Extended gateways: a pro-active approach towards sustainable logistics - the case of Flanders

van Lier, Tom[1]
Macharis, Cathy[2]
Van Breedam, Alex[3]
Vannieuwenhuyse, Bart[4]
Vanroye, Karel[5]
Hellemans, Roeland[6]

Abstract**:** *In this paper the concept of the "extended gateway" is introduced. An explanation is provided about the pro-active implementation. Extended gateways are prime locations in the hinterland, which reinforce the international gateways –seaports and airports-of a region. In container transport a natural evolution towards hinterland satellite creation exists as the gateways are getting more and more congested. On the other hand the logistics hotspots in the hinterland are reinforced by multimodal connectivity with the gateways and by a concentration of logistics activities which will create agglomeration effects. In order to apply this and other trends in the logistic activities of a region in a pro-active way, a methodology for the implementation of the extended gateway is provided in this paper. The methodology has been applied in the 5 provinces of Flanders.*

Keywords: extended gateways, intermodal transport, collaboration, planning

1. Introduction

The concept of the **extended gateways** has been introduced by Van Breedam and Vannieuwenhuyse (Van Breedam and Vannieuwenhuyse, 2006))[7]. In their definition "The gateway is extended with prime locations embedded in its integrated and multimodal hinterland network. With fast, frequent, reliable and efficient multimodal connections with the gateway these hinterland locations have the same opportunities for logistics activities as the original prime locations in the gateway".
This evolution from a focus on the gateways towards the hinterland can be found in many papers. Most are focusing on ports and the essential hinterland perspective in order to explain the competition between ports and the way containerization made it possible to create satellites, dry ports and the like in the hinterland (Van Klink and Van den Berg, 1998; Heaver et al. 2000, 2001; Notteboom, 2002; Notteboom and Rodrigue, 2008). Notteboom and Rodrigue (2005) describe this as **port regionalization**, showing the importance of the region/hinterland and the activities in the port hinterland network for the further development of the ports. By linking the ports more closely to the inland freight distribution centers, ports are getting a strategic advantage.
Heaver (1993) points out that intermodal terminals are very important in the competitive struggle between ports, to the point that these terminals make the difference and not the ports themselves. Also in the special issue of Goetz and Rodrigue (1999) the importance of

[1] Department MOSI-Transport and Logistics, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium
[2] Department MOSI-Transport and Logistics, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium
[3] TRI-VIZOR, Waterfront Research Park, Galileilaan 18, 2845 Niel, Belgium
[4] TRI-VIZOR, Waterfront Research Park, Galileilaan 18, 2845 Niel, Belgium
[5] Buck Consultants International, Excelsiorlaan 32-34, 1930 Zaventem-Brussels, Belgium
[6] Buck Consultants International, Excelsiorlaan 32-34, 1930 Zaventem-Brussels, Belgium
[7] The concept 'Extended Gateway' and logo has been registered in 2006.

terminals within the transportation networks is stressed. The papers from Notteboom (2002), Notteboom and Konings (2004), Notteboom (2006) and Notteboom and Rodrigue (2005, 2007) describe in a very comprehensive way the evolution towards **terminalization** of supply chains, giving the terminals within a supply chain a crucial role. For them an **extended gate** is used to transfer the temporary storage function to other nodes in the container network, primarily inland terminals and satellite ports (Rodrigue and Notteboom, 2009).
The terminalization, meaning the growing influence of transport terminals in the setting and operation of supply chains in terms of location, capacity and reliability, can have different origins: it can be bottleneck derived or warehousing derived (see Table 1). In both cases the globalization of our economy puts this pressure on the supply chains. In the container sector, this globalization has led to a move away from the deepsea terminals because of shortage of industrial premises, high land prices, congestion problems, the inland location of the European markets and severe environmental restrictions.

Type	Bottleneck-derived	Warehousing-derived
Nature	Terminal as a constraint	Terminal as a buffer
Concept	Rational use of facilities to maintain operational conditions	Incorporating the terminal as a storage unit
Challenge	Storage space, port call frequency, gate access	"Inventory in transit" with "inventory at terminal"
Outcome	Volume, frequency and scheduling changes	Reduce warehousing requirements at distribution centers

Source: Notteboom, 2009

Table 1: Terminalization

For Van Klink (2000) inland terminals can be considered as **extended gates** for sea ports, through which transport flows can be better controlled and adjusted to match conditions in the port itself. The inland terminals are of strategic importance as they improve the access to ports in both a physical and psychological way. For Slack (1999) satellite terminals can be a solution for the congestion in the hub, i.e. the port. Roso et al. (2009) use the concept of **dry ports**, i.e. inland intermodal terminals directly connected to seaport(s) with high capacity transport means, where customers can leave/pick up their standardized units as if it was directly to a seaport. They distinguish distant dry ports, midrange dry ports and close dry ports. The term dry ports shows that mainly a railway connection is meant as high capacity transport means.
Most of these papers point out that this evolution is a natural one and that the forces behind it are originating from the containerization process which is leading to the use of increasingly larger containerships and the use of only a few main hubs. This imposes serious challenges for the physical and spatial possibility to handle the growing number of containers in the ports.
In the last 15 years indeed different logistic zones in different European countries were created as an answer to the challenges in logistics:
- 'platformes logistiques' in France
- Güterverkehrszentren (GVZ) in Germany

- Interporti in Italy
- Freight Villages in the UK
- Zonas de Actividades Logisticas (ZAL) in Spain

In these logistics zones (also called freight villages if they are run by a single body, either public or private) many functions are combined. Because of the synergies between different logistical firms and economies of scale these logistic zones have a strong attractiveness for other external investments.

The extended gateways discussed in this paper are evolving from the same drivers as the extended gates or dry ports. However, it is broader in the possible use of different transport modes (also barge and even road transport[8]) to connect the gateway with the extended gateway (also called **logistical hotspot**). Also airports are included as gateways to a region. In addition, we are proposing a pro-active approach to make use of this evolution and to create substantial benefits for the region involved. The regional and local authorities should not stand back and watch the evolution but have an active role in it by identifying the logistical hotspots in the hinterland and actively direct investments towards them. In this paper we provide the methodology to do so.

The idea of a win-win gateway-hinterland is that the extended gateways on the one hand will reinforce the primary gateways by reducing congestion at the gates and by offering the clients of the port a lower total logistics costs then in other ports. On the other hand the logistics hotspots are reinforced by the strong connection with the port and by the concentration or cklustering of logistics activities which will create agglomeration effects. By the concentration of activities also more environmental means of transport can be used and even if road transport is used it can be optimized by bundling freight flows through collaboration with the other shippers in the hotspot. In that way the decrease of total logistics costs goes hand in hand with a decrease in external costs (Van Breedam and Vannieuwenhuyse, 2006).

In the next section the challenges to implement the extended gateway concept are described. A subsequent section will explain the pro-active methodology used in the case of Flanders.

2. Challenges to implement the Extended Gateway concept

The first important step is **to identify the logistics hotspots** in the region, i.e. Flanders. This will be explained in the next section. Important aspects of this challenge are: developing a multimodal approach, improving partnerships among shippers and searching for innovation in logistics. Flanders has a dense transport network, which is an abundantly clear advantage. Nevertheless capacity on that network is always restricted to a certain level. More and more Flanders has to deal with the problem of congestion. Challenges should also be assessed in this context.

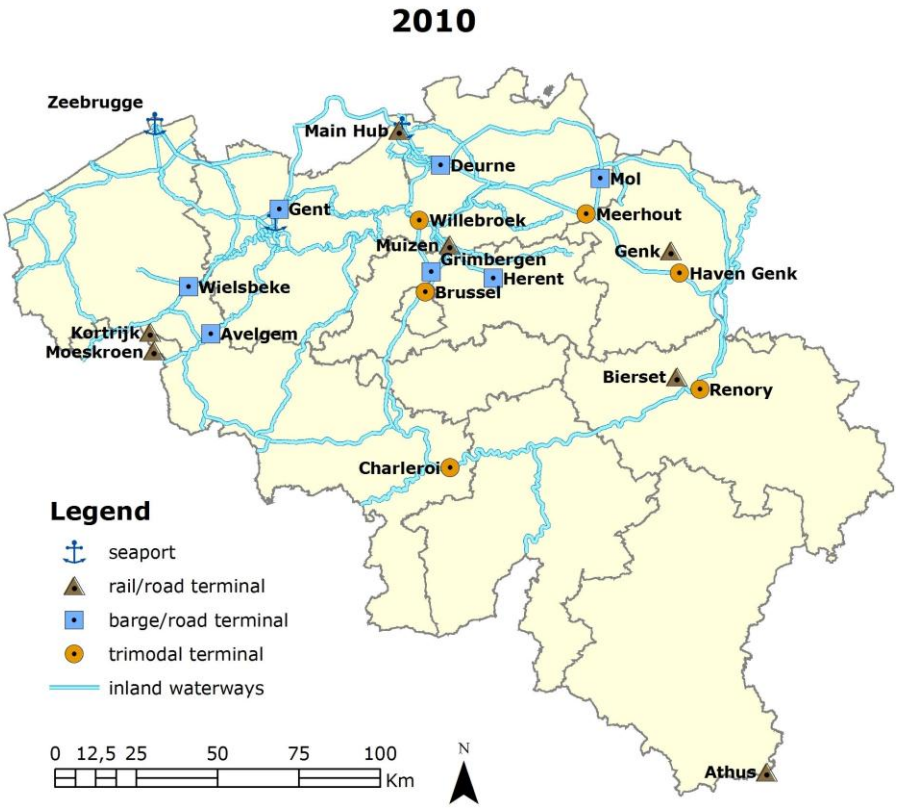
2.1. A multimodal approach

Terms like intermodal, multimodal and combined transport are often used in a confusing way. Therefore, **intermodal freight transport** has been specifically defined by OECD/ECMT as a specific kind of multimodal transport, namely the movement of goods in one and the same loading unit or vehicle by successive modes of transport without handling of the goods themselves when changing modes (European Conference of Ministers of Transport et al.,1997).

[8] As been noted by Notteboom and Rodrigue (2009), an extended gateway with only trucking will at some level of activity be confronted with diminishing returns such as congestion, energy consumption and empty movements so that it will get strong incentives to be reformed in a multimodal platform. However in the identification of interesting extended gateways in Flanders also regions with strong logistical activities with only a connection with road transport were kept into the analysis in order to look at their future possibilities.

A multimodal transport context is a context in which the decision maker is able to consider the different alternative transport modes and to choose the most appropriate one (Vannieuwenhuyse, 2002). That means that the decision maker has enough knowledge and experience about transport services in order to make that choice. The most appropriate transport mode might be a uni-modal solution (road, rail, inland navigation, air, SSS, pipelines,…) or a combination of modes in one trip (multimodal transport).
A multimodal network is considered as a combination of unimodal networks. Transhipment terminals function as multimodal nodes connecting the different modes. Interconnectivity (infrastructure) should be supported by interoperability (organisation). Intermodal transport can, in line with the above definition, be defined as the combination and integration of several transport modes, with the use of loading units (Macharis and Pekin, 2009). These loading units can be containers, swap bodies or even pallets. In Flanders several new intermodal barge terminals were set up in the last decade. The **terminal landscape** has become quite dense in Flanders with its 20 intermodal terminals on a surface of 13.521 km² (see Figure 1).

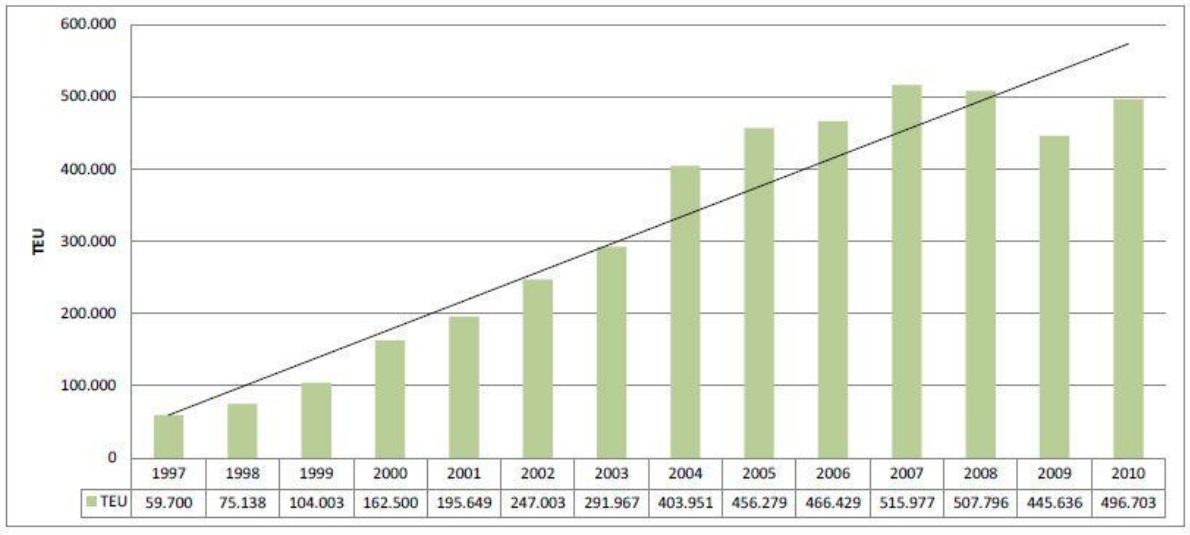
Figure 1 : Intermodal terminal landscape in Belgium (situation end of 2010)



Source: VUB MOSI-T, 2010

The intermodal barge terminals are handling more containers every year, with only a small drop due to the economic crises in 2008 and 2009. The subsequent economic recovery was immediately translated in a renewed growth in container handling at the intermodal barge terminals in 2010 (see Figure 2).

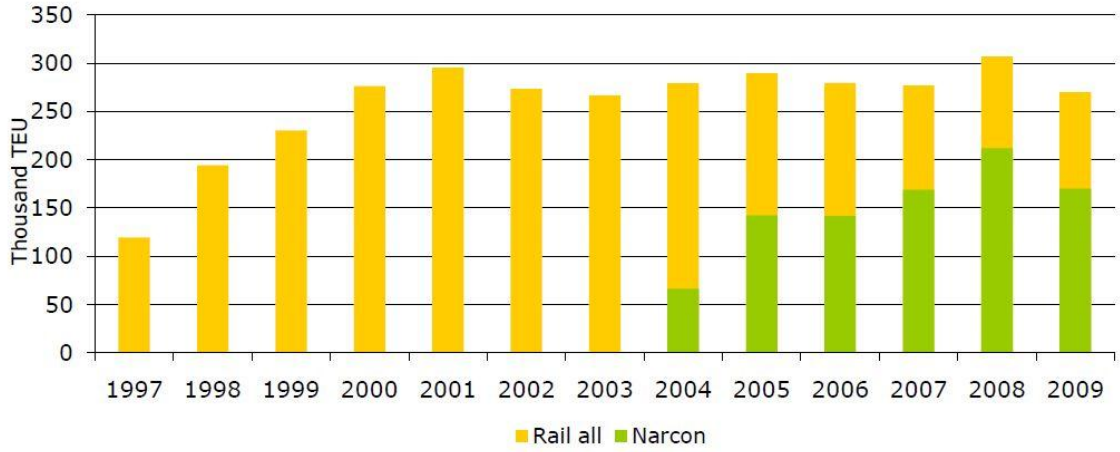
Figure 2 : Containers handled in the Flemish barge terminals



Source: VUB MOSI-T based on the data of Promotie Binnenvaart Vlaanderen (2011)

At the intermodal rail/road terminals such an increase cannot be noticed (see Figure 3). However if we look at the containers that were handled within the Narcon network, which is a network connecting the seaports of Antwerp and Zeebrugges with the hinterland, we notice that this concept is increasingly successful, with exception of the drop in 2009 as a result of the economic crisis. This success is partly due to the high frequency and the reliability of the service and by the extra financial support of the federal government in order to stimulate the service.

Figure 3 : Intermodal rail/road terminals



Source: VUB MOSI-T, 2011

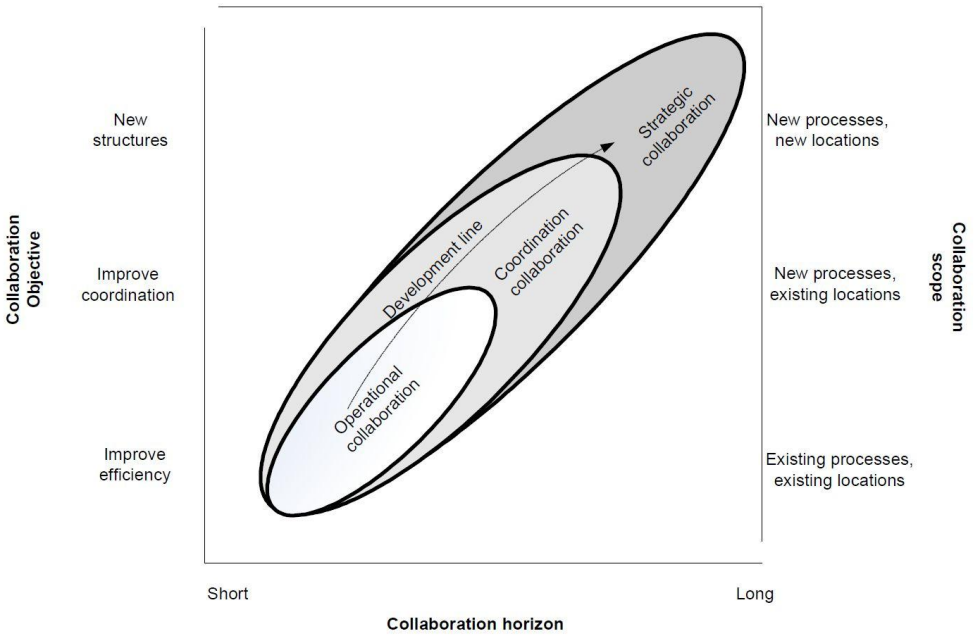
While implementing the extended gateway concept, the location and opportunities of these intermodal terminals were kept in mind. By pro-actively reinforcing the region around intermodal terminals with value added logistics, true logistic hotspots can be created. It can also work the other way around. Areas with already a dense concentration of flows can be identified as a possible location for a new intermodal terminal.
In order to encourage multimodality a distinction can be made between different opportunities, varying from organising information campaigns to developing and distributing decision support tools.

The creation of a neutral, multimodal information centre forms the first opportunity. Such an information centre offers information to logistics actors in order to give them the opportunity to choose the most appropriate logistics decision.
A better utilization of the available capacity is another opportunity. Optimising the opening hours of locks and terminals might be a useful tool here. The critical success factor for this is clearly a supply chain approach, in which all the actors in the whole process are involved.
The concept of total logistics cost is another tool to support multimodal decisions. The Flanders Institute for Logistics (VIL) has developed a manual to support logistics decision makers to reach the most appropriate modal split (VIL Series 2006.002). Several tools, like e.g. the total logistics cost, are incorporated in that manual (see Macharis et al. (2008) for an application of the concept).
As described above a multimodal network is essential for the development of a competitive extended gateway. Beside the infrastructure (= the hardware), there is also an organisational dimension (= the org- or software). Logistics actors have to collaborate in order to utilize the available infrastructure in an optimal way.

2.2. Collaboration

Encouraging collaboration is a second challenge in order to elaborate the Extended Gateway. Besides the infrastructure and the organisation on a macro-economic scale, developing an extended gateway requires also efforts on a micro-economic or company level. As mentioned above one should improve the utilization of the multimodal system. Through better collaboration among companies in the different steps in the supply chain cost reductions can be obtained.
Two forms of collaboration can, in general, be distinguished, namely horizontal and vertical collaboration. **Vertical collaboration** is defined as collaboration between parties that succeed each other in a particular generation process and therefore have different, non-competing activities, whereas **horizontal collaboration** is characterized by cooperation between (potential) competitors that operate at the same level(s) in the market (Vries and Vaart, 2004). Both horizontal and vertical collaboration can differ in collaboration scope and objective with three types of logistics collaboration identified by Vos et al. (2003): operational collaboration , coordination collaboration and strategic collaboration (see Figure 4).

Figure 4 : Three types of logistics collaboration



Source: Visser, L.J., 2007 (adapted from Vos et al., 2003)

Vertical collaboration among partners in the chain, e.g. through intensive information sharing, is more and more common practise. On the other hand, horizontal collaboration between companies at the same level in the supply chain seems often more difficult to realise. However, such horizontal collaboration results in a bundling of freight flows which leads to an increased utilisation of the transport network and the used equipment. Flanders has a huge concentration of freight flows which is an abundantly clear advantage since various potential bundling opportunities exist. This bundling would mean a better use of the equipment and by consequence an increased efficiency for the companies.
Two types of horizontal collaboration can be distinguished:
- Shippers collaboration
- Collaboration among logistics service providers

2.2.1. Shippers collaboration (see Caris et al., 2009)

Consolidation here can be obtained on several levels. Shippers can cooperate in purchasing. This might result in lower prices or higher service levels. However, also the supplier can win, because the latter can also profit of the economies of scale. It is indeed clear that it is easier to communicate with a limited number of clients. Another type of collaboration is in inventory control. Through holding a common stock, companies are able to reduce substantially their buffer and safety stocks. In this way companies can reduce inventory costs. A third type of collaboration is in transport. Through this type of collaboration companies can increase the utilization rate of trucks and decrease the number of vehicle moves. A next collaboration opportunity is on the level of services or facilities. Warehouses, manpower, and even value adding activities like reception, quality control and pre-assembling can be shared among different shippers.
Shippers have continuously been looking for opportunities to improve the efficiency and effectiveness of their supply chains. The aim of traditional supply chain management is to improve both criteria. However, above a certain threshold, a trade-off between efficiency and effectiveness becomes necessary. A higher service level typically means higher costs and vice versa. On top of this, the urge for more sustainable logistics is exerting an additional third pressure on the supply chain. Selecting the optimal trade-off between these three forces becomes even more challenging for all actors of the supply chain.
Further and substantial improvement of the sustainability, efficiency and effectiveness of supply chains can only be achieved through horizontal collaboration, i.e. the consolidation of supply chains or bundling of goods flows across multiple companies. Synergies or complementarities among (competing) supply chains can be exploited to substantially lower costs while increasing service level and sustainability.

2.2.2. Collaboration among logistics service providers

Even more challenging are the horizontal collaboration projects among direct competitors in the highly competitive logistics market. At the moment, most logistics service providers collaborations are limited to establishing groupage networks driven by the goal to cover together a larger geographic region and elaborating complementarity of services. Other drivers for collaboration are developing a common procurement department or investing together in innovative concepts. A common feature in this collaboration in different shapes is the presence of enough confidence and clear agreements, not only on the repartition of costs, but also on the sharing of benefits
Given the multimodal infrastructure, new opportunities can be created for the Extended Gateway through collaboration. The resulting freight flows between gateways and hinterland will be characterised by higher volumes, so that efficient and frequent connections can be built. From the inland terminals or platforms, which are connected with the gateway by means of these high volume flows, the collection of products or the fine distribution might be

organised and even controlled. These inland terminals or platforms are then incorporated as crucial nodes in the Extended Gateway.
A critical success factor here is creating a 'mental shift' towards collaboration and towards co-modality.

2.3. Innovation

The concept of the Extended Gateway strongly depends on an efficient multimodal transport system. Besides an integrated infrastructure providing enough capacity and an optimal organisation and utilization of that capacity e.g. through collaboration, there is still a third challenge to develop a competitive extended gateway: innovation. The transhipment from one mode to another stays an important bottleneck in combining transport modes within a trip. Every transhipment creates friction costs. Improvements in transhipment could further create opportunities for inter- or multimodal transport and as a consequence create more opportunities for the extended gateway.
Beside new or improved transhipment techniques on the terminals, other innovations which are studied today, are e.g.

- crane vessels: vessels having a crane on board which makes transhipment at quays without superstructure possible. In this way inland vessels can be treated at more locations, e.g. directly at shippers' sites.
- ecocombis or road trains: 60 tons/25 m truck combinations increasing the utilization of road capacity and improving the carbon footprint
- TGV Freight: using the high-speed rail network not only for passengers, but also for freight transport.

Through these innovations the threshold towards a multimodal approach is decreased, and as a consequence chances to develop a competitive extended gateway are increased.

3. A pro-active and bottom up approach: the case of Flanders

In order to identify the location of logistics activities in the hinterland, and thus the potential of the Flemish extended gateways, a bottom up approach was implemented. In each of the five provinces of Flanders a study was launched. The main sponsors were the respective Provincial Economic Development Agencies. Co-sponsoring was provided by the rail and waterway infrastructure managers (Infrabel, Waterwegen en Zeekanaal nv and NV De Scheepvaart), the different seaports (Gemeentelijk Havenbedrijf Antwerpen, Haven van Gent, Haven van Zeebrugge), the Belgian Airport Company and some Intermunicipal Companies.
The studies were conducted according to an identical four phased methodology (Buck Consultants International, Vrije Universiteit Brussel MOSI-T & Randstad, 2008):

- In a first phase the logistics "production" structure of the province was provided. Firstly, the logistics concentration was looked at based on employment figures and shift and share analyses were made. Secondly, market intelligence based on interviews with a broad range of private and public stakeholders complemented the formal analyses. Thirdly, an inventory of the intermodal infrastructure was carried out as well as a statistical analysis of freight flows based on Origin/Destination matrices. Finally, a "logistics" provincial map was produced.
- In a following phase a benchmarking was undertaken. Specific provincial locations with a high degree of market concentration were compared with international locations such as Venlo (NL) and Lille (Fr). A broad range of key performance indicators were used.
- By matching the results of phases one (the actual market situation) and two (the possible market situation), the logistics potential per province could be determined as well as the key activities to reap the full market potential.

- In the fourth and last phase, a provincial "business plan" was developed focussing on five key areas:
    - The creation of space for logistics activities;
    - Marketing, acquisition and awareness;
    - Infrastructure and the realisation of the extended gateway;
    - The organisation of the logistics market
    - Creating logistics knowledge and innovation.

Also a provincial logistics mission statement was provided. In three different scenarios the effects of the implementation of the business plan were measured (Buck Consultants International, Vrije Universiteit Brussel MOSI-T & Randstad, 2008):

- A business as usual scenario;
- A slow implementation of the business plan;
- An enhanced implementation of the business plan.

Each scenario provided the effects on employment and the environment and made an estimation of the impact on the required space for logistics activities.

- After finalizing the different provincial studies, the results were integrated in order to get a coherent view of logistics and the extended gateway in Flanders.

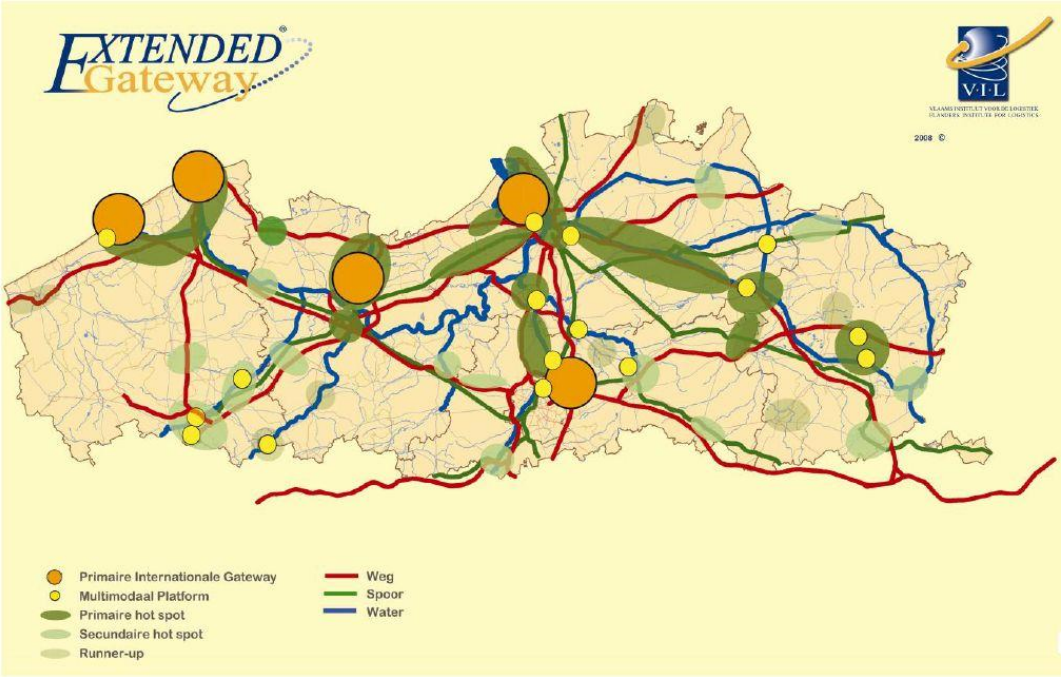
In Figure 5 the extended gateway for Flanders is presented in a schematic way. Gateways like the maritime ports of Antwerp, Zeebrugge, Ghent, Ostend and the airport of Brussels are indicated as well as the most important existing inland waterway and rail terminals. The connection between both the gateways and the transport nodes in the hinterland, is provided by a multimodal network. Most links are available. Some links are still missing. Completing an integrated multimodal network is the first challenge for logistics Flanders. A global and thorough study about the multimodal network and its transshipment points is for that reason necessary.

In the area around the gateways and the inland terminals, but also around the hinterland connections itselves, promising locations for logistics activities appear. These are the prime locations for the Extended Gateway Flanders.

In order to expand these locations collaboration among all relevant stakeholders should be realized. This is the second challenge. In Flanders industrial companies, logistics providers, infrastructure operators and authorities should work together in a more intensive and structural way.

A last challenge is innovation. Through the introduction of new techniques and new concepts the logistics sector in Flanders can be strengthened and kept competitive in Europe. The Extended Gateway is the ideal framework in order to realize this ambition.

Figure 5 : Three types of logistics collaboration



Source: Vlaams Instituut voor de Logistiek (VIL), 2009

4. Conclusions

In this paper the concept of the **extended gateways** was explained and a methodology was proposed to come to a pro-active approach for the implementation of the concept. The four phased methodology has been applied to the five provinces of Flanders. In order to be successful the different involved actors should now work further on the recommendations of the study. The local and regional government has a task in the creation of an institutional framework so that logistic activities should be primarily located in the identified hotspots and to overcome the existing infrastructural bottlenecks. In addition it can pro-actively stipulate bundling opportunities when locating a new company. The already established companies should start to find ways to collaborate and to rethink the mode choice of their freight flows. A neutral actor for the bundling of the goods can help to overcome the problems of confidentiality. The academic sector should cooperate with the logistics sector in order to provide adapted educational packages and help to create an open innovative laboratory with the sector.

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