Economic Importance of Belgian Transport Logistics

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by Frédéric Lagneaux

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ECONOMIC IMPORTANCE OF BELGIAN TRANSPORT LOGISTICS

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Statement of purpose:

Orders

Abstract

This paper is a publication issued by the Microeconomic Analysis service of the National Bank of Belgium.

This is the outcome of a first research project on the Belgian transport logistics sectors. In the past few years, the logistics business has turned out to play a significant part in wealth creation in our country, whose economy is driven by services. This study can be seen as an extension of Working Paper No. 115 on Belgian ports, issued in May 2007[1], as the activities under review are closely tied to transport in general and maritime transport in particular.

Considering that this is a first attempt to estimate the economic importance of Belgian transport logistics, it was decided to favour a sectoral approach, by focusing on some freight transport logistics sectors clearly defined in the NACE classification. The impact is presented in two parts: the direct effects and the indirect effects. Furthermore, a short analysis is provided about the economic impact of other activities, such as in-house logistics and European distribution centres.

An overview of some developments per sub-sector is provided for the period 2000 - 2005, with the emphasis on 2005. The core of the analysis, which is statistical and therefore not based on a survey, looks more specifically into developments in terms of value added, employment, investment and the financial situation of the companies concerned. A first estimate of developments over the 2005 - 2006 period is also provided for value added and employment.

Annual accounts data from the Central Balance Sheet Office are used for the calculation of direct effects, the study of financial ratios and analysis of the social balance sheet. Also worth mentioning is that the indirect effects of the activities concerned have been estimated in terms of value added and employment, on the basis of data from the NAI (National Accounts Institute). A comprehensive analysis of the linkages between the sectors under review and the other Belgian sectors is presented.

The activities under review accounted for no less than 3.1 p.c. of Belgian GDP and 3.4 p.c. of the country's domestic employment in 2005. Including indirect effects, these percentages respectively amounted to 5 and 5.3 p.c. in the same year. Taking some survey data into account, the overall impact would reach roughly 8 p.c. of the Belgian economy, if transport logistics business provided by external branches on the one hand and in-house transport logistics on the other were added to these above-mentioned sectoral percentages.

This report provides a comprehensive account of these issues, giving information per economic sector.

JEL classification: C67, J21, L91, L92, L93, L96, R15, R34 and R41.

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[1]   Lagneaux (2007).

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FOREWORD

Every year, the Bank[2] publishes an update of its study on the economic importance of the Flemish maritime ports and the Liège port complex. That publication provides some useful tools enabling the competent authorities and the public to get a clear picture of the impact Belgian ports have on the entire national economy. There is growing interest in similar research work for the logistics sectors in a country that is increasingly dominated by services and, therefore, by logistics activities, intertwined with the ports' operations and, further, with all transport activities. Belgium is indeed increasingly referred to as a *logistics paradise* (see below). It is one of the tasks of this report to verify this statement. This competitive advantage has to be borne in mind and further capitalised on, in order to embrace the ever faster pace of globalisation and to withstand worldwide competition. This study is aimed to help national and regional decision-makers to better understand the economic stakes lying in transport logistics, by way of a thorough estimation of its overall *economic* impact. This paper does not focus on the structural or technical background of every single sector reviewed.

INTRODUCTION

Economic context

2006 saw a confirmation of growth across the European continent, which balanced out against the US economy. Economic growth in the euro area is estimated to have risen from an average of 1.5 p.c. in 2005 to 2.8 p.c. in 2006 (GDP in volume), the highest rate since the beginning of the century. However the rising activity and the risk of inflation resulted in most central banks' raising their interest rates, including the ECB's gradual increase in its benchmark rate. In Belgium the evolution was pronounced too, since economic growth reached 2.9 p.c. in 2006, against 2 p.c. the year before. At global level, growth was still mainly driven by the Asian economies. World trade picked up, and almost equalled the pace seen in 2004, its expansion still far exceeding that of world GDP[3].

The Belgian economy is mainly driven by the tertiary sector, as approximately 75 p.c. of its GDP is derived from services, ranging from transport and communications to business services. This is the result of the *de-industrialisation*, accompanied by the outsourcing and relocation of a substantial share of industrial activities from the late 1980s onwards, and the ensuing boom of services and transport sectors over the same period. That percentage is roughly 10 p.c. higher than the average for the EU-27. In 2004 and 2005, investment surged in the service sectors, especially maritime transport and logistical services, followed by a substantial increase in industrial sectors the next year. Globalisation keeps intensifying and shipped volumes keep growing[4], along with ever-strengthening trading relations with the rest of Europe, in which the EU enlargement plays a considerable part, and the rest of the world. Belgian foreign trade is dynamic in the EU, with respect to its annual production[5], which makes our country very dependent on its transport infrastructure and logistics. Belgium is regarded as a transit country and its sea ports are seen as major European gateways that supply the whole continent. Above all, Belgian and European ports and consequently all modes of transport draw direct benefit from the growth of international trade. In this context, containerisation has confirmed its ascendancy over other packaging methods and logistics around it is gaining a tremendous momentum.

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[2] National Bank of Belgium. In short, NBB.

[3] For more details, see NBB (2007), *Annual Report 2006*, or Belgostat On-Line (www.belgostat.be). For European figures, see also Eurostat (ec.europa.eu/eurostat).

[4] In Belgium, maritime tonnage rose by 3.7 p.c. between 2004 and 2005, and by 6.3 p.c. between 2005 and 2006, driven by the structural growth of container transport (+ 9.5 p.c. annually). Short sea shipping, which accounts for half the maritime traffic in the Flemish sea ports, grew faster than deep sea shipping. More information in Lagneaux (2007).

[5] The share of imports and exports in Belgium's GDP has risen steadily since the creation of the Common Market. In 2000, it was slightly above the 70 p.c. mark. In 2006, the figures were higher than 80 p.c., substantially higher than the average score of the EU. Source: Belgostat.

Belgium's location, at the heart of the *Blue Banana*[6] (see figure 1), in the centre of an area where millions of consumers are concentrated, is of strategic importance. This is why our country is so often referred to as a *logistics paradise*. This description is somewhat relativised by the ongoing eastward reshaping of this "Banana" and the recently-published World Bank *Logistical Performance Index* ranking putting Belgium in 12th place worldwide for its logistical platform[7].

FIGURE 1   THE BLUE BANANA
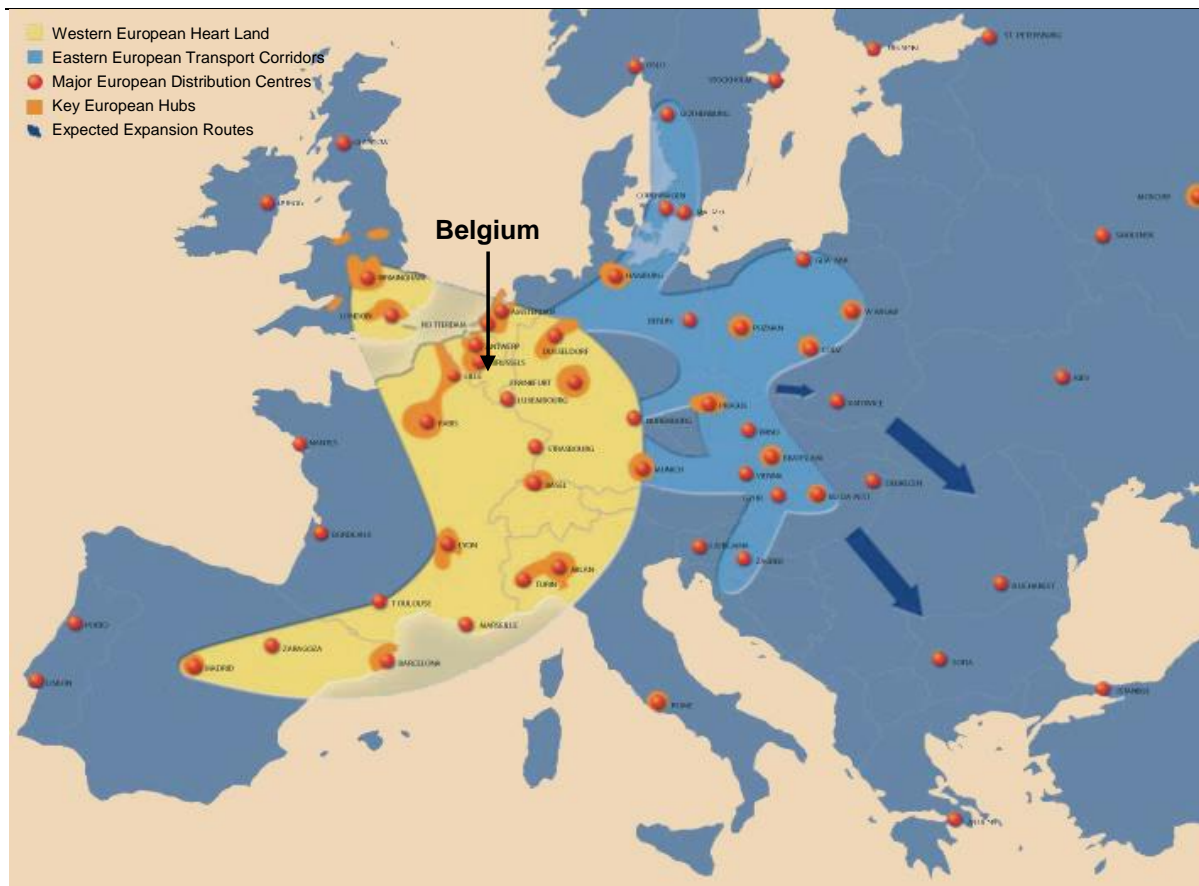
Source: Cushman & Wakefield (2006).

According to the latest Cushman & Wakefield *European Distribution Report*[8], seven Belgian provinces feature among the top 10 logistics regions within Europe (see section 2.1.6).

Logistics is more than ever considered by the federal and regional governments as a priority field for the development of national and regional economies, as such activities are expected to grow enormously in the future, boosting value added and creating new jobs. Governmental support and public investment in this field have consequently grown remarkably over the last few years. In Flanders, for instance, considerable efforts are made to solve the education gap between the needs of qualified workforce and the number of specialised graduates[9]. In addition, the Flanders Logistics programme aims to ensure a prosperous future for logistics activities in the Region, with an emphasis on increasing its visibility

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[6]   The notional region covering the major logistical poles and distribution centres of Europe, stretching from the south-east of the UK to north-eastern Spain and down to Madrid, through Benelux, western Germany, eastern France, Switzerland and northern Italy. This discontinuous corridor of urbanisation tends to extend eastward, with the starting up of new European distribution centres -EDCs- or regional distribution centres -RDCs- servicing expanding markets, in the wake of the enlargement of the European Union (EU). See also section 2.3.1.

[7]   For the purpose of this study, 150 countries were scrutinised and some 800 professionals from the sector surveyed. This ranking is topped by Singapore, the Netherlands and Germany. More information in World Bank (2007), *Connecting to Compete: Trade Logistics in the Global Economy*; www.worldbank.org.

[8]   Cushman & Wakefield (2006). Cushman & Wakefield is an internationally renowned real estate broker.

[9]   Pilot projects have been set up in 2007 by the Flemish Region, focusing on several aspects of the logistics issue, such as location, capacity utilisation, labour market, R&D and information technologies. More information on www.flanderslogistics.be.

abroad. This kind of move is being made in Wallonia as well. The Walloon Region's priority action plan for the future of Wallonia[10], also known as the "Marshall Plan", is a good example of what is going on at the regional level in Belgium: promoting, through appropriate economic and fiscal measures, the sectors with the highest potential, including the growing transport and logistics competitiveness pole, in order to enhance growth and development. Although quite limited in space, the development of logistics poles in Brussels Capital Region, in and around the port of Brussels in particular, is promising too.

At the European level, freight transport and logistics landscapes are evolving rapidly. Road transport, inland waterway transport and air transport of goods have been opened up to competition in the last ten years across the EU and other modes of freight transport or utilities are to follow suit in the coming years. This goes for the railways, since January 2007, and postal services, whose total liberalisation is planned for 2011[11]. Following the European Parliament's rejection of the directive on the liberalisation of port services at the beginning of 2006, the period of discussion on this subject is continuing, with some preferring a directive on transparency and fair conditions of competition between the ports. The EU Commission's Communication entitled "Keep Europe moving - Sustainable mobility for our continent"[12] stresses the key role logistics has to play in ensuring sustainable mobility and contributing to meeting other objectives, such as a cleaner environment, security of energy supply, etc. According to the Commission, "effective transport systems are essential to the continent's prosperity: not only do they facilitate the mobility of citizens and goods, they also have a significant impact on economic growth, social development and the environment". The transport industry - freight and passengers - accounts for about 7 p.c. of EU GDP and 5 p.c. of employment in the EU. The Commission describes it as "an important industry in its own right, which also has a major impact on the functioning of the European economy as a whole" and refers to mobility as "not simply an essential component of the competitiveness of European industries and services; it is also an essential citizen right". Overall, it is clear that these objectives put the Union's transport policy at the heart of the Lisbon agenda for growth and jobs, while their long-term vision balances the imperatives of sustainable development. According to some estimates, investment in logistics doubled between 2005 and 2006 in the EU, stimulated by the tremendous growth in central and eastern Europe where the number of third-party logistics providers - 3 PLs - is increasing rapidly[13].

Rationale and objectives of the study

This is a first endeavour to assess the economic importance of Belgian logistics on the basis of micro-economic information managed by the Bank. Logistics is very wide in scope, as it pervades the entire economy and generally encompasses a myriad of operations ranging from materials management to physical distribution. The technological operations around it, and in particular the information and communication technologies it uses (tracking and tracing, EDI systems, etc.), are gaining in importance in the logistics sector as a whole. However, here we will first concentrate only on *freight transport* logistics, tackling sectors clearly identified in the NACE classification[14] as transport-bound logistics sectors, all coming under the so-called freight transport logistics *cluster*[15]. Besides, these sectors generally include the above-mentioned sophisticated operations.

In this research paper, two main aspects of the economic impact are highlighted for the period 2000 - 2005: the direct and the indirect effects. The former concerns the activity resulting from the direct

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[10] In French: *Actions prioritaires pour l'Avenir wallon.* This plan was adopted by the Walloon Region on 30 August 2005 and was translated into new budget lines until 2009. More information on gov.wallonie.be/code/fr/action_prio.pdf.

[11] This liberalisation concerns all kinds of mail. The transport of parcels weighing more than 50 grammes was already liberalised in 2002.

[12] *Keep Europe Moving - Sustainable Mobility for our Continent* - COM(2006)336, a mid-term review of the European Commission's 2001 Transport White Paper, entitled "European transport policy for 2010: time to decide". See also the Commission's DG Transport website: http://ec.europa.eu/transport.

[13] Goodman Real Estate Investment Management (June 2007), *European Logistics Snapshot.*

[14] NACE-Bel 2003 classification, Belgian translation of the Eurostat's NACE classification, Rev. 1.1. See appendix 1.

[15] A cluster can be defined as "networks of production of strongly interdependent firms (including specialised suppliers) linked to each other in a value-adding production chain". See OECD (1999), *Boosting Innovation: The Cluster Approach.* Since the appearance of Porter's study on *The competitive advantage of nations* (The Free Press, New York, 1990), the cluster concept has become a central element of industrial policy. This approach was applied in the study on the maritime ports.

activity, expressed in terms of value added and employment, generated by transport logistics companies themselves, while the latter relates to the indirect value added and employment generated upstream, among their suppliers from other branches based in Belgium. Other aspects of the economic and social situation of the businesses under review are outlined in this report, such as their social balance sheet and financial health, over the period 2003 - 2005.

A first estimate of the 2005 - 2006 evolution of VA and employment is also provided.

Following a brief introduction, a few definitions of logistics are presented and the methodology used is explained. The analysis as such is then split up into four parts:
1) direct effects of the Belgian freight transport logistics cluster;
2) indirect effects of the Belgian freight transport logistics cluster and analysis of the sectoral linkages;
3) additional assessment of the economic impact of freight transport logistics services provided by other sectors or performed in-house by shippers[16] for their own use;
4) an attempt to globalise the economic impact of freight transport logistics in Belgium.

The whole national territory is covered by this research paper. Only section 2.1.6 will give some indication of the share attributed to each Belgian Region in the VA and employment totals. The microeconomic data used come from the companies' annual accounts filed with the Central Balance Sheet Office[17] and the statistics produced by the National Accounts Institute (NAI[18]). No additional survey was carried out. At the Central Balance Sheet Office, the 2006 accounts will not be officially closed until the beginning of 2008. Similarly, the NAI figures for VA and employment, necessary to estimate the indirect effects up to 2006, are only published after a certain time lag. Therefore, using the latest updates in all the calculations, the study covers the period until 2005. However, as a certain number of (mainly large) firms' 2006 accounts were filed in autumn 2007, an initial estimate of direct VA and employment can be made for the year 2006. The definitive figures for that year are expected in a later edition, in both direct and indirect terms, and including other variables.

With a view to drawing as complete a picture as possible of the overall impact of freight transport logistics, this sectoral study is complemented, in a final section, by the study of freight transport logistics activities carried out by external sectors and the same operations realised inside companies, which do not show up as part of the logistics sectors' business in the national accounts.

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[16] More precisely: charterers or road hauliers, depending on the mode selected. In French: *affréteurs*; in Dutch: *charteraars*.

[17] An NBB Microeconomic Information service. See www.nbb.be / Central Balance Sheet Office.

[18] The National Accounts Institute (NAI) set up by the law of 21 December 1994 links three institutions: the National Statistical Institute (NSI, now FPS Economy – Directorate General for Statistics and Economic Information), the National Bank of Belgium and the Federal Planning Bureau. The NAI's duties include drawing up the real national accounts and the input-output tables necessary for the estimation of the indirect effects. The most recent data available at the time of estimating indirect effects were the 2000 IOT and the 2003 SUT.

1   <u>LOGISTICS: DEFINITIONS AND METHODOLOGY</u>

The evident complexity of the object of this study calls for clear guidelines in terms of scope and calculation methods. After quoting a few historic definitions, one single definition will come to the fore and the methodology used for this analysis will be explained.

1.1   <u>DEFINITIONS</u>

A straightforward definition of logistics, which pervades the whole economy, is elusive. But an overview of some concepts attached to it can help bring out its significance for this study.

1.1.1   *Definitions from literature*

The term originates in the military world but is today broadly used in business and industry. Logistics experts are required on board large manufacturing companies and more and more specialised companies are designed to offer a wide range of logistics services addressed to companies which decide to outsource such activities. Originally, logistics referred to the military organisation of moving, lodging, and supplying troops and equipment. Its general definition today is the detailed organisation and implementation of a plan or operation[19]. It also refers to all means and methods of organising a service, an enterprise, etc.[20], as well as the process of controlling goods and information movements[21].

The following definitions add some useful elements to this first description.

    o BUSINESS LOGISTICS AND SUPPLY CHAIN MANAGEMENT[22]:
Logistics is that part of the supply chain process that plans, implements, and controls the efficient, effective flow and storage of goods, services, and related information from the point of origin to the point of consumption in order to meet customers' requirements[23]. The concept of *supply chain management* has emerged in recent years. It captures the essence of integrated logistics and even goes beyond it. Supply chain management is defined as the systematic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole[24].

    o FLANDERS INSTITUTE FOR LOGISTICS[25]:
In the context of the logistics of supply chain management, logistics encompasses four functional domains: purchase and procurement logistics, production logistics, distribution logistics and reverse logistics. Transport logistics is seen as the organisation of flows of goods and information across these functions.

    o HANDBOOK OF LOGISTICS AND SUPPLY CHAIN MANAGEMENT[26]:
Logistics contributes to the creation of time, place, and even form utility through the management of processes that enable companies to get the right goods to the right place at the right time in the right condition and at the right cost.

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[19]   Shorter Oxford English Dictionary (2007).

[20]   Le Robert (2007).

[21]   Van Dale Groot Woordenboek (2007).

[22]   Ballou R.H. (2004).

[23]   From the by laws of the *Council of Logistics Management*, accessed at CLM's web site http://www.clm1.org.

[24]   Mentzer J.T. et al. (2001).

[25]   *Vlaams Instituut voor de Logistiek*. See http://www.vil.be.

[26]   Brewer A.M., K.J. Button, D.S. Hensher (2001).

o A STUDY ON THE SOCIETAL VALUE OF LOGISTICS, THE NETHERLANDS[27]:

This study describes logistics as a "container concept"[28], whose definition can be very broad, since activities such as the transfer of goods within the same industry could be taken into account. The authors of the report instead choose to restrict its scope to the dedicated transport-bound logistics. Three segments make up logistics as a whole: physical logistical processes - which form the core of the logistics sector -, control and support. *Physical logistical processes* encompass transport modalities, transport (assistance) services, warehousing, handling, value-added logistics, storage and administrative settlement. *Control* concerns the forwarders, ship brokers, 3PL, 4PL (definitions in section 1.1.3 below), planning & control and management. *Support* covers ICT services, consulting / research, banks, insurance, accountants, maintenance, (temporary) employment agencies and leasing companies. In accordance with a strict definition, transport-bound logistics consists of the first two segments, actually corresponding to NACE branches 60 to 64[29], grouped under the heading "Transport, storage and communication". Supporting activities - the last segment -, critical though they are for logistics, fall outside the strictly defined array of sectors and form a separate group. A logistics company is usually active in more than one of the above-mentioned activities. The official NACE classification of a firm reflects its core business. It concerns external operations, as opposed to "in-house" ones.

o EU COMMISSION'S COMMUNICATION "KEEP EUROPE MOVING"[30]:

In this Communication, the European Commission defines the scope of activities to focus on, in the framework of its action plan for freight transport logistics. This sector is defined as that covering the planning, organisation, management, control and execution of freight transport operations in the supply chain.

1.1.2 *Agreed definition*

The terms logistics and supply chain have various meanings, as we have seen. A simple definition of logistics is elusive as every company, every market player or economic agent has its own, according to the operations and processes at stake to run their business. However, in order to avoid having to examine all logistics companies on an individual basis by surveying them and instead proceed with a systematic approach, we need to circumscribe the research area to a certain number of well-defined economic activities, whose scope is relevant to this study. It is generally agreed that sectors have to be considered in their strict definition, based upon the information the Bank collects and processes. Therefore, it was decided to focus on some specific branches referenced in the NACE classification. The translation into a strictly defined set of economic sectors is complemented by the study of the indirect effects, which aims to represent the derived implications the cluster under review has for the whole economy. The supply-chain concept, which is larger in scope than a sheer listing of activities such as these, can be approached on the basis of this twofold sectoral analysis.

Transport-bound logistics forms the only set of economic activities clearly defined in the NACE classification. In other classifications, such as the CBS[31] classification in the Netherlands, or the Novalog nomenclature [32] at European level, the same issue arises. As of May 2007, the Belgian joint commissions 140 (blue-collar workers) and 226 (white-collar employees), that previously only concerned transport activities and logistical activities on a residuary basis, group transport and logistics together. All firms in charge of road transport services on behalf of third parties now fall within the joint commission 140 or 226, as do the companies which provide exclusively logistics services on behalf of third parties. Companies which deliver logistics services inextricably bound up with a production or a trading activity, where these services relate to competence of other specific joint commissions, are not taken into account though. In other words, joint commissions 140 and 226 only tackle the distinct (outsourced) transport logistics activities[33].

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[27] TNO Inro (2003). Original title in Dutch: *Een verkenning naar de maatschappelijke waarde van logistiek.*

[28] *Containerbegrip* in the original text in Dutch.

[29] In the Netherlands, those sectors correspond to codes 65 to 75 of the CBS classification.

[30] *Keep Europe Moving - Sustainable Mobility for our Continent* - COM(2006)336.

[31] Dutch central statistical office, in Dutch *Centraal Bureau voor de Statistiek*, see http://www.cbs.nl/en-GB.

[32] See http://www.novalog-project.org/english/nomen.

[33] More information on that matter on http://www.meta.fgov.be.

These activities, considered in their own right by those commissions, are at the core of our study, which enables us to consider logistics as a separate economic cluster. Therefore, we choose to concentrate on **service providers in freight transport logistics.** Freight transport logistics encompasses the following activities: Transport via railways, furniture removal by road, freight transport by road, renting of trucks with driver, transport via pipelines, sea and coastal water transport, inland water transport, scheduled air transport, non-scheduled air transport, cargo handling in sea ports, other cargo handling, storage and warehousing in cold-storage buildings, other storage and warehousing, other supporting land transport activities, other supporting water transport activities, other supporting air transport activities, forwarding offices, transport mediation, chartering, ships' agencies, customs agencies, other activities of transport agencies, national post activities, courier activities other than national post activities. All these activities come under branches 60 to 64 of the NACE classification, as table 1 indicates (section 1.2.1).

1.1.3   Outsourcing trends

The *Handbook of Logistics and Supply Chain Management* examines in some depth the growing importance gained by logistics activities in our economy. In the context of wider recourse to outsourcing, a real market has sprung up for logistics services, as "third-party logistics service providers" (3PL) emerge among freight forwarders, or any companies that have developed new capabilities in some area of logistics. This is true for many transport companies that have operating divisions or subsidiaries providing logistics services to complement their carrier activities. Such a decision is often referred to as the "make or buy decision", which can apply to all industries. Whereas many companies traditionally carried out a wide range of logistics activities internally, activities which only large and vertically integrated manufacturing or retailing organisations could deal with, more and more of these operations are nowadays being managed or operated by third-party specialists[34].

In the complex and highly competitive economic and business environment facing most companies today, a single firm cannot control its whole product flow channel from raw material source to points of final destination or consumption. Outsourcing is often contemplated in companies that do not want to invest too much in large-scale logistics operations and instead prefer to focus on some specific processes. Opting for outsourcing may then mean more sustainable and efficient logistics, where operations and information systems are used more rationally. Among the reasons for a company to outsource logistics operations, the report *Sustainable logistics through outsourcing*[35] recalls some advantages offered by logistics specialists, such as a higher expertise, a better integration of warehouse and distribution, a greater flexibility and efficiency, a more favourable financial situation, lower own investments, variabilised fixed costs and a better concentration on core business. Other companies decide though not to outsource their transport logistics activities. By keeping these in-house, they actually consider they can have a better control over the entire process, get a foothold in the logistics services market themselves and gain a better understanding of it.

A Flanders Institute for Logistics (VIL) report[36] analyses the in- and outsourcing trends of logistics services in Flanders. Logistics services provision comes in several forms, usually taking one of the following descriptions:

- 1PL or "first party logistics" = the client irregularly subcontracts a very limited number of transport tasks, the provider's assignment being limited to transport of goods from origin to destination,
- 2PL or "second party logistics" = the service provider is in charge of operational activities, ranging from goods transport to warehousing but not of value-added logistics; the client and its supplier may have a contractual relation here,
- 3PL or "third party logistics" = 2PL + value added services covering the flow of goods and, increasingly, of information; the client and its supplier do have a contractual relation in this case,
- 4PL or "fourth party logistics" = 3PL + design, control and management: towards services integration, whose aim is to maximise the value generated in the logistics chain. The mission of the so-called lead logistics provider, i.e. supply chain integrator, is to manage all or a considerable part of the logistics operations provided by specialised subcontractors under its control, for the account of its client who decides to outsource their integration.[37]

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34   More information in Brewer A.M., K.J. Button, D.S. Hensher (2001).

35   Joanknecht & Vieveen BV (2002). Original title in Dutch: *Duurzame logistiek door outsourcing*.

36   VIL (2004), *In/Outsourcen van Logistieke Diensten in Vlaanderen*.

37   See definitions provided by VIL (2007), *Fourth Party Logistics.*

The evolution from in-house logistics operations to more complex logistics services provided by external providers is obvious. From internally executed operations, more companies tend to subcontract such activities, the service provider taking care of wider, more sophisticated and more integrated tasks than ever. Good examples of integration are postponement and reverse logistics. The former consists of a logistics organisation designed to postpone as far as possible mass product customisation operations within the logistics chain. The latter is meant to efficiently manage the reverse flows to the suppliers in order to guarantee the quickest response time[38]. According to the VIL's survey, more than 80 p.c. of the respondents outsourced their transport operations and almost 17 p.c. their warehousing operations in 2004. The highest growth in the outsourcing figures has been in the knowledge-driven businesses, in other words, in operations that are more complex than straightforward transport services.

A similar research paper, published early this year, analyses the most recent subcontracting trends in Belgium. The *Business Logistics Survey Outsourcing*[39] suggests that, in 2006, while 90 p.c. of the 306[40] surveyed Belgian shippers outsourced at least part of their transport activities, only 10 p.c. carried out all transport in-house and 19 p.c. mixed in-house operations with subcontracting. This effectively means that 71 p.c. of Belgian shippers choose to outsource 100 p.c. of their transport activities. Criteria such as reliability and price of the service are the first to be taken into account by the shippers when it comes to choosing their service providers. As regards warehousing, subcontracting seems to be less widespread but, over the same period, as many as 34 p.c. of the surveyed companies entrusted third parties to manage at least a part of their warehousing tasks, and 22 p.c. of them still outsource 100 p.c. of their warehousing activities while 12 p.c. mix the two methods. But, among the remaining 66 p.c., almost half of the companies intend to outsource those operations in the medium term, and a good many of them are even considering to take the step within a year. Here too, reliability and costs are paramount, but continuous service improvement, tracking and tracing performances and, above all, value added logistics, pay off substantially as well.

According to another source, the FPS Economy – Directorate General for Statistics and Economic Information, about 22.5 p.c. (data for 2005[41]) of the transport activities, expressed in tonne-kilometres or tkm, are taken by the shippers on their own account. Expressed in terms of shipped tonnes, this percentage amounts to 33.6 p.c. but this percentage is less relevant than that mentioned above, since it does not completely reflect the real activity of the shipper.

These observations confirm the overall outsourcing trend and supports an approach consisting in focusing on distinct freight transport logistics activities, represented by specialised freight transport logistics service providers.

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[38] Roland Berger pour l'Union Wallonne des Entreprises (2006).

[39] De Vos B. and J. Proot (2007). Data for 2006.

[40] Among the 306 valid responses, 13 sectors are represented in the sample, the largest ones being wholesalers (distribution in both durables and non-durables), chemicals, pharmaceuticals, food industry and mechanical construction.

[41] Report entitled *"Les transports routiers de marchandises effectués par les véhicules belges d'une charge utile d'une tonne et plus".* More information on http://statbel.fgov.be/pub/d7/p745y2004_nl.pdf (Dutch version) or http://statbel.fgov.be/pub/d7/p745y2004_fr.pdf (French version). The most recent figures are those for 2004. Therefore this is an extrapolation made by linear regression over the period 2000 - 2004, and applied to estimate the percentage in 2005.

1.2   METHODOLOGY: TWO-STEP APPROACH AND FURTHER DEVELOPMENTS

The assessment of the economic impact of an economic sector is usually carried out in two steps: the study of the direct and indirect effects it generates in the national economy. Therefore, we start our research by considering a "cluster"[42], this approach permitting to distinguish the strictly defined freight transport logistics sectors as recorded in the national accounts. The first step consists of calculating the economic, social and financial situation of the firms belonging to the freight transport logistics cluster defined below (section 1.2.1). The figures obtained and results pertain to the so-called direct effects (section 1.2.2). But the economic impact of the sectors under study deeply transcends them, as every job active in one logistics sector creates some activities upwards - at their suppliers -. This brings us to the second step of our reasoning. The indirect value added and employment apparent at their suppliers is taken into account for the measurement of the total economic impact of Belgian freight transport logistics, which consists of adding direct to indirect figures. Another way to estimate the indirect impact is to look into the technical coefficients and the backward and forward linkages, as defined in section 1.2.3. Backward linkages are related to the calculation of indirect VA and employment. The transport logistics cluster also impacts on activities downwards - on their customers -, which is highlighted by the forward linkages.

But, in a service-driven economy like Belgium's, freight transport logistics is pervasive insofar as it transcends sectoral borders. Indeed, we find many companies from external sectors, which do not belong to the cluster under review, e.g. commercial or industrial companies (especially in the chemicals, metal-working, food, etc.), that carry out logistics operations in-house, or even deliver them to third parties. This part is obviously not negligible. This has to be reckoned with when drawing an overall picture of the entire activity at a national scale. This is why a last section is dedicated to third parties not coming under any of the sectors mentioned before, i.e. freight transport logistics activities carried out by external sectors, and likewise logistics operations realised inside companies, which prefer to keep them in-house (section 1.2.4).

1.2.1   *Freight transport logistics cluster*

The cluster defined here encompasses all activities ranging from freight transport to the logistics attached to it. It comprises the NACE branches contained in table 1 below. A sectoral approach is followed. Table 1 links the 5-digit codes of the 24 NACE branches to a synthetic definition of the 12 sectors considered in this study (see third and last column). All the findings in this report are broken down by sector[43].

The cargo storage and cargo handling sectors are very close in their definitions. So are the forwarders and agencies sectors. However, a clear distinction between those activities is quite possible, and indeed pertinent, in a study about logistics. This requires a more precise analysis of these sectors than provided in the study on ports, which presents them in a more aggregate fashion.

Where applicable, the results will be presented in the order of appearance of the sectors as mentioned in column 3 of table 1. Likewise, a division will be mentioned between branches 60, 61 and 62, coming under the heading "transport sectors", and branches 63 and 64, under the heading "other logistics sectors".

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[42]   P.m.: a cluster is defined as "networks of production of strongly interdependent firms (including specialised suppliers) linked to each other in a value-adding production chain".

[43]   Attention: this term must not be confused with the institutional sectors presented in the national accounts, which actually denotes a set of institutional units, each defined with respect to the sort of producer they represent. More information in the methodology of the national accounts. See www.nbb.be.

TABLE 1   TRANSPORT LOGISTICS CLUSTER: SECTORS UNDER REVIEW

NACE code	Definition	Sector[44]
60100	Transport via railways	Rail transport
60241	Furniture removal by road	
60242	Freight transport by road	Road transport
60243	Renting of trucks with driver	
60300	Transport via pipelines	Pipeline transport
61100	Sea and coastal water transport	Sea and coastal water transport
61200	Inland water transport	Inland water transport
62100	Scheduled air transport	Air transport
62200	Non-scheduled air transport	
63111	Cargo handling in sea ports	Cargo handling
63112	Other cargo handling	
63121	Storage and warehousing in cold-storage buildings	Cargo storage
63122	Other storage and warehousing	
63210	Other supporting land transport activities	
63220	Other supporting water transport activities	Supporting transport activities
63230	Other supporting air transport activities	
63401	Forwarding offices	Forwarders
63405	Transport mediation	
63402	Chartering	
63403	Ships' agencies	Agencies
63404	Customs agencies	
63406	Other activities of transport agencies	
64110	National post activities	Postal services
64120	Courier activities other than national post activities	

Source: NBB.

As mentioned above, only <u>freight</u> transport activities are reviewed here. To manage this further selection, namely for branches 60.100, 61.100, 61.200, 62.100 and 62.200, whose official definitions do not cover the nature of "shipment", their respective lines in each year's supply tables were analysed so that goods transport could be distinguished from passenger transport. Only the former was taken into account for this study, the latter not falling within its scope. In other words, only freight transport operations were retained, on the basis of some specific "product codes"[45].

Table 2 indicates what share of each 3-digit NACE branch, the so-called "SUT branch"[46], was recorded. The 2000, 2001, 2002 and 2003 supply tables were analysed. As the 2003 supply table is the most recent available, it also had to apply for 2004 and 2005.

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[44]   Attention: this term must not be confused with the institutional sectors presented in the national accounts (see above).

[45]   Product codes considered in this research are those used in the national accounts. They are presented in appendix 1.

[46]   SUT stands for supply-use table. This aggregation level is the one used in the IOT and all the subsequent indirect effects calculations.

TABLE 2   SHARE OF EACH BRANCH RETAINED FOR THE STUDY OF *FREIGHT* TRANSPORT LOGISTICS
(percentages)

SUT branch	Definition	Corresponding 5-digit NACE branches	2000	2001	2002	2003	2004	2005
60A1	Transport via railways	60.100	18.0	15.5	15.6	13.7	13.7	13.7
60C1	Freight transport by road and removal services, transport via pipelines	60.241, 60.242, 60.243, 60.300	100.0	100.0	100.0	100.0	100.0	100.0
61A1	Sea and coastal water transport	61.100	97.8	98.4	98.3	98.6	98.6	98.6
61B1	Inland water transport	61.200	71.0	85.3	86.7	89.4	89.4	89.4
62A1	Air transport	62.100, 62.200	9.5	8.8	8.8	8.8	8.8	8.8
63B1	Cargo handling and storage, other supporting activities and organisation of transport	63.111, 63.112, 63.121, 63.122, 63.210, 63.220, 63.230, 63.401, 63.402, 63.403, 63.404, 63.405, 63.406	100.0	100.0	100.0	100.0	100.0	100.0
64A1	Post activities	64.110, 64.120	100.0	100.0	100.0	100.0	100.0	100.0

Source: NBB and NAI.

The calculation of these percentages was confronted with the sector and some academic world representatives' analyses on this matter. And these shares proved to correspond fairly well to reality.

Hypothesis:

It is assumed that, if φ per cent of a NACE branch relates to freight transport, then all the companies belonging to that branch realise the same φ per cent of their business in freight transport as well. For instance, only 13.7 p.c. of rail transport's output is attributable to actual freight transport. Therefore, it is assumed that all rail transport companies realise 13.7 p.c. of their activities in the freight transport. For the specific case of La Poste - De Post, which belongs to branch 64A1, only the mail activities - national, international and express delivery services - were retained, i.e. on average 88.1 p.c. over the period 2000 - 2006[47]. With regard to the other companies active in postal services, however, 100 p.c. of their business was recorded.

The definition of all the NACE branches is given in appendix 1. The SUT branches correspond to the aggregation level applicable in the algorithm used in estimating the indirect effects, the forward and backward linkages.

1.2.2   *Direct effects*

This part of the study concentrates on the analysis of the annual accounts of the private companies belonging to the sectors under review.

For the period 2000 – 2005, the main developments are presented in terms of the evolution of the following variables:

- Value added (VA) at current prices[48]: the value the firm adds to its inputs during the year via the production process. The firm's VA indicates its contribution to the wealth of the country or Region (cf. percentages of GDP). From an accounting point of view, the VA is calculated by the sum of staff costs, depreciation and value adjustments, operating result, provisions for liabilities and charges and certain operating expenses.

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[47]   This percentage corresponds to the share of the mentioned activities in the annual turnover realised by the national post company. Retail and financial services are indeed not part of the scope of this research. This percentage is applied to all figures relating to La Poste - De Post.

[48]   Unless otherwise stated, value added is reported at current prices throughout the text. Changes at constant prices are clearly indicated. Value added at constant prices was calculated using the gross value added deflator.

- Employment in full-time equivalents (FTEs): average salaried workforce during the year, direct employment concerning only paid staff working in firms in the population under review, indirect employment also including self-employed workers.
- Investment at current prices[49]: this corresponds to tangible fixed assets acquired during the year, including capitalised production costs.

These three variables explain the economic impact of the sectors under review. But employment, by the same token as the social balance sheet, also comes into the analysis of their social impact. This part deals in particular with the composition, movements and training of the labour force. In addition, as some companies' 2006 accounts were filed in autumn 2007, a first general estimate of direct VA and employment can be carried out for the year 2006. The theoretical basis here is that of the "flash estimates" published each year for the study of the maritime ports sector[50]. Apart from calculating the evolutions observed on the constant sample for the years 2005 and 2006, account is taken, on the one hand, of the companies which, in spite of being still active in 2006, failed to file their annual accounts for that year on time and, on the other, of the new companies which were not present in 2005 and only appeared in 2006. In so doing we strive to get the fullest picture possible for 2006, in terms of direct effects.

The financial analysis is based on the examination of three financial ratios and synthetic financial health indicator, using a model designed by the Bank[51]. The ratios in question are the return on equity after tax, liquidity in the broad sense, and solvency. The first ratio concerns the ability of firms to generate profits, and gives an indication of the yield generated by the firm for its shareholders, after tax. The second relates to the firm's ability to mobilise the cash resources to meet its short-term financial commitments on time. Finally, the last ratio indicates the firm's ability to honour all its short- and long-term financial commitments. This model analyses the differences in the financial risk profile between two types of firms: those which are not failing, and failing firms which are theoretically likely to go bankrupt or into judicial composition in the next three years. The firms are classified in terms of financial risk. Classes 3 and 4 correspond to firms in difficulty or in serious difficulty which have a well-above-average risk of failing.

1.2.3 *Indirect effects*[52]

The indirect impact of the sectors reviewed, which complements their direct effects, can be studied in two ways: the classic calculation of the indirect value added and employment based on a sectoral approach on the one hand and the underlying calculation of the linkages on the other. The former emphasizes the value added and employment generated at the suppliers of the sectors reviewed. All these suppliers were selected in branches not belonging to the transport logistics cluster but being in constant relation to it. The latter actually deals with the mutual relations between sectors, in terms of output. This sequence will be observed in section 2.2, which first presents the findings in terms of indirect value added and employment, then the linkages in detail.

Theoretically, linkages can be estimated following two frameworks: backward linkages on the one hand and forward linkages on the other. The former, according to the Leontief model, concentrates on the relations of the sectors under study with their suppliers and is used to estimate the indirect value added and employment, while the latter, according to the Ghosh model, enables the price impact one logistics sector has onto its customers to be measured. Both can be considered in order to quantify the upward and downward relationships between the sectors under review and the rest of the economy. We start with the input-output table or IOT (theorised in table 3). The latest Belgian IOT available is that of 2000.

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[49] Unless otherwise stated, investment is reported at current prices throughout the text. Changes at constant prices are clearly indicated. Investment at constant prices was calculated using the gross fixed capital formation deflator.

[50] See its latest publication on http://www.nbb.be/doc/TS/Enterprise/Press/2007/cp20071009EN.pdf.

[51] See Coppens F. A. Hermesse and D. Vivet (2004), and Vivet (2005).

[52] See also Coppens F. (2005); Coppens F. (2006); Coppens F., F. Lagneaux, H. Meersman, N. Sellekaerts, E. Van de Voorde, G. van Gastel, Th. Vanelslander and A. Verhetsel (2007).

The theoretical basis behind the making of the IOT is given in the methodology of the national accounts[53].

TABLE 3 **INPUT-OUTPUT TABLE**

	1	*2*	*...*	*n*	*f*	*x*
1	x_{11}	x_{12}	...	x_{1n}	f_1	x_1
2	x_{21}	x_{22}	...	x_{2n}	f_2	x_2
...	...	...	...	...	...	...
n	x_{n1}	x_{n2}	...	x_{nn}	f_n	x_n
m	m_1	m_2	...	m_n	m_f	
va	va_1	va_2	...	va_n		
x	x_1	x_2	...	x_n		

Source: NBB.

Legend: *n*   number of industries in economy
             x_{ij} output of industry *i* delivered to industry *j*
             va   value added
             m   import
             f   final demand (including exports)

The x_{ij} boxes depict the transactions from sector i to sector j. f_i is the final demand addressed to sector i.

The most disaggregate version of the IOT presents economic branches in the NACE 3-digit format, i.e. the SUT branches (see tables 2 and 4). The next version, that of 2005, is due out in 2008 (Federal Planning Bureau). This analysis is developed in two phases: first, study of interactions within the cluster under review, i.e. between the freight transport logistics sectors and, secondly, study of interactions between these and all the other sectors in the national economy. In the first phase, the dimension of the input-output (IOT) matrix under consideration is nxn (n = 7 here, see below), n being the number of studied NACE 3-digit sectors. Column e, setting out the deliveries of these sectors to all other sectors of the economy, corresponds to "external demand". In the second phase, IOT's dimension is NxN (N = 120 here), and column f only contains the final demand from the final consumers, which is simply referred to as "final demand".

The small matrix used for the first phase of our analysis, i.e. the study of the "inside" linkages, is presented in table 4, while the theoretical matrix shown by table 4 applies to the second phase of the analysis, concerning the overall relations with all the economic sectors.

TABLE 4 **SMALL INPUT-OUTPUT MATRIX: RELATIONS WITHIN CLUSTER REVIEWED**

	60A1	60C1	61A1	61B1	62A1	63B1	64A1	External demand *e*	output
60A1	x_{11}	x_{12}	x_{13}	x_{14}	x_{15}	x_{16}	x_{17}	e_1	x_1
60C1	x_{21}	x_{22}	x_{23}	x_{24}	x_{25}	x_{26}	x_{27}	e_2	x_2
61A1	x_{31}	x_{32}	x_{33}	x_{34}	x_{35}	x_{36}	x_{37}	e_3	x_3
61B1	x_{41}	x_{42}	x_{43}	x_{44}	x_{45}	x_{46}	x_{47}	e_4	x_4
62A1	x_{51}	x_{52}	x_{53}	x_{54}	x_{55}	x_{56}	x_{57}	e_5	x_5
63B1	x_{61}	x_{62}	x_{63}	x_{64}	x_{65}	x_{66}	x_{67}	e_6	x_6
64A1	x_{71}	x_{72}	x_{73}	x_{74}	x_{75}	x_{76}	x_{77}	e_7	x_7

Source: NBB.

This analysis will follow these two approaches, wherever relevant.

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[53] See also the explanation provided by http://www.nbb.be/doc/dq/F_pdf_dq/NFDE99.pdf (French version) and http://www.nbb.be/doc/dq/N_pdf_dq/NNDE99.pdf (Dutch version).

On the basis of the input-output table, technical backward and forward coefficients can be calculated. They then enable the linkages to be measured through the so-called Leontief L and Ghosh G matrices, used to quantify what impact one sector has on the others respectively in terms of necessary inputs (goods and services, production factors) and outputs (cost structure). These two input-output models, demand-driven and supply-driven, are complementary.

Table 5 presents a few formulae used to estimate these linkages. Key sectors (Oosterhaven and Stelder net multiplier[54]) are sectors whose impact on the others is greater than the opposite.

The algorithm used for the calculation of the indirect value added and employment is based on the backward linkage formulae (table 5), provided an output model is converted into a value added and employment model. Information about how this is obtained and how these coefficients are calculated and interpreted is provided in appendix 2.

These coefficients and linkages contribute to a better understanding of the ties between the sectors under review and the rest of the national economy. The data on which these are based, from the supply table in particular, could also help highlight some hidden logistics business carried out by economic branches which do not belong to any of the above-mentioned sectors.

TABLE 5 CALCULATION OF LINKAGES: FORMULAE

Technical coefficients (first level)	backward	$TIC_{ij} = a_{ij}$	linkage of industry j to its first-tier supplier i	in relation to the output of industry j
	forward	$TOC_{ij} = b_{ij}$	linkage of industry i to its first-tier customer j	in relation to the output of industry i
Cai and Leung linkages (all levels)	backward	$BL_j = \dfrac{\sum_{i=1}^{n} l_{ij}}{l_{jj}}$	linkage of industry j to all its suppliers	in relation to the output of industry j
	forward	$FL_i = \dfrac{\sum_{j=1}^{n} g_{ij}}{g_{ii}}$	linkage of industry i to all its customers	in relation to the output of industry i
Decomposed linkages (all levels)	backward	$BDec_{ij} = \dfrac{g_{ij}}{g_{jj}}$	linkage of industry j to its supplier i	in relation to the output of industry i
	forward	$FDec_{ij} = \dfrac{l_{ij}}{l_{ii}}$	linkage of industry i to its customer j	in relation to the output of industry j
Oosterhaven and Stelder net multipliers	$\dfrac{\text{Leontief multiplier of j} \times \text{final demand of j}}{\text{output of j}}$		if net multiplier > 1, then sector j is more important for the other sectors than vice versa and is said to be a **key sector**	

Source: NBB.

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[54] Oosterhaven J. and D. Stelder (2002). Interpretation of the net multiplier by Dietzenbacher E. (2005).

Legend:

TIC$_{ij}$: Technical input coefficients
TOC$_{ij}$: Technical output coefficients
BL$_j$: Cai and Leung backward linkages
FL$_i$: Cai and Leung forward linkages
BDec$_{ij}$: Decomposed backward linkages
FDec$_{ij}$: Decomposed forward linkages
l$_{ij}$: element of matrix L -Leontief-, on row i and column j (see below); Σ_i l$_{ij}$ = Leontief multiplier of sector j
l$_{jj}$: diagonal element of matrix L (see below)
g$_{ij}$: element of matrix G -Ghosh-, on row i and column j (see below)
g$_{ii}$: diagonal element of matrix G (see below)

1.2.4   *Overall economic impact of Belgian transport logistics*

As pointed out in section 2.3, many companies which do not belong to any sector of the cluster under review, e.g. trade or manufacturing industries, actually develop logistics processes and are active as service providers in general and freight transport logistics in particular. This is mainly for internal purposes but sometimes for external ends as well. Even though they are not officially classified in the branches under review (see section 1.2.1), they ought to be reckoned with in order to gain a clear and overall picture of the economic extent of transport-bound logistics activities in our country. All sectors falling outside the cluster under study and not presenting any apparent linkage in relation to it are not taken into account in the sectoral analysis. Therefore, taking the example of the European distribution centres (EDCs, see section 2.3.1), it is obvious that there is not enough information about how all those "unofficially" logistically-active companies allocate resources to genuine freight transport logistics operations. Determining whether the EDCs and some industrial branches are significantly linked to the cluster under review or not is a first task here. But the central goal of these further developments is to elaborate on the picture drawn hitherto by the traditional sectoral two-step economic impact analysis.

This sectoral analysis, while aiming to capture as much information as possible about freight transport logistics and the sectors linked to it, is indeed certainly not exhaustive. Only a comprehensive survey-based research project could complement this picture by adding figures about the other sectors' allocation of resources to logistics activities, both externally and internally. Resorting to a production approach, using additional data from the supply tables concerning the so-called "external sectors" on the one hand, freight transport logistics services delivered by other sectors - outside the cluster under review - can be estimated. On the other hand, figures published by a recent survey on outsourcing - and therefore insourcing - patterns in the transport logistics world enable us to estimate the importance of the same operations - namely transport and warehousing - that companies not classified in the cluster under study decide to realise in-house. Assuming certain hypotheses, these two elements are intended to add significant information to the picture already drawn by the study of direct and indirect effects.

2 <u>ECONOMIC IMPACT OF TRANSPORT LOGISTICS IN BELGIUM</u>

The analysis is presented in three distinct parts. The first one focuses on the findings made at the national level, in direct terms: value added, employment, social balance sheet, investment and financial situation. A sub-section attempts to break figures down according to locations of activity. The second part deals with the indirect effects, which complements the analysis of the direct effects. They are expressed in terms of indirect value added and employment, then in terms of sector-to-sector linkages. The third part tackles the transport logistics activities which could neither be recorded nor analysed via this traditional sectoral approach. A last paragraph summarises the analysis by globalising figures.

Before starting the analysis of the changes in direct value added, employment, investment and financial health in the sectors under review, it is interesting to look into some inland freight transport figures in Belgium:

> Expressed in tonnes, almost 70 p.c. of the total is shipped by road, 9 p.c. by train and the remaining 21 p.c. by inland waterways. But once expressed in tkm (tonne-kilometres) the true relative shares of the different modes can be best outlined (percentage points difference with 2004 between brackets): In our country, in 2005, roads still accounted for 72.4 p.c. (- 2.9 p.c.) of the total freight transport, railways 13.4 p.c. (+ 1.4 p.c.) and inland waterways 14.2 p.c. (+ 1 p.c.). With respect to the average score of the EU-27, the share of road transport in total inland freight transport has been lower in Belgium since 2004, that of rail transport is continuously lower and that of inland water transport is substantially higher (more than double since 2003)[55]. This indicates that Belgium plays a major part in that latter mode, backed up by its endowment in terms of inland water network and its openness towards short and deep-sea routes, which all remain outstanding and require more attention and support than ever. The expected evolution for the period 2000 - 2020 is remarkable, according to many observers. If the overall demand for goods transport increases by 70 p.c. in that period in terms of tkm, then road transport is expected to grow by more or less 60 p.c., and both rail and inland water transport each by roughly 100 p.c.[56] Such progress is enhanced by the boom of containerised transport - 2-digit growth on average in the past few years - and made possible by the increasing capacity offered by maritime ports to accommodate this trend (cf. Deurganck dock in Antwerp, TriLogiPort in Liège, APM Terminals in Zeebrugge, etc.). It could nevertheless be hampered in the longer run by the limited absorption capacity of these ports' hinterland and the congestion[57] issue, which cannot be ignored.

2.1.1 <u>*Value added*</u>

o Impact and evolution: overall analysis

The rise in value added was more moderate in 2005 than it was in 2003 and 2004. Growth was limited to 0.8 p.c. in the other logistics sectors, while it remained sustained in most transport sectors, since these branches enjoyed a 10 p.c. increase. Chart 1 reflects the growth at constant prices. Between 2004 and 2005, the constant price VA growth amounted to 2.9 p.c. on average for the 12 above-mentioned sectors, which is higher than the 2 p.c. increase noted both at national level and in the non-manufacturing branches[58]. At 9.3 billion euro in 2005, direct VA accounts for 3.1 p.c. of Belgian GDP.

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[55] Source: Eurostat.

[56] Sources: Federal Public Service (FPS) Economy - Directorate General for Statistics and Economic Information; TREMOVE-Model; European Commission; data processing realised by FEBIAC.

[57] The scale of empty running road freight transport plays a role in this phenomenon, as it nowadays reaches on average one fourth of total distances travelled by road hauliers in the EU. Source: Eurostat.

[58] NACE branches 01 - 14 and 40 - 95.

TABLE 6   **EVOLUTION OF DIRECT VALUE ADDED OF TRANSPORT LOGISTICS**
(millions of euro - current prices, unless otherwise stated)

Sectors	2000	2001	2002	2003	2004	2005	2006 e	Share in 2005 (in p.c.)	Change from 2004 to 2005 (in p.c.)	Annual average change from 2000 to 2005 (in p.c.)
Rail transport	403.4	349.6	360.4	318.7	316.7	289.8	n.	3.1	-8.5	-6.4
Road transport	2,605.6	2,712.0	2,828.7	2,902.3	2,996.4	2,989.6	n.	32.2	-0.2	+2.8
Pipeline transport..............	11.8	10.8	12.1	12.3	10.5	8.9	n.	0.1	-15.4	-5.5
Sea and coastal water transport	145.8	85.6	26.1	173.6	473.4	893.1	n.	9.6	+88.6	+43.7
Inland water transport	37.6	35.7	30.9	35.0	31.5	36.6	n.	0.4	+16.0	-0.6
Air transport	39.7	21.5	18.8	33.0	35.2	38.3	n.	0.4	+8.9	-0.7
TRANSPORT SECTORS	*3,244.0*	*3,215.3*	*3,277.0*	*3,474.8*	*3,863.7*	*4,256.3*	*4,228.8*	*45.8*	*+10.2*	*+5.6*
Cargo handling	394.2	403.8	419.3	513.7	558.2	596.8	n.	6.4	+6.9	+8.6
Cargo storage	377.4	438.5	479.6	533.0	531.2	586.5	n.	6.3	+10.4	+9.2
Supporting transport activities...........................	417.7	659.8	555.6	871.4	1,142.9	1,109.2	n.	11.9	-2.9	+21.6
Forwarders	523.2	521.3	531.7	542.6	614.0	623.1	n.	6.7	+1.5	+3.6
Agencies	347.2	332.8	328.3	369.6	413.9	416.9	n.	4.5	+0.7	+3.7
Postal services	1,520.6	1,524.9	1,545.0	1,629.4	1,738.6	1,707.7	n.	18.4	-1.8	+2.3
OTHER LOGISTICS SECTORS	*3,580.4*	*3,881.0*	*3,859.5*	*4,459.7*	*4,998.7*	*5,040.1*	*5,434.6*	*54.2*	*+0.8*	*+7.1*
DIRECT VALUE ADDED	*6,824.4*	*7,096.3*	*7,136.5*	*7,934.5*	*8,862.4*	*9,296.4*	*9,663.4*	**100.0**	**+4.9**	**+6.4**

Source: NBB.

○ Impact and evolution: sectoral analysis

In 2005, the 4.9 p.c. growth (in current prices, see table 6) is mainly attributable to the expansion of sea and coastal water transport, i.e. shipping, activities, fuelled by the remarkable expansion seen in that sector, notably in terms of investment (see below): Cobelfret Bulk Carriers marked a sharp rise, along with its 76.4 million euro VA, while the value added of Euronav multiplied by five (see changes in investment). Inland water transport enjoyed very favourable conditions in 2005, with a 16 p.c. rise, mainly due to Somef (+ 19.7 p.c.) and Belgian Oil Services (+ 13.5 p.c.). Cargo storage's VA rose by 10.4 p.c. thanks to DHL Solutions (formerly Danzas Logistics). Other rises were noted in air transport, and also in cargo handling services, where the rise at Belgian Ground Services and Schelde Container Terminal offset the decline at Hesse-Noord Natie (PSA Group). Road transport's VA slowed down, declines being noted at Ziegler and DHL Express, in spite of a progress at Frans Maas. VA in the remaining sectors slipped back. The restructuring at BNRC[59] Holding had a substantial downward impact on rail transport's VA. The same trend was noted at Société Nationale de Transport par Canalisations-Nationale Maatschappij der Pijpleidingen in pipeline transport and at Gemeentelijk

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[59] Belgian National Railway Company, better known as *SNCB* in French and *NMBS* in Dutch. Since 1 January 2005, BNRC has been restructured in order to conform to the European directives which require the infrastructure to be separated from the operation of the railways. The Belgian railways now comprise three separate entities, each enterprise having independent status: (1) Infrabel manages the infrastructure. It acts independently in managing everything relating to the railway infrastructure (such as the railway lines and the safety systems); (2) BNRC is the network operator, responsible for everything concerning the running of passenger and freight trains. It is therefore a railway operator in the same way as other private companies operating on the network; (3) responsible for coordinating the activities of Infrabel and the BNRC, BNRC Holding is also the parent company. All these entities were included in the present report. For more information on this subject: http://www.be-rail.be.

Autonoom Havenbedrijf Antwerpen in supporting transport activities, offset by the Brussels Airport's growth. The rise at TNT Express Worldwide (Euro Hub) was not enough to make up for declines in several smaller businesses, so figures reported for agencies remained stable. In postal services, VA at La Poste-De Post and DHL International declined, but the trend was quite the opposite at TNT Express Belgium and DHL Aviation.

CHART 1	VALUE ADDED EVOLUTION AT CONSTANT PRICES

(millions of euro, index 2000 = 100)
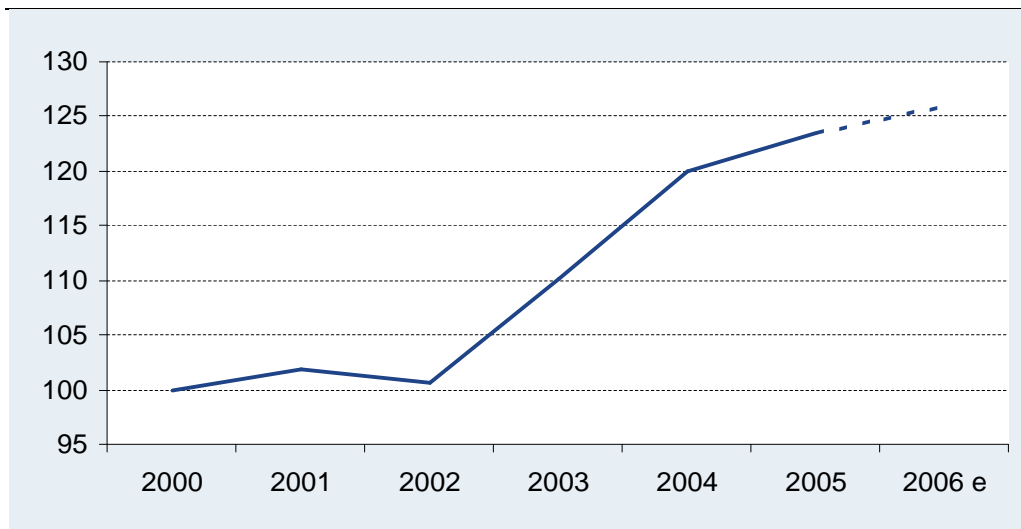
Source: NBB.

One could be tempted to compare, as regards the inland freight transport sectors, the share in VA with the share in terms of transport. In 2005, within the 3.3 billion euro VA generated by road transport, rail transport and inland water transport, the first accounted for 90.2 p.c., the second 8.7 p.c. and the third 1.1 p.c. This part of the activities under review is dominated by road transport, but at a percentage outstripping by far that of the tkm modal split mentioned above. This gives another evidence that the two latter modes remain underutilised. Their growth potential is therefore considerable.

    o Estimate for 2006 and future outlook

Most sectors saw an increase in VA in 2006, as it reached more than 9.6 billion euro (+ 3.9 p.c. in relation to 2005, i.e. + 1.9 p.c. at constant prices, which is below the average score of the non-manufacturing services - + 2.8 p.c. -). However, the share this represents in the Belgian GDP is unchanged in comparison to the previous year. The highest increases were noted in other logistics sectors (+ 7.8 p.c.), in the agencies, cargo handling and storage in particular, in spite of a stagnation at La Poste - De Post. A moderate decline was recorded in the transport sectors (- 0.6 p.c.), especially in sea and coastal water transport, one year after a tremendous rise in the same sector, while VA in rail and road transport picked up.

Over the long run, looking at the changes recorded between 2000 and 2005 (see last column of table 6), transport sectors' growth might remain slow, with the exception of booming maritime transport, while most other logistics sectors gradually take the lead, especially cargo storage and handling and supporting transport activities[60]. This tends to confirm the trend generally observed in a sector which is becoming more and more specialised, while basic transport activities remain more prone to restructuring and sometimes relocation.

    o Top 20 in 2005

As explained in section 1.2.1, it is assumed that, if φ per cent of a NACE branch relates to freight transport, then all the companies belonging to that branch realise the same φ per cent of their business

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[60] These three sectors together account for more than 26.2 p.c. of the direct value added of freight transport logistics in 2006, against 17.4 p.c. six years before.

in freight transport too. Likewise, only those φ per cent were retained for each company presented in tables 7 and 9.

Ranking	Name of company	Sector	Value added
	TABLE 7 **VA TOP 20 IN TRANSPORT LOGISTICS SECTORS IN 2005** (millions of euro)		
1	La Poste - De Post	Postal services	1,406.1
2	BNRC Holding	Rail transport	288.2
3	Gemeentelijk Autonoom Havenbedrijf Antwerpen	Supporting transport activities	233.2
4	Brussels International Airport Company	Supporting transport activities	211.3
5	Euronav	Sea and coastal water transport	208.4
6	Bocimar International	Sea and coastal water transport	206.5
7	Safmarine Container Lines	Sea and coastal water transport	176.9
8	Belgocontrol	Supporting transport activities	129.2
9	DHL Aviation	Postal services	105.6
10	Bocimar Belgium	Sea and coastal water transport	84.9
11	Cobelfret Bulk Carriers	Sea and coastal water transport	76.4
12	Belgian Ground Services	Cargo handling	72.2
13	AviaPartner Belgium	Supporting transport activities	64.0
14	Hesse - Noord Natie	Cargo handling	56.7
15	TNT Express Worldwide (Euro Hub)	Agencies	54.6
16	Interparking	Supporting transport activities	45.5
17	DHL International	Postal services	42.2
18	TNT Express Belgium	Postal services	42.1
19	Schelde Container Terminal Noord	Cargo handling	41.0
20	Tunnel Liefkenshoek	Supporting transport activities	38.8
	TOTAL of top 20		**3,583.8**

Source: NBB.

The leader of the VA ranking in freight transport logistics and by a great margin is La Poste-De Post, with its 1.4 billion euro contribution to Belgian GDP (table 7). It is followed by the railways operator BNRC Holding, the Antwerp port authority Gemeentelijk Autonoom Havenbedrijf Antwerpen and Brussels International Airport Company (a.k.a. BIAC and, today, Brussels Airport). Together, the top 10 companies represent 32.8 p.c. of the whole direct VA presented in table 6. Including the other companies from the top 20, this amounts to a 38.6 p.c. share. This percentage is rather low considering the 20 freight transport logistics companies showing the highest value added. One could speak of a certain spreading of activity.

The three big sea and coastal water transport companies, ranking 5th to 7th, even though they realise most of their business outside Belgium, have their headquarters in our country, file their annual accounts with the Central Balance Sheet Office and contribute to wealth creation in our territory.

2.1.2 _Employment and social balance sheet_

2.1.2.1 **Employment**

o Impact and evolution: overall analysis

After more or less moderate rises from 2000 until 2004, the year 2005 saw a general but limited decline in transport logistics employment (- 0.7 p.c.), which is also rendered by chart 2. This decline was noted in both transport sectors and other logistics sectors. This observation hides the fact that the decline in this second sectoral category is mainly due to downsizing taking place in postal services[61]. At roughly 130,400 FTEs in 2005, direct employment accounts for 3.4 p.c. of Belgian domestic employment, or 4.1 p.c. of Belgian salaried employment.

TABLE 8	**EVOLUTION OF DIRECT EMPLOYMENT OF TRANSPORT LOGISTICS** (FTEs, unless otherwise stated)									
Sectors	2000	2001	2002	2003	2004	2005	_2006 e_	Share in 2005	Change from 2004 to 2005	Annual average change from 2000 to 2005
								(in p.c.)	(in p.c.)	(in p.c.)
Rail transport	7,496	6,538	6,662	5,758	5,457	5,150	n.	3.9	-5.6	-7.2
Road transport	46,873	47,840	48,250	49,299	50,284	49,952	n.	38.3	-0.7	+1.3
Pipeline transport..............	6	7	6	11	18	13	n.	0.0	-28.0	+17.7
Sea and coastal water transport	618	498	459	460	548	635	n.	0.5	+15.9	+0.6
Inland water transport	443	302	309	315	314	342	n.	0.3	+9.0	-5.1
Air transport	1,077	318[62]	366	400	374	380	n.	0.3	+1.4	-18.8
TRANSPORT SECTORS	_56,512_	_55,502_	_56,052_	_56,244_	_56,995_	_56,472_	_57,305_	_43.3_	_-0.9_	_+0.0_
Cargo handling	4,491	4,477	5,955	5,531	5,749	5,573	n.	4.3	-3.1	+4.4
Cargo storage	5,049	6,374	6,570	7,296	7,053	7,534	n.	5.8	+6.8	+8.3
Supporting transport activities............................	3,424	6,062	5,152	7,768	9,195	9,409	n.	7.2	+2.3	+22.4
Forwarders	7,780	7,841	7,832	8,058	8,036	8,221	n.	6.3	+2.3	+1.1
Agencies	5,009	5,016	4,614	5,312	5,607	5,801	n.	4.4	+3.5	+3.0
Postal services	39,688	39,724	40,612	38,559	38,719	37,380	n.	28.7	-3.5	-1.2
OTHER LOGISTICS SECTORS	_65,441_	_69,493_	_70,735_	_72,523_	_74,359_	_73,917_	_74,565_	_56.7_	_-0.6_	_+2.5_
DIRECT EMPLOYMENT.....	**121,953**	**124,995**	**126,787**	**128,766**	**131,354**	**130,389**	**131,870**	**100.0**	**-0.7**	**+1.3**

Source: NBB.

o Impact and evolution: sectoral analysis

The boom seen in water transport activities in 2005 was noted in terms of employment as well: + 15.9 p.c. in sea and coastal water transport and + 9 p.c. in inland water transport (table 8). Good examples of these were respectively the surge in the workforce at Cobelfret Bulk Carriers and URS Ocean Towage on the one hand, and Somef on the other. Employment in air transport rose by 1.4 p.c. thanks to Delta Air Transport, TNT Airways, in spite of a shrinking workforce at European Air Transport.

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[61] If La Poste-De Post were withdrawn from the population studied, then the curve presented in chart 2 would look quite different: it would follow an upward trend and reach 109.4 in 2003, 112.2 in 2004, 113.1 in 2005 and 117.1 in 2006.

[62] This fall, when compared with level of 2000, is primarily due to the bankruptcy of the former Belgian national airline Sabena in 2001 and the ensuing large-scale redundancy programme.

In cargo storage, employment rose by 6.8 p.c., thanks to DHL Solutions, despite a decline at Logistics Nivelles. The increase reached 2.3 p.c. in supporting transport activities, thanks to Gemeentelijk Autonoom Havenbedrijf Antwerpen, De Scheepvaart and AviaPartner Belgium, tempered by declines at Belgocontrol and Brussels International Airport Company. Employment rose by 2.3 p.c. at forwarders, at Kuehne & Nagel in particular, by 3.5 p.c. in agencies, such as TNT Express Worldwide Euro Hub. Due to the restructuring of BNRC Holding, employment slipped back in rail transport. It slowed down in road transport too, as a result of declines at DHL Express Belgium, Ziegler and Frans Maas, in spite of moderate rises at Henri Essers en Zonen Internationaal Transport, among others. Employment showed a slight downturn in pipeline transport, as well as in cargo handling, where Hesse-Noord Natie's shrinking workforce was hardly offset by the rise at Belgian Ground Services. A decline was noted in postal services, especially at La Poste-De Post, while trends were going upwards at TNT Express Belgium, DHL Aviation and United Parcel Services Belgium.

CHART 2   **EMPLOYMENT EVOLUTION**
(FTEs, index 2000 = 100)
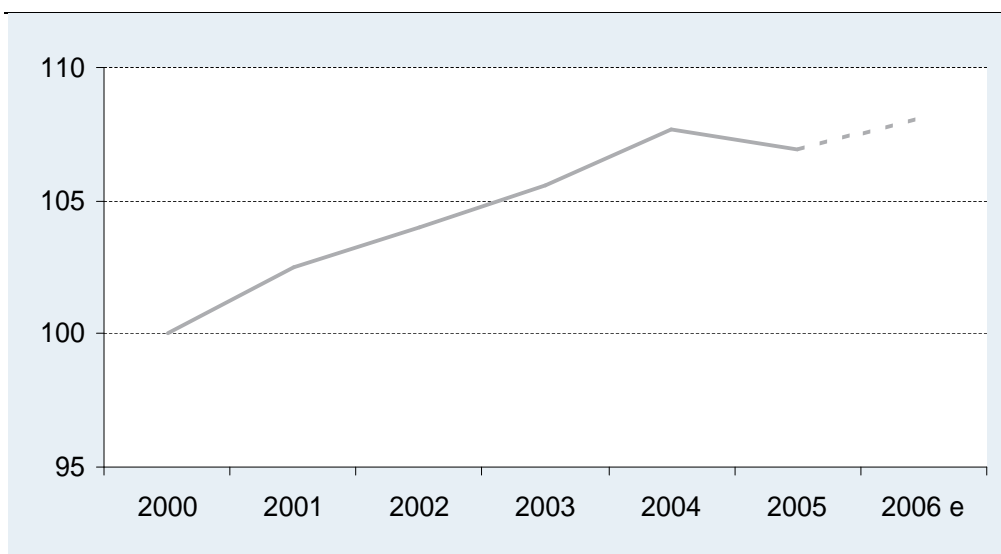
Source: NBB.

As far as the inland freight transport sectors are concerned, it may also be worth comparing the share in employment with the share in terms of transport. In 2005, within the 55,400 FTEs employed in road transport, rail transport and inland water transport, the first represented 90.1 p.c., the second 9.3 p.c. and the third 0.6 p.c. This part of the activities under review is dominated by road transport, but at a percentage also outstripping by far that of the tkm modal split mentioned above.

o   Estimate for 2006 and future outlook

Between 2005 and 2006, direct employment picked up in all freight transport logistics sectors (+ 1.1 p.c.). Transport sectors saw a 1.5 p.c. rise in the same period, owing to sea and coastal water transport in particular and a workforce which picked up in road transport, offset by some falls in rail and air transport. Rises were somewhat lower in other logistics sectors (+ 0.9 p.c.). Positive changes were noted in agencies, cargo handling and storage, forwarders and supporting transport activities, but this trend was tempered by a substantially decreasing workforce in postal services, combined with a relative but steady decline of mail activities at La Poste - De Post. The almost 132,000 FTEs accounted for the same percentage of Belgian domestic employment and salaried employment as in 2005.

Over the long run though, looking at recent developments recorded over the period under study (see last column of table 8), employment in the different transport sectors might remain stable or even decrease, with the exception of booming maritime transport, while most other logistics sectors, cargo storage and handling and supporting transport activities in particular[63], should see further growth in their workforce.

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[63]   These three sectors together account for almost 18.1 p.c. of the direct employment of freight transport logistics in 2006, against only 10.6 p.c. six years before.

This tends to confirm the observations referred to in section 2.1.1, and illustrates the shift taking place from purely transport-oriented activities towards more complex logistics services.

o Top 20 in 2005

This ranking resembles that outlined for value added, under the same assumptions concerning the distribution of freight transport activity among the companies mentioned (φ per cent). Table 9 is also topped by La Poste-De Post, followed by BNRC Holding and DHL Aviation. In 2005, the first 10 companies together accounted for 35.4 p.c. of the direct employment in the sectors under review (table 8). The 51,750 full-time equivalents working in the top 20 companies represented 39.7 p.c. of that same total. This percentage is rather low considering the 20 freight transport logistics companies employing the largest number of workers. This is further evidence of the spreading of activity mentioned before.

TABLE 9   EMPLOYMENT TOP 20 IN TRANSPORT LOGISTICS SECTORS IN 2005
(FTEs)

Ranking	Name of company	Sector	Employment
1	La Poste - De Post	Postal services	31,776
2	BNRC Holding	Rail transport	5,134
3	DHL Aviation	Postal services	1,740
4	Gemeentelijk Autonoom Havenbedrijf Antwerpen	Supporting transport activities	1,646
5	Belgian Ground Services	Cargo handling	1,226
6	AviaPartner Belgium	Supporting transport activities	1,226
7	Belgocontrol	Supporting transport activities	1,017
8	TNT Express Worldwide (Euro Hub)	Agencies	860
9	DHL International	Postal services	781
10	Brussels International Airport Company	Supporting transport activities	740
11	ABX Logistics (Belgium)	Supporting transport activities	692
12	Logistics Nivelles	Cargo storage	678
13	DHL Express (Belgium)	Road transport	572
14	United Parcel Service Belgium	Postal services	564
15	De Scheepvaart	Supporting transport activities	560
16	TNT Express Belgium	Postal services	550
17	Schenker	Forwarders	549
18	Ziegler	Road transport	502
19	Hesse - Noord Natie	Cargo handling	470
20	DHL Solutions	Cargo storage	463
	TOTAL of top 20		**51,746**

Source: NBB.

2.1.2.2 Social balance sheet

The social balance sheet covers various aspects of employment in the firm: recruitment and composition of the workforce, the contractual status and standard of education of the employees, staff costs, training policy, and reasons for terminating contracts. The results set out below for direct employment in the Belgian freight transport logistics branches are not exhaustive. They relate to the reduced population of companies which filed their accounts in accordance with the full format and completed the items in the "social balance sheet" annex to the annual accounts necessary for this study, over the period 2003 - 2005. It only represents, for 2005, 13.7 p.c. of the entire population under review but still 73.8 p.c.[64] of direct employment and 76.8 p.c. of direct value added. Three aspects of the employment situation are examined: the type of contract and human resources, staff turnover and trends in training policy. Table 10 summarizes the main developments recorded between 2003 and 2005.

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[64] This proportion is very stable throughout the period under consideration.

o Type of contract and human resources

At the end of the 2005 financial year, for each blue-collar worker, there were almost two white-collar workers, 1.86 to be precise, i.e. 7.8 percentage points more than in 2004 but 3.3 points lower than in 2003. The proportion of female workers remained the same as in 2004, i.e. 25 p.c. of the workforce in the freight transport logistics cluster, a level significantly lower than the national average (more than 37 p.c.). In 2005, in the companies fulfilling the conditions mentioned above, the number of hours worked declined by a total of 6.9 p.c., that fall being due both to full-time work which was down by 6.9 p.c., and part-time work by 6.7 p.c. (top of table 10), in contrast to the evolution on national level.

TABLE 10   SOCIAL BALANCE SHEET IN FREIGHT TRANSPORT LOGISTICS
(percentages)

	2004	2005
INTERNAL HUMAN RESOURCES[65]**:** changes compared to the previous year		
Full-time hours worked by internal human resources	-4.8	-6.9
Corresponding costs	*+5.4*	*+2.1*
Part-time hours worked by internal human resources	+6.0	-6.7
Corresponding costs	*+11.9*	*+9.8*
Total hours worked by internal human resources	-3.5	-6.9
Corresponding costs	*+6.1*	*+2.9*
HOURLY LABOUR COSTS (in euros per hour)		
Hourly labour costs	25.9	28.7
*National average hourly labour costs ***	*30.8*	*31.9*
EXTERNAL HUMAN RESOURCES[66]**:** changes compared to the previous year		
Hours worked by hired temporary workforce	+32.3	+20.1
Corresponding costs	*+44.2*	*+19.2*
Hours worked by staff placed at the enterprise's disposal	-0.8	+29.7
Corresponding costs	*-0.2*	*+31.1*
EXTERNAL HUMAN RESOURCES: share in total number of hours worked by internal workforce		
Hours worked by hired temporary workforce	6.0	7.8
Hours worked by staff placed at the enterprise's disposal	7.2	10.1
REASONS STATED FOR TERMINATING THE CONTRACT		
Retirement	8.6	11.7
Early retirement	8.0	2.0
Redundancy	16.3	17.5
Other reason[67]	67.1	68.7
TRAINING		
Percentage of employees attending training in the year (total)	49.1	53.5
*National average percentage of employees attending training in the year ***	*39.4*	*39.6*
Percentage of hours worked actually spent in training programmes	0.8	1.0
Average number of hours spent in training by the employees (total)	29.2	28.3
Average percentage of staff costs dedicated to training programmes	1.3	1.5
TRAINING: changes compared to the previous year		
Hours spent by men on training	-13.0	+1.6
Corresponding costs	*-2.2*	*+11.5*
Hours spent by women on training	-11.7	+18.5
Corresponding costs	*+4.3*	*+26.8*

Source: NBB (full-format accounts only). * National data come from Heuse P. and Ph. Delhez (2006): figures were calculated for a reduced population over the period 2004 - 2005.

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[65]   Employees recorded in the staff register of the firms considered.

[66]   Hired temporary staff and staff placed at the enterprise's disposal. The latter refers to the workers an employer places at other users' disposal. Those users exercise part of the employer's authority over the seconded workers, who remain contractually bound to their employer. Definition enshrined in the law of 24 July 1987 on "Temporary labour, hired temporary staff and staff placed at third users' disposal".

[67]   Mainly expiry of temporary contracts and spontaneous departures.

Marked declines were recorded in postal services, road and rail transport, and cargo handling, which is in line with the evolutions noted in table 8. For these three last sectors though, the decline in full-time hours was partly compensated by a rise in part-time hours worked. Conversely, staff costs continued their upward trend, rising by a total of 2.9 p.c., outstripping the average national trend. These rises contrast with the declines in the corresponding hours worked, a fact observed in air transport, while labour costs in supporting transport activities increased much faster than the number of hours worked. Taking all categories together, full-time working represented 87.3 p.c. in 2005, just like the year before, which is 1 percentage point lower than the score in 2003. Hourly labour costs came to 28.7 euro (lower than national average of 31.9 euro), against 25.9 euro in 2004. The average annual cost per FTE totalled 44,903 euro, or 4.5 p.c. more than in 2004 but below the national level (48,764 euro in 2005[68]). These rather low wages compared to average levels noted for the entire economy mirror the fact that transport logistics is a highly competitive sector, which employs workers with a relatively low education level and faces fierce competition from Eastern European countries. This is particularly true for road transport for instance, where the cost of labour per capita is the second lowest, at 42,638 euro in 2005, after postal services, at 40,240 euro. The latter is facing increasing competition too, as it gears up for full liberalisation of the sector. The cluster under study does show a great diversity of situations in terms of wages. By way of example, the average labour cost in sectors such as transport supporting activities, inland water transport, cargo handling, agencies and forwarders is close to 50,000 euro and in sea and coastal water transport it is above the 90,000 euro mark. This reflects the diversity of qualifications requirements of all these sectors. This observation finds a confirmation in the continuous shift taking place from basic transport towards value-added logistics business, the latter besides offering higher profit prospects.

The number of hours worked by external personnel continued to increase in 2005, with a 20.1 p.c. rise for hired temporary staff compared to the previous year and, after a year of stagnation, a 29.7 p.c. rise for staff placed at the enterprise's disposal (third section of table 10). The costs corresponding to these two categories were up by 19.2 p.c. for the first and 31.1 p.c. for the second. Together they accounted for roughly 18 p.c. of the total hours worked by internal human resources in 2005. The hired temporary workforce alone represents 7.8 p.c. of that total, which is higher than the 4 p.c. recorded at national level (reduced population). As regards the rises in hired temporary work hours and corresponding costs, substantial movements in sea and coastal transport, postal services, inland water transport and cargo storage should be noted. Concerning the hours worked and the costs associated with staff placed at the enterprise's disposal, the most significant rises came from cargo storage, road transport and sea and coastal transport.

o Staff turnover

The total number of employees (in FTEs) taken on during the year 2005 was 6.8 p.c. lower than in 2004. This decline is due mainly to a cut in recruitment of permanent staff (- 7.4 p.c.) and concerned supporting transport activities, air and road transport, while postal services and sea and coastal transport recruited more permanent staff than in 2004. Looking at the total figures, postal services, cargo handling, road transport and supporting transport activities were the first sectors concerned by overall declining recruitment, which suggests, as regards post companies, that they hired less temporary staff than in 2004. On the whole, temporary labour, which accounts for approximately 39 p.c. of the contracts signed in 2005, remained stable in the cluster under review. The proportion of men recruited in 2005 was down in the case of the less skilled (primary and secondary education). Conversely, it increased in the case of those holding higher education and university qualifications, up from 8.7 to 11.2 p.c. and 2.9 to 4 p.c. respectively. About 85 p.c. of men hired in 2005 hold certificates from primary or secondary school, while the proportion of male employees hired with higher education or university qualifications is only 15 p.c. The share of women recruited increased in all cases except for those holding a certificate of primary school. Consequently, those taken on from higher education categories were proportionally more numerous: 52.2 instead of 51 p.c. for secondary school certificate holders, 17.9 instead of 16.4 p.c. for high school graduates and 6.7 instead of 5.1 p.c. for university graduates. Roughly 25 p.c. of women hired in 2005 hold degrees from high school or university. In line with the continued rise in recruitment of highly qualified employees throughout the economy, transport logistics, just like the manufacturing industry, has seen this trend accompanied by a proportionate decline in the recruitment of less qualified workers.

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[68] Annual average calculated for a reduced population.

The total number of logistics sector employees (in FTEs) who left their job dropped by 16.1 p.c. between 2004 and 2005, a fall which was mainly driven by the decline seen in short-term contracts. All forms of contracts taken together, major declines were recorded in postal services, cargo handling, rail transport and, to a lesser extent, in road and air transport, while numbers increased considerably in sea and coastal transport. All sectors were involved in the downward trend in the termination of permanent contracts, except forwarders and supporting transport activities. Among all the contracts terminated, the proportions of retirements and redundancies rose in 2005 (fourth section of table 10). The percentage recorded here for retirements is proportionately higher than the national average, unlike the three other categories of contract terminations. There was only a marginal increase in the percentage attributed to other reasons, i.e. expiry of temporary contracts and spontaneous departures. At the same time the percentage of early retirements continued to fall, as in the rest of the Belgian economy. The rate of turnover[69] for workers employed under permanent contracts in the population under review amounted to roughly 19.4 p.c. in 2005, which is higher than the national average (12.8 p.c. in the reduced population). This certainly might be linked to the harsh competitive environment these sectors face.

o Training[70]

The proportion of men attending training courses remained steady in relation to 2004, at 47.9 p.c., as did the number of hours spent on training. The number of women receiving training was proportionately a lot higher in 2005, at 70.6 p.c. against 55.2 p.c. a year earlier. For both genders taken together, that proportion reached 53.5 p.c., which is above the national average (two last sections of table 10). This outstanding growth originates in road and air transport, postal services, agencies and supporting transport activities. Consequently, the number of training hours was up by 18.5 p.c. for women. The costs associated with training rose by 11.5 p.c. for men and 26.8 p.c. for women. Considering both genders together, the share of these costs in total staff costs thus increased from 1.3 to 1.5 p.c. between 2004 and 2005, which is well above the national average but still below the 1.9 p.c. target set by the generation pact[71] for 2006, which only the energy and financial services sectors had met in 2005. As regards the proportion of working hours spent on training programmes, this rose from 0.8 to 1 p.c. over the same period, again a better score than the Belgian average. Postal services, air transport, sea and coastal water transport and cargo handling are the sectors where such rises were significantly noted. For each employee taking part in training programmes, time spent annually on training amounted to 28.3 hours in 2005, which corresponds to the national average (28.5 hours).

2.1.3 *Investment*

o Impact and evolution: overall analysis

Investment in freight transport logistics seems to have followed an exponential trend since 2002, at almost the same pace in both transport sectors and other logistics sectors. This general evolution is quite clear from chart 3, presenting changes at constant prices. Between 2004 and 2005, the constant price growth amounted to 50.1 p.c. on average for the 12 sectors under review.

o Impact and evolution: sectoral analysis

In 2005, a marked increase was noted in sea and coastal water transport (+ 108.3 p.c. in current prices, see table 11). This was mainly attributable to companies which renewed or enlarged their fleet, such as Euronav (acquisition of the Tanklog fleet) or Safmarine Container Lines. One possible explanation is that some Belgian ship owners decided to return to the Belgian maritime flag, in the wake of the new tonnage tax regime in force since 2004 which offers financial incentives, particularly for owners of large ships[72]. The investment stagnation at Cobelfret Bulk Carriers and the decline at Bocimar Belgium only

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[69] Number of staff departures in t, divided by the workforce recorded at the end of the year t less staff recruitments plus departures recorded during this year. For more information, see Heuse P. and Ph. Delhez (2006).

[70] Here training is meant in the formal sense, i.e. courses in premises reserved for that purpose, within the firm or outside. It therefore excludes on-the-job training, for example, mentoring and self-training.

[71] Pact for the Solidarity between Generations. Details in Heuse P. and Ph. Delhez (2006).

[72] Every shipowner has to apply for this regime. Upon approval of the request, the tonnage tax regime applies for a ten-year term. More information on that matter on the Royal Belgian Shipowners Association's website: www.brv.be.

had a limited effect on the total. A very substantial increase was also noted in cargo handling where those amounts tripled, thanks to PSA Hesse-Noord Natie and its Deurganck dock terminal, to Antwerp Gateway and to MSC Home Terminal. Inland water transport, cargo storage and agencies respectively owe their growths to the fast-expanding firms Vlaamse Tankvaart Maatschappij, Fresh Fruit Terminal (Antwerp) and TNT Express Worldwide. In rail transport, the year of the restructuring of the BNRC Holding - and the ensuing takeover of infrastructure investments by Infrabel, one of its subsidiaries -, saw a significant revival of investment, particularly in network modernisation and extension, improved hinterland accessibility for the sea ports, etc.[73]

TABLE 11   **EVOLUTION OF DIRECT INVESTMENT OF TRANSPORT LOGISTICS**
(millions of euro - current prices, unless otherwise stated)

Sectors	2000	2001	2002	2003	2004	2005	Share in 2005	Change from 2004 to 2005	Annual average change from 2000 to 2005
							(in p.c.)	(in p.c.)	(in p.c.)
Rail transport....................	275.7	187.3	274.5	205.7	156.4	172.6	4.1	+10.4	-8.9
Road transport	753.9	745.4	686.7	694.2	694.7	700.4	16.5	+0.8	-1.5
Pipeline transport	0.3	17.8	7.4	7.0	53.9	47.0	1.1	-12.7	+172.5
Sea and coastal water transport..........................	60.4	29.5	67.5	363.5	1,002.4	2,088.4	49.2	+108.3	+103.1
Inland water transport.......	29.1	19.2	20.9	17.2	13.5	55.3	1.3	+310.9	+13.7
Air transport.....................	50.0	8.3	21.8	8.6	9.5	4.9	0.1	-48.7	-37.3
TRANSPORT SECTORS	*1,169.4*	*1,007.5*	*1,078.8*	*1,296.3*	*1,930.3*	*3,068.6*	*72.3*	*+59.0*	*+21.3*
Cargo handling.................	138.6	141.1	100.6	137.3	156.9	542.6	12.8	+245.9	+31.4
Cargo storage	135.8	141.7	131.1	105.3	107.0	201.3	4.7	+88.0	+8.2
Supporting transport activities	258.3	363.2	346.2	233.7	371.9	244.3	5.8	-34.3	-1.1
Forwarders	70.9	96.0	77.0	108.3	90.6	66.1	1.6	-27.0	-1.4
Agencies..........................	72.6	75.0	73.7	44.4	41.9	48.0	1.1	+14.6	-8.0
Postal services.................	110.5	78.5	81.0	73.9	101.1	72.7	1.7	-28.1	-8.0
OTHER LOGISTICS SECTORS	*786.7*	*895.4*	*809.5*	*702.9*	*869.3*	*1,174.9*	*27.7*	*+35.1*	*+8.4*
DIRECT INVESTMENT.......	**1,956.1**	**1,903.0**	**1,888.3**	**1,999.2**	**2,799.7**	**4,243.5**	**100.0**	**+51.6**	**+16.8**

Source: NBB.

In road transport, in spite of substantial growth at Frans Maas and Nagel Belgium, investment has remained stable, mainly due to proportionate falls at Noord Limburgs Distributie Center and Osplag en Distributie Ter Haeghe. A decline was noted in supporting transport activities, because of a change in the classification of MSC Home Terminal, now part of the cargo handling sector (see above), and a substantial reduction at Gemeentelijk Autonoom Havenbedrijf Antwerpen. Pipeline transport saw an outstanding development in 2004, hence a slight decline the year after, declining figures being noted at FL Zeebrugge, among other things. With air transport and forwarders, declines were noted as well, respectively at European Air Transport and ECS European Containers. The decline in postal services noted between 2004 and 2005 is primarily the consequence of the huge investments recorded the previous year, namely at TNT Express Belgium, in addition to the starting up of a large number of new postal services operators in 2004.

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[73] BNRC Holding invests 4.8 billion euro over the period 2005-2007. The major part (roughly 3.3 billion euro) is laid out through Infrabel. More information on www.b-rail.be. Attention, only 13.7 p.c. of these amounts is retained in the present study (cf. comments on table 2).

CHART 3   INVESTMENT EVOLUTION AT CONSTANT PRICES
(millions of euro)
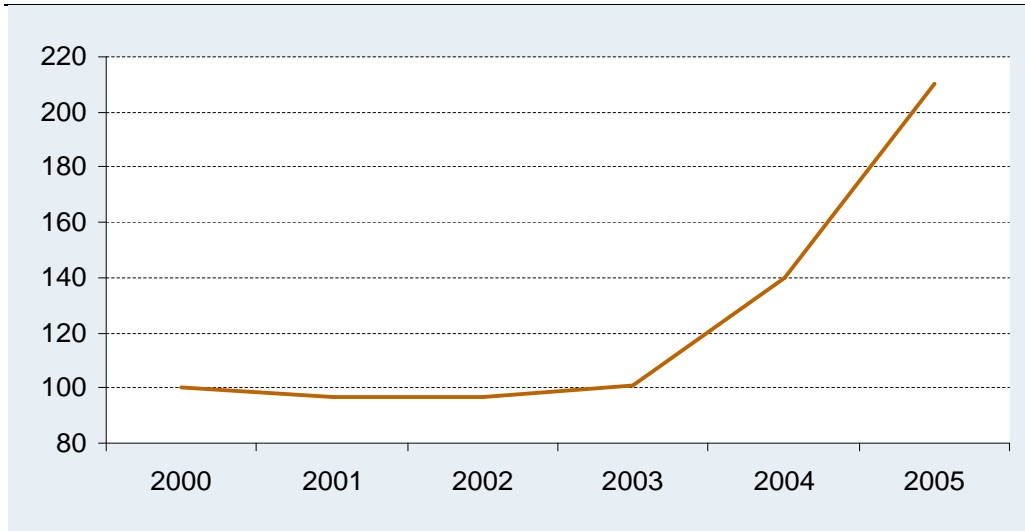
o   Top 20 in 2005

TABLE 12   INVESTMENT TOP 20 IN TRANSPORT LOGISTICS SECTORS IN 2005
(millions of euro)

Ranking	Name of company	Sector	Investment
1	Euronav	Sea and coastal water transport	1,296.0
2	Safmarine Container Lines	Sea and coastal water transport	178.7
3	Cobelfret Ferries	Sea and coastal water transport	158.5
4	Antwerp Gateway	Cargo handling	155.3
5	Infrabel	Rail transport	127.0
6	Hesse - Noord Natie	Cargo handling	121.7
7	MSC Home Terminal	Cargo handling	95.3
8	Bocimar International	Sea and coastal water transport	94.0
9	Excelerate	Sea and coastal water transport	70.0
10	Bocimar Belgium	Sea and coastal water transport	56.4
11	Excelsior	Sea and coastal water transport	55.4
12	Gemeentelijk Autonoom havenbedrijf Antwerpen	Supporting transport activities	52.4
13	F.L. Zeebrugge	Pipeline transport	42.3
14	Exmar Shipping	Sea and coastal water transport	38.5
15	Kleimar	Sea and coastal water transport	38.2
16	Belgocontrol	Supporting transport activities	37.3
17	La Poste - De Post	Postal services	37.1
18	Delphis	Sea and coastal water transport	35.9
19	Société Wallonne des Aéroports	Supporting transport activities	35.3
20	Fresh Fruit Terminal (Antwerp)	Cargo storage	28.0
	TOTAL of top 20		**2,753.2**

The investment top 20 is dominated by sea and coastal water transport firms, owing to the boom in maritime transport, and especially containerised services, resulting, for the first three companies in particular, in massive projects worldwide, the renewal of vessel fleets (see explanation above), etc. as table 12 indicates. Another observation that can be drawn from these figures is the higher concentration of investment operations, in comparison with value added and employment. The first ten companies of this ranking accounted for 55.4 p.c. of direct investment in freight transport logistics. The 2.75 billion

euro spent on investment in the twenty companies making up this top 20 league represented 64.9 p.c. of that same total, which is indeed higher than the percentages reached by value added and employment top 20s. But this may prove quite exceptional, as some outstanding events took place in 2005, as explained in the comment on table 11. Worth mentioning is the percentage reached by the top 10 and top 20 in 2004 compared to total investment: respectively 47.3 and 57.8 p.c.

2.1.4 *Financial situation*

The financial situation of the companies belonging to the freight transport logistics cluster is analysed through observing the evolution of some financial ratios: the return on equity after tax, liquidity in the broad sense and solvency. These ratios can be considered together as tools to establish a clear picture of the financial position occupied by each sector studied. This analysis is complemented by the chart about the percentage of firms facing financial difficulties. This chart is made up on the basis of a synthetic financial health indicator developed by the NBB. Changing population of companies can have a huge impact on financial ratios and the financial health indicator. Some figures can change dramatically because of movements (newcomers or disappearing companies) directly affecting financial entries and their real significance. Therefore, it was decided to work with a constant sample for the years 2003 to 2005. This contains all firms that filed their accounts in 2003, 2004 and 2005, and which meet certain conditions underpinning the calculation of these ratios[74]: on average 80.8 p.c. of the entire population, 88.3 p.c. of the direct VA and 92.2 p.c. of the direct employment under review are recorded in the constant sample.

2.1.4.1 **Financial ratios**

Table 13 highlights the evolution of the three ratios per transport logistics sector.

o There was a substantial rise in the return on equity after tax in freight transport logistics in 2005, especially in transport sectors (table 13). Major rises were seen in rail transport, sea and coastal water transport - record level of the net profit after taxes since 2004 for some major players -, air transport and agencies. Relevant examples of these movements are respectively given by the financial situation which improved at BNRC Holding, as an accounting consequence of its restructuring in 2005, good results marking Safmarine Container Lines and Bocimar International, and return on equity rising at Delta Air Transport and at Mediterranean Shipping Company Belgium. In the other sectors, return on equity either fell or remained unchanged. Declines were noted in road transport, inland water transport, cargo handling, cargo storage, supporting transport activities, forwarders and postal services. The average score was slightly above that of Belgian non-financial corporations.

o Liquidity improved significantly in 2005 and this ratio exceeded 100 p.c. on average, mainly thanks to the performance of some other logistics sectors. The net working capital of road transport, air transport, cargo handling, supporting transport activities, forwarders, agencies and postal services increased and was positive (i.e. a liquidity ratio ≥ 1). The ability of several firms to mobilise cash resources to meet their short-term commitments improved significantly, namely Ziegler, Delta Air Transport and European Air Transport, Schelde Container Terminal, Brussels International Airport Company and ABX Logistics Belgium, Schenker, Conti-Lines, La Poste-De Post, TNT Express Belgium and DHL International. In all the other sectors, that ratio deteriorated. This was the case in rail transport, sea and coastal water transport, inland water transport and cargo storage.

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[74] Example of those conditions: for the purpose of calculating the return on equity, all data must correspond to a 12-month financial year and the denominator, namely the equity, must be strictly positive.

TABLE 13   **FINANCIAL RATIOS IN TRANSPORT LOGISTICS FROM 2003 TO 2005**
(Globalisation)

Sectors	Return on equity after tax (in p.c.)			Liquidity in the broad sense			Solvency (in p.c.)		
	2003	2004	2005	2003	2004	2005	2003	2004	2005
Rail transport	-8.6	-17.5	-0.6	0.76	0.57	0.51	24.8	12.4	17.2
Road transport	3.4	7.8	4.4	1.05	1.07	1.25	29.2	30.8	30.8
Pipeline transport	10.2	4.1	4.1	0.99	1.08	0.93	30.2	39.7	37.2
Sea and coastal water transport	-1.2	103.4	114.9	0.69	0.98	0.62	20.7	22.4	26.7
Inland water transport	6.9	10.7	7.7	1.04	1.18	1.07	31.7	31.9	30.5
Air transport	-50.7	9.8	16.1	1.03	0.93	1.33	9.5	10.9	14.3
TRANSPORT SECTORS	*0.1*	*17.4*	*23.3*	*0.93*	*0.96*	*0.96*	*26.7*	*25.0*	*27.9*
Cargo handling	9.9	12.7	10.8	1.15	1.06	1.16	32.1	33.4	31.5
Cargo storage	6.6	5.5	3.4	0.58	0.95	0.84	30.7	30.7	33.0
Supporting transport activities	2.2	2.7	1.0	0.85	0.68	1.04	56.3	54.2	54.9
Forwarders	14.5	23.7	21.4	0.98	1.03	1.11	15.7	15.0	19.6
Agencies	11.6	12.4	45.5	0.92	0.95	2.08	28.9	29.7	42.7
Postal services	-9.4	6.7	-17.0	1.15	1.12	1.17	25.4	21.2	23.7
OTHER LOGISTICS SECTORS	*3.3*	*6.2*	*6.1*	*0.94*	*0.97*	*1.11*	*38.3*	*35.9*	*39.6*
Weighted average	**2.4**	**9.3**	**10.6**	**0.93**	**0.97**	**1.04**	**34.1**	**32.1**	**35.7**
Non-financial corporations[75]	7.6	6.9	10.1	1.22	1.24	1.29	40.6	41.6	43.4

Source: NBB.

o Solvency ratio exceeded the 2003 record, in both categories of sectors, transport and other logistics. An increase in solvency was seen in rail transport, sea and coastal water transport, air transport, cargo storage, forwarders, agencies and postal services. By way of example, we can quote rises at BNRC Holding, Cobelfret Bulk Carriers and Bocimar International, Delta Air Transport, Belgotank, Schenker, TNT Express Worldwide Belgium, La Poste-De Post and DHL Aviation. In some other sectors, firms' ability to honour their short- and long-term financial commitments slowed down or declined. In road transport, there was no change, while solvency ratios declined in inland water transport and cargo handling.

2.1.4.2   Synthetic financial health indicator

The financial health of freight transport logistics companies can be studied on the basis of the NBB's synthetic financial health indicator[76]. Chart 4 depicts the percentage of firms going through financial difficulties, i.e. classified in risk categories 3 or 4. Its evolution makes it possible to assess the change in risk-taking patterns among the companies under review. The same conditional constant sample applies for this specific analysis, but with one more constraint: this bankruptcy prediction model applies to firms employing more than five workers[77].

The cluster average percentage of firms in financial difficulty, i.e. those in risk classes 3 and 4, increased between 2004 and 2005, rising from 9.1 to 10 p.c., slightly up on 2003. It was SMEs that were most affected by this increase, as their percentage was up from 9.2 to 10.3, while for large firms the increase was smaller, from 8.7 to 9 p.c. This picture contrasts with the situation of non-financial corporations

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[75]   These figures relate to the situation of all Belgian non-financial corporations. See Lagneaux F. and D. Vivet (2006).

[76]   Coppens F. A. Hermesse and D. Vivet (2004), and Vivet (2005).

[77]   On average, the proportion of companies complying with all these conditions - constant sample and minimum number of employees - is only 28.8 p.c., which nevertheless concern 89 p.c. of the direct employment under review.

which enjoyed better financial health throughout the Belgian economy as a whole, especially in the case of SMEs.

CHART 4   **EVOLUTION OF FINANCIAL RISKS**
(percentages)

10.09 p.c.: other logistics sectors
10.05 p.c.: cluster average
10.03 p.c.: transport sectors

Transport sectors — Other logistics sectors — Average cluster
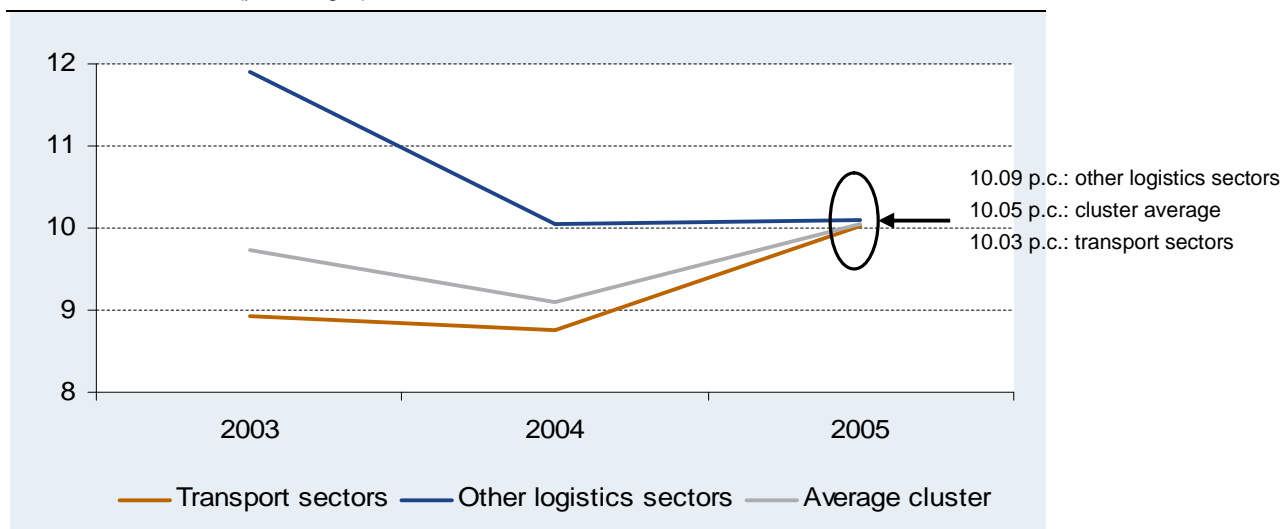
Source: NBB.

Chart 4 gives the percentages of freight transport logistics enterprises which were more exposed to financial risks than the average (classes 3 and 4). Behind these trends, we find, in 2005, an increasing number of firms running financial risks in road transport, inland water transport, cargo handling and postal services. Conversely, fewer companies were in that situation in the following sectors: agencies, air transport, cargo storage, forwarders, rail transport and sea and coastal water transport. Taking transport sectors and other logistics sectors separately, the percentage of firms in classes 3 and 4 rose in 2005 in the former, from 8.7 to 10 p.c., while it remained stable in the latter, at 10.1 p.c., after quite a difficult year in 2003. Some companies from the agencies, forwarders and cargo storage sectors had to deal with profound financial difficulties then.

These figures can also be translated in terms of jobs concerned. Here too the percentage rose between 2004 and 2005, because in 2005, 7 p.c. of the employees worked in companies facing financial difficulties, instead of 6.3 p.c. the year before. However these percentages mitigate somewhat those found in terms of number of business units concerned.

2.1.5   _Breakdown of findings by company size_[78]

TABLE 14   **BREAKDOWN OF FINDINGS IN FREIGHT TRANSPORT LOGISTICS IN 2005**

	Number of firms		Direct VA (millions of euro)		Direct employment (FTEs)		Direct investment (millions of euro)	
	Large firms	SMEs	Large firms	SMEs	Large firms	SMEs	Large firms	SMEs
TOTAL	548	7,994	6,684.0	2,612.4	89,075	41,314	3,368.7	874.8

Source: NBB.

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[78] Enterprises are deemed large if their annual average number of workers exceeds 100 or if they exceed more than one of the following three limits: annual average number of workers – 50 units; annual turnover (excluding VAT) – 7.3 million euro; balance sheet total – 3.65 million euro. These are the criteria applicable from the 2005 financial year. More information in section 15 of the Companies Code (law of 7 May 1999).

The freight transport logistics cluster is made up of a myriad of small and medium-sized enterprises. Considering figures for 2005 (table 14), nearly 8,000 SMEs are registered in the sectors studied, which is 93.6 p.c. of the population reviewed. But, in terms of direct value added, employment and investment, they do not represent more than 28.1, 31.7 and 20.6 p.c. respectively, the remainder being generated by large companies.

These figures ought to be put into perspective though. Economic activity is, for instance, more highly concentrated in some other areas, such as manufacturing industry, which enjoys a strong presence in sea ports[79]. To get a better picture of the relative concentration - or rather the spread - of activity in the cluster, please refer to the top 20 classifications in tables 7, 9 and 12.

2.1.6 *Breakdown of findings by Region*[80]

Today only a very limited number of survey-based analyses could demonstrate the relative importance of transport logistics in the Regions which make up Belgium, i.e. Brussels, Flanders and Wallonia. Some of them make reference to a report published by the real estate broker Cushman & Wakefield (see below). In this section, direct value added and employment of the different branches or establishments of the so-called "multi-regional" companies under review, i.e. the companies established in more than one location, are presented by Region. On the basis of NAI data, they are broken down regionally according to two different approaches: (1) location of head office and (2) location of local branches. They give two distinct pictures of how the activity is distributed between the three Regions. Once again, the NACE code, and therefore the sector, considered for each entity - branch or subsidiary - remains that of the parent company, whether it be "multi-regional" or "mono-regional", the activity only being geographically distributed among the different locations, and not across sectors.

This section starts with a summary of the different regional contexts in terms of transport logistics.

2.1.6.1 Regional specificities[81]

Before going further into the context of each Region, some useful information is provided by Cushman & Wakefield's European Distribution Report 2006[82] about opportunities for setting up new logistics and distribution businesses across Europe. This report presents an updated version of the Regions' ranking in terms of attractiveness for the establishment of such activities on their soil. The criteria retained in this analysis and their respective weighting percentage are shown in the first row of tables 15 and 16 below.

Figure 2 presents a map of Belgium, with a clear distinction between its three Regions: Flanders to the north, Brussels in the centre and Wallonia to the south. The provinces are distinguished as well: West Flanders, East Flanders, Antwerp, Limburg and Flemish Brabant make up Flanders, while Hainaut, Walloon Brabant, Liège, Namur and Luxembourg constitute Wallonia.

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[79] See Lagneaux (2007).

[80] Region understood in the administrative sense of the word.

[81] Unless otherwise stated, all figures mentioned in this section are from Federal Public Service (FPS) Economy - Directorate General for Statistics and Economic Information.

[82] Cushman & Wakefield (2006). See also VIL (2006).

FIGURE 2   BELGIAN REGIONS AND PROVINCES
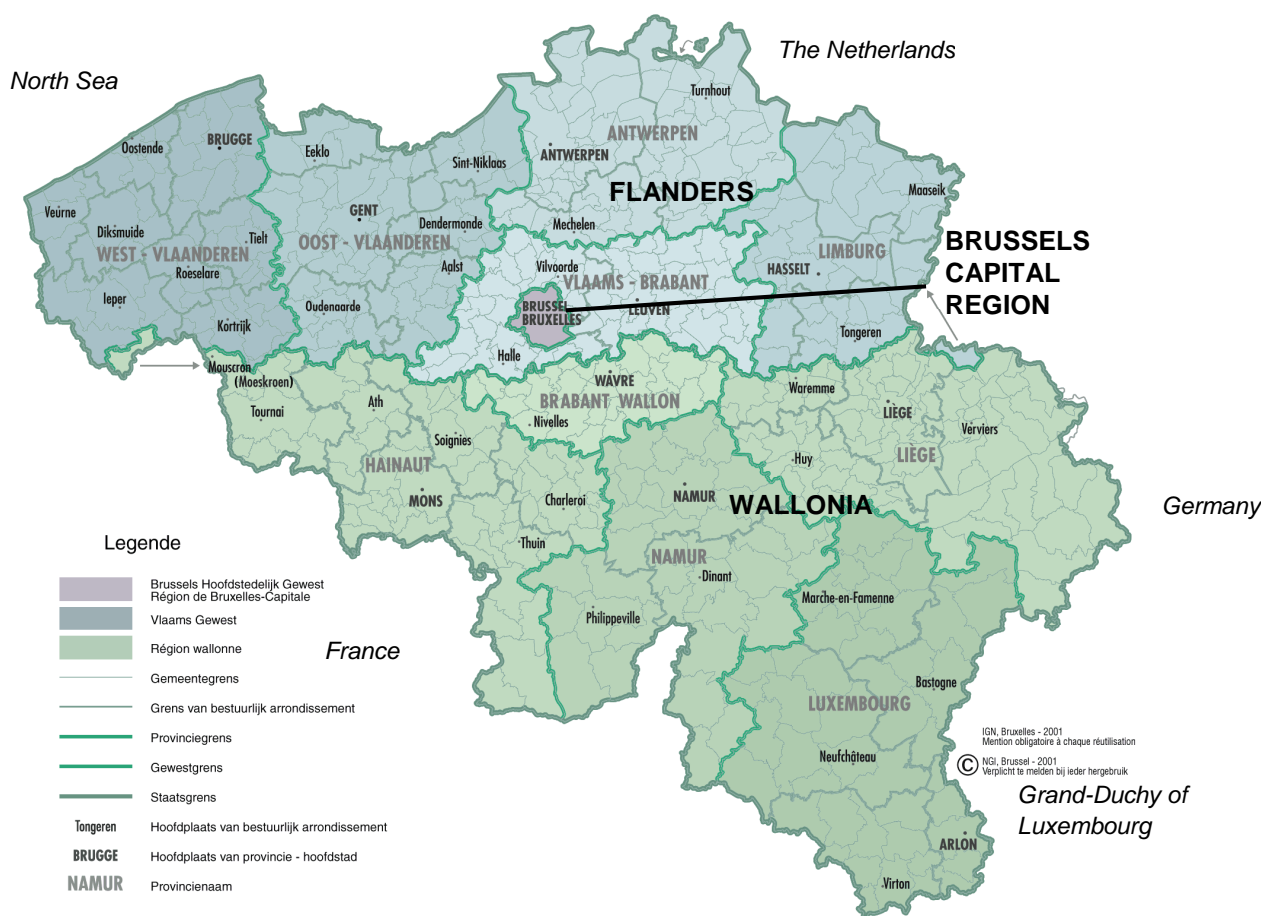
Source: NBB, National Geographic Institute and Cushman & Wakefield.

Table 15 gives the ranking of the most attractive NUTS 1 European regions for distribution and, consequently, logistics activities by NUTS 1 region (i.e., in the case of Belgium, the Regions). Quite remarkably, this list is topped in 2006 firstly by Flanders and secondly by Wallonia. The highly positive change noted for Wallonia between 2004 and 2006 can be partly explained by the fact that the model used for the ranking of the regions has, since 2006, included a parameter concerning the purchasing power within a three-hour driving time radius, instead of the population density. Moreover, Wallonia has done very well in the last couple of years in terms of developing its logistics parks. Flanders remains at the top of the classification and Brussels Capital Region, in spite of this change in the methodology, still occupies a top-ten position.

Now let us see what the specific situation in each province is. Table 16 gives that ranking by NUTS 2 region (i.e. in the case of Belgium, the provinces and the Brussels Capital Region).

Seven out of the ten top-ranking European NUTS 2 regions in terms of attractiveness for logistics activities are Belgian provinces. And nine of the ten Belgian provinces and Brussels Capital Region are in the top 15. The southern Belgian province of Luxembourg, which is not mentioned in table 16, comes in 21st place. Quite remarkably, this ranking is topped, in decreasing order, by the provinces of Limburg, Liège, Hainaut and Antwerp, the provinces having already achieved the highest scores in 2004. Besides, they enjoy the presence of major hubs and communication routes. They currently accommodate the largest logistics centres in Belgium and, each in their respective Region, the largest warehousing areas. Nevertheless, the same Distribution Report points out that the centre of gravity of the European logistics sector might shift further eastward, considering the recent enlargement of the EU's single market.

TABLE 15 **RANKING OF NUTS 1 REGIONS ACCORDING TO THEIR ATTRACTIVENESS**

TOP 10	COSTS	TRANS-PORT SYSTEM	ACCES-SIBILITY	SUPPLY	LABOUR	KNOW-HOW	TOTAL SCORE	RANKING 2006	RANKING 2004
weighting (in p.c.)	*21.875*	*31.25*	*31.25*	*9.375*	*3.125*	*3.125*			
Flanders (B)	6.6	1.7	1.2	1.6	4.1	2.1	5.1	**1**	1
Wallonia (B)	6.0	2.2	1.2	1.8	3.8	4.4	5.2	**2**	7
Nord-Pas-de-Calais (F)	4.9	2.4	1.7	2.0	4.6	5.0	5.3	**3**	3
Saarland (D)	4.6	3.3	1.8	1.2	3.5	4.3	5.6	**4**	4
Ile-de-France (F)	6.2	1.8	2.3	2.6	1.7	3.7	5.8	**5**	2
Est (F)	5.0	3.0	1.7	2.4	4.8	5.0	5.8	**6**	6
Brussels Capital Region (B)	8.7	1.7	1.0	2.6	1.1	3.0	5.8	**7**	5
Nordrhein-Westfalen (D)	8.7	2.5	0.8	2.0	4.0	3.8	6.3	**8**	8
Zuid-Nederland (NL)	8.9	2.2	0.7	1.9	10.2	2.7	6.5	**9**	9
Rheinland-Pfalz (D)	7.4	3.3	1.3	1.9	5.3	4.2	6.7	**10**	10

Source: Cushman & Wakefield (2006).

TABLE 16 **RANKING OF NUTS 2 REGIONS ACCORDING TO THEIR ATTRACTIVENESS**

TOP 15	COSTS	TRANS-PORT SYSTEM	ACCES-SIBILITY	SUPPLY	LABOUR	KNOW-HOW	TOTAL SCORE	RANKING 2006	RANKING 2004
weighting (in p.c.)	*21.875*	*31.25*	*31.25*	*9.375*	*3.125*	*3.125*			
Limburg (B)	5.4	2.0	1.0	1.3	3.6	1.7	2.4	**1**	1
Liège (B)	6.0	1.5	1.0	2.3	3.2	2.5	2.5	**2**	2
Hainaut (B)	5.4	2.3	2.1	1.3	2.8	3.3	2.8	**3**	4
Antwerp (B)	7.9	1.4	1.3	2.3	1.8	1.0	2.9	**4**	3
Düsseldorf (D)	9.1	1.6	0.7	2.5	2.0	2.5	3.1	**5**	11
Namur (B)	6.2	2.4	1.8	2.8	2.5	3.5	3.1	**6**	19
Flemish Brabant (B)	8.2	1.8	1.4	2.5	2.5	2.3	3.2	**7**	12
Alsace (F)	5.2	2.8	2.3	3.0	3.7	3.8	3.2	**8**	9
Nord-Pas-de-Calais (F)	5.4	2.5	2.7	2.5	3.4	3.8	3.3	**9**	8
East Flanders (B)	7.0	2.0	2.4	2.3	3.3	2.0	3.3	**10**	7
Limburg (NL)	8.3	2.2	0.8	2.5	7.7	2.0	3.3	**11**	15
West Flanders (B)	6.4	1.8	3.2	1.9	4.3	1.1	3.3	**12**	6
Walloon Brabant (B)	8.2	2.2	1.8	2.5	1.4	3.3	3.4	**13**	17
Cologne (D)	10.1	1.8	0.8	3.0	2.8	2.5	3.4	**14**	18
Brussels Capital Region (B)	9.2	1.8	1.6	3.3	0.8	2.3	3.5	**15**	13

Source: Cushman & Wakefield (2006).

FIGURE 3 POPULATION DENSITY IN BELGIUM
(number of residents per square kilometre)

	22 - 411
	412 - 1041
	1042 - 2238
	2239 - 5286
	5287 - 8393
	8394 - 20259

25 km
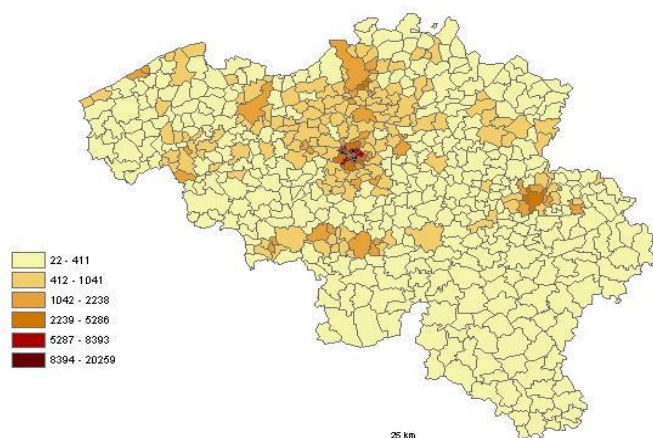
Source: Federal Public Service (FPS) Economy -Directorate General for Statistics and Economic Information.

Brussels Capital Region, the most densely populated Belgian Region with its 1 million inhabitants for only 161 square kilometres (see figure 3), which lies enclosed within the Flemish Region, comprises 19 municipalities with a bilingual status. Most large Belgian companies have their headquarters in Brussels, including a substantial number of Flemish and Walloon logistics enterprises (see below). Brussels is where most Belgian and international organisations - including the EU and NATO - and corporations, services to enterprises, banking and insurance companies are established. It is one of the most dynamic areas for real estate business on the continent. Within the Brussels Capital Region, the area concentrating the highest number of transport logistics activities remains the port of Brussels, situated to the north-west. But the zones offering the most logistics services are actually located on the outskirts of the capital, on Flemish territory, including Brussels Airport in Zaventem.

Flanders, with its 6 million inhabitants for 13,522 square kilometres, is home to very highly concentrated industrial and transport clusters, such as the extremely dense area between Antwerp, the main city of Flanders, and Brussels, its four sea ports[83], Brussels Airport, the main Belgian airport for both passengers and freight traffic[84], the Scheldt linking Flanders and France, the Albert Canal linking Antwerp and Liège, numerous major logistics areas in all Flemish provinces, etc. According to the VIL (2006), extended gateways (see figure 4) are the effective multimodal hinterland network of Flanders, consisting of the connections between the gateways (airports and sea ports) and multimodal platforms. All the top sites for European distribution activities are located within this network, having the characteristics of a "prime location", where logistical costs of delivering and distributing goods to European destinations are kept to a minimum. By promoting this concept, Flanders' ability to provide activities with logistical added value, and consequently accommodate European distribution centres within this network, is enhanced.

Wallonia, home to 3.4 million inhabitants over 16,844 square kilometres, is the largest Region of Belgium with a substantial part of its territory still available for setting up new businesses. Some former industrial Regions are gradually restructuring in order to accommodate booming business, mainly in services to enterprises and logistics. The economically densest territories remain Walloon Brabant and the route linking Brussels to Namur, capital of Wallonia, as well as the strip of land alongside the rivers Sambre and Meuse crossing the Hainaut, Namur and Liège provinces, where Wallonia's four

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[83] Namely Antwerp - the second biggest sea port in Europe -, Ghent, Ostend and Zeebrugge.

[84] Brussels Airport belongs to the group of midsize international airports in Europe, in the top 20 in terms of passenger traffic and in the top 10 in terms of freight handling. The latter is mainly attributable to activities of a certain number of transport logistics providers, including DHL. See also VIL (2005b).

"autonomous harbours"[85] are established. Multimodal centres are being developed in most provinces, Charleroi and Liège enjoying the presence of the four modes of transport, as reminded by Logistics in Wallonia (see figure 5), including the Brussels South Charleroi Airport and Liège Airport, respectively the second commercial passenger airport in Belgium and a specialist freight airport, ranking 8th in Europe - 2nd in Belgium - in terms of tonnage of cargo handled. Also, the Liège port complex remains the third inland port in Europe.

FIGURE 4   MAIN LOGISTICS AREAS IN FLANDERS AND POTENTIAL "EXTENDED GATEWAYS"
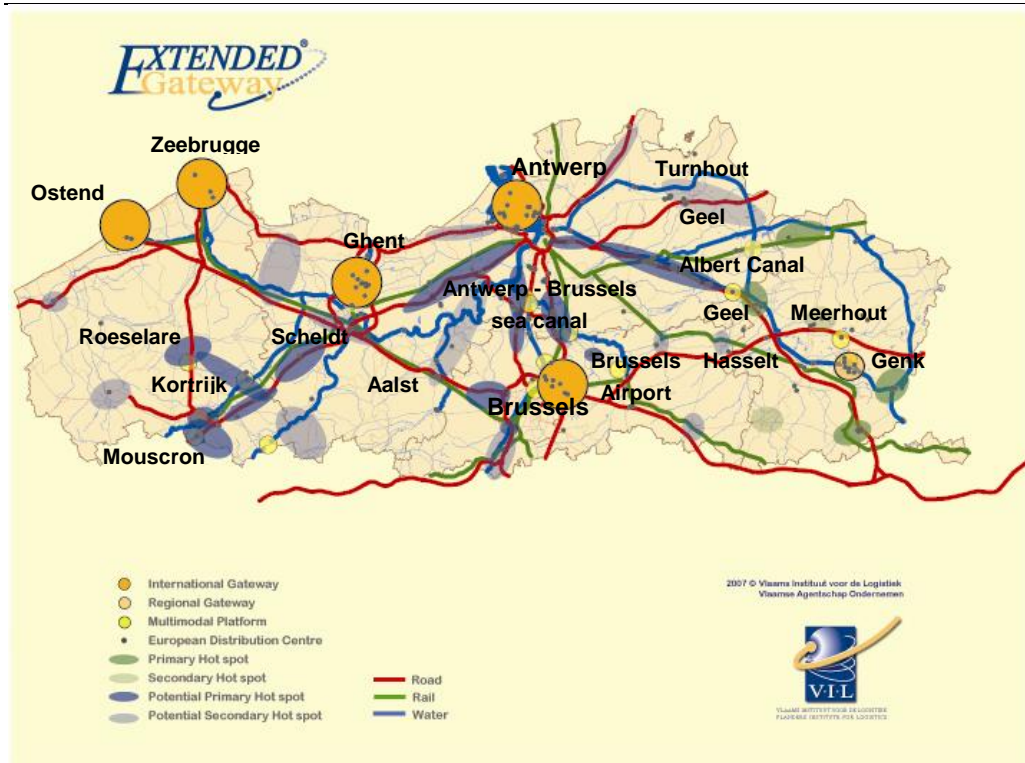
Source: VIL.

FIGURE 5   MAIN MULTIMODAL LOGISTICS PARKS IN WALLONIA
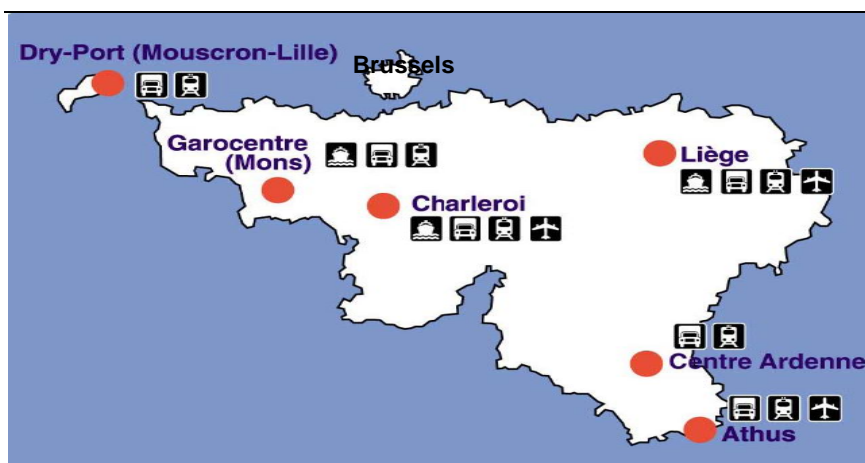
Source: Cluster Transport & Logistique (2005a).

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[85]   From west to east: *Port Autonome du Centre-Ouest*, *Port Autonome de Charleroi*, *Port Autonome de Namur* and *Port Autonome de Liège*.

2.1.6.2 Regional breakdown according to location of head offices

The following two charts only cover the activity generated by the companies reviewed, whether they be "mono-regional" ("mono") or "multi-regional" ("multi"), broken down by Region according to their headquarters' location.

CHART 5	BREAKDOWN OF VALUE ADDED ACCORDING TO LOCATION OF HEAD OFFICE IN 2005	CHART 6	BREAKDOWN OF EMPLOYMENT ACCORDING TO LOCATION OF HEAD OFFICE IN 2005
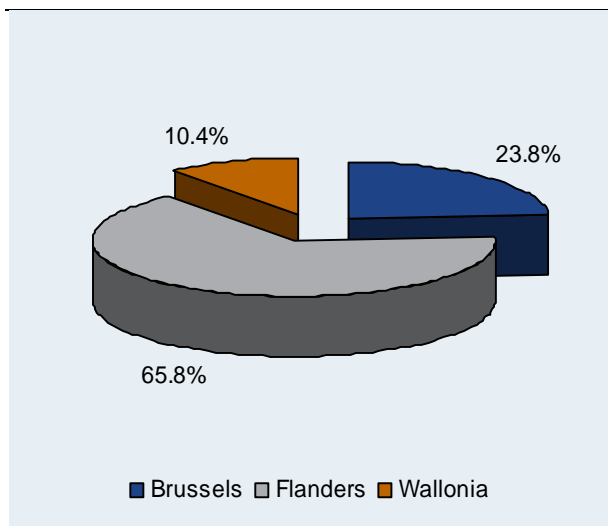
10.4%
23.8%
65.8%

■ Brussels □ Flanders ■ Wallonia

Source: NBB.

11.9%
34.4%
53.7%

■ Brussels □ Flanders ■ Wallonia
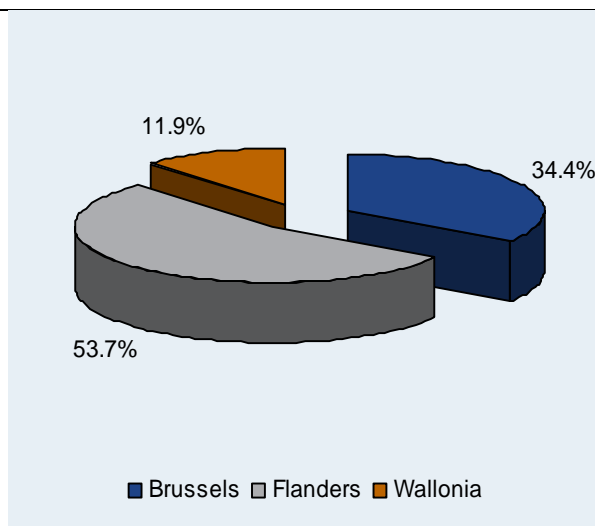
Source: NBB.

When the activity of the companies belonging to the population under review is broken down by Region according to the location of their head offices, Flanders emerges as the first Region where freight transport logistics businesses choose to have their headquarters, followed by Brussels and finally Wallonia. In spite of its very small size, Brussels can boast the main offices[86] of logistics companies accounting for almost one fourth of the wealth generated and more than one third of the workforce employed countrywide.

2.1.6.3 Regional breakdown according to location of local branches

In 2005, the 178 "multi" companies under review, i.e. the largest companies, that own more than one branch on the Belgian territory, accounted for 35.2 p.c. of the direct value added and 44.9 p.c. of the direct employment of the entire population.

Charts 7 and 8 concern all companies, both "mono" and "multi", having either one single office or many offices spread over the different Regions. Here, activity is broken down by Region according to the location of the local branches.

The picture given in these charts is different to that emerging from charts 5 and 6. In spite of its critical importance for accommodating logistics companies' headquarters, Brussels Capital Region actually accounts for no more than 6.3 p.c. of the value added and 9 p.c. of the employment of the cluster, if its local business is taken into account. The economic weight of Flanders becomes even more visible here, as that Region accounts for more than three-quarters of the cluster's value added and almost 70 p.c. of its employment. The northern region can therefore be described as a mature leader in Belgian logistics. Wallonia, on the other hand, is the Region with the highest growth potential for logistics activities, because of the spaces available and its ideal location (see above). Bearing in mind that this Region is following a growing trend, it accounted for "only" 16.5 p.c. of the value added of the cluster and almost 22 p.c. of its employment in 2005.

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[86] Head offices in the case of "multi" companies.

CHART 7   BREAKDOWN OF VALUE ADDED
ACCORDING TO LOCATION OF LOCAL
BRANCHES IN 2005
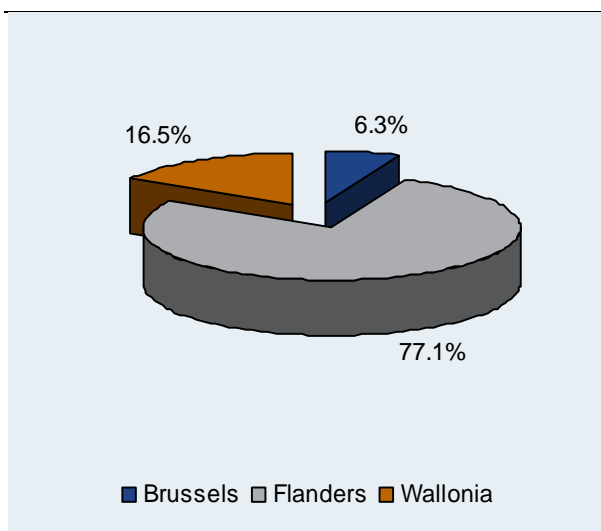
CHART 8   BREAKDOWN OF EMPLOYMENT
ACCORDING TO LOCATION OF
LOCAL BRANCHES IN 2005

16.5%   6.3%

77.1%

■ Brussels ■ Flanders ■ Wallonia

21.7%   9.0%

69.3%

■ Brussels ■ Flanders ■ Wallonia
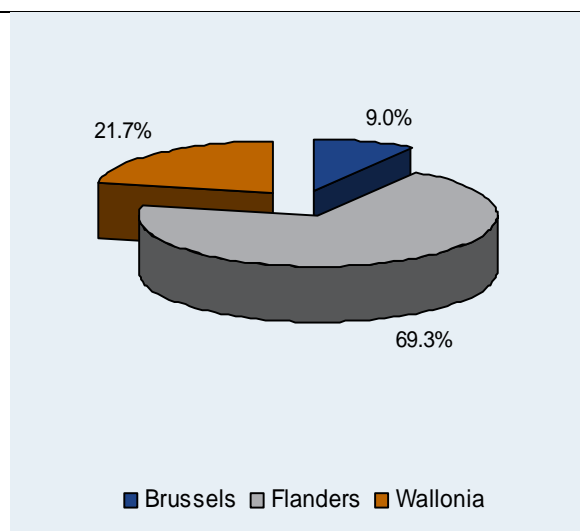
Source: NBB and NAI.

Source: NBB and NAI.

Table 17 shows, for each Region and from all data concerning both "mono" and "multi" companies, the 10 companies producing the highest value added in 2005, in decreasing order. Some "multi" companies are naturally present in more than one Region (e.g. La Poste - De Post).

TABLE 17   VALUE ADDED REGIONAL TOP 10 IN 2005

	Brussels		Flanders		Wallonia
1	La Poste - De Post (multi)	1	La Poste - De Post (multi)	1	La Poste - De Post (multi)
2	BNRC Holding (multi)	2	Gemeentelijk Autonoom Havenbedrijf Antwerpen (mono)	2	BNRC Holding (multi)
3	ABX Logistics (Belgium) (mono)	3	Brussels International Airport Company (mono)	3	TNT Express Worldwide (Euro Hub)[87] (mono)
4	Interparking (multi)	4	Euronav (mono)	4	Société Wallonne de Financement Complémentaire des Infrastructures (mono)
5	Intercontainer - Interfrigo (mono)	5	Bocimar International (mono)	5	Logistics Nivelles (mono)
6	Infrabel (mono)	6	Safmarine Container Lines (mono)	6	Société Wallonne des Aéroports (mono)
7	Société nationale de Transport par Canalisations - Nationale Maatschappij der Pijpleidingen (mono)	7	Belgocontrol (multi)	7	Gefco Benelux (multi)
8	Ziegler (multi)	8	BNRC Holding (multi)	8	Waldico (mono)
9	Doyen Auto (multi)	9	DHL Aviation (mono)	9	Brussels South Charleroi Airport (mono)
10	Shurgard Self Storage (multi)	10	Bocimar Belgium (mono)	10	Belgocontrol (multi)

Source: NBB and NAI.

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[87] TNT Express Worldwide (Euro Hub) is established at Liège Airport (see above).

Table 18 gives, for each Region and from all data concerning both "mono" and "multi" companies, the 10 companies employing the largest workforce in 2005, again in decreasing order.

TABLE 18   EMPLOYMENT REGIONAL TOP 10 IN 2005

	Brussels		Flanders		Wallonia
1	La Poste - De Post (multi)	1	La Poste - De Post (multi)	1	La Poste - De Post (multi)
2	BNRC Holding (multi)	2	BNRC Holding (multi)	2	BNRC Holding (multi)
3	ABX Logistics (Belgium) (mono)	3	DHL Aviation (mono)	3	TNT Express Worldwide (Euro Hub) (mono)
4	Interparking (multi)	4	Gemeentelijk Autonoom Havenbedrijf Antwerpen (mono)	4	Logistics Nivelles (mono)
5	Ziegler (multi)	5	Belgian Ground Services (mono)	5	Waldico (mono)
6	Intercontainer - Interfrigo (mono)	6	AviaPartner Belgium (multi)	6	Gefco Benelux (multi)
7	Christian Salvesen Distribution Services (mono)	7	Belgocontrol (multi)	7	Brussels South Charleroi Airport (mono)
8	De Haven van Brussel - Le Port de Bruxelles (mono)	8	Brussels International Airport Company (mono)	8	Société Base de Villers-le-Bouillet (mono)
9	Doyen Auto (multi)	9	DHL International (multi)	9	Transports et Travaux 's Heeren (multi)
10	De Nationale Transportmaatschappij (mono)	10	De Scheepvaart (multi)	10	Dachser Belgique (multi)

Source: NBB and NAI.

The economic impact of freight transport logistics, in terms of direct value added and employment, can be interpreted at regional level.

While the activities under review accounted, in direct terms, for 3.1 p.c. of Belgium's GDP and 3.4 p.c. of domestic employment in 2005 (see tables 6 and 8), those activities attached to each Region (cf. charts 7 and 8), represented, in the same year, 1.1 p.c. of Brussels' GDP and 2.1 of its domestic employment, 4.3 p.c. of Flanders' GDP and 4.3 p.c. of its domestic employment, and 2.3 p.c. of Wallonia's GDP and 2.9 p.c. of its domestic employment[88]. These percentages are roughly the same as in 2004.

From these figures, we could infer that freight transport logistics has a robust foothold in the Flemish economy. The current strategy implemented by the Flemish government, e.g. the Flanders Logistics programme, is intended to reinforce this position even further in the near future. The relative presence of such activities is lower in Wallonia and Brussels. In Wallonia, nevertheless, many projects, supported by regional authorities and the Logistics in Wallonia structure, currently tend to foster the creation and the development of logistics activities, with emphasis on the value-added activities. This is the case of Liège TriLogiPort, for instance, and the numerous other inland harbours in Hainaut along the river Sambre and logistics parks in the other provinces. Brussels Capital Region is following the same path with incentives for investment in new logistics areas, generally concentrated in the harbour zone, which is constantly expanding and modernising.

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[88] Calculations made on the basis of NAI (2007), *Regional Accounts 1995 - 2005*.

2.1.7 _Direct effects: summary_

TABLE 19   **DIRECT EFFECTS: SUMMARY**
(percentages)

	Value added (current prices)		Employment (FTEs)		Investment (current prices)	
	Share in 2005	Annual average change from 2000 to 2005	Share in 2005	Annual average change from 2000 to 2005	Share in 2005	Annual average change from 2000 to 2005
Transport sectors	45.8	+5.6	43.3	+0.0	72.3	+21.3
Other logistics sectors	54.2	+7.1	56.7	+2.5	27.7	+8.4
Cluster's direct effects	100.0	+6.4	100.0	+1.3	100.0	+16.8

Source: NBB.

From the value added and employment figures (table 19), we see that other logistics sectors have progressively taken the lead over the transport sectors, as the growth recorded in the former is greater than that recorded in the latter over the period considered. In 2005, the cluster reviewed accounts, in direct terms, for 3.1 p.c. of the Belgian GDP and 3.4 p.c. of its domestic employment. The recruitment among the better educated workers is higher than ever before and the proportion of white-collar workers is still rising. In 2005, a substantial rise was also recorded in the number of hours worked by external staff. The evolution of part-time working, still fairly limited compared with national figures, depends on the sector considered. But the strong international competition most transport sectors are facing goes a long way towards explaining the fairly low wage level, quite high staff turnover rate and the continuous specialisation and integration of logistics activities (towards 3PL and 4PL). As regards investment, the booming activities in the maritime transport naturally played a substantial part in the fact that it enjoyed an exponential growth in the recent years.

While Brussels Capital Region accommodates a large number of logistics companies' head offices, value added and employment generated by transport logistics businesses, an SMEs' sector above all, actually pertains to the Flemish and Walloon Regions, Flanders holding a leading position and Wallonia taking all possible steps to develop a supportive environment for those activities. Whereas most companies of the cluster enjoyed an improvement of their return on equity after tax, their liquidity in the broad sense and their solvency, the percentage of firms running financial risks slightly increased in 2005.

2.2   INDIRECT EFFECTS

The indirect impact of the sectors reviewed, which complements their direct effects, is approached in two ways: the classic calculation of the indirect value added and employment based on a sectoral approach on the one hand and the underlying calculation of the linkages on the other. The former emphasizes the value added and employment generated at the suppliers of the sectors reviewed. All these suppliers were selected in branches not belonging to the transport logistics cluster but being in constant relation to it. The latter actually deals with the mutual relations between sectors, in terms of output. These two analyses are, in sequence, presented in the two sub-sections below.

2.2.1   *Indirect value added and employment*

This section is inspired by the theory on the backward linkages (see point 2.2.2.1 and appendix 2). Here, estimates are carried out until the year 2005 as the algorithm is based on two sets of data, the input-output table (IOT) 2000, on the one hand, and the supply-use tables (SUT) for 2000, 2001, 2002 and 2003, on the other. The 2000 IOT is published by the Federal Planning Bureau, while the 2003 SUT, used in the calculations for 2003, 2004 and 2005, is processed by the National Accounts Institute.

2.2.1.1   **Indirect value added**

TABLE 20   INDIRECT VALUE ADDED
(millions of euro - current prices, unless otherwise stated)

Sectors	2000	2002	2004	2005	Share in 2005 (in p.c.)	Multiplier in 2005
TRANSPORT SECTORS	*1,935.1*	*2,053.3*	*2,008.2*	*2,090.4*	*35.5*	*1.49*
OTHER LOGISTICS SECTORS	*3,602.0*	*3,795.2*	*3,551.5*	*3,795.1*	*64.5*	*1.78*
Indirect value added	**5,537.1**	**5,848.5**	**5,559.7**	**5,885.5**	**100.0**	**1.65**
Direct value added	6,824.4	7,136.5	8,862.4	9,296.4		
Direct + indirect value added	12,361.5	12,985.0	14,422.1	15,181.9		

Source: NBB and NAI.

Table 20 should be considered alongside table 6 (direct value added). In comparison to the evolution of direct value added, indirect value added has grown quite moderately between 2000 and 2005. This is due to the fact that the sectors under review tend to incorporate more and more activities in their increasingly complex supply of services, leaving less room for their suppliers. Moreover, the branches under review occupy a very high position in the economy, as they are mostly regarded as and actually are service providers, delivering a wide range of services to a vast number of economic sectors. Other elements can explain this trend, as detailed below. Adding indirect to direct figures, VA amounts to more than 15 billion euro in 2005, which accounts for 5 p.c. of Belgian GDP.

Multipliers, i.e. the ratio of the sum of direct and indirect effects on direct effects, are consequently moderate, albeit with some exceptions: the inland waterway and air transport sectors depend heavily upon services to enterprises, such as business and management consultancy activities (74B1) and monetary and other financial intermediation (65A2), as well as wholesale trade and commission trade (51A1). More generally the cluster under study depends to a large extent, and in decreasing order, upon several other branches of activity, namely renting of automobiles and other transport equipment (71A1), real estate activities (70A1), legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling (74A1), labour recruitment and provision of personnel (74E1), investigation and security activities, industrial cleaning and miscellaneous business activities (74F1) and manufacture of coke, refined petroleum products and nuclear fuel (23A1).

To some extent, a parallel can be drawn with the analysis of the backward linkages, which reveals, among other things, the first-line and overall connections between the cluster being studied and

branches 51A1, 70A1, 23A1 and 71A1 through the backward technical coefficients, and branches 71A1 and 74F1 through the decomposed backward linkages (see point 2.2.2.1).

2.2.1.2   Indirect employment

TABLE 21   INDIRECT EMPLOYMENT
(FTEs, unless otherwise stated)

Sectors	2000	2002	2004	2005	Share in 2005 (in p.c.)	Multiplier in 2005
TRANSPORT SECTORS	*27,998*	*28,584*	*23,556*	*24,239*	*33.8*	*1.43*
OTHER LOGISTICS SECTORS	*55,922*	*54,919*	*45,221*	*47,535*	*66.2*	*1.68*
Indirect employment	**83,920**	**83,503**	**68,777**	**71,774**	**100.0**	**1.57**
Direct employment	121,953	126,787	131,354	130,389		
Direct + indirect employment	205,873	210,290	200,131	202,163		

Source: NBB and NAI.

Table 21 is meant to be read next to table 8 (direct employment). Adding indirect to direct figures, employment comes to more than 202,000 FTEs in 2005, which represents roughly 5.3 p.c. of Belgian domestic employment, or 6.4 p.c. of Belgian domestic salaried employment.

Subcontracting to external branches - i.e. branches selected outside the cluster reviewed - seems to have shrunk in the last few years, especially in the other logistics sectors, notably in cargo handling and storage, but also for freight forwarders. This is primarily due to the phenomenon outlined above: freight transport logistics is more integrative than ever, as more operations than before are now carried out by logistics providers themselves. Consequently, recourse to external operators is limited, or part of the business is outsourced to foreign suppliers, which is in line with a second phenomenon, namely the internationalisation of supporting activities[89]. Increasing integration of transport logistics (-> 3PL -> 4PL), technological progress and the internationalisation of supporting activities, including ICT technologies and banking services, and of the transport industry in general, entail a reduction of indirect effects within the national territory. Moreover, EU integration has made relocation of specialised logistics business easier. But non-Belgian data are not reviewed in this paper.

Note:

It should be stressed that the sectors under review are service providers, working in an environment where outsourcing is dominant and even growing (see section 1.2). This does not mean that these service providers themselves outsource more operations to third parties than before, as explained above.

Consequently, multipliers are rather low, albeit with a few exceptions: the fairly high multiplier noted in 2005 in the sea and coastal water transport, inland water transport and air transport sectors can be explained by their dependence on business services, and especially business and management consultancy activities, management activities of holding companies and coordination centres (74B1). Besides, the cluster studied here depends considerably on the following branches, in decreasing order of importance: labour recruitment and provision of personnel (74E1), investigation and security activities, industrial cleaning and miscellaneous business activities (74F1), retail trade; repair of personal and household goods (52A1), wholesale trade and commission trade (51A1) and financial intermediation (65A2).

Some connections outlined in the study of the backward technical coefficients and decomposed linkages (see below), i.e. with branches 51A1 and 74F1, are found here as well.

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[89]   As pointed out in TNO Inro (2003), third segment of logistics, see definitions in section 1.1.1.

2.2.2 *Linkages in terms of production / output*

All calculations in this section are made on the basis of the input-output table for the year 2000, which is the most recently published set of data released by the Federal Planning Bureau in this respect. Since a top-down approach is applied to this part of the study, working with national figures from the IOT 2000, data are presented at a different aggregation level from the information provided by the Central Balance Sheet Office. Here SUT codes are "99X9" codes corresponding to 3-digit NACE codes (see above). Everytime such a code is mentioned, it will be followed by its translation in terms of 5-digit NACE code and/or the corresponding sectors. For the definition of branches, it can always be referred to appendix 1.

First phase: Analysis of the reduced matrix

This part revolves around the reduced or "inside" input-output matrix representing the relations in the year 2000 between the sectors studied.

TABLE 22	**SMALL INPUT-OUTPUT MATRIX: RELATIONS WITHIN CLUSTER REVIEWED**
	(millions of euro)

	60A1	60C1	61A1	61B1	62A1	63B1	64A1	External demand	Total output
60A1	0.8	4.9	0.0	0.0	0.0	7.9	36.4	1,379.2	1,429.2
60C1	18.9	253.9	**1.7**	2.6	3.7	258.5	147.2	8,171.4	8,857.8
61A1	0.0	5.0	20.3	0.0	0.0	52.2	0.0	1,885.9	1,963.5
61B1	0.0	26.6	0.1	22.8	0.1	0.7	0.0	213.1	263.5
62A1	0.0	0.3	1.1	0.2	272.1	115.4	4.8	3,268.3	3,662.3
63B1	1.5	749.0	875.2	4.1	584.5	1,600.4	23.3	5,402.3	9,240.4
64A1	0.0	32.7	0.0	0.1	3.2	42.2	58.7	2,507.0	2,643.9

Source: NBB.

This matrix reads as follows:

Table 22 represents the intermediary deliveries between logistics sectors, their external demand, including the deliveries to all the other sectors and final demand from final consumers, and their total output. By way of example, sector 60C1 (encompassing NACE 60.241, 60.242, 60.243 and 60.300) delivered altogether, in 2000, goods and services worth 1.7 million euro to sector 61A1 (NACE 61.100).

This analysis only concentrates on the interrelations within the transport logistics cluster. It is referred to as the study of the "inside" linkages.

Second phase: Looking beyond the studied branches' boundaries

The whole input-output table contains 120 rows and 120 columns and is therefore too big to fit in a single page, but the principle remains the same, except that here all the sectors are represented and final demand corresponds only to final consumption. The ensuing analysis will be developed in the next sections as well, focusing on some major relations between the sectors under review and the other sectors or industries.

This part focuses on the relations between the transport logistics sectors and the rest of the Belgian national economy, whether those other sectors are part of the studied cluster or not. It is referred to as the study of the "overall" linkages. Only relations accounting for at least 5 p.c. are retained in this part of the paper.

2.2.2.1 **Backward linkages**

This section aims to show what influence logistics sectors have on their suppliers' business. Two phases are followed in the framework of this demand-driven input-output model: the first one concentrates on the interactions within the cluster under review through the analysis of the reduced matrix; the second

looks beyond its boundaries and discusses the relations between the studied sectors and the rest of the Belgian economy.

2.2.2.1.1 First phase: Analysis of the reduced matrix

Here we analyse the activity generated upwards, i.e. on the side of the suppliers within the studied cluster.

Backward technical coefficients a_{ij}

TABLE 23   BACKWARD TECHNICAL COEFFICIENTS (1ST PHASE)
(percentages)

	60A1	60C1	61A1	61B1	62A1	63B1	64A1
60A1	0.1	0.1	0.0	0.0	0.0	0.1	1.4
60C1	1.3	2.9	0.1	1.0	0.1	2.8	5.6
61A1	0.0	0.1	1.0	0.0	0.0	0.6	0.0
61B1	0.0	0.3	0.0	8.7	0.0	0.0	0.0
62A1	0.0	0.0	0.1	0.1	7.4	1.2	0.2
63B1	0.1	8.5	44.6	1.6	16.0	17.3	0.9
64A1	0.0	0.4	0.0	0.1	0.1	0.5	2.2

Source: NBB and NAI.

The backward technical coefficients a_{ij} represent the relations -primary effects- sectors have with their first-tier suppliers. Within the cluster under review it is obvious, from table 23, that branch 61A1, i.e. NACE 61.100 (sea and coastal water transport), has close relations with its suppliers from branch 63B1, i.e. NACE 63.111, 63.112, 6.121, 63.122, 63.210, 63.220, 63.230, 63.401, 63.402, 63.403, 63.404, 63.405 and 63.406 (cargo handling, supporting transport activities, forwarders and agencies), as 44.6 p.c. of the former's output is supplied by the latter. It means that, for 61A1 to produce commodities for an amount of 100, it would require, at first level, input from 63B1 for a value of 44.6, whatever the monetary unit. Substantial relations (16 and 8.5 p.c. respectively) link branches 62A1 (air transport) and 60C1 (road transport and pipeline transport) with those same suppliers from cargo handling, supporting transport activities, forwarders and agencies. The other noticeable figures are those technical coefficients linking the sectors to themselves. It comes as no surprise that, at the first level, cargo handling and other transport supporting activities are very important for many other transport logistics branches (see also section 2.2.1.2.1).

Let us see if these observations are confirmed when looking at the infinite level of interdependencies.

Cai and Leung backward linkages BL_j

TABLE 24   CAI AND LEUNG BACKWARD LINKAGES (1ST PHASE)
(percentages)

60A1	60C1	61A1	61B1	62A1	63B1	64A1
101.7	111.4	157.0	103.3	120.4	105.4	109.1

Source: NBB and NAI.

Relative to their own output, the aggregate backward linkages theorised by Cai and Leung give a picture of the influence each logistics sector has on its suppliers within the cluster under review, at an infinite level (suppliers of all tiers). On the basis of table 24, we have to admit that the sector having the strongest influence on its suppliers' production decisions inside the logistics cluster is 61A1, i.e. sea and coastal water transport, with a 157 p.c. score. It is followed by 62A1 and 60C1, i.e. air transport and road transport and pipeline transport, which score respectively 120.4 and 111.4 p.c.

Backward decomposed linkages BDec_{ij}

Backward decomposed linkages (table 25) show the effect of deliveries relative to the suppliers' output, at an infinite level, which gives another picture altogether. This table highlights branch 60C1 (road transport and pipeline transport) having a strong influence on suppliers from branches 61B1 (inland water transport) and 63B1 (cargo handling and storage, other supporting activities and organisation of transport) and 60C1. Branch 61A1 (sea and coastal water transport) has a notable influence on suppliers from branch 63B1.

TABLE 25   BACKWARD DECOMPOSED LINKAGES (1ST PHASE)
(percentages)

	60A1	60C1	61A1	61B1	62A1	63B1	64A1
60A1	100.0	0.4	0.1	0.0	0.1	0.6	2.6
60C1	0.2	100.0	0.4	0.0	0.3	3.0	1.7
61A1	0.0	0.5	100.0	0.0	0.2	2.7	0.0
61B1	0.0	11.1	0.1	100.0	0.1	0.6	0.2
62A1	0.0	0.3	0.4	0.0	100.0	3.4	0.2
63B1	0.0	9.9	11.5	0.1	7.7	100.0	0.5
64A1	0.0	1.4	0.2	0.0	0.3	1.7	100.0

Source: NBB and NAI.

Key sectors

TABLE 26   KEY SECTORS (1ST PHASE)
(percentages)

	60A1	**60C1**	**61A1**	61B1	**62A1**	63B1	**64A1**
Ratio	98.2	**106.2**	**152.9**	91.5	**116.4**	75.2	**105.9**

Source: NBB and NAI.

To root out the main sector among the Belgian transport logistics cluster which has, irrespective of its size, the highest impact on its commercial partners within the cluster under review, we resort to the Oosterhaven and Stelder net multiplier. If the ratio defined on the last row of table 5 in the theory is greater than 1 or 100 p.c., then it means that this particular logistics sector is more important for the rest of the cluster than vice versa. Then it is said to be a key sector.

Table 26 shows that sea and coastal water transport (branch 61A1) plays, regardless of its size or output, a key role within the cluster under study, as its influence on the other logistics sectors is higher than theirs on it. This confirms the findings of table 24. Then come, in descending order, air transport (branch 62A1), road and pipeline transport (branch 60C1) and postal services (branch 64A1). The other logistics branches have less influence on the rest of the cluster under review.

2.2.2.1.2   Second phase: Looking beyond the studied branches' boundaries

In this section, we analyse the activity generated upwards, i.e. on the external suppliers' side of the sectors under review, whether they be part of the studied cluster or not. As there are too many sectors to represent them all on a single table, a selection was necessary: only the most significant and relevant relations (≥ 5 p.c.) are shown in the sub-sections below. The Cai and Leung backward linkages and the key ratios are still represented in full.

Backward technical coefficients a_{ij}

Backward technical coefficients a_{ij} can also be calculated when considering the whole economy. The most significant (≥ 5 p.c.) backward technical coefficients are presented in table 27. They depict the relations logistics sectors have with their first-tier suppliers among all the Belgian economic sectors. From the figures presented here we can conclude that branch 61A1 (sea and coastal water transport)

has a major first-tier or direct influence on suppliers from branches 63B1 (cargo handling and storage, other supporting activities and organisation of transport) and 71A1 (renting of automobiles and other transport equipment). Sector 62A1 (air transport) substantially impact the operations of its suppliers from branches 63B1 and 23A1 (manufacture of coke, refined petroleum products and nuclear fuel) and, more moderately, from 71A1, 51A1 (wholesale trade and commission trade) and 35A1 (building and repairing of ships, manufacture of railway and tramway locomotives and rolling stock, aircraft and spacecraft). 64A1 (postal services) companies present some considerable ties with their suppliers from road and pipeline transport, 63B1 with 70A1 (real estate activities), while 60C1 shows substantial relations with suppliers from 23A1 and 63B1.

TABLE 27   **BACKWARD TECHNICAL COEFFICIENTS** (2ND PHASE)
(percentages)

	60A1	60C1	61A1	61B1	62A1	63B1	64A1
23A1		5.6		13.5	12.7		
35A1					5.3		
50A1				9.9			
51A1					5.6		
60C1							5.6
61B1				8.7			
62A1					7.4		
63B1		8.5	44.6		16.0	17.3	
70A1						6.0	
71A1			10.5		5.7		

Source: NBB and NAI.

Cai and Leung backward linkages BL_j

TABLE 28   **CAI AND LEUNG BACKWARD LINKAGES** (2ND PHASE)
(percentages)

60A1	60C1	61A1	61B1	62A1	63B1	64A1
132.5	154.3	228.2	163.0	184.4	188.0	132.4

Source: NBB and NAI.

Relative to their own output, the aggregate backward linkages theorised by Cai and Leung, give a picture of the influence each sector has on its suppliers across the entire Belgian economy, at an infinite level (suppliers of all tiers). On the basis of table 28, we can see that, relative to their respective size, the logistics sectors score very high here. This list is topped by branch 61A1 (sea and coastal water transport), with 228.2 p.c. Next come sectors 63B1 (cargo handling and storage, other supporting activities and organisation of transport), 61B1 (inland water transport), 62A1 (air transport) and 60C1 (road transport and pipeline transport), with respectively 188, 184.4, 163 and 154.3 p.c.

Backward decomposed linkages $BDec_{ij}$

Backward decomposed linkages (table 29) show the effect of the reviewed branches' deliveries relative to their suppliers' output, at an infinite level. From this table we see that branch 63B1 is prevailing in the production organisation of branches 20A1 (manufacture of wood and of products made of wood and cork), 41A1 (collection, purification and distribution of water), 45A1 (site preparation), 45D1 (building installation), 71A1 (renting of automobiles and other transport equipment). Branch 61A1 (sea and coastal water transport), 71B1 (Renting of other machinery and equipment, and other household goods) and 74F1 (investigation and security activities, industrial cleaning and miscellaneous business activities). Branch 60C1 (road transport and pipeline transport) has a strong influence on suppliers from branches 41A1, 61B1 (inland water transport), 63B1 and 71A1 has a major impact on its suppliers from branch 63B1 and 71A1, branches also impacted by their customers from sector 62A1. Branch.

TABLE 29   **BACKWARD DECOMPOSED LINKAGES** (2ND PHASE)
(percentages)

	60A1	60C1	61A1	61B1	62A1	63B1	64A1
20A1						5.6	
41A1		14.8				8.6	
45A1						6.0	
45D1						8.2	
60A1	100.0						
60C1		100.0					
61A1			100.0				
61B1		11.5		100.0			
62A1					100.0		
63B1		10.2	11.6		7.8	100.0	
64A1							100.0
71A1		6.9	8.5		8.4	9.1	
71B1						7.4	
74F1						7.8	

Source: NBB and NAI.

Key sectors

TABLE 30   **KEY SECTORS** (2ND PHASE)
(percentages)

	60A1	60C1	**61A1**	61B1	62A1	63B1	64A1
Ratio	86.9	68.3	**175.6**	42.1	97.0	78.1	23.5

Source: NBB and NAI.

Irrespective of the transport logistics sectors' own size or output, its seems that only branch 61A1 (sea and coastal water transport) plays a key role considering the entire Belgian economy, as it scores 175.6 p.c. (table 30). Branch 62A1's (air transport) score is close to one (97 p.c.) but we cannot consider it as a key sector in 2000, in the sense provided by Dietzenbacher (2005).

2.2.2.2   Forward linkages

Resorting to a supply-driven input-output model, this section aims at emphasizing what influence logistics sectors have in the price formation in other sectors. This part of the analysis is particularly important, as regards a cluster made up of service providers having a considerable impact on a vast number of economic sectors. Two phases are followed: the first one concentrates on the interactions within the cluster under review through the analysis of the reduced matrix; the second one looks beyond its boundaries and discusses the relations between the studied sectors and the rest of the Belgian economy.

2.2.2.2.1   First phase: Analysis of the reduced matrix

These linkages describe the relations of the sectors under review with their customers within the studied cluster.

<u>Forward technical coefficients b_{ij}</u>

The forward technical coefficients b_{ij}, usually referred to as dependency coefficients, depict the relations sectors have with their first-tier customers. Within the cluster under review it is quite clear, from table 31, that branch 61B1; i.e. NACE 61.200 or inland water transport, presents close relations to its customers from branch 60C1, i.e. NACE 60.241, 60.242, 60.243 and 60.300 or road transport and pipeline transport, as 10.1 p.c. of the former's output is delivered to the latter. Even closer relations (17.3 p.c.) are noted as regards deliveries from branch 63B1, or cargo handling and storage, other supporting activities and organisation of transport, to itself.

TABLE 31   FORWARD TECHNICAL COEFFICIENTS (1ST PHASE)
(percentages)

	60A1	60C1	61A1	61B1	62A1	63B1	64A1
60A1	0.1	0.3	0.0	0.0	0.0	0.6	2.5
60C1	0.2	2.9	0.0	0.0	0.0	2.9	1.7
61A1	0.0	0.3	1.0	0.0	0.0	2.7	0.0
61B1	0.0	10.1	0.0	8.7	0.0	0.3	0.0
62A1	0.0	0.0	0.0	0.0	7.4	3.2	0.1
63B1	0.0	8.1	9.5	0.0	6.3	17.3	0.3
64A1	0.0	1.2	0.0	0.0	0.1	1.6	2.2

Source: NBB and NAI.

<u>Cai and Leung forward linkages FL_j</u>

TABLE 32   CAI AND LEUNG FORWARD LINKAGES (1ST PHASE)
(percentages)

60A1	103.9
60C1	106.2
61A1	104.0
61B1	111.6
62A1	104.7
63B1	125.3
64A1	103.9

Source: NBB and NAI.

Relative to their own output the aggregate forward linkages theorised by Cai and Leung give a picture of the influence each sector has on its customers within the cluster under review, at an infinite level (customers of all tiers). On the basis of table 32, we have to admit that the sector having the strongest influence on its customers inside the logistics cluster, with a 125.3 p.c. score, is 63B1 (cargo handling and storage, other supporting activities and organisation of transport). Referring back to Ghosh's model, it means that this sector plays a major part in the cost structure of its customers belonging to transport logistics branches. For the record it is also the most important SUT branch in the studied cluster in terms of output (see table 22). It is followed by 61B1, i.e. inland water transport, which scores 111.6 p.c.

<u>Forward decomposed linkages $FDec_{ij}$</u>

Forward decomposed linkages show the effect of deliveries with respect to the customers' output, at an infinite level. From table 33 we see that branch 63B1 has a strong influence on customers from branches 61A1 (sea and coastal water transport) and, more moderately though, on 62A1 (air transport) and 60C1 (road transport and pipeline transport). Branch 60C1 has a notable influence on customers from branches 64A1 (postal services) and 63B1.

TABLE 33   **FORWARD DECOMPOSED LINKAGES** (1ST PHASE)
(percentages)

	60A1	60C1	61A1	61B1	62A1	63B1	64A1
60A1	100.0	0.1	0.1	0.0	0.0	0.1	1.4
60C1	1.3	100.0	1.6	1.1	0.7	3.4	5.7
61A1	0.0	0.1	100.0	0.0	0.1	0.7	0.0
61B1	0.0	0.3	0.0	100.0	0.0	0.0	0.0
62A1	0.0	0.1	0.7	0.1	100.0	1.5	0.2
63B1	0.2	8.7	45.1	1.8	17.3	100.0	1.4
64A1	0.0	0.4	0.3	0.1	0.2	0.6	100.0

Source: NBB and NAI.

2.2.2.2.2   Second phase: Looking beyond the studied branches' boundaries

The linkages presented below describe the relations of the sectors under review with their customers inside <u>and</u> outside the studied cluster, i.e. other economic branches which utilise logistics services. As there are too many sectors to represent them all on a single table, a selection was necessary: only the most significant and relevant relations (≥ 5 p.c.) are shown in the sub-sections here below. The Cai and Leung forward linkages are still represented in full.

Forward technical coefficients b_{ij}

TABLE 34   **FORWARD TECHNICAL COEFFICIENTS** (2ND PHASE)
(percentages)

	27A1	40A1	51A1	60C1	61A1	61B1	62A1	63A1	63B1	64B1
60A1										
60C1			8.0							
61A1										
61B1	12.2	6.0	9.3	10.1		8.7				
62A1							7.4	21.2		
63B1			10.0	8.1	9.5		6.3		17.3	
64A1			19.6							9.0

Source: NBB and NAI.

Forward technical coefficients b_{ij} can also be calculated when considering the whole economy (table 34). These dependency coefficients depict the relations logistics sectors have with their first-tier customers among all the Belgian economic sectors. From the figures shown here we could conclude that branch 63B1 (cargo handling and storage, other supporting activities and organisation of transport) has a major first-tier or direct influence on itself and on branches 51A1 (wholesale trade and commission trade), 61A1 (sea and coastal water transport), 60C1 (road transport and pipeline transport) and 62A1 (air transport), the latter having a major influence on the cost structure of branch 63A1 (travel agencies and tour operators). Branch 61B1 happens to have a major influence on customers from branches 27A1 (manufacture of basic iron and steel, and of ferro-alloys), 60C1 (road transport and pipeline transport), 51A1 and 40A1 (electricity, gas, steam and hot water supply). Customers from branch 51A1 are also impacted by deliveries from 64A1 (postal services) and 60C1 (road transport and pipeline transport).

Cai and Leung forward linkages FL_j

Relative to their own output the aggregate forward linkages theorised by Cai and Leung give a picture of the influence each sector has on its customers across the entire Belgian economy, at an infinite level (customers of all tiers). On the basis of table 35, we have to admit that, relative to their respective size, the logistics sectors score very high here. This list is topped by branch 64A1 (postal services), with 280.7 p.c., whose value added and employment ranked second among the sectors under review in 2000

(see tables 6 and 8). This means that postal services represent the sector having the highest price impact onto the entire national economy. Next come sectors 62A1 (air transport) and 61B1 (inland water transport), with respectively 221.5 and 211.1 p.c.

TABLE 35 **CAI AND LEUNG FORWARD LINKAGES** (2ND PHASE)
(percentages)

60A1	167.2
60C1	191.5
61A1	136.0
61B1	211.1
62A1	221.5
63B1	182.7
64A1	280.7

Source: NBB and NAI.

Forward decomposed linkages FDec$_{ij}$

TABLE 36 **FORWARD DECOMPOSED LINKAGES** (2ND PHASE)
(percentages)

	15F1	20A1	26D1	60A1	60C1	61A1	61B1	62A1	63A1	63B1	64A1	65A2
60A1				100.0								
60C1		5.1	6.4		100.0				12.3		6.1	
61A1						100.0						
61B1							100.0					
62A1								100.0	436.6			
63B1	6.9				9.0	45.2		17.5	80.3	100.0		
64A1									32.1		100.0	6.5

Source: NBB and NAI.

Forward decomposed linkages (table 36) show the effect of the reviewed branches' deliveries relative to their customers' output, at an infinite level. From this table we see that branch 63B1 (cargo handling and storage, other supporting activities and organisation of transport) has a strong influence on customers from branches 63A1 (travel agencies and tour operators) and, more moderately though, on 61A1 (sea and coastal water transport), 62A1 (air transport), 60C1 (road transport and pipeline transport) and 15F1 (manufacture of grain mill products, starches and starch products). Branch 62A1 (air transport) has a huge impact on its customers of branch 63A1 (travel agencies and tour operators), which is also substantially impacted by deliveries from 64A1 (postal services) and 60C1 (road transport and pipeline transport). The latter has a substantial influence on branches 63A1, 20A1 (manufacture of wood and of products made of wood and cork), 26D1 (manufacture of articles of concrete, plaster and cement, natural stone, and other non-metallic mineral products) and 64A1. This last branch exerts an influence on branches 63A1's and 65A2's (financial intermediation) cost structure.

Quite remarkable here is the fact that, in contrast with the forward technical coefficients presented in table 34, the wholesale and agents involved in sales branch does not seem to be substantially impacted by logistics activities if we consider the infinite level. This shows how a supposed strong relation between two "neighbour" sectors can be put into perspective when analysing the infinite level. Branch 51A1, a transit sector above all, actually gets a 2.4 p.c. score for its relation with supplying branch 60C1 and a 3 p.c. score with 63B1.

2.2.3 *Indirect effects: summary*

Indirect value added was relatively stable over the period 2000 - 2005, while indirect employment was shrinking. This is due to the position occupied by the sectors studied in the economy, as well as to the increasing integration of logistics activities. These tend to become more and more complex in the competitive environment logistics businesses are in. In 2005, direct and indirect impact of the transport logistics cluster accounted to 5 p.c. of Belgian GDP and 5.3 p.c. of domestic employment.

Among the findings made in the section about the linkages, it is worth pointing out which sectors of the cluster under review really stood out in 2000. Sea and coastal water transport certainly did, as this activity plays a major part as regards its backward linkages, meaning that a substantial number of suppliers from both logistics and other economic sectors greatly depend on that sector. This sector is key to the cluster concerned as it is to the rest of the national economy. Air transport is also significantly important within the studied cluster and for some other sectors as well. Trade branches and services are directly impacted by the activities of their clients from the cluster under study, but looking beyond the first-tier suppliers, we also find some impact on manufacturing industries, construction and other services.

Looking into the forward linkages, the cargo handling and storage, supporting transport activities, forwarders and agencies sectors, all coming under the same 3-digit NACE branch, are clearly dominant, as their impact on the cost structure of their customers is considerable, either inside or outside the logistics cluster. Then come, in decreasing order, road and pipeline transport, postal services and air transport. Trade branches, steel industry and energy are directly impacted as first-tier customers of the freight transport logistics cluster. Looking beyond this first level, some other links become apparent, towards customers from some manufacturing industries and financial institutions, beside the very close relations observed between the cluster's sectors themselves.

2.3 IMPACT OF EXTERNAL AND IN-HOUSE TRANSPORT LOGISTICS

The economic impact calculated hitherto, in terms of value added and employment, incorporates direct effects of the so-defined freight transport logistics cluster on the one hand, and indirect effects thereof on the other. Indirect effects are worked out on the basis of computed data from the 2000 IOT and more recent SUTs and include the indirect business generated upwards, i.e. to suppliers or subcontractors of the sectors studied.

Nevertheless, this sectoral approach, which consists of the classic method used in the economic impact assessments, ought to be complemented in the framework of our research. As already mentioned, freight transport logistics service providers as defined in the NACE branches do not entirely cover that activity. The sectoral analysis which was carried out forms a significant basis for estimating the overall economic importance of the activities under review, including a calculation of indirect effects. Yet freight transport logistics services pervade the entire economy. Some of them cannot be captured through a sectoral approach, because they are supplied by other or "external" branches, which cannot be recorded as such. Another sizeable part of the supply chain has not been revealed either: the so-called "in-house" freight transport logistics. It is also the aim of this paragraph to attempt to tackle those activities which cannot be derived from the national accounts.

To begin our reasoning about those "hidden" activities, in the accounting sense of the word, let us comment on a very obvious example: the European distribution centres. These EDCs, grouping together a considerable array of logistics operations, have a strong foothold and are even flourishing in Western Europe, particularly in Belgium. However, as we shall see, their official classification, that of their parent company, usually falls outside the scope of the envisaged freight transport logistics sectors. This is an additional incentive to pursue our goal of assessing the remaining part of the logistics activities in question, i.e. freight transport logistics operations performed by external sectors or inside shippers' companies, which choose to keep some transport and warehousing operations in-house. This will be taken up again after a short descriptive section about EDCs.

2.3.1 EDCs

This section takes a look at some features of the European distribution centres (EDCs) established in at least one of the three Regions making up the Belgian federal state and will check whether these EDCs are linked to the cluster under review in any significant way.

> Definition:
> "A European Distribution Centre is a distribution centre, not necessarily linked to a production site, whose main activity consists in the receipt and storage of goods, order collection and the shipping of goods to at least five European countries. In addition, an EDC is increasingly involved in value added logistics, postponed manufacturing being combined with distribution activities, where the distribution centre forms a critical connection between the supply chain and the consumer."[90]

Charts 9 and 10 depict the share each NACE branch holds in terms of breakdown of activity - value added and employment - in the enterprises running at least one EDC in Belgium. Altogether, more than 300 companies have at least one EDC active on the Belgian territory, representing 565 EDCs employing directly more than 14,000 people.

As one can see from these charts, most companies running one or more EDCs, in at least one of the three Regions, do not belong to any of the freight transport logistics sectors. The sectors with the highest representation here are classified in manufacturing industries: are noted, in decreasing order, branches 15.960 (manufacture of beer), 27.100 (manufacture of basic iron and steel and of ferro-alloys), 26.110 (manufacture of flat glass), 24.160 (manufacture of plastics in primary forms), 24.421 (manufacture of medicines) and 21.121 (manufacture of paper). It is interesting to stress that branch 27.100, part of the SUT branch 27A1, is also one of those sectors whose cost structure is directly impacted by the transport logistics cluster, and more precisely by branch 61B1 (inland water transport, see section 2.2.2.2.2). Taking all the chemical branches together, whose NACE codes begin with '24', it turns out that chemicals account for roughly 15 p.c. of the value added and employment of the companies running at least one EDC in Belgium. The heading "other sectors" mainly contains trade branches - also impacted cost-wise - and some transport logistics branches. But activity there is very spread out. Therefore, apart from branches 60.242 and 63.122, respectively belonging to the so-defined road transport and cargo storage sectors, none of them stand out nor is represented separately on these charts[91]. For the definition of other branches, please refer to appendix 1.

There is one exception to this observation: in Brussels Capital Region, according to the port of Brussels and the Brussels Enterprise Agency, the largest companies running EDCs on the Brussels territory belong to sectors supporting transport activities and road transport. In Flanders, according to the VIL, about 200 companies run about 400 EDCs on Flemish soil[92]. The largest EDC in Flanders - and in Belgium - belongs to Nike European Holding (Fast-moving consumer goods company based in Meerhout, between the Albert Canal and the E313 motorway). The automotive, food, chemical and pharmaceutical industries are also very well represented, which is not the case for logistics branches, proportionately not nearly so well represented in Flemish EDCs than in Brussels centres. According to the AWEX/OFI, a hundred or so companies run about 150 EDCs in Wallonia, the largest ones mostly active in metalworking, food, construction, chemical and pharmaceutical industries. The distribution of sectors in the southern region is also reflected in the observations made at national level (see charts 9 and 10 below).

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[90] Sleuwaegen L. et al. (2002).

[91] For the sake of keeping these charts readable, only 5-digit NACE branches where companies running at least 1 EDC employ altogether at least 1,000 FTEs or represent altogether at least 100 million euro of value added were retained.
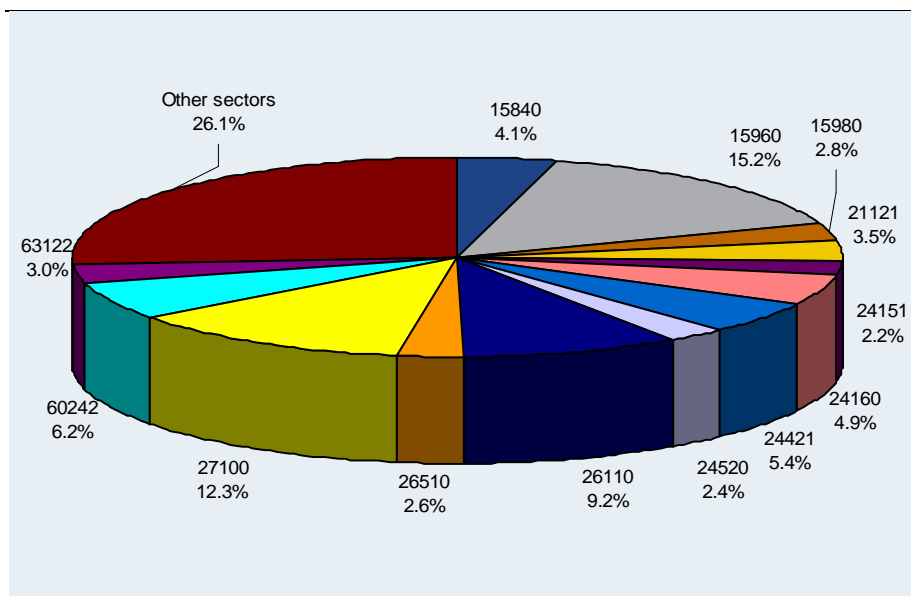
[92] Provincial distribution of the Flemish EDCs in 2005: 35 p.c. in Antwerp, 32 p.c. in East Flanders, 18 p.c. in Limburg, 8 p.c. in West Flanders and 7 p.c. in Flemish Brabant. Source: VIL (2005a).

CHART 9

CHART 9   **SECTORAL BREAKDOWN OF VALUE ADDED OF COMPANIES RUNNING AT LEAST ONE EDC**
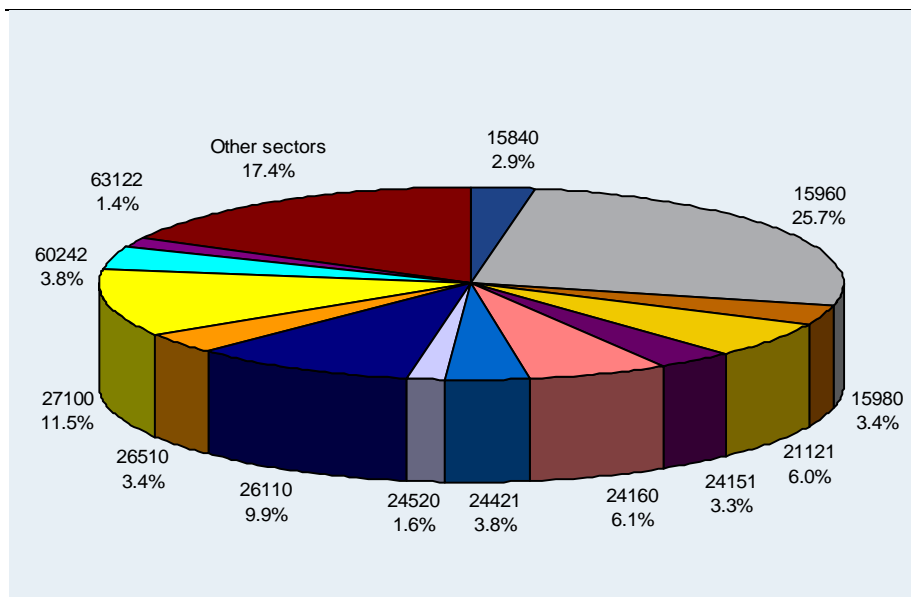
Source: NBB.

CHART 10   **SECTORAL BREAKDOWN OF EMPLOYMENT OF COMPANIES RUNNING AT LEAST ONE EDC**

Source: NBB.

Legend:

NACE code	Definition	NACE code	Definition
15840	Manufacture of cocoa, chocolate, confectionery	24520	Manufacture of perfumes and toilet preparations
15960	Manufacture of beer	26110	Manufacture of flat glass
15980	Production of mineral waters and soft drinks	26510	Manufacture of cement
21121	Manufacture of paper	27100	Manufacture of basic iron and steel and of ferro-alloys (ECSC)
24151	Manufacture of fertilizers		
24160	Manufacture of plastics in primary forms	60242	Freight transport by road
24421	Manufacture of medicines	63122	Other storage and warehousing

2.3.2 *Freight transport logistics activities performed outside the cluster reviewed*

EDCs provide a very good example of activities clearly oriented towards freight transport logistics and yet not necessarily registered as such in the national accounts, their official core business pertaining to other branches, mainly manufacturing industries. The two following sections tackle this issue by attempting to complement the classic sectoral analysis provided by paragraphs 2.1 and 2.2, with a view to estimating overall value added and employment in that specific bunch of logistics activities.

2.3.2.1 Freight transport logistics performed by external branches

This additional set of quantitative information is obtained from the national accounts.

Freight transport logistics mainly concerns a specific cluster, as defined in section 1.2.1. This cluster comprises all the branches officially dedicated to freight transport logistics. Direct and indirect effects were analysed in terms of value added and employment, for every sector making up that cluster. However, several other sectors, which do not fall within the rather narrow scope defined for this study, are also responsible for a considerable amount of operations such as freight transport by road, cargo handling and storage.

The task of ascertaining that specific commercial or industrial branches are linked significantly or not to the cluster under review was completed in paragraph 2.2. In this section 2.3.2.1, we try to value the provision of freight transport logistics services those external branches assure themselves. This requires analysing the most recent supply table, i.e. dating from 2003, and applying it to the cases of 2004 and 2005.

The rationale behind this estimation is as follows:

For each SUT branch listed in the 2003 supply table, we compare, according to a <u>production approach</u>, the supply of freight transport logistics "products"[93] - i.e., to be specific, services - to the total output of that branch. The resultant percentage is then multiplied by the value added and the employment of that branch for the year considered (using data from the Central Balance Sheet Office). It is assumed that the percentage of output is, for every branch, constant during the period 2003 - 2005, and corresponds to the actual share of activity dedicated to freight transport logistics, expressed in terms of value added and employment.

As a result we see that, in 2004, an additional 831.5 million euro VA was generated by those external sectors' production of freight transport logistics, as well as 9,702 FTEs. In 2005, no less than 852.3 million euro and 9,660 FTEs could be put on those external sectors' account.

These figures are drawn from national accounts. They pertain to sectors which are not officially dedicated to such operations but which are still very active in transport logistics. The most active branches in that respect are, in decreasing order, 51A1, 52A1, 75A3, 74B1, 27B1, 90A1 and 74F1 (see definitions in appendix 1).

2.3.2.2 In-house freight transport logistics

This section consists of a more qualitative analysis about transport and warehousing operations carried out inside the non-logistics companies themselves, and for their own use.

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[93] The following product codes are retained in this analysis: 60A02, 60A03, 60C01, 60C02, 60C03, 61A02, 61B02, 62A02, 63B01, 63B02, 63B03, 63B04, 63B05, 63B06, 64A01 and 64A02. The precise definition of all these products is given at the bottom of appendix 1.

Referring back to the Business Logistics Survey Outsourcing[94] and the statistics from FPS Economy mentioned in section 1.2, we were able to estimate the freight transport activity realised inside companies for their own use and that is therefore not visible outside and not apparent in the national accounts. The outsourcing patterns of two processes, namely transport activities and warehousing activities, are tackled by that Business Logistics survey. From the figures presented, it is easy to deduce the share of companies, referred to as shippers here, which choose not to outsource such operations.

According to this survey, 10 p.c. of the shippers in Belgium carried out 100 p.c. of transport operations in-house and 19 p.c. of them mixed in-house processes with subcontracting for transport in 2006. If we consider a 50-50 p.c. mix, then we can calculate roughly that 19.5 p.c., i.e. 10 + 19/2, carried out 100 p.c. of freight transport operations themselves. As regards warehousing, the same survey suggests that, assuming the same 50-50 ratio, 72 p.c., i.e. 66 + 12/2, carried out 100 p.c. of such activities in-house. We can see that 3.8 times more shippers keep warehousing activities in house, than transport activities. If this is true for 2006, we assume it holds true for 2005 as well. Assuming that this ratio also applies to the percentage of transport activities, expressed in tkm, carried out by the shippers themselves, i.e. 22.5 p.c. in 2005, according to the FPS economy, then we find that they run 22.5 p.c. * 3.8, i.e. 85.2 p.c. of their warehousing activities themselves too.

Hypotheses:

1) It is assumed that trends observed in 2006 are valid for 2005;
2) The share of shippers is supposed to correspond to the share of logistical activities operated by them or outsourced;
3) If such activities are partly outsourced, then it is assumed that they are realised 50 p.c. in-house and 50 p.c. outsourced;
4) The volume of warehousing -handling and storage- activities can be derived from the transport business;
5) Transport activities are best reflected by the quantities handled, multiplied by the distance travelled (tkm unit);
6) These figures can apply to value added and employment estimates.

Under these hypotheses, we can apply the findings firstly to figures for road transport, the only mode which can be widely operated by average firms, and secondly to warehousing activities, the latter actually corresponding to the cargo handling and cargo storage sectors. Figures from the direct value added and employment tables in sections 2.1.1 and 2.1.2 can be processed accordingly: see "Estimation formula" in table 37.

TABLE 37   TRANSPORT LOGISTICS OPERATIONS REALISED IN-HOUSE
(millions of euro or FTEs, unless otherwise stated)

Value added in 2005		Direct	Estimation formula	**In-house**	Direct + in-house
Transport sectors	road transport	2,989.6	x 22.5 / 77.5 =	**867.8**	3,857.4
	other transport	1,266.7		**0.0**	1,266.7
Other logistics sectors	cargo handling and cargo storage	1,183.3	x 85.2 / 14.8 =	**6,839.0**	8,022.3
	remaining branches	3,856.8		**0.0**	3,856.8
TOTAL		**9,296.4**		**7,706.7**	**17,003.2**

Employment in 2005		Direct	Estimation formula	**In-house**	Direct + in-house
Transport sectors	road transport	49,952	x 22.5 / 77.5 =	**14,499**	64,451
	other transport	6,520		**0**	6,520
Other logistics sectors	cargo handling and cargo storage	13,107	x 85.2 / 14.8 =	**75,753**	88,860
	remaining branches	60,810		**0**	60,810
TOTAL		**130,389**		**90,252**	**220,641**

Source: NBB with data from De Vos B. and J. Proot (2007) and FPS Economy (2007).

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[94] De Vos B. and J. Proot (2007). Data for 2006. This study was supervised by experts in transport logistics, among whom Prof. Dr. A. Van Breedam (University of Antwerp, Managing Director of the VIL) and Prof. Dr. F. Witlox (University of Ghent).

This represents a substantial complement to the direct VA and employment figures.

2.4 OVERALL ECONOMIC IMPACT

The first goal of this study is to assess the overall economic impact of freight transport logistics in Belgium. By analysing the reviewed logistics cluster's direct and indirect effects in terms of value added and employment, a clear picture can be obtained by adding the two together (cf. section 2.2.1). Resorting to this traditional sectoral method, total value added generated by freight transport logistics thus corresponds to 5 p.c. of Belgian GDP and 5.3 p.c. of domestic employment.

TABLE 38   **OVERALL ECONOMIC IMPACT OF FREIGHT TRANSPORT LOGISTICS:**
(millions of euro or FTEs, unless otherwise stated)

Value added in 2005					
	←		ESTIMATIONS		→
	Sectoral approach		Production approach	Survey	
Sectors	Direct effects	*Indirect effects*	*From external branches*	*In-house logistics*	***OVERALL***
Road transport	2,989.6	*n.*	*n.*	*867.8*	
Other transport	1,266.7	*n.*	*n.*	*0.0*	
TRANSPORT SECTORS	4,256.3	*2,090.4*	*n.*	*867.8*	
Cargo handling and storage	2,292.5	*n.*	*n.*	*6,839.0*	
Remaining logistics branches	2,747.6	*n.*	*n.*	*0.0*	
OTHER LOGISTICS SECTORS	5,040.1	*3,795.1*	*n.*	*6,839.0*	
SUM	**9,296.4**	***5,885.5***	***852.3***	***7,706.7***	***23,741.0***
Share in Belgian GDP (in p.c.)	**3.1**	***1.9***	***0.3***	***2.6***	***7.9***
Direct + indirect (in p.c.)	*5.0*				
Trends	*up*	*steady*	*up*	*down*	

Employment in 2005					
	←		ESTIMATIONS		→
	Sectoral approach		Production approach	Survey	
Sectors	Direct effects	*Indirect effects*	*From external branches*	*In-house logistics*	***OVERALL***
Road transport	49,952	*n.*	*n.*	*14,499*	
Other transport	6,520	*n.*	*n.*	*0*	
TRANSPORT SECTORS	56,472	*24,239*	*n.*	*14,499*	
Cargo handling and storage	13,107	*n.*	*n.*	*75,753*	
Remaining logistics branches	60,810	*n.*	*n.*	*0*	
OTHER LOGISTICS SECTORS	73,917	*47,535*	*n.*	*75,753*	
SUM	**130,389**	***71,774***	***9,660***	***90,252***	***302,075***
Share in Belgian domestic employment (in p.c.)	**3.4**	***1.9***	***0.3***	***2.4***	***8.0***
Direct + indirect (in p.c.)	*5.3*				
Trends	*up*	*moderately down*	*up*	*down*	

Source: NBB and NAI, with data from De Vos B. and J. Proot (2007) and FPS Economy (2007).

In addition, we have striven to complement this sectoral view, in order to tackle freight transport logistics activities which do not clearly appear as such in the national accounts as they are not produced by any of the sectors under review. The observations made on external sectors can be partly confirmed by the analysis of the linkages. However the case of the EDCs and the linkages observed above are good incentives for pursuing the estimation of "hidden" logistics activities. Knowing that such activities are supplied by other or "external" branches and that another substantial part of the supply chain is kept "in-house", section 2.3 delved further into hidden logistics activities.
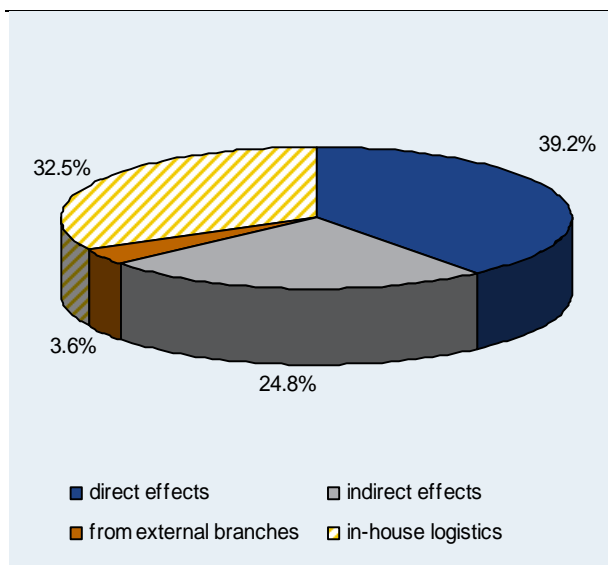
To quantify operations carried out in-house, a rough estimate could be made on the basis of survey data and using quite restrictive assumptions. Although these estimates should be interpreted with caution, it is nevertheless interesting to globalise the figures, for the two main variables studied in this report, i.e. value added and employment. This can be achieved by adding figures from freight transport logistics performed by external sectors and from the part of transport and warehousing operations carried out in-house by shippers themselves to figures of the cluster's direct and indirect effects.

Providing that overall picture for 2005, table 38 helps complete the analysis of the economic importance of freight transport logistics.

From this summary table, we see that overall VA generated by freight transport logistics operations, both outsourced and visible in the national accounts on the one hand, and external or in-house and therefore not visible in the national accounts on the other, amounts to almost 24 billion euro, i.e. 7.9 p.c. of Belgium's GDP in 2005. On the employment front, the same operations generate roughly 302,000 FTEs, i.e. 8 p.c. of Belgian domestic employment or 9.6 p.c. of Belgian domestic salaried employment.
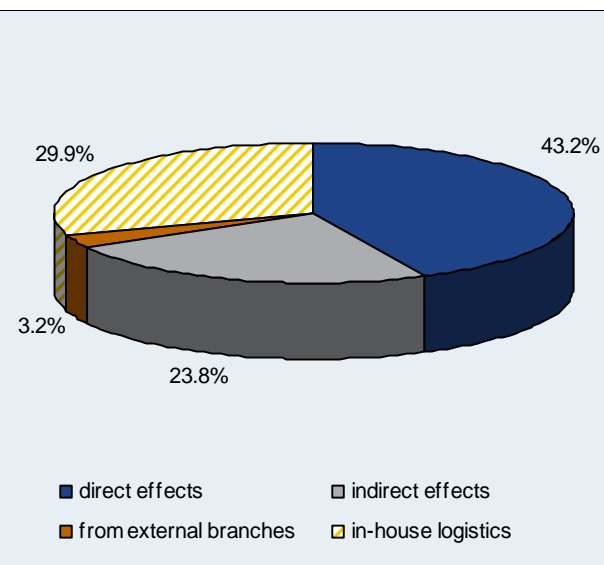
Charts 11 and 12 depict the relative share in value added and employment attributable to the cluster's direct and indirect effects, as well as to freight transport logistics activities performed by external branches and to such operations realised in-house, within the shippers' companies. The last lines of each part of table 38 show the trends followed by these four elements, as observed empirically: outsourcing keeps growing, along with an ever-strengthening integration of logistical operations (-> 3PL -> 4PL), which reinforces the economic impact of the cluster under review. Conversely, fewer logistics operations are expected to be carried out in-house by the shippers themselves. On average, the share of the activities under review in the total Belgian economy is not likely to fall under the 8 p.c. threshold in the coming decade, as it is expected to rise even further.

CHART 11	RELATIVE SHARE OF EACH COMPONENT IN OVERALL VALUE ADDED (millions of euro, 2005)	CHART 12	RELATIVE SHARE OF EACH COMPONENT IN OVERALL EMPLOYMENT (FTEs, 2005)

direct effects   indirect effects
from external branches   in-house logistics

39.2%   24.8%   3.6%   32.5%

direct effects   indirect effects
from external branches   in-house logistics

43.2%   23.8%   3.2%   29.9%

Source: NBB.   Source: NBB.

The estimates set out above ought to be confirmed by a larger-scale survey and this exercise needs to be repeated in the future. Two more final questions should be tackled prior to this study's conclusion: foreign trade and transit, and reverse logistics. Most of these activities are already integral parts of the above-mentioned totals.

 o Foreign trade and transit

According to the Balance of Payments, freight transport logistics activities yielded, in the fiscal year 2005, more than 5.9 billion euro revenue in goods transport and 1.9 billion euro in auxiliary services, all transport modes taken together. These amounts substantially outstripped expenditure noted for the same sectors in the same year, i.e. 4.2 and 0.7 billion euro respectively.

Almost 6.8 billion tkm of goods passed through Belgium in transit in 2005, accounting for roughly 10 p.c. of the total volume of goods shipped by road, rail and inland waterways at national level. By comparison, import and export figures accounted for about 50 p.c. of that total and the remainder, i.e. domestic transport, slightly more than 40 p.c. From these figures, published by the FPS Economy – Directorate General for Statistics and Economic Information, it is quite straightforward to figure out that about 60 p.c. of the goods carried in these three modes originate from or are destined for foreign countries. Our country is more than ever a prime location in terms of foreign trade, the share of transit having increased most significantly between 2000 and 2005[95]. Applying the ratio of transit on import and export in 2005, i.e. approximately 20 p.c., to the 7.8-billion-euro revenue (5.9 + 1.9 billion euro) yielded by exported freight transport logistics activities, an amount of about 1.6 billion euro is estimated. This is the revenue generated by transit in Belgium which accounts for roughly 17 p.c. of direct VA of the freight transport logistics sectors. Considering only the margin, i.e. 2.9 billion euro (5.9 + 1.9 - (4.2 + 0.7)), then the estimate comes to 0.6 billion euro, equivalent to 6 p.c. of the cluster's direct VA. All these figures have already been included in the analysis of the economic importance of the cluster under review.

 o Reverse logistics

Reverse logistics, which concerns the logistical management of returns systems, mainly consists of managing backward flows of goods and materials. This covers several areas, such as the recycling of materials and products, and the repair of damaged goods. Although this domain of logistics does not clearly appear in the scope of our research, most of it actually pertains to freight transport logistics and has therefore been dealt with in this paper: empty boxes and other services attached to transport and warehousing are in fact recorded in the figures mentioned so far. The only complementary elements which would theoretically deserve more attention are those related to other activities, such as processing of recyclable material or waste. These are found under the supply table product codes 37A01, 37A02 and 90A01, i.e. recycling of metal materials, recycling of non-metal materials and decontamination, refuse collection and waste management respectively. Looking closer into their output in 2003 (the most recent data available) though, we come to the conclusion that these activities are rather negligible in comparison to the freight transport logistics services reviewed in this report. It should be noted that reverse logistics is a quite new activity, enjoying a rapid expansion. Therefore, 2003 statistical data are probably not recent enough to estimate its current importance. More information on this issue is provided by VIL[96]. Sector and product codes are listed in appendix 1.

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[95] According to the FPS Economy – Directorate General for Statistics and Economic Information, the share of foreign trade + transit in the total in terms of tkm remained virtually stable between 2000 and 2005, only growing from 57 to 59 p.c. But looking inside that sub-total, a substantial increase in transit traffic's share was noted during that period, from 5 to 10 p.c., while the import and export trade's share fell from 52 to 49 p.c.

[96] VIL (2007), *Reverse Logistics in Vlaanderen*.

3 <u>CONCLUSION</u>

The years 2005 and 2006 saw a continued expansion in worldwide trade and maritime cargo traffic, mainly sustained by the thriving Asian economies. Belgium was no exception to the rule. Containerised transport is booming and this constitutes a considerable opportunity for transport activities and transport logistics in particular. Maritime and inland ports, logistical areas and distribution centres are developing rapidly. Logistics pervades the entire economy.

After going through a few definitions of the term, we came to the conclusion that a single and limitative definition is needed. Therefore, this study concentrates on a particular array of sectors coming under the *freight transport logistics* label. The cluster they form is a strategic one for our service-oriented economy. The federal and regional governments are aware of the tremendous economic stakes in its development, by recognising its specificity (cf. the 2007 revision of the composition of joint commissions 140 and 226). This importance is also mirrored by the findings made in this paper, whose main goal is to give a first picture of the national economic impact of freight transport logistics, rather than scrutinising the technical or structural background of every single logistics sector.

The evolution of the transport sector is reflected in the changes observed in the contribution to the national wealth, in the population employed in these services and in the investment taking place in the companies under review. The sectoral approach makes it possible to highlight the direct contribution of the cluster in terms of value added, employment and investment, over the period 2000 - 2005, with a first assessment for 2006. Linkages between the sectors under review and the rest of the economy, and indirect value added and employment are also estimated. More estimates are given about freight transport logistics activities which could not be isolated, insofar as they are operated by companies which do not belong to the cluster studied, either for third parties or for their own account. This very last case is referred to as in-house logistics which, in spite of the growth of subcontracting and outsourcing, still accounts for a significant share in freight transport logistics activities as a whole.

Belgium benefits from an outstanding situation in Europe in terms of transport and routes of communication. This is reflected in this paper's findings about the economic importance of freight transport logistics. This cluster's direct value added has been growing rapidly since 2003. In 2005, it rose by 2.9 p.c. at constant prices, owing to the expansion of sea and coastal and inland water transport, as well as air transport and cargo storage. This percentage should be compared to the 2 p.c. increase noted the same year both at national level - Belgian GDP in volume - and in the non-manufacturing branches. In 2006, a lower growth rate was noted, a growth mainly driven by other logistics sectors. At the same time value added in road transport and postal services stagnated. Including indirect value added, the economic impact of the cluster under review amounted to 5 p.c. of Belgian GDP in 2005. The analysis of the top 20 points to some spreading of logistics activity, the cluster under consideration being made up of a myriad of SMEs. Complex high-value-added logistics sectors tend to grow faster than pure transport sectors in the long run, except in the case of maritime transport. This is observed in a context of ever-increasing international competition and easier relocation of basic transport operations.

Direct employment in freight transport logistics grew between 2000 and 2004 but went through a moderate dip in 2005 (- 0.7 p.c.). This was mainly the result of restructuring in postal services and rail transport, sectors which are being gradually liberalised on a European scale. Employment stagnated in road transport, while most of the other logistics sectors saw some progress, which continued into the next year. The employment figures picked up in 2006, thanks to water transport and other logistics services. Including indirect figures, employment generated by the cluster studied accounted for 5.3 p.c. of Belgian domestic employment in 2005. The percentage of women employed in this cluster is still below the national average but they tend to get more training opportunities, while recruitment among the better educated workers is higher than ever before and the proportion of white-collar workers is still rising. In 2005, a substantial rise was also recorded in the number of hours worked by external staff. The evolution of part-time working, still fairly limited compared with national figures, depends on the sector considered. But the strong international competition - in particular with fast-growing East European economies - most transport sectors are facing goes a long way towards explaining the fairly low wage level, quite high staff turnover rate and the continuous specialisation and integration of logistics activities

(towards 3PL and 4PL). Generating value added is indeed paramount, in order to withstand international competition, especially from the east of Europe.

Based on the input-output table for 2000, the analysis of the linkages between the sectors making up the studied cluster and between these and the rest of the economy reveals that sea and coastal water transport certainly plays a major part as regards its backward impact. This sector is key to the freight transport logistics cluster as it is to the rest of the national economy. Looking into the forward linkages, the sectors cargo handling and storage, supporting transport activities, forwarders and agencies are clearly dominant, as their impact on the cost structure of their customers is considerable, either inside or outside the logistics cluster. Some EDCs are part of the cluster studied, many others show very close links with it.

Investment, for its part, saw a marked acceleration in 2005, on the previous year, and indeed the rest of the period under survey. The growth rate came to roughly 50 p.c. at constant prices, mainly as a result of massive investment in fleet renewal or enlargement in some shipping companies, and in port infrastructure. Substantial rises were also noted in cargo handling and storage, whereas some declines were recorded in air transport, supporting transport activities and postal services. Investment generally sees a higher concentration than the other two variables - value added and employment -, in an economic area dominated by SMEs. This was certainly true in 2005, an exceptional year in that respect. The return on equity after tax increased in the same year. The ability of the freight transport logistics companies to honour their short- and long-term financial commitments increased too, as liquidity in the broad sense - net working capital again positive - and these firms' solvency position improved. The score of financial risks in transport and other logistics sectors levelled off, with roughly 10 p.c. of the companies under review running financial risks according to the NBB's financial health indicator.

The final and more qualitative part of the analysis focuses on the freight transport logistics activities which could not be derived from a sectoral approach. The goal of this section was to piece together the overall economic impact of freight transport logistics in Belgium. The economic importance of these activities supplied by other or external branches - e.g. some EDCs - and the part of the supply chain covered in-house were tackled. National statistics and survey data suggest that, in addition to the estimates made via the sectoral analysis, a lot of logistics activity is still carried out outside the cluster reviewed. So, taking these additional data into account, overall VA generated by freight transport logistics operations is thought to have reached almost 24 billion euro in 2005, i.e. 7.9 p.c. of Belgian GDP, while overall employment in the same tasks is estimated to involve roughly 302,000 FTEs, or 8 p.c. of Belgian domestic employment.

It was empirically observed, and confirmed by the findings made in this paper, that outsourcing is continuing to expand, in favour of transport logistics businesses, along with an ever-growing integration of logistical operations. This naturally tends to reinforce the economic impact of the cluster under review. Conversely, in-house logistics is expected to continue on a downward path. Altogether, the share of the analysed sectors and operations in the Belgian economy as a whole looks set to rise further, and the context of globalisation and expansion of trade, transport and distribution activities backs this statement. Examples abound of projects where generation of value added and employment is expected: sea and internal ports' expansion programmes - Deurganck dock in Antwerp, APM Terminals in Zeebrugge, TriLogiPort in Liège, new sites available in the Brussels harbour, etc. -, continuous development of the logistics area around Brussels Airport, implementation of the extended gateways concept, development of logistic parks and distribution centres throughout the country, etc. These projects are fostered by the regional governments, namely via the Brussels International Development Plan, the Flanders Logistics scheme and the Priority Action Plan for the Future of Wallonia (Marshall Plan). Flanders' lead is unquestionable here, but the southern region is gradually making up lost ground by attracting new businesses, on platforms such as Aeropole in Charleroi, Liège Airport, TriLogiPort and many other logistics areas, in both central and outlying locations.

The future development of transport and transport logistics also depends on the further improvements in terms of maritime access, the modernisation of the customs services, a higher mobility on the labour market, promoting vocational training to develop competences oriented towards the logistics world, making more land available for transport activities, enhancing the image of the Belgian Regions as top locations for logistics and distribution activities and, last but not least, solving the congestion issue. Developing river and rail transport is the key, something that is well understood and dealt with at European level: the Trans-European Transport Networks are being developed. In this framework, some

far-reaching projects are on the agenda, the Seine-Scheldt river connection, navigability on the inland waterway network - cf. Naiades action plan -, and interoperability of the railway networks. The use of priority rail freight corridors - e.g. the Ferrmed route -, and of existing freight lines, such as between Antwerp, Zeebrugge and Athus, the Iron Rhine, etc., is being promoted. Solutions must be found for road transport as well, considering that it is still by far the first inland transport mode and it is bound to keep expanding dramatically in the coming years. A better organisation of cargo traffic is necessary in order to mitigate its adverse effects on the environment, by curbing congestion and greenhouse gases emissions. The scale of empty running road freight transport should, for instance, be limited, as it nowadays reaches on average one quarter of total distances travelled by road hauliers in the EU. Maritime and air transport, i.e. non-substitutable modes on their respective market segments, also need to drastically improve their environmental performance. More generally, strict environmental norms - Kyoto Protocol, EU ETS, etc. - have to be seriously taken into account when developing transport logistics activities. Modal shift, intermodality - cf. Marco Polo II programme - and technological advances such as green technologies and state-of-the-art navigation systems, besides contributing to better ecological and economic performances in the transport sector, could also become a considerable source of jobs in the coming years. On the whole, these objectives are meant to maintain a balanced but sustained development of freight transport logistics, upon which our economic well-being inevitably depends.

LIST OF ABBREVIATIONS

AWEX-OFI	Walloon Foreign Trade and Investment Agency / Office for Foreign Investors
BNRC	Belgian National Railway Company (in French: *SNCB*; in Dutch: *NMBS*)
ECB	European Central Bank
EDC	European Distribution Centre
EDI	Electronic Data Interchange
ETS	Emissions Trading System
EU	European Union
FPS	Federal Public Service
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
ICT	Information and Communication Technologies
IOT	Input-Output Table
n.	Not available
NACE-Bel	Belgian version of the statistical Nomenclature of Economic Activities of the European Community
NAI	National Accounts Institute
NBB	National Bank of Belgium
NUTS	European Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Cooperation and Development
p.c.	per cent
PL	Party Logistics
RDC	Regional Distribution Centre
SME	Small and Medium-sized Enterprise
SUT	Supply-Use Table
tkm	tonne - kilometre
US	United States (of America)
VA	Value Added
VIL	Flanders Institute for Logistics (In Dutch: *Vlaams Instituut voor de Logistiek*)

APPENDIX 1: LISTS OF NACE BRANCHES AND PRODUCTS (NACE-BEL 2003)

Table 39 contains all SUT branches of our economy, i.e. 3-digit NACE branches. The sectors making up the freight transport logistics cluster under review are mentioned in greater detail, i.e. 5-digit codes. They are presented in bold.

TABLE 39		NACE BRANCHES
SUT branches	5-digit NACE code (where applicable)	Sector definition
01A1		Agriculture, hunting and related service activities
02A1		Forestry, logging and related service activities
05A1		Fishing, operation of fish hatcheries and fish farms
14A1		Other mining and quarrying industries
15A1		Production, processing and preserving of meat and meat products
15B1		Processing and preserving of fish and fish products
15C1		Processing and preserving of fruit and vegetables
15D1		Manufacture of vegetable and animal oils and fats
15E1		Manufacture of dairy products
15F1		Manufacture of grain mill products, starches and starch products
15G1		Manufacture of prepared animal feeds
15H1		Manufacture of bread; manufacture of fresh pastry goods and cakes
15I1		Manufacture of sugar, chocolate and sugar confectionery
15J1		Manufacture of pasta, coffee and tea, and other food products
15K1		Manufacture of beverages, except mineral waters and soft drinks
16L1		Production of mineral waters and soft drinks
16A1		Manufacture of tobacco products
17A1		Preparation and spinning of textile fibres, weaving and finishing of textiles
17B1		Manufacture of made-up textile articles, except apparel, other textiles
18A1		Manufacture of apparel, dressing and dyeing of fur
19A1		Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
20A1		Manufacture of wood and of products made of wood and cork; manufacture of articles of straw and plaiting materials
21A1		Manufacture of paper and paperboard
22A1		Publishing
22B1		Printing and service activities related to printing, reproduction of recorded media
23A1		Manufacture of coke, refined petroleum products and nuclear fuel
24A1		Manufacture of basic chemicals
24B1		Manufacture of pesticides and other agro-chemical products
24C1		Manufacture of paints, varnishes and printing ink
24D1		Manufacture of pharmaceuticals
24E1		Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
24F1		Manufacture of other chemical products
24G1		Manufacture of man-made fibres
25A1		Manufacture of rubber products
25B1		Manufacture of plastic products
26A1		Manufacture of glass and glass products
26B1		Manufacture of ceramic products
26C1		Manufacture of cement, lime and plaster
26D1		Manufacture of articles of concrete, plaster and cement, natural stone, and other non-metallic mineral products
27A1		Manufacture of basic iron and steel and of ferro-alloys (ECSC)
27B1		First processing of steel, production of non-ECSC ferro-alloys and non-ferrous metals
28A1		Manufacture of structural metal products, tanks, reservoirs, central heating radiators and boilers

SUT branches	5-digit NACE code (where applicable)	Sector definition
28B1		Treatment and coating of metals; general mechanical engineering
28C1		Manufacture of cutlery, tools and general hardware
29A1		Manufacture of engines and turbines, except aircraft, vehicle and cycle engines
29B1		Manufacture of other general purpose machinery
29C1		Manufacture of agricultural, forestry machinery and machine tools
29D1		Manufacture of domestic appliances n.e.c.
30A1		Manufacture of office machinery and computers
31A1		Manufacture of electric motors, generators and transformers, distribution and control apparatus, insulated wire and cable
31B1		Manufacture of accumulators, primary cells and batteries, electric lamps and lighting equipment
32A1		Manufacture of radio, television and communication equipment and apparatus
33A1		Manufacture of medical, precision and optical instruments, watches and clocks
34A1		Manufacture of motor vehicles
34B1		Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers, parts and accessories for motor vehicles
35A1		Building and repairing of ships, manufacture of railway and tramway locomotives and rolling stock, aircraft and spacecraft
35B1		Manufacture of motorcycles, bicycles and other transport equipment n.e.c.
36A1		Manufacture of furniture
36B1		Manufacture of jewellery and related articles
36C1		Manufacture of musical instruments, sports goods, games and toys, other manufacturing n.e.c.
37A1		Recycling
40A1		Electricity, gas, steam and hot water supply
41A1		Collection, purification and distribution of water
45A1		Site preparation
45B1		General construction of building, civil engineering works, erection of roof covering and frames
45C1		Construction of motorways, roads, airfields and sport facilities, water projects; other construction work involving special trades
45D1		Building installation
45E1		Building completion, renting of construction or demolition equipment with operator
50A1		Sale, maintenance and repair of motor vehicles and motorcycles, sale of vehicle parts and accessories
50B1		Retail sale of automotive fuel
51A1		Wholesale trade and commission trade
52A1		Retail trade; repair of personal and household goods
55A1		Hotels and other provision of short-stay accommodation
55B1		Restaurants, bars, canteens and catering
60A1	**60100**	**Transport via railways**
60B1	60211	Passenger city transport
60B1	60212	Other scheduled passenger land transport
60B1	60230	Other land passenger transport
60C1	**60241**	**Furniture removal by road**
60C1	**60242**	**Freight transport by road**
60C1	**60243**	**Renting of trucks with driver**
60C1	**60300**	**Transport via pipelines**
61A1	**61100**	**Sea and coastal water transport**
61B1	**61200**	**Inland water transport**
62A1	**62100**	**Scheduled air transport**
62A1	**62200**	**Non-scheduled air transport**
62A1	62300	Space transport
63B1	**63111**	**Cargo handling in sea ports**
63B1	**63112**	**Other cargo handling**
63B1	**63121**	**Storage and warehousing in cold-storage buildings**
63B1	**63122**	**Other storage and warehousing**
63B1	**63210**	**Other supporting land transport activities**

SUT branches	5-digit NACE code (where applicable)	Sector definition
63B1	**63220**	**Other supporting water transport activities**
63B1	**63230**	**Other supporting air transport activities**
63A1	63301	Travel agencies
63A1	63302	Tour operators
63A1	63303	Travelling guides, tourist assistance activities
63B1	**63401**	**Forwarding offices**
63B1	**63402**	**Chartering**
63B1	**63403**	**Ships' agencies**
63B1	**63404**	**Customs agencies**
63B1	**63405**	**Transport mediation**
63B1	**63406**	**Other activities of transport agencies**
64A1	**64110**	**National post activities**
64A1	**64120**	**Courier activities other than national post activities**
64B1	64200	Telecommunications
65A2		Financial intermediation
66A2		Insurance
67A1		Activities auxiliary to financial intermediation and insurance
70A1		Real estate activities
71A1		Renting of automobiles and other transport equipment
71B1		Renting of other machinery and equipment, and other household goods
72A1		Computer and related activities
73A1		Research and development
74A1		Legal, accounting, book-keeping and auditing activities; tax consultancy; market research and public opinion polling
74B1		Business and management consultancy activities, management activities of holding companies and coordination centres
74C1		Architectural and engineering activities and related technical consultancy, technical testing and analysis
74D1		Advertising
74E1		Labour recruitment and provision of personnel
74F1		Investigation and security activities, industrial cleaning, miscellaneous business activities
75A3		Public administration except defence and compulsory social security
75B3		Defence activities
75C3		Compulsory social security activities
80A1		Education
85A1		Human health activities
85B1		Veterinary activities
85C1		Social work activities
90A1		Sewage and refuse disposal, sanitation and similar activities
91A1		Activities of membership organisations n.e.c.
92A1		Motion picture and video activities, radio and television
92B1		Other entertainment activities
92C1		News agency activities and other cultural activities
92D1		Sporting activities and other recreational activities
93A1		Other service activities
95A4		Private households with employed persons

Source: NBB and NAI (NACE-Bel 2003 Rev. 1.1).

Table 40 presents all the national accounts' product codes defining freight transport logistics operations.
A list with the product codes relating to reverse logistics is also provided.

TABLE 40   PRODUCT CODES

- o   Freight transport logistics "products" in the supply and use tables:
  - o   60A02 : Transport of goods via railways (post excluded)
  - o   60A03 : Transport of post via railways
  - o   60C01 : Other transport of goods by road (post and removal included)
  - o   60C02 : Renting of trucks with driver
  - o   60C03 : Transport via pipelines
  - o   61A02 : Sea and coastal transport of goods (post included)
  - o   61B02 : Inland waterway transport of goods
  - o   62A02 : Air transport of goods (post included)
  - o   63B01 : Cargo handling services
  - o   63B02 : Cargo storage services
  - o   63B03 : Other services relating to land transport
  - o   63B04 : Other services relating to sea and inland water transport
  - o   63B05 : Other services relating to air transport
  - o   63B06 : Other transport middlemen
  - o   64A01 : National post services
  - o   64A02 : Other post services (national post excluded)
- o   Other product codes corresponding to specific waste processing activities (part of reverse logistics processes):
  - o   37A01 : Recycling of metal materials
  - o   37A02 : Recycling of non-metal materials
  - o   90A01 : Decontamination, refuse collection and waste management

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Source: NBB and NAI.

APPENDIX 2: INDIRECT EFFECTS: THEORY[97]

Indirect effects are presented here following two frameworks: backward linkages on the one hand and forward linkages on the other hand. The former, according to the Leontief model, concentrates on the relations of the studied sectors with their suppliers and is used to estimate the indirect value added and employment, while the latter, according to the Ghosh model, enables the price impact one logistics sector has onto its customers to be measured. Both can be considered in order to quantify the upward and downward relationship between the sectors under review and the rest of the economy. Table 41 provides the basic model for an input-output table. The following methodology will be based on this table. The theoretical basis behind the making of the IOT is given in the methodology of the national accounts[98].

TABLE 41   INPUT-OUTPUT TABLE

	1	2	...	n	f	x
1	x_{11}	x_{12}	...	x_{1n}	f_1	x_1
2	x_{21}	x_{22}	...	x_{2n}	f_2	x_2
...	...	...	...	...	...	...
n	x_{n1}	x_{n2}	...	x_{nn}	f_n	x_n
m	m_1	m_2	...	m_n	m_f	
va	va_1	va_2	...	va_n		
x	x_1	x_2	...	x_n		

Source: NBB.

Legend:

	n	number of industries in economy
	x_{ij}	output of industry i delivered to industry j
	va	value added
	m	import
	f	final demand: it may contain only the output to final consumers but, if we restrict our analysis to the matrix made up of the studied sectors, then f_i may also contain all the output of sector i falling outside the studied sectors.

On that basis, technical backward and forward coefficients can be calculated. They, in turn, make it possible to measure the linkages through the so-called Leontief L and Ghosh G matrices, respectively used to quantify what impact one sector has on the others in terms of necessary inputs (goods and services, production factors) and of outputs (cost structure). Table 41 presents a few formulae used to depict these linkages. Key sectors (Oosterhaven and Stelder net multiplier[99]) are those sectors whose impact on the others is greater than the opposite.

Relations between the sectors

The relationships between the logistics sectors and other sectors are measured by technical input and output coefficients - which measure the direct effects of changes in demand and prices - and also by backward and forward linkages, which measure the ties with suppliers and customers.

Input-output analysis[100] subdivides an economy into a certain number n industries and final demand sectors. The final demand sectors are households' and government's expenditure, investment and exports. The output of an industry i, for instance the forwarders, (represented by x_i) equals the sum of

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[97] See also Coppens F. (2005); Coppens F. (2006) and Coppens F., F. Lagneaux, H. Meersman, N. Sellekaerts, E. Van de Voorde, G. van Gastel, Th. Vanelslander and A. Verhetsel (2007).

[98] See also the explanation provided by http://www.nbb.be/doc/dq/N_pdf_dq/NNDE99.pdf (Dutch version) and http://www.nbb.be/doc/dq/F_pdf_dq/NFDE99.pdf (French version).

[99] Oosterhaven J. and D. Stelder (2002). Interpretation of the net multiplier by Dietzenbacher E. (2005).

[100] For more details see Miller R.E. and P.D. Blair (1985).

its supplies to other industries and its supplies to final demand or $x_i = \sum_{j=1}^{n} x_{ij} + f_i$. Defining technical

input coefficients as $a_{ij} = x_{ij}/x_j$, with x_{ij} the supply of sector i (e.g. the forwarders) to sector j (e.g. the

agents) and x_j the total output of sector j, this can be rewritten as $\boxed{x_i = \sum_{j=1}^{n} a_{ij} x_j + f_i}$ or in matrix

notation $\boxed{x = Ax + f}$, in which A is a square matrix of technical coefficients, x a column vector of industry outputs and f a column vector of final demands.

TABLE 42   CALCULATION OF LINKAGES: FORMULAE

Technical coefficients (first level)	backward	$TIC_{ij} = a_{ij}$	linkage of industry j to its first-tier supplier i	in relation to the output of industry j
	forward	$TOC_{ij} = b_{ij}$	linkage of industry i to its first-tier customer j	in relation to the output of industry i
Cai and Leung linkages (all levels)	backward	$BL_j = \dfrac{\sum_{i=1}^{n} l_{ij}}{l_{jj}}$	linkage of industry j to all its suppliers	in relation to the output of industry j
	forward	$FL_i = \dfrac{\sum_{j=1}^{n} g_{ij}}{g_{ii}}$	linkage of industry i to all its customers	in relation to the output of industry i
Decomposed linkages (all levels)	backward	$BDec_{ij} = \dfrac{g_{ij}}{g_{jj}}$	linkage of industry j to its supplier i	in relation to the output of industry i
	forward	$FDec_{ij} = \dfrac{l_{ij}}{l_{ii}}$	linkage of industry i to its customer j	in relation to the output of industry j
Oosterhaven and Stelder net multipliers		$\dfrac{\text{Leontief multiplier of } j \times \text{final demand of } j}{\text{output of } j}$		if net multiplier > 1, then sector j is more important for the other sectors than vice versa and is said to be a **key sector**

Source: NBB.

Legend:

TIC$_{ij}$: Technical input coefficients
TOC$_{ij}$: Technical output coefficients
BL$_j$: Cai and Leung backward linkages
FL$_i$: Cai and Leung forward linkages
BDec$_{ij}$: Decomposed backward linkages
FDec$_{ij}$: Decomposed forward linkages
l$_{ij}$: element of matrix L -Leontief-, on row i and column j (see below); Σ_i l$_{ij}$ = Leontief multiplier of sector j
l$_{jj}$: diagonal element of matrix L (see below)
g$_{ij}$: element of matrix G -Ghosh-, on row i and column j (see below)
g$_{ii}$: diagonal element of matrix G (see below)

    o <u>Backward linkages</u>

This matrix equation is the base equation of the Leontief model, also referred to as a demand-driven input-output model. It enables us to compute the total effect of an industry on the economy. Indeed, a change in final demand for products of industry i has two kinds of effects:

1. a 'direct' effect that is induced by the second term in the equation $x = Ax + f$, i.e. a change in the output of sector *i*. It can be seen that this direct effect is provided by $\Delta x_i = \Delta f_i$;

2. a series of indirect effects that are caused by this direct effect. The sector *i* has to increase its output and, in order to do so, it has to increase its intermediary purchases. As such, there is a 'first level' indirect effect provided by the first term of the equation $\Delta x^{(1)} = A\Delta x^{(0)}$. These purchases, for their part, generate higher level indirect effects, $\Delta x^{(2)} = A^2 \Delta x^{(0)}$, ...

The total effect is provided by $\Delta x = \left(I + A + A^2 + A^3 + ...\right)\Delta f = \left(I - A\right)^{-1}\Delta f$. The matrix $L = (I - A)^{-1}$ is called the Leontief inverse. Its column sums are the Leontief multipliers and, under the above reasoning, they provide the total effect of a unit of change in final demand for a sector. If the demand of sector *j* rises, the suppliers of sector *j* will have to produce more.

These Leontief multipliers show the impact of one industry on the rest of the economy via its supply chain. As such, they are a measure of the 'linkage' of an industry to its suppliers. This is called 'backward linkage' and the Leontief multipliers are a measure of backward linkage. As explained in Cai J., Leung P. (2004)[101], this backward linkage measure is not pure, because of intrasectoral and cyclical deliveries. If the Leontief multiplier is considered as a measure for backward linkage, it also deals with the effects of purchases by sector *i* at sector *j* and by sector *j* at sector *k*, sector *k* at sector *l*,... and finally sector *m* at sector *i*. Therefore, this measure also contains some forward linkage. It can be 'purified' by dividing each Leontief multiplier by the diagonal element in the same column of the Leontief inverse. The total (direct and indirect) linkage of an industry with all its suppliers can thus be measured by the Leontief multiplier divided by the diagonal elements l_{jj} (Cai and Leung):

$$BL_j = \frac{\sum_{i=1}^{n} l_{ij}}{l_{jj}} \qquad (IO1)$$

where l_{ij} is the *(i,j)* element of the Leontief inverse.

CALCULATION OF INDIRECT VALUE ADDED AND EMPLOYMENT:

The algorithm used for the calculation of the indirect value added and employment is based on the above-mentioned formulae.

Indirect employment can be calculated on the basis of the following operations:
National input-output table (or IOT) X: (x_{ij}), nxn matrix, x_{ij} representing the deliveries from branch i to branch j
Population under review P: (p_j), nx1 matrix, p_j being the percentage of national branch j represented by the population under review
Employment E: (e_i), nx1 matrix, e_i being the employment of branch i at national level
Technical input coefficient A: (a_{ij}) = x_{ij} / x_j , x_j being the nx1 matrix of the outputs j

Knowing that $\Delta x^{(k)}$ = $A^{(k)}$. Δf (see above) and ΔE = $\hat{E}$. $^{\wedge}X^{-1}$. ΔX then:

Indirect employment at level k =

> $\Delta e_i^{(k)}$ = e_i / x_i . Δx_i = $a_{ij}^{(k)}$ Δf_j
>
> If k = ∞ then $\Delta e_i^{(\infty)}$ = e_i / x_i . $(1 - a_{ij})^{-1}$. Δf_j = e_i / x_i . l_{ij} . Δf_j [L(l_{ij}) being the "Leontief inverse"]
>
> Indirect employment is derived from Δe_i. The correction factor P is applied.

We can indeed work out what volume of employment is created upwards, at first level (k = 1), but also second (k = 2), third (k = 3), etc. until the infinite level (k = ∞). This is what is presented in this report, in

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[101] Cai J. and P. Leung (2004).

order to give the fullest possible picture of the overall economic impact that the sectors studied have on the national economy as a whole.

The same logic applies to the calculation of the indirect value added. Then "E" only needs to be replaced by "VA".

o Forward linkages

Ghosh[102] developed an alternative input-output model, i.e. a supply-driven input-output model. The output of a sector j is equal to its purchases plus its imports plus value added. The two last terms are called the 'primary inputs' and will be noted as pi. The base equation of the Ghosh model is thus derived from $x_j = \sum_{i=1}^{n} x_{ij} + pi_j$ by defining technical output coefficients $b_{ij} = x_{ij}/x_i$. The base equation is provided by $x = B'x + pi$ [103].

This Ghosh model can be used to analyse how costs are propagated through the economy[104]. When an industry i increases its prices, this has an impact on the costs of all its clients, i.e. the cost of their purchases increases. In order to maintain their value added at the same level, they will also raise their prices, entailing higher costs for their clients. These effects are provided by the column sums of the transposed Ghosh inverse $G = (I - B)^{-1}$. This means that the column sums of the transposed Ghosh inverse - and therefore the row sums of the Ghosh inverse - are a measure of linkage to the clients, i.e. forward linkage. Again, this is not a pure measure. Dividing the row sums of the Ghosh inverse by the diagonal element in the same row yields a pure measure. Thus forward linkage is measured by:

$$FL_i = \frac{\sum_{j=1}^{n} g_{ij}}{g_{ii}} \qquad (\text{IO2})$$

in which g_{ij} is the (i,j) element of the Ghosh inverse.

o Decomposed linkages

It should be pointed out that the measures (IO1) and (IO2) measure linkage of an industry <u>in relation to its own size</u>. It does not provide any information about the absolute impact of an industry. In order to analyse the absolute impact these measures must be <u>decomposed</u>. As such, the absolute (purified) total backward impact of an industry j on another industry i is provided by $(l_{ij}/l_{jj})x_j$, in relation to the size of industry i, yields a measure of dependence of i with respect to j [105]:

$$BDec_{ij} = \frac{l_{ij}}{l_{jj}} \frac{x_j}{x_i} \qquad (\text{IO3})$$

It can be shown that this is equal to

$$BDec_{ij} = \frac{g_{ij}}{g_{jj}} \qquad (\text{IO3'})$$

and measures the share of output from industry i that is (directly or indirectly) related to industry j.

Similarly, the decomposed forward linkage measure can be found:

$$FDec_{ij} = \frac{l_{ij}}{l_{ii}} \qquad (\text{IO4})$$

is a measure of the payments of i that are attributable to j. It is a measure of cost dependence of i with respect to j.

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[102] See Ghosh A. (1958).
[103] The apostrophe of B' denotes the transposition of matrix B.
[104] See Dietzenbacher E. (1997), Coppens F. (2006)
[105] See Coppens F. (2006)

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