JOURNAL OF

INTERNATIONAL LOGISTICS AND TRADE

CONTENTS

Papers

Volume 10, Number 1, April 2012, pp.3~41

Determinants For Assigning Value-added Logistics Services To Logistics Centers Within A Supply Chain Configuration

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Abstract

A number of literature contributions have underlined the importance of developing value-added logistics activities or VALS in order to help improve customers' satisfaction. However, there is usually very little attention given regarding where to perform these VALS. This study aims to: (1) identify a comprehensive set of factors which may influence the location of VALS, (2) to analyze to what extent those factors influence location decisions, and (3) to distinguish the determinants behind the location choices for distribution centers and for the kind of VALS that will be developed in these distribution centers.

In this paper, we will present a conceptual framework on the locations of VALS in view of the identifying determinants for assigning VALS to logistical centers. We argue that the optimal location of VALS is determined by complex interactions between the determinants at the level of the choice of a distribution system, distribution center location factors, and different logistical characteristics regarding products.

Keywords : *distribution center, value-added logistics, location analysis, product logistics characteristics, distribution system*

Submisson Date : 12/02/2011 Revision Date : 03/06/2012 Acceptance Date : 03/06/2012

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1. Conceptual Framework

The scope of logistics has been extended beyond its traditional coverage of transportation and warehousing activities to include packaging, labeling, assembly, purchasing, distribution, manufacturing, finance, customs clearance, and other forms of customer service. These logistics activities, often called 'low end' and 'high end' value-added logistics services or VALS, are a prime source for revenue generation and add value to distribution centers and warehousing facilities. A key issue for logistics service providers is to decide on where to perform these value-added logistics services. For example, should these activities be performed at the source in the country of export (e.g. in a Chinese warehouse), an intermediate location (e.g. a distribution center near a major hub port) or somewhere close to the consumer markets (e.g. close to an inland terminal). While extensive literature exists on location analysis for the placement of distribution centers, there are very few studies regarding the critical factors which influence the decision of where in the network to perform value-added logistics activities. Although value-added logistics activities often take place in distribution centers and warehouses, the factors which influence the locations of the distribution centers are not necessarily identical to the determinants that guide the location of value-added logistics services. In this paper, we argue that the decision on where to perform value-added logistics activities is determined by a complex interaction between the selection of a distribution system, the location of the distribution centres and the logistics characteristics for the associated product or products. These three levels of interaction are presented in Figure 1.

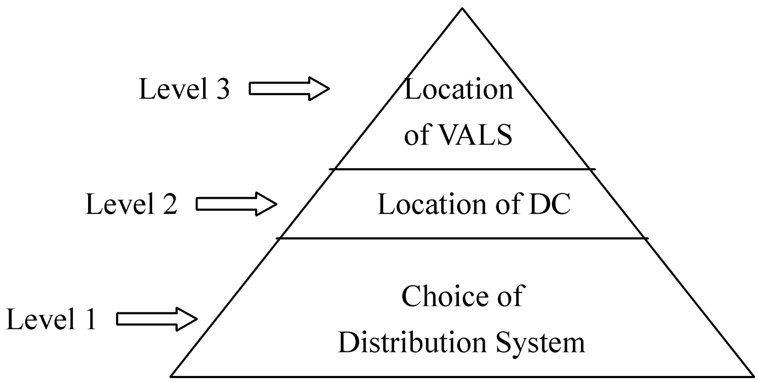


Figure 1.
Value-added logistics location analysis framework

This paper will mainly focus on logistics flows for export products from Asia to Europe. The paper structure is as follows. We will first discuss the framework for the analysis of value-added logistics locations as depicted in Figure 1, starting from the bottom of the pyramid by discussing the selection of the European distribution network configurations which range from a highly centralized EDC system to a decentralized distribution system. Port and inland distribution centers will also be discussed in this section. After that, the drivers which determine the locations of the distribution centers as well as the popular distribution locations in Europe will be discussed. Finally, we will reach the top of the pyramid by identifying the determinants for VALS location selection. The three levels in Figure 1 are linked to each other. On one hand, companies select the type of distribution network, and then decide on where to perform VALS based on distribution location factors and VALS location factors. On the other hand, the type of VALS which is performed can have a significant impact on the selection of the distribution type and the location of the distribution center(s). The linkages between the three levels of the VALS location framework will be illustrated by analyzing product characteristics and their relationships with the framework. In addition, we will present a case study related to sportswear and a case study on fashion logistics before finishing up with our conclusions.

2. Level 1: Distribution Network Configuration in Europe

2.1 Typology

Supply chains are being redesigned in order to better respond to varying customer and product service level requirements. When it comes to the distribution of overseas goods, a general European distribution structure does not exist (Notteboom, 2009; Rodrigue and Notteboom, 2010). Companies can opt for direct delivery without going through a group of NDCs, (National Distribution Centers) RDCs, (Regional Distribution Centers) or a tiered structure in which one EDC (European Distribution Center) and several NDCs/RDCs are combined to form a European distribution network (Figure 2).

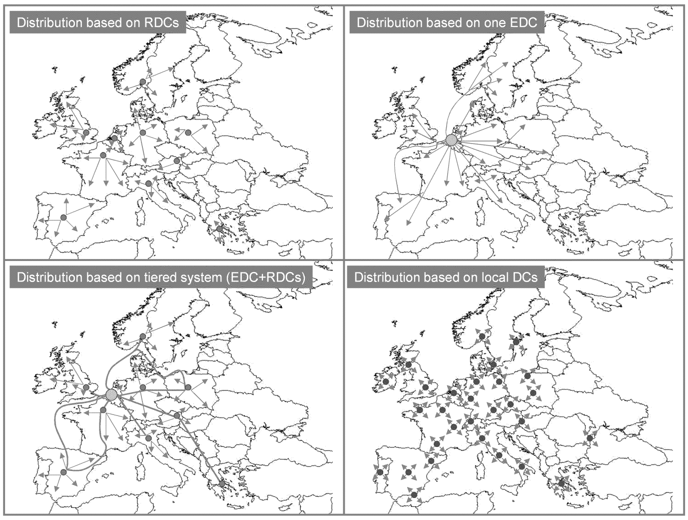


Figure 2.
Distribution network configurations for containerized import cargo in Europe
Source: Notteboom (2009)

Rodrigue and Notteboom (2010) illustrated how distribution network configurations in Europe were transformed. The establishment of the European internal market in 1993 gave companies a chance to consolidate their distribution operations into one central European Distribution Center covering all European Union countries instead of having national distribution centers in the countries they present. The rise of EDCs meant increased distances to the final consumers and in some market segments, local market demand has led companies to opt for regional distribution centers. Recently, a certain degree of decentralization within the European distribution structure has also taken place. Presently, the tiered structure which consists of one EDC in combination with some smaller local warehouses, 'merge in transit' concepts or 'cross docking' offer a good mix to guarantee frequency of delivery and distribution cost control. Companies these days often opt for this(refer to earlier tiered structure of distribution system) hybrid distribution structure of centralized and local distribution facilities. For instance, they use an EDC for medium and slow-moving products and RDCs for fast-moving products. These RDCs typically function as rapid fulfillment centers rather than simply holding inventories.

The increasing focus on logistics service providers and shippers to deliver goods across Europe in only 24h to 48h supports a shift from the EDC based distribution networks (top right in Figure 2) to more tiered structures (bottom left). Companies might even opt to upgrade one or more RDCs in their network to an EDC status, leading to a double or triple EDC configuration. At the other extreme of the spectrum, goods might be directly delivered to the logistics platforms of wholesalers or supermarket chains in a practice commonly known as DC bypass.

2.2 Centralized and decentralized distribution centers

The choice determinants for a centralized DC vs. several decentralized DCs have been highly discussed over the years. According to Kuipers and Eenhuizen (2004), "On one hand, the number of distribution centers serving regional markets are increasing, favoring inland locations which are close to markets. On the other hand the number of centers which serve global markets are also growing, favoring locations close to large international seaports or airports." Notteboom (2009) indicates that the choice between the various distribution formulas depends on among other things, such as the type of product and the frequency of deliveries. In the fresh food industry for example, worldwide or European distribution centers are not common because the type of product dictates the location distribution structure. In the pharmaceuticals industry, European distribution centers are common, but regional or local distribution centers are not present, because the pharmaceutical products are often manufactured in one central plant and delivery times are not that critical. However, high tech spare parts are usually expensive and need to be delivered within a few hours.

Cost-service trade-offs also have an impact on the choice between a centralized or decentralized distribution network configuration (Nozick and Turnquist, 2000). On one hand, centralization of inventories offers an opportunity to reduce costs; on the other hand, storing products as close to the final consumers as possible could help the company to increase its customer responsiveness. This approach has been further developed by Nozick and Turnquist (2001) through the addition of a company's inventory costs and inventory policies as critical drivers.

2.3 Ports and inland ports as locations for distribution centers

The dynamics in logistics networks are also affected by the large-scale development of inland ports which are mainly located in Europe, North-America and parts of China (cf. Yangtze basin). The dry port concept has been addressed and discussed extensively in recent literature (Roso et al., 2009; Notteboom and Rodrigue, 2009b). The various functions of inland logistics centers are wide and range from simple cargo consolidation to advanced logistics services. Many inland locations with multimodal access have become broader logistics zones. They have not only assumed a significant number of traditional cargo handling functions and services, but have also attracted many related services such as distribution centers, shipping agents, trucking companies, forwarders, container repair facilities and packing firms. Quite a few of these logistics zones are competing with seaports for what the location of distribution facilities are concerned. A shortage of industrial premises, high land prices, congestion problems, the inland location of the European markets and severe environmental restrictions are some of the most common reasons that persuade companies not to locate in a seaport. The availability of fast, efficient and reliable intermodal connections is one of the most important prerequisites for the further development of inland terminals (see e.g. Woxenius et al., 2004 and Van Klink and Van den Berg, 1998).

The interaction between seaports and inland locations leads to the development of a large logistics pole consisting of several logistics zones. Seaports are the central nodes that drive the dynamics in large logistics poles. But at the same time, seaports rely heavily on inland ports to preserve their attractiveness (Notteboom and Winkelmans, 2004). The emergence of large logistics poles poses new challenges and changes the traditional relationship between ports and inland ports. With the creation of logistics poles, port benefits might become available to users in inland locations. An active port regionalization strategy (see Notteboom and Rodrigue, 2005) makes it possible to greatly benefit from the reshaped networking among nodes. Ports have to fully benefit from synergies with other transport nodes and other players within the networks of which they are involved with. This supports the development of a broader regional load center network, which serves the large logistics poles. At the same time, the corridors towards the inland terminal network can create the necessary margin for the further growth of seaborne container traffic in the port. Inland terminals as such acquire an important satellite function with respect to ports, as they can help to relieve the seaport area from potential congestion.

Notwithstanding the increase in inland ports throughout many parts of the world, seaports typically remain key constituents of many supply chains. Many ports have actively stimulated logistics polarization in port areas through the enhancement of flexible labor conditions, smooth customs formalities (in combination with freeport status) and powerful information systems.

Logistics activities can take place on the terminal itself, in a logistics park where several logistics activities are concentrated or in the case of industrial subcontracting on the site of an industrial company. While there is a clear tendency in the container sector to move away from the terminal, in other cargo categories an expansion of logistics conducted at the terminals themselves can be witnessed. As such, a mix of pure stevedoring activities and logistics activities occurs.

Many seaports have responded by creating logistics parks inside the port areas or in the immediate vicinity of the ports. The concentration of logistics companies in dedicated logistics parks offers far more advantages than providing small and separated complexes. Five basic types of port-based logistics parks can be distinguished (Buck Consultants International, 1996; Kuipers, 1999):

- Traditional seaport-based logistics park: this type of logistics park is associated with the pre-container area in seaports.

- Container oriented logistics parks. This is the most dominant type and contains a number of large warehouses close to the container terminal locations and intermodal terminal facilities.

- Specialised seaport-based logistics parks. This type of park specializes in different functions which are often closely related to the characteristics of the seaport. The park may focus on the storage of liquid bulk (chemicals), on trade in which a combination of warehousing and office space is offered to a number of import-export companies from developing countries, or on high-value office-related employment in which Fourth Party Logistics Service Providers, logistics software firms, financial service providers to the maritime industry and consultants are located in the park.

- Peripheral seaport-based logistics parks. These parks are located just outside the port areas, which typically offer advantages with respect to congestion, as well as the cost of land and labor. These peripheral parks are part of the greater seaport region and may benefit from suppliers and other specialized inputs associated with the seaports.

- Virtual port-based logistics parks. These parks are located outside the greater seaport area, sometimes at a distance of more than a hundred kilometers from the seaport itself, but have a clear orientation to one or more seaports with respect to the origins of the (containerized cargo).

The term ‘virtual’ is associated with a process called ‘virtual subharborization’, the rise of port-based activities in the hinterland of the ports combined with a stagnation of these activities in the ports themselves. Distribution centers are the primary example of this activity (Buck Consultants International, 1996). The process of virtual subharborization is closely linked to the creation of large logistics poles.

As the hinterland is transformed into a competitive location, the question remains as to which logistics activities are truly port-related. In the new logistic market environment, the following logistics activities typically find a good habitat in ports (Derveaux, 2004):

- Logistics activities resulting in a considerable reduction in the transported volume;

- Logistics activities involving big volumes of bulk cargoes, suitable for inland navigation and rail;

- Logistics activities directly related to companies which have a site in the port area;

- Logistics activities related to cargo which needs flexible storage to create a buffer (products subject to season dependent fluctuations or irregular supply);

- Logistics activities with a high dependency on short-sea shipping.

Moreover, port areas typically possess a strong competitiveness for distribution centers in a multiple import structure and as a consolidation center for export cargo. Ferrari et al. (2006) rightly pointed out that the decision to locate an EDC inside of a port provided advantages and disadvantages. According to Ferrari et al. (2006), the most cited advantages were summarized as follows:

- Good integration and cooperation between terminal operations and distribution center activities;

- Possibility to re-export from the port to other markets;

- Reduced traffic congestion and pollution for local inhabitants by operating EDC activities inside the port area.

The most cited disadvantages of a location in a seaport were:

- Port land tends to be more expensive than land in immediately surrounding areas. The arrows in Figure 3 illustrate that this clearly is the case in Rotterdam, Antwerp and Le Havre. The 'market price' of port land is often higher because port authorities want to avoid facing opportunity costs linked to the sub-optimal use of prime locations in the port areas. Still, port authorities cannot price the port land too high because they have to take into account the competitive setting in attracting logistics operations;

- Port land tends to be 'priced' in a different way. Very often the logistics service provider cannot buy the land because most ports in Europe are of the landlord type whereby the port authority gives the port land in concession to the private port or warehouse operator for a specific term (see Notteboom, 2007 and Theys et al., 2010 for an extensive discussion on concession agreements);

- Manufacturers have less flexibility because of the constraint of having to use a port close to where the EDC is located. This changes in a situation in which the EDC is equidistant between two ports where inter-port competition is generated;

- The work regime in distribution centers in ports is often managed in accordance to the same (sometimes very restrictive) rules for dock workers. For example, registered dock workers in the ports of Ghent, Zeebrugge and Antwerp in Belgium are categorized into two separate groups, namely the General Contingent and the Logistics Contingent (in Antwerp via a law which was passed on December 19, 2000 and in Zeebrugge via the Royal Decree which was signed on July 5, 2004). Dock workers of the Logistics Contingent perform dock labour in locations where, in preparation for further distribution or forwarding of the goods, the latter undergo a transformation which results indirectly in identifiable added value. A similar arrangement exists in the port of Ghent although the names of the contingents are different (for an extensive analysis, see Notteboom, 2010). Logistics service providers might decide not to locate a distribution center in a port partly because of the complexity of the dock labour system in a particular port, or because of a lack of experience with the existing social dialogue patterns in that port (i.e. the present relationship between port employers and labour unions);

- In some cases, the port is located far away from the final destination of the goods.

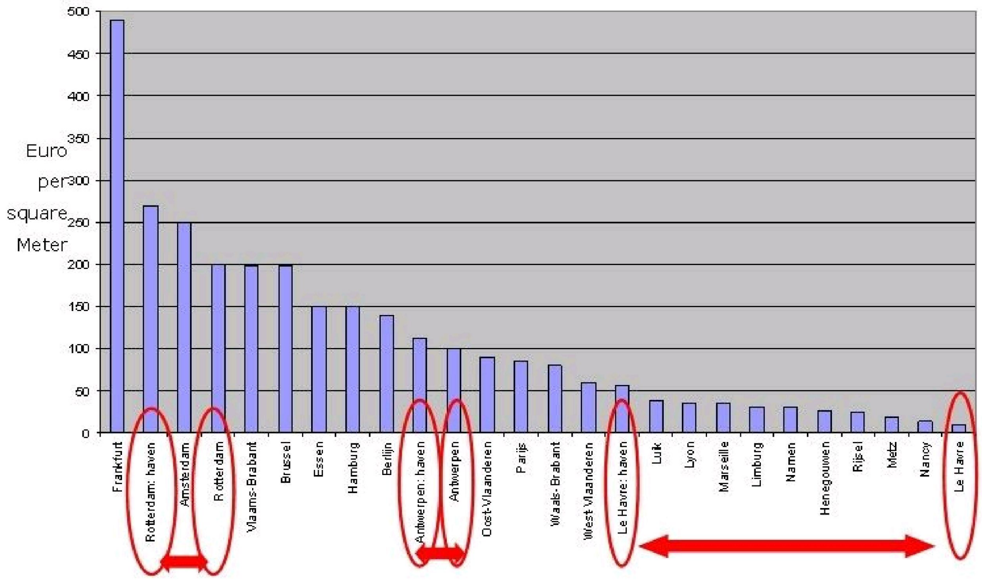


Figure 3.

Distribution network configurations for containerized import cargo in Europe

Source: own compilation based on C&W (2006), Lasalle (2006) and DTZ (2005)

3. Level 2: Location Selection for Distribution Centers

3.1 Factors influencing the location of distribution centers

Facility location decisions as well as distribution center and warehouse location analysis have received considerable attention from academics and practitioners alike over the past few decades. The resultant body of literature has been thoroughly reviewed by ReVelle and Eiselt (2005), Current Min Schilling (1990) and Owen and Daskin (1998). Multi-criteria research, analytical hierarchy process (AHP), and goal programming methodology are often used as ways to analyze location selection (Alberto, 2000; Badri, 1998; Green et al., 1981). Chen (2001) constructed a fuzzy preference relation matrix which provides a ranking order of all of the candidate distribution locations. Christopher et al. (2006) argued that supply chain strategy should be based upon a careful analysis of the demand/supply characteristics of the various products/markets. The optimal distribution location decisions involve careful attention to inherent trade-offs among facility costs, inventory costs, transportation costs, and customer responsiveness (Nozick and Turnquist, 2000). They are also influenced by the inventory stocking policies of the company (Nozick and Turnquist, 2001).

The variables which affect site selection are thus numerous and quite diverse. They can be of a quantitative or a qualitative nature, cf. centrality, accessibility, size of the market, track record regarding reputation/experience, land and its attributes, labour (costs, quality, productivity), capital (investment climate, bank environment), government policy and planning (subsidies, taxes) and personal factors and amenities. Traditional location selection criteria have always emphasized cost related variables such as economies of scale, transportation costs. However, these days non-cost-based variables play a more important role when selecting the locations of distribution centers and variables such as infrastructure support, local labor market characteristics, and institutional factors are frequently considered. The top five major factors which have been identified as strongly influencing international location decisions are: costs, infrastructure, labour characteristics, government and political factors and economic factors (MacCarthy and Atthirawong, 2003). A survey conducted by Hilmola and Lorentz (2010) identified several top warehouse location selection criteria (see Table 1).

Table 1.
Warehouse location criteria

Ranking	Warehouse location Criteria
1	Road transportation connection
2	Low distribution costs
3	Assembly/manufacturing plants near-by
4	Infrastructure support for intermodal transportation
5	Third party logistics solutions are widely available
6	Inbound logistics are easy to connect
7	Low cost labour
8	Railroad connection
9	Future expand potential
10	Company specific warehouse available for lease/rental
11	Availability of labour
12	Enlargement space in the future
13	Air transportation connection
14	Sea transportation connection

Source: Hilmola and Lorentz (2010)

3.2 Distribution Centers in Europe

Some locations are more “EDC preferable” than others. According to the statistics of the Holland International Distribution Council (HIDC), 57% of EDCs serving American companies and 56% of those serving Asian companies are located in the Netherlands. This concentration level is far higher than the other EU countries in the ranking, namely Belgium and Germany (Ferrari et al., 2006). The Netherlands is among the best locations in Europe because companies can take advantage of its central geographical position, good accessibility and infrastructure, expertise of logistics transportation and industry, efficient banking system, and multicultural society with a good knowledge of English (Ferrari et al., 2006).

Cushman & Wakefield (C&W) publishes the European Distribution Report every two years in order to compare Europe’s top-regions for logistics, based on macro-economic factors with an impact on distribution and logistics. The reports traditionally rank countries in and around the so called “Blue Banana” area, and have recently expanded to cover most of the “Key European Hubs” including 61 regions. In 2009, Liège in Belgium was ranked as the top location for EDCs, closely followed by the provinces of Limburg and Hainaut in Belgium and Nord-Pas-de-Calais in France. The main reasons given for the top rankings were excellent access to the main European markets, a centralized geographic location which covers a wide range of European markets, top transport infrastructure and volume, being located close to main ports, or with good multimodal links to those ports, low costs for land, warehousing and labor, and a labor force which is available, highly productive, skilled regarding supply chain jobs, and possesses good language knowledge (Cushman & Wakefield, 2009).

Table 2.
Top EDC locations 2009

Ranking 2009	Region
1	Liege
2	Limburg -B (Genk-Hasselt)
3	Hainaut (Charleroi)
4	Nord-Pas-de-Calais (Lille)
5	Namur
6	Luxembourg -B (Arlon)
7	Alsace (Strasbourg)
8	Oost-Vlaanderen (Gent)
9	Antwerpen
10	Arnsberg

Source: Cushman & Wafefield (2009)

C&W also forecasts the top regions for logistics up to the year 2020. According to this forecast, Liège will not be able to hold onto its top position in the future: it is extremely well located, but the limited availability of land gives this region a slight disadvantage compared to the province of Hainaut, which received the top ranking in C&W's view. This reflects the growing importance of good transport infrastructure for markets south of the actual core European logistics regions; the Seine-Nord canal junction which will upgrade the inland waterway infrastructure between the Paris region and the North of France and Belgium also increases the score of Nord-Pas-de-Calais and Hainaut.

Table 3.
Forecasted top EDC locations in 2020

Forecast 2020	Region
1	Hainaut (Charleroi)
2	Limburg -B (Genk-Hasselt)
3	Liege
4	Nord-Pas-de-Calais (Lille)
5	Düsseldorf
6	Köln
7	Alsace (Strasbourg)
8	Arnsberg
9	Vlaams Brabant (Vilvoorde)
10	Saarland

Source: Cushman & Wakefield (2009)

4. Level 3: Location Selection for VALS

The large number of recent literature contributions has underlined the importance of developing value-added logistics activities in order to help improve customers' satisfaction (Peters et al., 1998; Ryan, 1996). By definition, value-added services refer to unique or specific activities which firms can jointly develop in order to enhance their efficiency, effectiveness, and relevancy (Bowersox et al., 2010), while establishing a competitive advantage in the market place (Gordon, 1989). Apart from its contribution towards achieving customization, value-added services can also contribute to the horizontal integration of the supply chain (Hoek, 2001).

It is difficult to generalize all possible value-added services because these services tend to be customer specific, and it is the customers' opinion of the service quality which determines their satisfaction level (Bowersox et al., 2010; Mentzer et al., 2001). Thus, logistics service providers offer unique VALS in order to enable specific customers to achieve their objectives. For example, Nike produces and delivers customized shoes to individual customers in order to add value to a rather standardized product; Katoen Natie from Antwerp also tailors its service for customers by offering pre-assembly of car dashboards and wiring (Drewry Shipping Consultants, 1999).

Several common VALS offered by logistics service providers have been identified in recent literature, including repacking, labeling, assembling/re-assembling, quality control, order picking, cross docking, reverse logistics, distribution, localizing and customizing, installation and instruction, purchasing/procurement, price tagging, and offering information services (Lai, 2004; Hoek, 2001; Bowersox et al., 2010).

Where to perform these VALS is a crucial decision for logistics service providers, which has received little attention in academic literature. Different activities lead to different location preferences for operation. For example, if product volume increases significantly after repackaging, this activity would be better off being performed close to the final market in order to reduce shipping volume and transportation costs. Another example is that: some added value customization functions in the European market have to be performed in proximity to the final markets since market fragmentation renders source-based prohibitive for many ranges of goods (e.g. a change from an ISO-pallet to a Europallet, or a change in packaging in order to meet the local tastes and languages). Hence, VALS cater to the groupings of different cultures in Europe, implying a variety of tastes, preferences and languages (Rodrigue and Notteboom, 2010).

It is also interesting to notice that once a VALS location has been selected, the situation does not remain unchanged forever. At a certain moment, the factors which drove one company to choose a certain VALS location might no longer be relevant. Changing the VALS location (level 3) to another facility does not take a lot of time (i.e. a matter of weeks or months). However, relocating a distribution center (level 2) takes much longer: once an EDC has been set up, the logistics service provider typically operates the facility for at least 5 to 10 years, mainly because of the sunk costs involved in setting up the EDC. A complete change of the distribution system (level 1) will be even more complex and time consuming. By redistributing the VALS location within the nodes of their distribution network, companies can have a short-term impact on the quality and service attributes within the network without having to change the distribution structure or the facility locations.

The diversity of VALS itself does not provide guidance in helping to decide where to perform these activities: the logistics characteristics of different products also play a key role in making the location decision and link the three levels of the location framework in Figure 1 together.

5. Logistics Characteristics of Products and the Link to the Location Framework

Each individual product has different logistics characteristics (Kuipers and Eenhuizen, 2004). Logistics characteristics of goods will have an impact on operational decisions related to issues such as shipment scale, frequency and velocity, as well as the associated infrastructural level (Notteboom and Rodrigue, 2009). Fashion goods and commodities, for instance, have different logistics factors which require different supply chain strategies (Mason-Jones et al, 2000; Christopher et al., 2006). Fashion goods have a relatively high product shelf value and profit margin, a short product life cycle, high demand variability, a distribution focus measured in service requirements instead of costs, and high requirements in terms of market response flexibility. Commodities, on the other hand, have a relatively low product shelf value and profit margin, a long product life cycle, low demand variability, a distribution focus measured by cost rather than service level, and low requirements on market response flexibility. Fisher (1997) classified products into two categories: 'functional' and 'innovative', and illustrated that the functional products tend to have a stable and predictable demand as well as long lifecycles. Innovative products, in contrast, generally have an unpredictable demand and short lifecycles.

When considering VALS, the most relevant logistics characteristics of products are:

- Distribution focus measurements: services vs. costs
- Intensity of distribution and economies of scale
- Replenishment lead time and demand uncertainty (supply/demand characteristics)
- Ratio of transportation costs as part of total costs
- Product life cycle
- Market response flexibility
- Product profit margin
- Country-specific products or packaging requirements

As discussed in the VALS location framework earlier, for some products, when deciding where to operate VALS, companies first select their distribution system, then choose a specific location for their distribution center(s), and finally decide what kind of VALS to perform in each of the DCs. However, in some cases the VALS which need/can be developed can also have a significant impact on the choices regarding the distribution system and or DC location selection (see Figure 4). Different situations exist mainly due to the various logistics characteristics of different products. The mix of structural logistics factors with relation to products will have a significant impact in determining which distribution network structure the companies will adopt, where to locate the distribution centers, as well as where to operate the VALS. In the upcoming sections, we will elaborate on how different logistics characteristics influence the three levels of the VALS location framework. We will also discuss the linkages between the three levels in more detail.

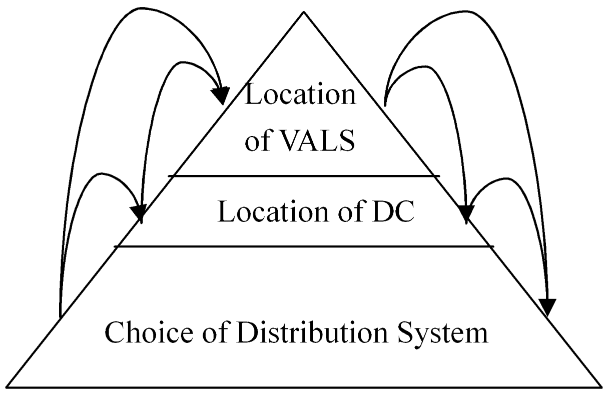


Figure 4.
Linkage among levels of the VAL location framework

5.1 Distribution focus measurements: services vs. costs

Generally speaking, for most labour intensive activities, lower costs may well outweigh higher costs of transport and longer lead times. As a result, these activities are performed in the warehouse at the source in the country of export or at a centralized distribution center. In contrast, service oriented activities which imply quick responses to customers' requests are typically operated near the final market within several decentralized distribution centers. The higher the service requirements of the activity, the closer to the final market the VALS are going to be positioned and the more appropriate it becomes to operate in a decentralized distribution center (see Figure 5).

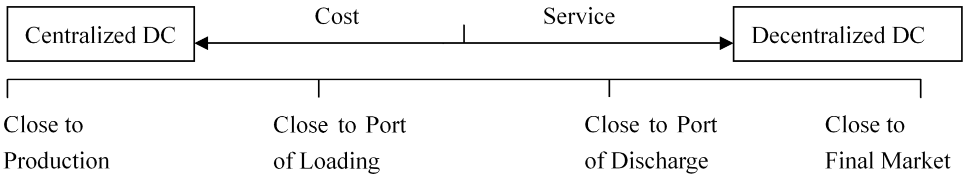


Figure 5.
Distribution focus measurement: Cost & Service

5.2 Intensity of distribution and economies of scale

The delivery frequency is expected to increase as manufacturers and retailers seek to achieve even greater economies linked with low levels of inventory as well as time-based distribution. This will come as a paradox between pressures toward economies of scale and high frequency delivery (Notteboom and Rodrigue, 2009). The centralized distribution system is sensitive to economies of scale. Large economies of scale and a low delivery frequency will lead VALS close to the production origin and promote the centralization of distribution, whereas small economies of scale and a high delivery frequency will push logistics services in the opposite direction (see Figure 6).

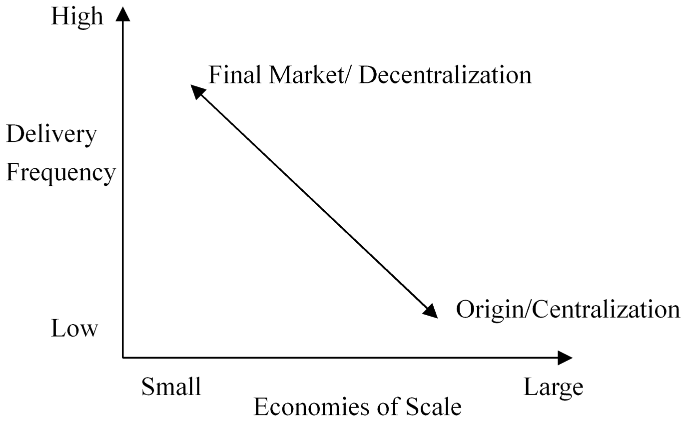


Figure 6.
Intensity of delivery & Economies of scale

5.3 Replenishment lead time and demand uncertainty (supply/demand characteristics)

Replenishment lead time is “the time that elapses from the moment at which it is decided to place an order, until it is physically on the shelf ready to satisfy customer demands” (Silver et al., 1998). Generally speaking, the longer the replenishment lead time, the more safety stock companies need to keep, making it better to include the inventory into a centralized DC structure.

The demand variability of the product is also a major element affecting logistics decisions. Stable and predictable demand leads companies to locate closer to low cost sites and centralize their distribution. Unstable and unpredictable demand requires a quicker response and a higher service level, resulting in companies locating closer to the final market and decentralizing their distribution.

Christopher et al. (2006) designed a matrix which relates different supply chain strategic solutions with their supply/ demand characteristics (see Table 4).

Table 4.
Relating supply chain solutions to supply/demand characteristics

Supply Demand Characteristics	Resulting Pipelines
• Short Lead Time + Predictable Demand	• Lean Continuous Replenishment
• Short Lead Time + Unpredictable Demand	• Agile Quick Response
• Long Lead Time + Predictable Demand	• Lean, Planning and Execution
• Long Lead Time + Unpredictable Demand	• Leagile Production/ Logistics Postponement

Source: Christopher (2006)

This matrix serves as a basis to evaluate distribution solutions based on their account supply/demand characteristics regarding VALS (see Figure 5). First, in situations where demand is stable and predictable and lead time is short, an EDC may be appropriate because logistics services providers can take advantage of a centralized distribution center in order to reduce costs. Second, on the other extreme, (long lead time and high demand variability) the ideal solution is to have one EDC and several RDCs in order to balance costs and response times. Third, if the lead time is long but demand remains stable, there is an opportunity for the logistics service provider to pursue low costs. Finally, when demand is unpredictable but lead times are short, operating close to the final market is required in view of offering quick responses to customers.

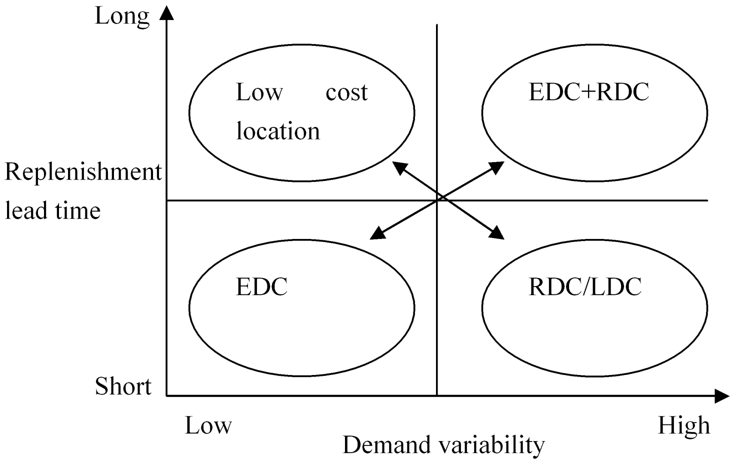


Figure 7.
Relating supply/demand characteristics to the distribution system

5.4 Ratio of transportation costs as part of total costs

A high ratio of transportation costs as part of total costs usually implies long transport distances within supply chains as well as increased energy costs. The percentage of transportation costs in total costs is determined by factors such as the future balance between global sourcing strategies and local sourcing, as well as the continued attractiveness of low cost countries in global supply chains (Notteboom and Rodrigue, 2009). In other words, a high percentage of transportation costs in total costs might motivate logistics service providers to move their activities closer to the customers.

5.5 Product life cycle

Longer life cycles are typical for 'standard' products, such as canned soup, which have relatively stable customer demand, lower market requirements, and a lower profit margin. These kinds of products are appropriate to operate at a centralized low cost site. However, VALS on products with a shorter life cycle would be better performed closer to the final markets.

5.6 Market responding flexibility

If the products need to be able to respond quickly to possible changes in the market, it is better to position the VALS near the customer base.

5.7 Product profit margin

A low profit margin product will have to concentrate on reducing costs and might therefore be better served via a more centralized distribution concept. High profit margin products generally demand a closer link with the customers in order to increase the service levels.

5.8 Country-specific products or packaging requirements

Country-specific products or packaging requirements are beginning to show remarkable flexibility. This function traditionally took place near final markets, but depending on the production structure and the product type, it can be moved directly to the manufacturer or to intermediate locations. Conventionally, market specific packaging was performed at port of entry locations. However, standardization and the creation of economic blocks, particularly in Europe, have expanded this range to a major continental gateway. This could pose a challenge to the development of logistical activities in import-oriented regions such as Western Europe and North America. In addition, if the packaging requirements result in a significant increase in product volume, it is better to perform this activity close to the final market in order to reduce shipping volume and transportation costs.

6. Case Study 1: Nike ELC

This section focuses on the Nike European logistics center at Laakdal in Belgium as a means of illustrating some of the concepts and insights which have been developed in this paper. A survey questionnaire was developed in order to collect information on the determinants that Nike used in the decision-making process regarding the distribution system. The three levels are depicted in Figure 1: choice of distribution system, location of EDC and location of VALS.

6.1 Level 1: Choice of distribution system

Nike Inc., was founded in 1972 in Oregon, and is a well-known world leading company in the sports industry. Nike originated from Blue Ribbon Sports (BLS), a company which was founded in 1964 with an investment of $500 each by Phil Knight and Bill Bowerman. The company has evolved from being an importer and distributor of Japanese specialty running shoes to becoming one of the world leading companies in the design, distribution and marketing of athletic footwear and apparel.

Before the opening of the European internal market in 1993, Nike - like many other international companies - used national distribution centers to serve different European countries. In 1994, Nike built one European operations and logistics distribution center in Laakdal in Belgium to serve all of the countries. This Nike European Logistics Center (ELC) coordinates all the logistical activities between 200 factories and 30,000 clients in 55 countries. All of Nike’s shoes, clothing and accessories which are found in stores in Europe, the Middle East and Africa (the so-called EMEA region) pass either virtually or physically through the facility in Laakdal. The term ELC refers to the fact that the facility not only focuses on distribution, but also delivers VALS to the goods passing through.

Nike’s distribution system in Europe is thus based on a centralized configuration with some of the goods passing through the ELC also reaching parts of the Middle East and Africa. While Nike operates the ELC in Laakdal, the distribution centers of large customers (such as Footlocker and Decathlon) act as a type of ‘external’ RDC which mainly involves cross-docking.

By changing from 32 decentralized DCs prior to 1994 to 1 EDC, Nike has benefitted from big savings on inventory costs and close-outs at the end of each season. While the savings on warehousing and transportation costs were limited, Nike took into account a trade-off between the product life cycle and demand variability when deciding whether to build the centralized distribution center (see Figure 8). Because of the short product life cycle and high demand variability of Nike’s products, it is better to have one centralized distribution center. If the product life cycle is long and the demand is stable, the company can decentralize its products at a low risk. The main logistics characteristics of Nike’s apparel and footwear display a short product life cycle (typically three months due to seasonality), unpredictable customer demand, a high product profit margin, and a distribution focus on service. Given these facts, the strong seasonality and high demand variability were strong incentives for Nike to build the centralized distribution center at Laakdal.

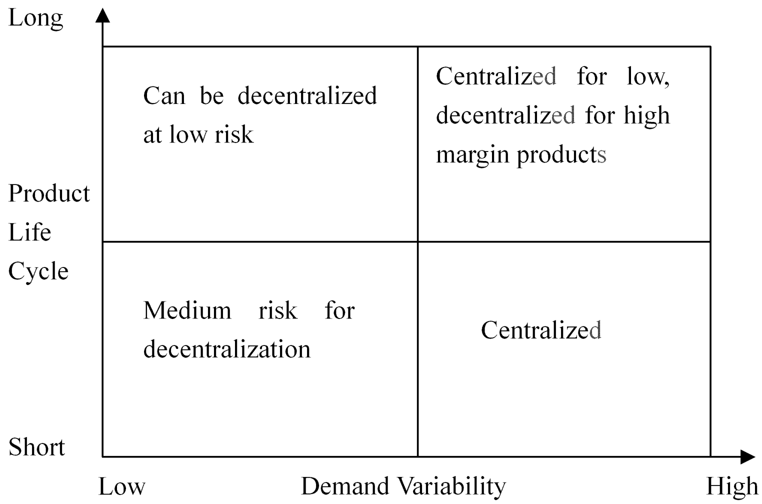


Figure 8.
Centralization vs. Decentralization

Source: Nike

6.2 Level 2: Location choice for the ELC

The Laakdal facility is located along the Albert Canal about 45 km east of the port of Antwerp and adjacent to a large inland container terminal (Figure 9). Laakdal is a small town in Belgium, with a population of around 15,000, and an area of 42.5 square km.

Source: base map adapted from Rodrigue and Notteboom (2011)

Figure 9.
Location of Nike's ELC

Nike's decision to set-up the ELC in Laakdal was mainly based on the following rationale.

Central location - Laakdal is located in the south-eastern part of the province of Antwerp in Flanders, which is often called the gate to Europe. About 60% of European purchasing power is located within 300 miles of Flanders. More than 800 European distribution centers are located in Flanders, and if including all of Belgium and the Netherlands, the number hits around 2000 EDCs. Being located in the central part of the blue banana of Europe, Nike's ELC is well positioned and its products can reach any part of Europe within 4 days.

Infrastructure - The infrastructure support for intermodal transportation near the Nike facility in Laakdal is very good. As mentioned earlier, the ELC is positioned next to the Albert Canal (which connects Antwerp to Liège and the Meuse River) and the WCT inland container terminal in Meerhout. As a result, 96% of Nike's inbound flow is delivered by water via regular container barge services coming from the ports of Antwerp, Rotterdam and Zeebrugge. The barge dependency of Nike's inbound flows also adds to its environmental friendly business focus. Besides the excellent inland waterway access, the ELC is very close to highway E313 which connects Antwerp to Germany. The cargo airports of Brussels and Liège are also within a 100km distance. In March of 2007, Nike welcomed its first inbound container delivery via rail. The first outbound rail left the facility in October of 2008. The addition of rail means that the Laakdal facility has tri-modal access to the gateway ports in Benelux and the European hinterland.

Other important location factors which were identified by Nike relate to the co-operation with local authorities, the availability of an educated work force and the integration process within Nike Belgium.

6.3 Level 3: VALS at Nike ELC

Nike's products can be delivered to their European customers via three different supply chain models:

- Directly from the factory to the customer (one container/one customer);
- From the factory to the customer via a deconsolidation center (one container/multiple customers);
- From the factory to the customer via the ELC in Laakdal.

The third supply chain model (see Figure 10) implies that finished footwear and apparel products first go from the factories in Asia to a consolidator and then to a port of loading in Asia. Most of Nike products are manufactured in China and Vietnam and regular container liner services then transport the manufactured goods to Europe. After the containerized products are discharged in the ports of Rotterdam, Antwerp or Zeebrugge, they are then transferred directly to the Laakdal distribution center, in most cases by inland container barge. The adjacent WCT terminal in Meerhout has regular barge connections with the container load centers located in the Rhine-Scheldt Delta.

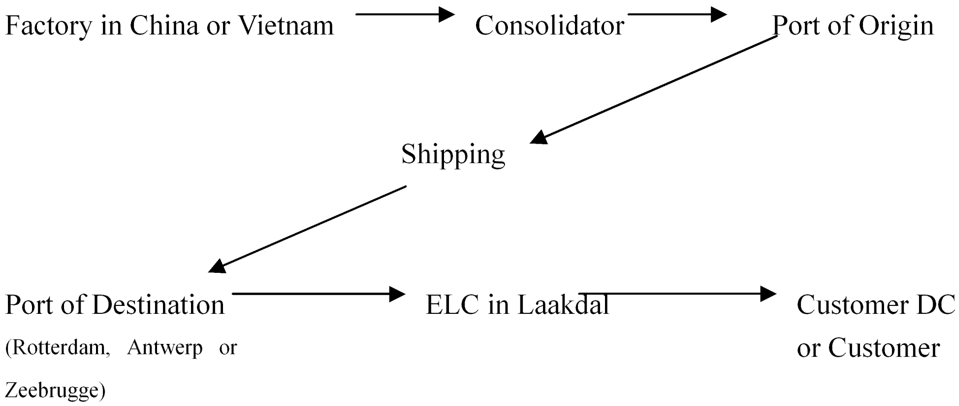


Figure 10.
Nike's Supply Chain

The main activities in the Laakdal ELC are described in Figure 11. The VALS are mainly related to quality control, cross-docking, product labeling, shoebox labeling, the application of security tags, outer carton labeling, palletizing, final packaging, and order picking for Nike's online store orders. Depending on customers' requests, the activities of the Nike ELC can also include the transfer of loose shirts, T-shirts and pants onto hangers in order to make the products shop ready. About 30% of the products are sent to the customers directly without repacking, while the remaining 70% of the products are processed on an item basis in the facility. Big customers with massive order volumes, such as Footlocker, receive the products directly from the Laakdal ELC without repacking. For repacked goods, the logistics system in the ELC is aimed at deconsolidation and reconsolidation. On the inbound side containers are deconsolidated into cartons and then into individual product items. After order picking, the individual items are reconsolidated into cartons, followed by the palletization of the cartons and outbound shipment via truck (in a few cases also by trailer on rail).

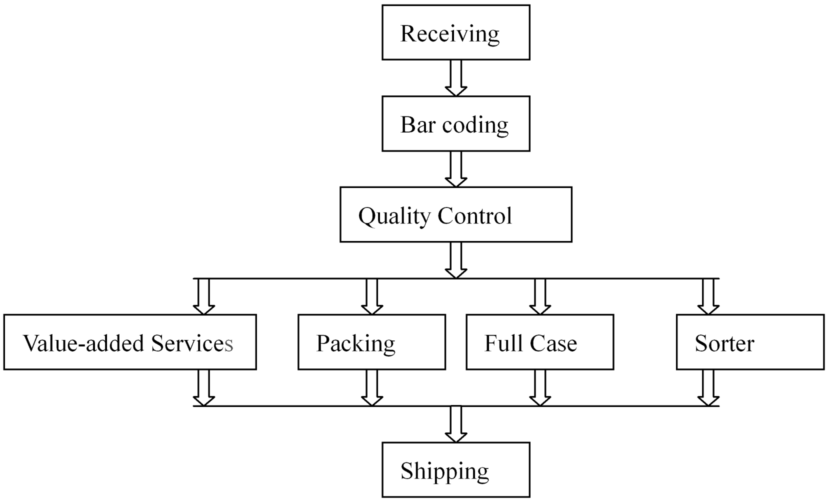


Figure 11.
Major activities in Nike's Laakdal distribution center

Some other value-added services are performed at the source in the country of export. For example, one of the factories in Vietnam has a separate line for producing customized Nike footwear. Customers order customized shoes from the Nike store website using a NikeID, and the factory in Vietnam takes customized orders and produces the products accordingly. Finally, in some cases Nike operates its VALS in a local 3PL close to the customer at the customers' request.

Nike uses the following criteria when deciding where to perform VALS:

- The inventory must be committed to the customer. This means that Nike only executes product value-added services or customized packaging at the factory if there is a direct link between the purchase order and the customer's sales order. In other cases, the inventory is only allocated to the sales orders after receipt at the EDC. This criterion is by far the most important one;
- Complexity and capability of factories, EDC, RDC or 3PL;
- Speed to market - lead times;
- Integration with the customers;
- Cost comparison between different options.

We asked a senior logistics manager at Nike ELC to apply the 5 point Likert scale in order to weigh the location factors that have an impact on where to perform VALS. The senior logistics manager at Nike ELC identified the proximity to the markets/customers, and the integration with customers as the most important factors. This result is in line with the criteria, which was previously described (see Table 5). These factors are followed by costs (wages, land costs, and energy costs), and the quality and price of road transport connections. The least important factors which influenced the location of VALS in the Nike distribution system are government/ political factors and the legal and regulatory framework.

Table 5.
Importance of location factors which have an impact on VALS location selection – survey results for Nike ELC

Factors	Overall importance	Factors	Overall importance
Costs:		Proximity to suppliers	3
Wages	4	Proximity to markets/ customers	5
Land costs	4	Proximity to production	3
Energy costs	4	Competitive environment	3
Labor market characteristics	2	Quality of life	3
Quality and price of road transport connections	4	Social and cultural factors	3
Quality and price of rail connections	3	Government and political factors	1
Quality and price of barge connections	2	Legal and regulatory framework	1
Infrastructure support for intermodal transportation	2	Level of integration with customers	5
Proximity to a (gateway) seaport	2		

6.4 Future trends impacting the Nike ELC in Laakdal

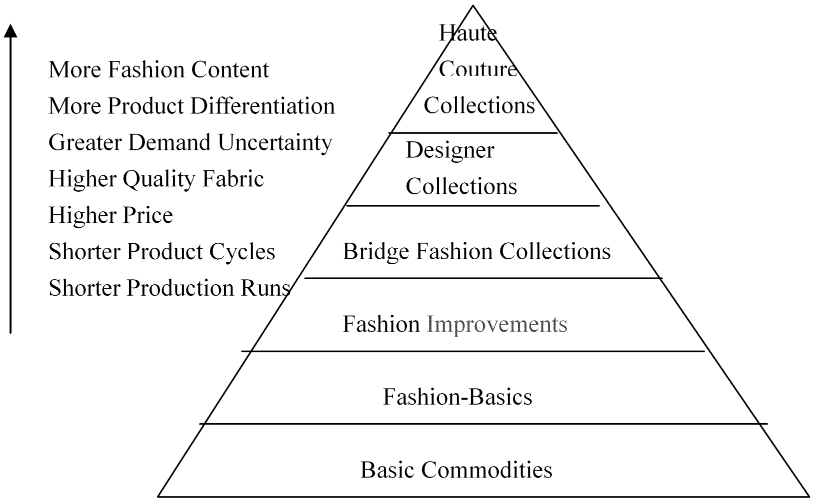
The Nike ELC is increasingly changing from a wholesale DC to a retail DC. As a wholesale DC, monthly seasonal orders per style are delivered to customers via the customers’ DCs. A retail DC, in contrast, delivers straight to the final market. This shift implies more VALS at the ELC as products have to be made customer ready. For example, a store ready label and price tag have to be available on the product, and the logistics flows are becoming more complex because they involve smaller orders, shorter lead times, and a higher SKU (stock keeping unit, such as color*size*type variety).

7. Case Study 2: Fashion Logistics, Luxury Fashion vs. Fast Fashion

7.1 Characteristics of the fashion industry and fashion products

The logistics strategy of the fashion industry has long attracted the interest of researchers. The value chain of the fashion industry is typically "buyer-driven" (Gereffi, 1999). Unlike "producer-driven" value chains in which large manufacturers play a central role in coordinating production networks, "buyer-driven" value chains are those in which large retailers, marketers, and branded manufacturers play the pivotal roles in setting up decentralized production networks in a variety of exporting counties such as China, Turkey, Mexico and India (Gereffi, 1999). Three main types of clothing enterprises were identified by Dunford (2004). First, principal enterprises design collections, develop prototypes and samples, as well as market and distribute the clothing that other enterprises manufacture for them. Second, manufacturers, usually small and highly specialized, engage in what is generally called CMT (cut-make-trim). Third, vertically integrated own-account enterprises sometimes design, make, and sell clothing through their own distribution networks. The fashion industry is characterized by (a) short development cycles of fashion products, (b) rapid proto-typing, (c) small batches of products, (d) a large variety of products, and (e) a spread of costs across a wide range of goods.

The characteristics of fashion products in general have short life cycles, high volatility, low predictability, and high impulse purchasing. Quick response time to current trends has also been recognized as critical in the fashion industry (Christopher et al., 2004). Doeringer and Crean (2006) designed a fashion pyramid (see figure 12), and indicated that "as products move up the fashion pyramid from commodity and fashion basics to designer and haute couture collections, designs and fabric become more differentiated, markets become smaller and more specialized, and demand becomes less and less sensitive to price. These products are sold through a wide range of retail outlets—department stores, high-end specialty chains, and fashion boutiques". The brands of these products are seen as luxury brands. Phau and Prendergast (2001) proposed four central features of a luxury brand including (a) perceived exclusivity; (b) well recognized brand identity; (c) high levels of brand awareness and (d) strong sales and customer patronage.



Source: Doeringer and Crean (2006)

Figure 12.
Fashion pyramid

7.2 VALS for luxury fashion products

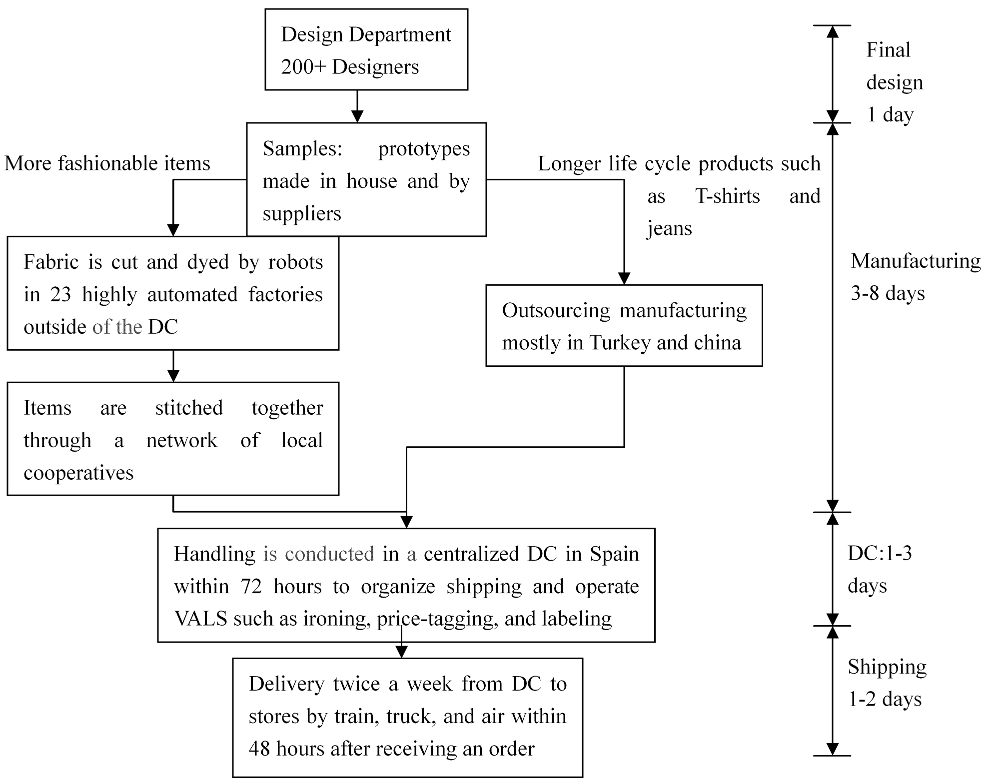
Luxury brands in general operate on a traditional ready-to-wear calendar of fall and spring collections. Retailers place orders months ahead of the seasons and offer the clothing collections to a loyal customer base. Luxury brand companies design collections, and then pass the designs on to their vendors along with strict specifications regarding the finished products, while advising them at every stage of production. Suppliers then have sufficient time to do everything necessary to convert these already polished designs into finished products that are ironed, quality checked, price-tagged and packaged (Tokatli et al., 2008). Thus products from luxury brands have a longer lead time, a higher shelf value, and a lower density of transportation than basic fashion products.

A good example is the British luxury fashion brand Burberry, which was founded in 1856 by Thomas Burberry and is famous for its distinctive Burberry check. In March 2011, Burberry had 417 directly-operated stores and 56 franchise stores worldwide (Burberry annual report 2010-2011), consisting of an haute couture line Prorsum collection, a London collection (Burberry's 'wear to work line'), Burberry Birt (Burberry's 'wear at weekend' line), and Japanese Burberry Blue and Burberry Black line (Tokatli, 2010). The design director is responsible for the design of the Burberry Prorsum collection, while its London-based design team is responsible for the design of the Burberry London range and also oversees the design direction of other Burberry brand lines and ranges (Moore and Birtwistle, 2004). The company outsources the manufacturing, but purchases directly, or retains full control over the purchase by third-party manufacturers, of all raw materials that bear the Burberry name or other Burberry trademarks (Moore and Birtwistle, 2004). Each year, Burberry markets two clothing collections for spring/summer and autumn/winter. Initial orders from wholesale customers are received for spring/summer between the previous June and September, and orders for the autumn/winter seasons are received by March at the latest in the same year (Moore and Birwistle, 2004). In 2010, Burberry began to operate a synchronized monthly flow of new products and floorsets across its physical and virtual real estate, featured in tailored digital assets (Burberry strategy and mission 2011). As a means of reducing goods, handling costs and improving delivery times, the company has adopted full-package manufacturing. The adoption of full-package manufacturing shifts the procurement of raw materials to the manufacturing suppliers, meaning that the manufacturing suppliers finance the whole process of manufacturing. Suppliers are only paid after the raw materials are procured, and the manufacturing is completed, the labels are attached, the finished products are packed and sent to the buyers (Tokatli, 2010). Burberry now operates direct shipments of products from suppliers to wholesale customers in the USA and the Asia Pacific, and plans to extend this service to major wholesale customers worldwide (Moore and Birtwistle, 2004).

7.3 VALS for fast fashion products

In the 1990's, fashion retailers at lower positions in the fashion pyramid experienced a shift in the culture of fashion to fast fashion. The pioneers were retailers such as Spanish Zara and Mango, Swedish H&M, British brands Next and Topshop, and US-based Gap (Tokatli and Kizilgun, 2009). Fast fashion products provide a great variety of styles in limited quantities, with very rapid cycles of designing to putting products in stores (Tokatli et al., 2008). Zara of Spain is known for its twice-weekly deliveries. US-based Anthropologies even receives and displays new clothing items every day of the week except for the weekend (Tokatli and Kizilgun, 2009). While ready-to-wear buyers try to fully control their suppliers, fast fashion buyers seem to give their supplier more freedom; and even pass high-value added activities such as product design onto their suppliers. The outsourcing of designs can help fast fashion companies move even faster when they buy finished products directly because they save time by not having to designing and produce the products.

There are two types of fast fashion retailers: some are retailers with no manufacturing facilities of their own (represented by Gap, H&M and Mango), the others (represented by Benetton and Zara) are retailers with factories (Tokatli, 2008). Zara, with 1723 stores in 77 countries (Inditex annual report 2010), keeps almost half of its production in Spain and Portugal in order to produce high design, more fashionable items which quickly respond to the market and keep pace with constantly changing fashion trends, while outsourcing more basic items in order to help reduce costs. After receiving real time information, Zara's 200 plus designers are able to quickly decide on the designs, finalize the choice of fabrics, send out dyed and cut fabrics for sewing and finishing to 400 nearby suppliers in Spain and Portugal, organize shipping, perform VALS such as ironing, price-tagging and labeling, and put the products in stores within two weeks (Tokatli, 2008). The process of Zara's design, manufacturing and delivery is presented in figure 13.



Source: own compilation based on Fernie and Sparks (2009), Gallaugher (2008)

Figure 13.
Zara's design, manufacturing, and delivery process

All products, regardless of their origin, are distributed to the stores from Zara's centralized distribution centers, where products are inspected and immediately shipped in accordance with the time zones. Before 2003, Zara's logistics system, which served worldwide customers consisted of an approximately 50,000 square meter facility located in La Coruña, but added a second distribution center in Zaragoza in 2003. The logistics system ran on software that was designed by the company's own teams (Inditex annual report 2010). The lead time between receiving an order at the distribution center and the delivery of the goods to the stores was, on average, 24 hours to Zara stores throughout Europe, and up to 48 hours to stores in America and Asia. Most of the VALS Zara performs in the distribution center relate to pre-pricing, tagging of items and putting most items on racks so that the store managers can put them on display the moment that they are delivered without having to iron them first (Ferdows et al., 2004, Tokatli, 2008). Zara's practices of sending half-empty trucks across Europe, or paying for airfreight twice a week to ship coats on hangers to Japan clearly went against the principles of efficiency; but Zara's management team valued global quick responsiveness as being more important than efficiency (Ferdows et al., 2004, Tokatli, 2008). Zara began to operate in its second centralized distribution center in the Zaragoza logistics center in 2003 in an attempt to increase capacity. This distribution center adds 123,000 square meters of warehouse space and is used to distribute products to Zara stores throughout Europe and some other destinations in the American continent and the Asia-Pacific region (Cambra-Fierro and Ruiz-Benitez, 2009). The increased handling capacity in the distribution center could help to reduce waiting periods for orders and allow the company to respond to the market even faster (Ferdows et al., 2004). The Zaragoza logistics center also offers excellent infrastructures with direct access to both railway and highway networks, as well as to the airport of Zaragoza. Zara is also able to take advantage of the integration of different activities that the platform provides. Right next to the Zara distribution center, a company which handles all of the ironing of the clothing was established. In order to save on both time and costs, this company is connected to Zara's logistics center by an underground tunnel which includes an automatic line that moves the clothing between the facilities (Cambra-Fierro and Ruiz-Benitez, 2009).

7.4 Link between the case study and the conceptual framework

In order to compare the VALS of luxury fashion and fast fashion, we can link this case study back to the theory that we pointed out in section 5. Compared to fast fashion products, luxury fashion products have lower intensity of distribution, smaller economies of scale, longer lead times, longer product life cycles, less requirements regarding market response flexibility, a higher profit margin, and a higher shelf value (see table 6).

Table 6.
Product characteristics for luxury fashion products and fast fashion products

	Luxury Fashion Products	Fast Fashion Products
Intensity of distribution	Lower	Higher
Economies of scale	Smaller	Larger
Lead time	Longer	Shorter
Product life cycle	Longer	Shorter
Market response flexibility	Less requirements	More requirements
Product profit margin	Higher	Lower
Product shelf value	Higher	Lower

As indicated in section 5.2, products with lower intensity of distribution give companies a chance to operate VALS close to the production sites in order to help reduce costs. Burberry accomplished this by adopting a full-package manufacturing strategy. The fact that Zara performs VALS in its centralized distribution center in Spain shows the need for the centralization for products with large economies of scale. When compared to fast fashion products, luxury fashion products have relatively longer lead times and longer product life cycles, which provide enough time for luxury brands' suppliers to add price tags and label finished products. Finally, luxury brand products have a higher profit margin and a higher product shelf value, so there is more flexibility for luxury brands to choose where to operate VALS.

In addition to product characteristics, companies' business strategies also play a key role in determining where to operate VALS in this case study. Zara operates a twice-per-week delivery which requires it to perform its VALS in a centralized facility. Also, since fast fashion products are often supplied by a wide range of small suppliers, it is more realistic to operate VALS in a centralized distribution center.

8. Conclusions and Further Research

This paper analyzes how location decisions regarding VALS are made. Based on the logistics characteristics of the products, logistics service providers have to first choose their distribution network structure, followed by location decisions for each of the distribution centers in their network. Finally, they have to decide where to perform specific VALS. We presented a conceptual framework containing three levels in order to depict this process and to demonstrate the linkages between these three levels.

The first case study demonstrated that Nike opted for a distribution network centered around one ELC, mainly because Nike products have a short product life cycle, an unpredictable customer demand, a distribution focus on service, and a high product profit margin. The ELC was set up in Laakdal because of its geographical advantages and connectivity. The ELC also performs VALS according to customers' requests. The criteria that Nike used in deciding where to establish these VALS were also discussed in the paper.

The second case study regarding fashion logistics showed different product characteristics and different VALS strategies of luxury fashion products vs. fast fashion products. It was indicated that in the fashion industry, even if the products have similar characteristics, the company strategy may make a big difference in determining the location where the VALS are performed.

Further research on this topic will be aimed at the comparison among different types of products (e.g. pharmaceutical products, consumer electronics, etc...) in view of examining how different logistics characteristics of products have an impact on VALS dynamics and the related location decisions. We will also invite logistics managers to participate in a future Delphi study. This future research, which will use the Delphi technique in a multi-criteria analysis setting, should provide further detailed insight into the determinants of where to effectively perform VALS.

References

Alberto, P(2000). The Logistics of Industrial Location Decisions: An Application of the Analytic Hierarchy Process Methodology. *International Journal of Logistics: Research and Applications.* 3(3).

Badri, M.A(1999). Combining the analytic hierarchy process and goal programming for global facility location-allocation problem. *International journal of production economics.* 62, 237-248.

Bowersox D.J., Closs D.J., and Cooper, M.B(2010). *Supply Chain Logistics Management,* third Edition. The McGraw-Hill/Irwin Series Operations and Decision Sciences. pp, 65-66.

Buck Consultants International(1996). *Seaports and Their Hinterland.* Nijmegen: Buck Consultants International.

Burberry annual report (2010/11). Available at http://201011.annualreport.burberry.com/.

Burberry strategy and mission, under Burberry corporate profile. Available at http://www.burberryplc.com/bbry/corporateprofile/strmis/

Cambra-Fierro, F. and Ruiz-Benitez, R(2009). Advantages of intermodal logistics platforms: insights from a Spanish platform. *Supply chain management: an international journal.* 14/6 (2009) 418-421.

Chen, C.T(2001). A fuzzy approach to select the location of the distribution center. *Fuzzy sets and systems.* 118, 65-73.

Christopher, M., Lowson, R. and Peck, H(2004). Creating agile supply chains in the fashion industry. *International Journal of Retail and distribution Management.* vol.32, 2004.

Christopher, M., Peck, H. and Towill, D(2006). A taxonomy for selecting global supply chain strategies. *International Journal of Logistics Management.* 17(2), 277-287

Current, J., Min, H. and Schilling, D(1990). Multi-objective analysis of facility location decisions. *European Journal of Operational Research.* 49, 295-307.

Cushman & Wakefield(2009). Comparison of Prime Locations for European Distribution and Logistics 2009.

Cushman & Wakefield and Healey & Baker(2006). European Distribution Report 2006. London, 12 p.

Derveaux, H(2004). Port logistics: the Antwerp case. in S. Licheng and T. Notteboom (eds.), Proceedings of the first international conference on logistics strategy for ports, Dalian Maritime University Press, pp. 394-407

Doeringer, P. and Crean, S(2006). Can fast fashion save the U.S. apparel industry. *Socio-Economic Review.* Sep. 2006, 4(3), pp 353-377.

Drewry Shipping Consultants(1999). *Market outlook for car carriers: new opportunities in a new millennium.* London Drewry Shipping Consultants.

Dunford, M(2006). Industrial districts, magic circles, and the restructuring of the Italian textiles and clothing chain. *Economic Geography.* 82(1):27-59, 2006.

Dunford, M(2004). *The changing profile and map of the EU textile and clothing industry.* European industrial restructuring in a global economy: Fragmentation and relocation of value-chains. ed. M. Faust, U. Voskamp, and V. Wittke, 293-318. Gottingen, Germany: SOFI Berichte.

DTZ Consulting & Research(2005). Benchmark Study Le Havre－Antwerp－Rotterdam. 35p.

Ferdows, K., Lewis, M. and Machuca, J(2004). Rapid-fire fulfilment. *Harvard business review,* Harvard business school publishing corporation.

Fernie, J. and Sparks, L(2009). Retail logistics: changes and challenges. *Logistics and retail management.* Ed. John Fernie and Leigh Sparks, Kogan Page limited, 3rd edition, pp 3-37.

Ferrari, C., Parola, F. and Morchio, E(2006). Southern European ports and the spatial distribution of EDCs. *Maritime Economics and Logistics.* 8, 60-81.

Fisher, M.L(1997). What is the right supply chain for your product. *Harvard Business Review.* March-April 1997, reprint No. 97205.

Gallaugher, J(2008). Zara case: Fast fashion from Savvy systems. Book: *Information Systems: A Manager's Guide to Harnessing Technology.* Flat World Knowledge, L.L.C. (2010)

Gereffi, G(1999). International trade and industrial upgrading in the apparel commodity chain. *Journal of International Economics.* 48, 1 (June 1999), pp. 37-70.

Gordon, J(1989). A textbook case of adding value. *Distribution.* 88, August, 103-105

Green, G.I., Kim, C.S. and Lee, S.M(1981). A Multi-criteria Warehouse Location Model. *International Journal of Physical Distribution & Logistics Management.* 11 (1), 5-13.

Hilmola, O.-P. and Lorentz, H(2010). Warehousing in Europe- Northern actor perspective. *European Transport.* 45, 15-33.

Hoek, R.I(2001). The contribution of performance measurement to the expansion of third party logistics alliances in the supply chain. *International Journal of Operations & Production Management.* 21(1/2), 15-29.

Inditex annual report(2010). Available at http://www.inditex.com/en.

LaSalle, J.L(2006). Belgium Warehousing Report. Brussels, 12p.

Kuipers, B(1999). Liège, Genk or the Maasvlakte: What is the Difference? Spatial Behaviour of Europan Distribution Centres. In: R.H.J. Rodenburg and A.L. Kruse (eds.), Vervoerslogistieke werkdagen 1999. Delft: Connekt.

Kuipers, B. and Eenhuizen, J(2004). A framework for the analysis of seaport-based logistics parks. ICLSP 2004, Dalian. 22-26 September 2004.

Lai, K.-H(2004). Service capability and performance of logistics service providers. *Transportation Research. Part E,* 40, 385-399.

MacCarthy, B.L. and Atthirawong, W(2003). Factors affecting location decisions in international operations- a Delphi study. *International Journal of Operations & Production Management.* 23(7), 794-818.

Mason-Jones, R., Naylor, B. and Towill, D.R(2000). Lean, agile, or leagile? Matching your supply chain to the marketplace. *International Journal of Production Research.* 38 (17), 4061-4070.

Mentzer, J.T., Flint, D.J. and Hult, G.T(2001). Logistics Service Quality as a Segment-Customized Process. *Journal of Marketing.* 65, 82-104.

Moore, C. and Birtwistle, G(2004). The Burberry business model: creating an international luxury fashion brand. *International Journal of Retail and distribution Management.* vol.32, No. 8, 2004, pp 412-422.

Moore, C., and Birtwistle, G(2005). The nature of parenting advantage in luxury fashion retailing- the case of Gucci group NV. *International journal of retail and distribution management.* vol. 33, No. 4, 2005, pp. 256-270.

Notteboom, T(2007). Concession agreements as port governance tools. In: Brooks, M. (ed.), Devolution, port governance and performance, *Research in Transportation Economics.* 449-467.

Notteboom, T(2009). An economic analysis of the European seaport system: report for the European Sea Ports Organization (ESPO). Antwerp: ITMMA- University of Antwerp

Notteboom, T(2010). Dock labour and port-related employment in the European seaport system: key factors to port competitiveness and reform. Antwerp: University of Antwerp, ITMMA. 87 p.

Notteboom, T and Winkelmans, W(2004). FR-WP1:Overall Market Dynamics and Their Influence on the Port Sector. Factual Report on the European Port Sector, European Seaports Organisation. 4-60, Brussels: ESPO

Notteboom, T. and Rodrigue, J.P(2005). Port regionalization: towards a new phase in port development. *Maritime Policy and Management.* 32(3), 297-313

Notteboom, T. and Rodrigue, J.P(2009). The future of containerization: perspectives from maritime and inland freight distribution. *GeoJournal.* 74, 7-22.

Notteboom, T., and Rodrigue J.P(2009b) Inland terminals within North American and European supply chains. Transport and Communications Bulletin for Asia and the Pacific. *Journal of the United Nations Economic and Social Commission for Asia and the Pacific,* 78, 1-39

Nozick, L.K. and Turnquist, M.A(2000). A two-echelon inventory allocation and distribution center location analysis. *Transportation Research. Part E,* 37, 425-441.

Nozick, L.K., and Turnquist, M.A(2001) Inventory, transportation, service quality and the location of distribution centers. *European Journal of Operational Research.* 129, 362-371.

Owen, S.H. and Daskin, M.S(1998). Strategic facility location: A review. *European Journal of Operational Research.* 111 (3), 423-447

Peters, M., Cooper, J., Lieb, R.C. and Randall, H.L(1998). The third-party logistics industry in Europe: provider perspectives on the industry's current status and future prospects. *International Journal of Logistics: Research and Applications.* 1(1), 9-26.

Phau, I. and Prendergast, G(2001). Consuming luxury brands: the relevance of the rarity principle. *Journal of Brand Management.* vol.8, No.2, pp 122-137.

Revelle, C. S., Eiselt, H.A(2005). Location analysis: A synthesis and survey. *European Journal of Operational Research.* 165, 1-19.

Rodrigue, J.P. and Notteboom, T(2010). Comparative North American and European Gateway Logistics: The Regionalism of Freight Distribution. *Journal of Transport Geography.* 18(4), 497-507.

Rodrigue, J.-P. and Notteboom, T(2011). Dry Ports and the Maritime Hinterland: Gaining Momentum. *Port Technology International.* no. 50.

Roso,V., Woxenius, J. and Lumsden, K(2009). The dry port concept: connecting container seaports with the hinterland. *Journal of Transport Geography.* 17(5), 338-345.

Ryan, N(1996). Technology strategy and corporate planning in Australian high - value - added manufacturing firms. *Technovation.* 16(4), 195-201.

Silver, E.A., Pyke, D.F. and Peterson, R(1998). *Inventory Management and Production Planning and Scheduling.* Third Edition. John Wiley & Sons. New York, pp. 48.

Theys, C., Ryoo, D.K. and Notteboom, T(2008). Towards a generic framework for the development of logistics in seaports: lessons from the Busan case. *Journal of International Logistics and Trade.* 6(2), 1-22.

Theys, C., Notteboom, T.E., Pallis, A.A. and De Langen, P.W(2010). The economics behind the awarding of terminals in seaports: towards a research agenda. *Research in Transportation Economics.* 27 (1), 37-50.

Tokatli, N(2007). Asymmetrical power relations and upgrading among suppliers of global clothing brands: Hugo Boss in Turkey. *Journal of Economic Geography.* 7 (2007) pp. 67-92.

Tokatli, N(2008). Global sourcing: insights from the global clothing industry- the case of Zara, a fast fashion retailer. *Journal of Economic Geography.* 8 (2008) pp. 21-38.

Tokatli, N(2010). Old firms, new tricks and the quest for profits: Burberry's journey from success to failure and back to success again. *Journal of Economic Geography.* (2010) pp.1-23.

Tokatli, N., and Kizilgün, Ö(2009). From manufacturing garments for ready-to-wear to designing collections for fast fashion: evidence from Turkey. *Environment and Planning A* 2009. vol. 41, pp. 146-162.

Tokatli, N., Wrigley, N. and Kizilgun, Ö(2008). Shifting global supply networks and fast fashion: made in Turkey for Marks & Spencer. *Global networks* 8. 3 (2008) 261-280.

Van Klink, H.A. and Van den Berg, G.C(1998). Gateways and Intermodalism. *Journal of Transport Geography.* 6 (1), 1-9.

Woxenius, J., Roso, V. and Lumsden, K(2004). The Dry Port Concept-Connecting Seaports with Their Hinterland by Rail. in: Licheng, S. and Notteboom, T.(eds.), Proceedings of the First International Conference on Logistics Strategy for Ports, Dalian. Dalian Maritime University Press. 305-319.