportation networks. Further, dry ports are seen as hubs for distribution and inter-modal nodes for transportation, beneficial for whole SC.
6 Conclusion

In order to conclude the thesis, the findings covering the research questions are presented following the suggestions for further research.

The thesis was accomplished to reduce the identified gap in the literature. It was ascertained, that Swedish dry ports operate in a market with a high level of competition; therefore, intermodal terminals need to understand and evaluate the internal and external factors, influencing their evolution, and adapt their services in order to remain competitive.

The study was completed, based on two case studies (dry ports in Vaggeryd and Nässjö) as well as the contribution of twelve associated network actors. Through the cases, this thesis took an investigation of how dry ports have developed in Småland, Sweden, regarding the value added services, layout and their networks. During the study, the research questions, mentioned in the purpose, were answered. In the following paragraphs each research question is addressed.

6.1 Findings and discussion

Firstly, the layout design is influenced by the infrastructure, soil conditions, available space, and the available market of a specific location. Continuing, the main influences are value adding services (which are required) and the efficiency of the designed site. During the thesis similarities were discovered; the designs of the studied terminals were rectangular in shape, therefore, creating an optimal site to load/unload trains and trucks and also to store containers and increase equipment efficiency. Besides, the pavements were constructed and security precautions implemented. Moreover, the future improvements, pointed out by representatives of the studied dry ports, would lead to more efficiency, thus, cost savings.

The main goal for the dry ports is to satisfy the needs of its customers; therefore, they need to offer corresponding value added services. The literature identified that these services are changing over time. The cases have shown that value added services are starting at basic services, such as load and unload units, and developing to smart business solutions. Furthermore, the most services are established following the market demand.

The network of a dry port is extensive, both the academic literature and the studied cases have identified this fact. However, the studied dry ports’ initial network increases in complexity over time. Collaborating with supplementary actors allows handling more volumes and offering more services for a larger market. Thus, the increasing network assists the dry ports to develop. Furthermore, different actors benefit for the collaboration, however, they have different goals.

During the thesis the authors discovered that new dry ports usually establish their operations in the most effective way, trying to use the best practices. However, the terminals operating in the area have gained the loyalty and trust of their partners and customers over time. Thus, makes it hard for new terminals to establish relationships even though their design and infrastructure may be better.

These implications of the conclusions resulting from this thesis are the following. Firstly, the authors suggest that municipalities, who are considering establishing a dry
port should analyse the physical requirements of their location and the demand of the market. Secondly, the municipality has to attract different actors associated to intermodal transportation in order to create the strong foundation for the dry port. Thirdly, when establishing the dry port, the actors could start on a small scale (using best practices), with basic services, since the costs of establishment are high. In addition promotion should start during the establishment and increases the image of dry port constantly. Hence, the demand for more capacity and services grows over time. As a result, more investments are needed for the extension of the dry port, activities they perform and the needed equipment. Fourthly, during the development of the terminal the involved actors need to be interconnected, furthermore, exchange information with their customers to develop precise services, since those are mostly requested by the market.

6.2 Suggestions for further research

Due to the constraints of time and volume it was not possible to assess all perspectives. Thus, the thesis authors propose some remarks regarding this study in order to improve it. First, the use of quantitative method in order to address more shippers, road and rail carriers would be useful. Second, more cases involved would gain a better picture of the competition in the market and clearer distinction between differences in evolution. Third, the purpose of the study could be broader, linking explanatory and interpretive approaches in order to gain deeper knowledge.

Besides, there are some recommendations for further research of value adding services in this subject. Due to the limited geographical area assessed, the services offered by cases were similar. However, the investigation of VA services development in other areas of Sweden is needed, in order to gain a complete picture of how dry ports’ activities evolve in different regions, since different districts require a different set of services.

The field is relatively new and needs to be studied further. For instance, to scrutinise different cases in order to confirm the idea, that having a previous terminal (e.g. as a project) in the area, before the actual dry port, helps to gain more benefits. Further research about networks and networking in terms of facilitation of legal aspects, cooperation and administration as well as financial aspects of collaboration should be researched, in order to improve the knowledge about the implications of networking. Additional, the specific goals of different players may be considered as well as the interruption for the market, when a municipality gets involved in a terminal processes, determined.
References


Williamson, K., Bow, A., Burstein, F., Darke, P., Harvey, R., Johanson, G., McKemmish, S., Oosthuizen, M., Saule, S., Schauder, D., Shanks, G., & Tanner, K.


Appendices

Appendix 1 Sweden GDP Growth Rate: percentage change (Trading Economics, 2012)

![GDP Growth Rate Graph](image)

Appendix 2 Key words and interpretations defining dry ports (own illustration)

<table>
<thead>
<tr>
<th>Key words</th>
<th>Interpretations</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal</td>
<td>Inland intermodal terminal</td>
<td>Roso et al., 2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Harrison et al., 2002</td>
</tr>
<tr>
<td>Container terminal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connection to a seaport</td>
<td>Direct rail connection at least with one seaport</td>
<td>Roso et al., 2009</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cezar-Gabriel, 2010</td>
</tr>
<tr>
<td></td>
<td>Distance from a seaport, with different modes of transport functioning as a cluster of logistics</td>
<td>Rahimi et al., 2008, Harrison et al., 2002</td>
</tr>
<tr>
<td></td>
<td>Value added services</td>
<td>Rahimi et al., 2008</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Roso et al., 2009</td>
</tr>
<tr>
<td>Similar services as a seaport</td>
<td>Different modes of transport</td>
<td>Harrison et al., 2002, ESCAP, 2010</td>
</tr>
<tr>
<td></td>
<td>Can be identified as origin or destination for the transported goods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Integrated physical plant which meets the markets demand</td>
<td>Zimmer, 1996</td>
</tr>
</tbody>
</table>
Appendix 3 Organisations involved in the study (own illustration)

<table>
<thead>
<tr>
<th>Actors category</th>
<th>Performance, activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry ports</td>
<td>Transhipment of containers/trailers, customs clearance, daily rail shuttle with a seaport.</td>
</tr>
<tr>
<td>Seaports</td>
<td>Transhipment of containers, customs clearance, daily services to (worldwide) locations.</td>
</tr>
<tr>
<td>Shippers</td>
<td>Initiates the transportation process.</td>
</tr>
<tr>
<td>Intermodal operators</td>
<td>Coordinates intermodal transportation, may operate rail shuttles, specialised for smaller flows (block trains).</td>
</tr>
<tr>
<td>Rail carriers</td>
<td>Operates rail shuttles, takes the risk of transportation.</td>
</tr>
<tr>
<td>Road carriers</td>
<td>Operates transport of shipments.</td>
</tr>
<tr>
<td>Transport administrative</td>
<td>Administrated all modes of traffic.</td>
</tr>
<tr>
<td>Research institutions</td>
<td>Independent, co-operative transport research organisation.</td>
</tr>
</tbody>
</table>
## Appendix 4 Interview guideline for the dry ports (own illustration)

<table>
<thead>
<tr>
<th>Question groups</th>
<th>Questions</th>
<th>Comments</th>
</tr>
</thead>
</table>
| Conversation beginning   | What is your position in the company?  
How long are you working there?  
How long does the dry port exist?  
- *Was the company operating the terminal from the beginning?*  
| Helps to start discussion |
| Dry port foundation      | What was the role of the dry port operator during the founding of the terminal?  
What are the main reasons to establish the dry port in the specific site?  
What were the first activities performed?  
Why did the actors want to establish the dry port?  
| Creates understanding of the development |
| Dry port development     | Who was involved and who invested in the development of the terminal?  
What is the general trend regarding the amount of TEU’s handled by the dry port. Where there large fluctuations?  
What is the percentage of containers and trailers of the total amount of goods handled?  
Does this company/dry port have strategic partnerships?  
In your opinion what are the strengths and weaknesses of the dry port?  
- *Have they changed over time?*  
| Assists to find out how company changed over time |
| Value added services     | What value added activities does the dry port offer today?  
Does the terminal include a warehouse?  
- *When build, size, services offered there?*  
Which value added activities are requested by customers?  
| Analyse services offered by dry port |
| Location and layout      | Why is the dry port located in this specific area?  
- *Are there any limitations to this location?*  
- *Are there any limitations for the DP, due to government regulations?*  
What layout does the dry port use and why?  
| Helps to understand the location and layout importance |
| Competition and measure- | Who are the direct competitors of your dry port?  
Are the competitors larger, the same size or smaller?  
- *The main advantages they have (in your opinion).*  
How does the dry port measure its performance and the performance of its network?  
What are the opportunities and threats for your dry port?  
| Indicates the performance of dry port and competitors |
|                          | Extra thoughts, comments - gives possibility for individual input of respondents                                                           |                                                                          |

C
Appendix 5 Interview guideline for the port of Gothenburg (own illustration)

<table>
<thead>
<tr>
<th>Questions groups</th>
<th>Questions</th>
</tr>
</thead>
</table>
| Establishment of dry ports | When the need for more space for the port of Gothenburg was first felt and therefore the need for dry ports in Sweden considered?  
When the Gothenburg port gave the first initiative for inland terminal, which territory was chosen for the first dry port/inland terminal and why?  
How many dry ports in Sweden did the port of Gothenburg helped/initiated to establish?  
Do all dry ports which want to be found need to be approved from port of Gothenburg?  
Main reasons to initiate/establish dry ports and inland terminals in Sweden? |
| General dry port questions | What are pros and cons for having dry ports in Sweden?  
Do you think there is enough traffic and volume for all of them to remain in the market?  
Which area or specific location do you consider to be the most important for having a dry port in Sweden?  
What are the main improvements suggested or required for a dry port and why?  
Is the IT system, to keep track of shipments, integrated with the IT systems of different dry ports? If so, with which ones and why those dry ports?  
Do you have any additional comments or thoughts about the dry port concept?  
Could you explain the reason to implement the evaluating system of rail ports that the port of Gothenburg uses to grade dry ports/inland terminals? |
| Specific question regarding the cases | According to the brochure for Nässjö logistic park 2020 the M. Karestedt presents ambitions to improve relationship and development of dry port in terms of goods volumes and the breadth of the services. Can you please explain how port of Gothenburg helps to improve dry ports activities?  
Port of Gothenburg emphasises the need and importance of collaboration to improve rail shuttle system in Sweden. Can you please describe the well-developed cooperation between different actors (railport terminals, rail operators, goods owners and National Rail Administration)?  
- What is the main goal for this collaboration?  
- What kind of relations do you have with dry ports in this case? |

Do you have any additional comments or thoughts about the dry port concept?
Appendix 6 Interview guideline for the port of Helsingborg (own illustration)

<table>
<thead>
<tr>
<th>Questions groups</th>
<th>Questions</th>
</tr>
</thead>
</table>
| Establishment of dry ports | When the need for more space for the port of Helsingborg was first felt and therefore the need for new Combiterminal considered?  
- Was it only due to the space limits in the seaport?  
Does the Helsingborg port have any relations with other inland terminals/dry ports in Sweden?  
Did the port of Helsingborg helped/initiated to establish any other inland terminals or dry ports in Sweden?  
- Please indicate main reasons to initiate/establish dry ports and inland terminals? |
| General dry port questions | What are pros and cons for having dry ports/inland terminals in Sweden?  
Do you think there is enough traffic and volume for all of them to remain in the market?  
Which area or specific location do you consider to be the most important for having a dry port in Sweden?  
What are the main improvements suggested or required for a dry port/inland terminal and why?  
Is the IT system, to keep track of shipments, integrated with the IT systems of different dry ports?  
- If so, with which ones and why those dry ports? |
|                     | Do you have any additional comments or thoughts about the dry port concept?                                                                                                                                                                                               |
Appendix 7 Interview guidelines for associated actors (own illustration)

<table>
<thead>
<tr>
<th>Associated actor</th>
<th>Questions</th>
</tr>
</thead>
</table>
| Hector rail AB   | When the relationship between Vaggeryd Logistics centre and Hector rail is supposed to be established?  
When who took the initiative establishing partnership/relationship?  
How long did the process take from the idea until the actual transport (first shipment)?  
What main reasons you could indicate for this relationship you are working on?  
Are you working together with other dry ports in Småland region?  
- Which ones, main reasons?  
What main reasons (benefits) for working with a dry port?  
What factors you are considering as most important for establishing the relationship with dry ports?  
What improvements you are considering service wise? |
| Green Cargo AB   | How many dry port partners do you have in Småland? Which ones, main reasons for partnership?  
Who usually takes the initiative establishing partnership/relationship?  
How long did the process take from the idea until the actual transport (first shipment)?  
What main reasons you could indicate for this relationship?  
What improvements you are considering in the relationship, service wise?  
What advantages do you have by working together with dry ports? |
| Trafikverket AB  | Why did Trafikverket feel the need for dry ports?  
- Main reasons for helping the dry ports?  
What are the pros and cons in the dry port concept?  
What does the Trafikverket do to assist the establishment/development of dry ports? |
| Svensk Logistikpartner AB | Are there any specific requirements when working with a dry port?  
What are a pros and cons for serving a dry port? (flow of containers, change of distance, profitability)  
Are there any privileges for your company (preferred firm of Vaggeryd) to manage all the flow to and from the customers in the specific region you are operating or the customers can choose the trucking company themselves?  
Is there any kind of integration or collaboration between you and the Vaggeryd terminal?  
Have you considered any improvement of this relationship between LP Svensk Logistikpartner AB and Vaggeryd dry port? |
<table>
<thead>
<tr>
<th>Associated actor</th>
<th>Questions</th>
</tr>
</thead>
</table>
| Waggeryd Cell AB | How long Waggeryd Cell AB uses dry port of Vaggeryd services?  
What are the main reasons (benefits for company), why Waggeryd Cell AB is using the dry port?  
What pros and cons company can see for dry port concept?  
What value added services the company feels to be necessary or improved in the dry port? |
| Trafikforskning AB | Could you describe the relationship TFK has with Vaggeryd terminal nowadays?  
What benefits for area and country can you see with a dry port concept?  
What recommendations do you offer for a dry port in order to increase safety level and efficiency?  
Do you think that a dry port is a considerable element in the transportation network in Sweden? Why? |
| Logpoint AB | What are the main activities of Logpoint AB?  
How is Logpoint AB connected to Torsvik terminal?  
Which trend can you identify in the transportation market?  
- *Volumes, development of dry ports, VA services.*  
What best practices for dry ports regarding the layout, VA services and networking you would indicate?  
What services are the most requested in Småland’s area?  
- *is the trend different in other areas.* |
Appendix 8 The schematic representation of involved actors (own illustration)

Arbitrary symbols, used in the map, are presented in the table together with the interviewed experts and the companies represented.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Actor</th>
<th>Company</th>
<th>Contact person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipality</td>
<td>Vaggeryd</td>
<td>Municipality</td>
<td>Carl-Gunnar Karlsson</td>
</tr>
<tr>
<td>Municipal organization</td>
<td>Logpoint AB</td>
<td>Rune Petersson Sofia Runn</td>
<td></td>
</tr>
<tr>
<td>Dry port (operator)</td>
<td>Vaggeryds Kombiterminal (PGF Tåg AB)</td>
<td>Henning Berggren</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Högländets terminal (Transab AB)</td>
<td>Anders Wittskog</td>
<td></td>
</tr>
<tr>
<td>Seaport</td>
<td>Port of Gothenburg</td>
<td>Stig-Göran Thorén</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Port of Helsingborg</td>
<td>Oskar Jonsson</td>
<td></td>
</tr>
<tr>
<td>Rail carrier</td>
<td>Hector rail</td>
<td>Jonas Swartling</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Svensk Logistikpartner AB</td>
<td>Dennis Johansson</td>
<td></td>
</tr>
<tr>
<td>Road operator (Carrier)</td>
<td>Svensk</td>
<td>Dennis Johansson</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Svensk Logistikpartner AB</td>
<td>Dennis Johansson</td>
<td></td>
</tr>
<tr>
<td>Intermodal operator</td>
<td>Green Cargo</td>
<td>David Larsson</td>
<td></td>
</tr>
<tr>
<td>Transport authority</td>
<td>Trafikverket</td>
<td>Lennart Andersson</td>
<td></td>
</tr>
<tr>
<td>Research institution</td>
<td>Trafikforskning AB</td>
<td>Maria Mustonen</td>
<td></td>
</tr>
<tr>
<td>Port terminal</td>
<td>APM Terminals</td>
<td>Hans Gutsch</td>
<td></td>
</tr>
<tr>
<td>Shipper/customer</td>
<td>Waggeryds Cell AB</td>
<td>Jessica Fredriksson</td>
<td></td>
</tr>
</tbody>
</table>
## Appendix 9 Macro environment influences for dry ports (own illustration)

<table>
<thead>
<tr>
<th>Example</th>
<th>Opportunities</th>
<th>Threats</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safeguard fair competition</td>
<td>Every company has the same chances in the market</td>
<td>Government can intervene in the daily business practices</td>
<td>Konkurrensverket, (2012), A. Wittskog (personal communication, 2012-04-05)</td>
</tr>
<tr>
<td>Economic growth</td>
<td>Increase traffic, more financial opportunities</td>
<td>Not an equal divided between metropolita and rural areas</td>
<td>Eurostat (2012c, e), Trading Economics (2012). M. Mustonen, personal communication, 2012-04-23</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Good connection</td>
<td>Some areas are being developed earlier, due to the limited amount of resources</td>
<td>Bärthel et al. (2011), L. Andersson, personal communication, 2012-04-11 R. Petersson, personal communication 2012-05-10</td>
</tr>
<tr>
<td>Population</td>
<td>Increasing, as well as the consumption of goods</td>
<td>Urbanisation</td>
<td>Eurostat, (2012f),</td>
</tr>
<tr>
<td>Environmental awareness, high level education</td>
<td>New markets, services</td>
<td>Railway infrastructure is not up to date</td>
<td>Eurostat (2012d, g)</td>
</tr>
<tr>
<td>IT systems</td>
<td>Enable to integration and information sharing</td>
<td>Trade-off between integration and confidentiality</td>
<td>Almotairi et al. (2011) D. Johansson (personal communication, 2012-04-02)</td>
</tr>
<tr>
<td>Handling equipment</td>
<td>Decrease the handling time of shipments</td>
<td>Mismatch between capacity and demand</td>
<td>Rodrigue et al. (2009). M. Mustonen (personal communication, 2012-04-23)</td>
</tr>
</tbody>
</table>
Appendix 10 Intermodal network in Southern Sweden in 2008 (Bärthel et al., 2011)

Appendix 11 Considerations before establishing dry port (own illustration)

<table>
<thead>
<tr>
<th>Areas to consider</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market analysis</td>
<td>Bärthel et al. (2011), H. Berggren (2012-03-16), A. Wittskog (2012-04-05)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Rahimi et al. (2008), Bärthel et al. (2011), H. Berggren (2012-03-16)</td>
</tr>
<tr>
<td>Marketing solutions</td>
<td>Bärthel et al. (2011), A. Wittskog (2012-04-05)</td>
</tr>
<tr>
<td>Relationships and Communication</td>
<td>Bärthel et al. (2011), Rahimi et al. (2008), H. Berggren (2012-03-16), A. Wittskog (2012-04-05)</td>
</tr>
</tbody>
</table>