

---

Thesis submitted in partial fulfillment of the requirements for the joint academic degree of:

*Master in Economics and Business*  
*Master specialization Urban, Port & Transport Economics*



## ***Logistics Centres as economic drivers of their regions***

*Host University: Erasmus Universiteit of Rotterdam*

*Department of Erasmus School of Economics*

**Benjamin Vrochidis**

## **Acknowledgement**

This dissertation is the end of my journey in obtaining my Master Diploma at Erasmus School of Economics. There are many people who motivated and support me with various ways in order to complete successfully the process of my thesis. First of all, I would like to thank my supervisor Professor Michiel Nijdam whose valuable comments and useful instructions make my academic work more fruitful, conceivable and applicable for further research. He was always available to assist me, he was patient and he finally helped me to gain a great depth and breadth of knowledge about the software of QGIS (Quantum GIS). Without having any previous knowledge about this cross-platform, his guidance about QGIS contributed on the successful completion of my thesis research.

Also, I owe special thanks to Mrs. Indira Bazzeo from the department of “New Projects and Development Unit” at Interporto Bologna SpA for her generous support and help during the collection of necessary data. Additionally, I would like to thank Mrs. Nadine Küßner from ISL (Institute of Shipping Economics and Logistics) in Bremen who supported my research with useful information. Also, the valuable discussions and directions which I have taken by Jeanett Bolther (External Funding and Knowledge Transfer Office Manager of ZLC-Zaragoza Logistics Centre) contributed significantly on the inspiration of the subject that I investigated on. Moreover, she provided me with publications and statistical elements which could not be obtained easily by me.

Finally, I would like to express my deepest love to my family (Antonios, Apostolia, Thanasis & Thewni) and my best friends Thomas, Eugenia, Fani, Vasilis, Antonios, Thanasis, Nikos, Ioannis, Maria and Antonis. Their encouragement and their unwavering support were the driving force and the guiding light of my research which might not be completed without them. For this reason, I owe them everything and I wish I could put into words how important they are to me.

Rotterdam, 19<sup>th</sup> of September, 2013,

Vrochidis Benjamin

## Table of Contents

CHAPTER 1: Introduction.....	1
1.1 Background .....	1
1.2 Purpose of Study.....	3
1.3 Empirical Analysis/Methodology.....	4
1.4 Project Outline.....	5
CHAPTER 2 : What is a Logistics Centre? .....	6
2.1 Varieties of Logistics Centre .....	6
2.2 Evolution of Logistics Centres.....	10
2.3 Definition of Logistics Centre.....	12
2.4 Main characteristics/features of Logistics Centres .....	14
2.5 Advantages of Logistics Centres .....	15
2.6 General attributes of logistics centres.....	18
CHAPTER 3 : Frame of Reference & Choice of Theories .....	20
3.1 The initiator of thesis statement .....	20
3.2 Major Findings .....	22
CHAPTER 4 : Methodology.....	27
4.1 Determination of Regional and Economic Indicators.....	27
4.1.1 Economic Variables of Regions .....	28
4.1.2 Economic Variables related to Logistics Centres .....	28
4.2 Data sources and availability .....	32
4.3 The sample of selected logistics centres-European cases.....	33

CHAPTER 5 : Case Analysis and Interpretation .....	35
5.1 European Overview .....	35
5.2 Interporto Bologna (Case 1) .....	41
5.2.1 General Information and Ownership Structure .....	41
5.2.2 Facilities and Services Provided.....	43
5.2.3 Major actors and commodities handled .....	44
5.2.4 Measuring the Impact .....	45
5.3 GVZ Bremen (Case 2).....	52
5.3.1 General Information and Ownership Structure .....	52
5.3.2 Facilities and Services Provided.....	55
5.3.3 Major actors and commodities handled .....	56
5.3.4 Measuring the impact .....	57
5.4 Interporto Quadrante Europa (Case 3) .....	63
5.4.1 General Information and Ownership Structure .....	63
5.4.2 Facilities and Services Provided.....	65
5.4.3 Major actors and commodities handled .....	67
5.4.4 Measuring the impact .....	68
5.5 Plataforma Logistica de Zaragoza (Case 4) .....	74
5.5.1General Information and Ownership Structure .....	74
5.5.2 Facilities and Services Provided.....	76
5.5.3 Major actors and commodities handled .....	77
5.5.4 Measuring the impact .....	78
5.6 Budapest Intermodal Logistics Centre (Case 5) .....	85
5.6.1General Information and Ownership Structure .....	85
5.6.2 Facilities and Services Provided.....	87
5.6.3 Major actors and commodities handled .....	88
5.6.4 Measuring the impact .....	89
Chapter 6 : Overview & Conclusion.....	95
6.1 Accumulated results of case-study analysis .....	95

6.2 Further Analysis through the comparison of the 5 cases.....	97
6.3 Limitations .....	102
6.4 Future Research.....	103

## **List of Figures**

Figure 1.1: Structure of Research.....	5
Figure 2.1 : Hierarchy of European Logistics Facilities .....	7
Figure 2.2 Reverse Logistics Procedure.....	17
Figure 4.1: European Logistics Centres .....	33
Figure 5.1: European Overview of employment concentration in transport & logistics .....	36
Figure 5.2: European Overview of change in employment concentration .....	36
Figure 5.3: The volume of logistics in European regions.....	38
Figure 5.4: Comparison of selected logistics regions .....	39
Figure 5.5: The five selected European logistics centres-regions .....	40
Figure 5.6: Main Shareholders of Interporto Bologna SpA .....	41
Figure 5.7: Riad and Rail Network of Interporto Bologna .....	42
Figure 5.8: Layout of Interporto Bologna .....	43
Figure 5.9: Main operators of Interporto Bologna.....	44
Figure 5.10: GDP per capita of Emilia-Romagna .....	45
Figure 5.11: Unemployment rate of Emilia-Romagna.....	45
Figure 5.12: Business Investment Rate in Emilia-Romagna .....	46
Figure 5.13: Number of Patents by priority year in Bologna .....	46
Figure 5.14: Annual Road Freight Transport in Bologna .....	48
Figure 5.15: Air freight transport in Emilia-Romagna .....	48
Figure 5.16: Number of Persons Employed in Emilia-Romagna.....	49
Figure 5.17 Number of local units in Emilia-Romagna .....	50
Figure 5.18: The organizational and management structure of GVZ Bremen .....	53
Figure 5.19: Transport Network of GVZ Bremen.....	54
Figure 5.20: Layout of GVZ Bremen .....	55
Figure 5.21: GDP per capita of Bremen-Kreisfreie Stadt	
Figure 5.22: Unemployment Rate of Bremen .....	57
Figure 5.23: Business Investment Rate in Bremen .....	58

Figure 5.24 Number of Patents by priority year in Bremen-Kreisfreie Stadt.....	59
Figure 5.25: Annual Road Freight Transport in Bremen-Kreisfreie Stadt	
Figure 5.26: Deep-sea and inland maritime transport of freight in Bremen .....	60
Figure 5.27: Number of Persons Employed in Bremen .....	61
Figure 5.28: Number of local Units in Bremen.....	62
Figure 5.29: Transport Network of Interporto Quadrante Europa .....	64
Figure 5.30: Transport Network of Interporto Quadrante Europa .....	64
Figure 5.31: Layout of Interporto Quadrante Europa .....	66
Figure 5.32: GDP per capita of Veneto.....	68
Figure 5.33: Unemployment rate of Veneto .....	68
Figure 5.34: Business Investment Rate in Verona.....	69
Figure 5.35: Number of Patents by priority year in Verona .....	69
Figure 5.36: Annual Road Freight Transport in Verona.....	70
Figure 5.37: Air freight transport in Veneto.....	71
Figure 5.38: Number of Persons Employed in Veneto .....	71
Figure 5.39: Number of local Units in Veneto .....	72
Figure 5.40: Number of Trucks registered in Veneto.....	72
Figure 5.41: Main Shareholders of PLAZA.....	74
Figure 5.42: The geo-strategic position of PLAZA .....	75
Figure 5.43: Road and Rail Networks of PLAZA .....	75
Figure 5.44: Layout of Plataforma Logistica de Zaragoza.....	76
Figure 5.45: GDP per capita of Zaragoza .....	78
Figure 5.46: Unemployment rate of Aragón .....	79
Figure 5.47: Business Investment Rate in Aragón .....	79
Figure 5.48: Number of Patents by priority year in Zaragoza .....	80
Figure 5.49: Annual Road Freight Transport in Zaragoza .....	80
Figure 5.50: Annual national and international railway goods transport in Aragón.....	81
Figure 5.51: Air freight transport in Aragón.....	81
Figure 5.52: Number of Persons Employed in Aragón .....	82
Figure 5.53: Number of local Units in Aragón .....	83
Figure 5.54: Number of Trucks registered in Zaragoza .....	83
Figure 5.55: The organizational and management structure of Budapest Intermodal Logistics Centre .....	85
Figure 5.56: European TEN-T Corridors.....	86

Figure 5.57: Rail/Road/Inland Waterway connections of BILK .....	86
Figure 5.58: Layout of Budapest Intermodal Logistics Terminal.....	87
Figure 5.59: The development stages of BILK's warehouses .....	88
Figure 5.60: GDP per capita of Budapest .....	89
Figure 5.61: Unemployment rate of Central Hungary.....	89
Figure 5.62: Business Investment Rate in Central Hungary .....	90
Figure 5.63: Number of Patents by priority year in Budapest .....	91
Figure 5.64: Annual Road Freight Transport in Budapest .....	91
Figure 5.65: Air freight transport in Central Hungary .....	92
Figure 5.66: Number of Persons Employed in Central Hungary .....	93
Figure 5.67: Number of Trucks registered in Budapest .....	93

## List of Tables

<u>Table 2.1: Examples of Logistics Facilities</u> .....	10
<u>Table 2.2: The Evolution Stages of Logistics Centres</u> .....	11
<u>Table 2.3: Logistics Centres Features</u> .....	13
<u>Table 3.1: Advanced Operations and Jobs in Logistics Centres</u> .....	21
<u>Table 3.2: Examples of European Logistics Centres in the literature</u> .....	24
<u>Table 5.1: Classification of European logistics regions</u> .....	37
<u>Table 5.2: The entire rail framework of Interporto Bologna</u> .....	47
<u>Table 5.3: Traffic volumes of Interporto Bologna</u> .....	47
<u>Table 5.4: Number of directly and indirectly local units in Emilia-Romagna</u> .....	50
<u>Table 5.5 Companies included in Interporto Quadrante Europa</u> .....	67
<u>Table 5.6 Global and European Companies of Zaragoza Logistics Platform</u> .....	77
<u>Table 5.7: Key Partners of BILK Logistics Pte.Co.</u> .....	88
<u>Table 6.1: Accumulated Overview of adopted regional economic indicators for all selected European Logistics Centres</u> .....	96

## CHAPTER 1

### Introduction

#### 1.1 Background

Nowadays, numerous logistics clusters have been established around the world and they affect positively the general quality of transportation and delivery services to large populations. Some of the most widely known types of these logistics intensive clusters are: inland clearance depot, intermodal freight centre, logistics centre, dry port, inland and intermodal terminal, distribution centre and others. This research focus on the concept of logistics centre in order to examine the importance of these clusters as economic drivers of their regions. In contrast to the general perception for logistics centres as facilitators of intermodal operations or local distributors, this report will investigate another conceptualization of logistics centres as regional generators of business and economic development. Furthermore, this differentiated approach of logistics centres will increase their attractiveness as potential strategic tools by policymakers. As a result, the general purpose of this thesis is on the one hand to prove the regional economic impact of logistics centres, and on the other hand to persuade both local and national governments for the necessity of these facilities' development.

First of all, many economists have investigated profoundly the role of various industrial clusters as jobs generators and drivers of economic growth. Concerning to logistics centres, there are only a few cases (especially in USA) whose economic impacts to the regional development has been investigated but not yet broadly in European logistics centres. Despite also the fact that there is a wide range of different methodological researches about the impact of logistics centres to the improvement of transport system efficiency, there is a noteworthy shortage of appraisal methods about the role of logistics centres as initiators and promoters of regional economic activities. With only a few references about the significance of logistics centres at the economic growth of regions, the already existing theoretical framework of this statement seems to be quite insufficient.

As far as the empirical relevance is concerned, the concept of logistics centre could not be characterized as a new concept due to the fact that it appeared at 1960's (Rimienė & Grundey, 2007). During the last 4 decades, a great variety of freight and logistics processes has been added to the concept of "European Logistics Centres" thanks to the borderless market of Europe and the growth of international trade, especially from Asia. Containerization, near-shoring, outsourcing of transport and logistics activities, improved information technology and international standardization, global sourcing, increased safety and security measures in supply chains, sustainable transport and shorter product life cycles are only few of the most important changes in trade, logistics and transport industry that influence significantly the array and the quality of services offered by logistics centres. During this time, the way that things are produced, packed, stored and transported has been changed and the demand for differentiated services therefore leads to highly differentiated logistics solutions, such as logistics centres. In parallel with all of these worldwide economic changes, there are two additional explanations for the increased interest about logistics centres: the fast growing rate of environmental restrictions and the severe congestion problems inside and outside of cities-transport nodes. As a result, the strong connection between integrated logistics services and the satisfaction of customers, at 21<sup>st</sup> century, lead not only to the initial adoption of logistics centres' concept but also it justifies the continuing success of these centres (United Nations, 2002).

Concerning to the increasing demand of logistics centres, both international or smaller and medium companies are seeking either their allocation to logistics centres or the outsourcing of their logistics activities (repacking, labeling, bar-coding, light assembly and other value-added services) to 3<sup>rd</sup> or 4<sup>th</sup> party logistics operators which are located in this specific kind of centres. Therefore, the combined presence of both logistics services companies (freight forwarders, hauliers, computer and communication centre, etc.) and companies with logistics intensive operations in the same location, (e.g. distribution operations of retailers) generates some unique benefits for the main actors of logistics centres in contrast to the corresponding firms of other industrial clusters (Yossi, Sheffi, 2010). Sharing their infrastructural and functional resources, logistics centres offer both high quality and frequency on transportation services as well as continuous warehouse capacity in real time. Due to the fact that companies are able to spend a lot in order to increase their flexibility on the continuously volatile demand of markets, their major aim is to gain this priceless advantage through their direct or indirect engagement on logistics centres.

In the same line with companies, there is a great variety of different examples from countries which have already comprised both bimodal and trimodal inland terminals and logistics centres on their national transport system (Notteboom & Rodrigue, 2009). Despite the economic challenges of mutable business environment the last 4 years, owing to the European debt crisis and global economic recession, many countries have already expanded their transport and logistics infrastructure. The main purpose of these investments was to absorb the negative impacts of recent economic crisis due to the fact that most European countries have recognized the interdependent relations between the agglomerated logistics facilities and economic growth. Except of individual strategies, European Union has already financially and administratively supported various projects (which aim to the improvement of transport and logistics networks) such as the National Transport Development Programme (1996–2010), European TEN-T Development Programme, Freight Transport Logistics Action Plan and Best Urban Freight Solutions project (BESTUFS, 2007)<sup>1</sup>. Eventually, the acknowledgment of logistics centres' contribution can be verified by the fact that either the majority of European countries or European Union have supported a wide range of strategies for the establishment of these centres.

Meanwhile, the success of logistics centres have also been recognized by regional and national policymakers due to the fact that these centres can participate importantly to regional development and to reverse contingent economic recessions as well as to act as employment generators. Based on the recognition of logistics centres' contribution, the main purpose of this study and its major logically emerged research question is: *"How essential is the development and the contribution of logistics centres to regional economic growth?"*. The next two sections of this chapter will determine more comprehensively the major theoretical and methodological directions of this research.

---

<sup>1</sup> BESTUFS (2007), the Best Urban Freight Solutions project initiated by the European Commission notes that the main functions of freight villages are transportation-related activities (such as forwarding, warehousing, and additional logistic services), a connection to a minimum of two transport modes, the settlement of different economically interdependent companies, and a governance structure that can best exploit potential synergies among tenants.

## **1.2 Purpose of Study**

In parallel with the main and broader role of logistics centres as promoters of intermodal transportation, there is also an additional and similarly important role for these centres as initiators of regional economic development. Additionally, the agglomeration of companies with logistics-intensive operations in a given location not only provides these companies with certain competitive advantages, but they also contribute significantly to the economic growth in the regions where they are located. Although, an examination of academic literature confirms that the majority of authors have penetrated only on the contribution of logistics centres to the effectiveness of global supply chain. As a result, the main aims of this research is to analyze and investigate whether or not logistics centres can operate as economic-drivers of their regions and also an additional aim is the provision of recommendations for action to local policymakers. Concretely, this study is focusing on the potential influence of logistics centres at regional unemployment rate, Gross Domestic Product (GDP) and job creation, investment attractiveness and trade volumes (regional imports/exports). Apparently, the regional economic return from logistics centres will be explored through the investigation of the following different aspects:

### **❖ What is a Logistics Centre?**

- Varieties of Logistics Centres
- Historical Review
- Definition of Logistics Centres

### **❖ Logistics Centre "features"**

- Entire frame of Logistics Centres
- Organizational structure
- Major characteristics of Logistics Centres
- Services/Activities/ Infrastructures

### **❖ Frame of Reference & Choice of Theories**

### **❖ Determination of regional economic indicators**

- Regional Imports and Exports (Loading and Unloading tons of regions) by air/road/rail/inland shipping
- Direct And Indirect Employment
- Number of Patent Applications (regional Innovation Index)
- Location Quotient Index
- Regional GDP and GDP per capita
- Business Investment Rate
- Number of transport and logistics enterprises registered in region
- Unemployment rate (%)
- Wages and Salaries in transport and logistics sector

❖ **Selection of Vicarious European Logistics Centres**

- Methodological Framework
- Case Studies / Research Strategy
- Collection of regional economic data
- Qualitative and Quantitative Research

### **1.3 Empirical Analysis/Methodology**

As an attempt to meet the quantitative expectations of this research, some indicative and representative case studies of existing logistics centres will be analyzed in order to enhance the comprehension of thesis's topic and also to add further insight to this analysis. A comparable proceeding has been used to examine 5 different European logistics centre. Generally speaking, a case study comprises of detailed information about the unit of analysis with a view to obtaining in depth knowledge (Collis & Hussey, 2003). All examples, which will be used in the empirical analysis, are European as well as particularly well-structured and significantly advanced in comparison to other logistics centres from the same continent. Initially, a summary of information has been created in order to organize the major features and characteristics of those five European logistics centres. As a result, these selected and different cases were developed including transport and logistics services, size of facilities, location, available transportation modes and intermodal infrastructure, value-added and ancillary services, the role and the organizational contribution of public and private sector and the socio-economic base of their region.

Afterwards, the main part of empirical analysis includes the quantitative collection and statistical interpretation of regional indicators such as unemployment rate, GDP, regional imports/exports etc. This interpretation has been implemented through the creation of various graphs, datasets, tables and charts which illustrate the temporal fluctuations and variations of the examined regional economic indicators. The empirical analysis finally results to a comparison of these indicators' level between the five selected logistics centres. Concerning to this final step, the comparison has been depicted through an accumulated overview of all indicators for the five selected cases in order to contribute on more conceivable conclusions and research outcomes.

Taking into consideration the selection criteria of sample, the final choice was influenced more by the level of logistics centres' multimodality and intermodality (which implies the interface of at least two modes of transport, in general road and rail) as well as their transport and logistics performance (estimated Intermodal Road/Rail Traffic, Number of tenants etc.). Additionally, another equally important factor which influences considerably the choice of those five European cases is the pursuit to have as much national diversity and variety as possible in order to succeed the highest possible reliability and national representativeness. To conclude, the adoption of the whole abovementioned methodology seems to be the most appropriate one in order to define and interpret the economic impact of logistics centres to their regions. In comparison to the selected methodology, other assessment tools such as Cost- Benefit Analysis (CBA) and Multi-Criteria Analysis (MCA) seem to be less applicable and not so feasible due to the fact that these methods are most suitable for the evaluation of future or recently constructed investments (Jan Anne Annema et al, 2007).

## 1.4 Project Outline

The next section (Chapter 2) includes a brief presentation of logistics centres types and features in conjunction with the determination of the specific type of logistics centres which will be used for this research. Apparently, the major purpose of study will be fulfilled by two different methodological approaches. Referring to the first one, a review of key academic papers and existing literature (strongly related with the regional economic impact of logistics centres) have been created and presented in Chapter 3 in order to estimate and determine appropriately the conceptual framework's margins of thesis statement. The second implemented method is a qualitative and quantitative analysis of the five selected European Logistics Centres' cases. After the analysis of methodology in Chapter 4, a case analysis including several relevant features from each logistics center was presented in Chapter 5. In the same chapter, a general European overview of NUTS-2 regions depicts the intense of logistics activities at all 27 countries of European Union. At the final section, an agglomerated overview and a comparison of regional economic impacts of the selected logistics centres comes to some interesting and useful conclusions. More illustrative, the following figure depicts the whole thesis's structure from the first chapter of introduction to the last one of conclusion:

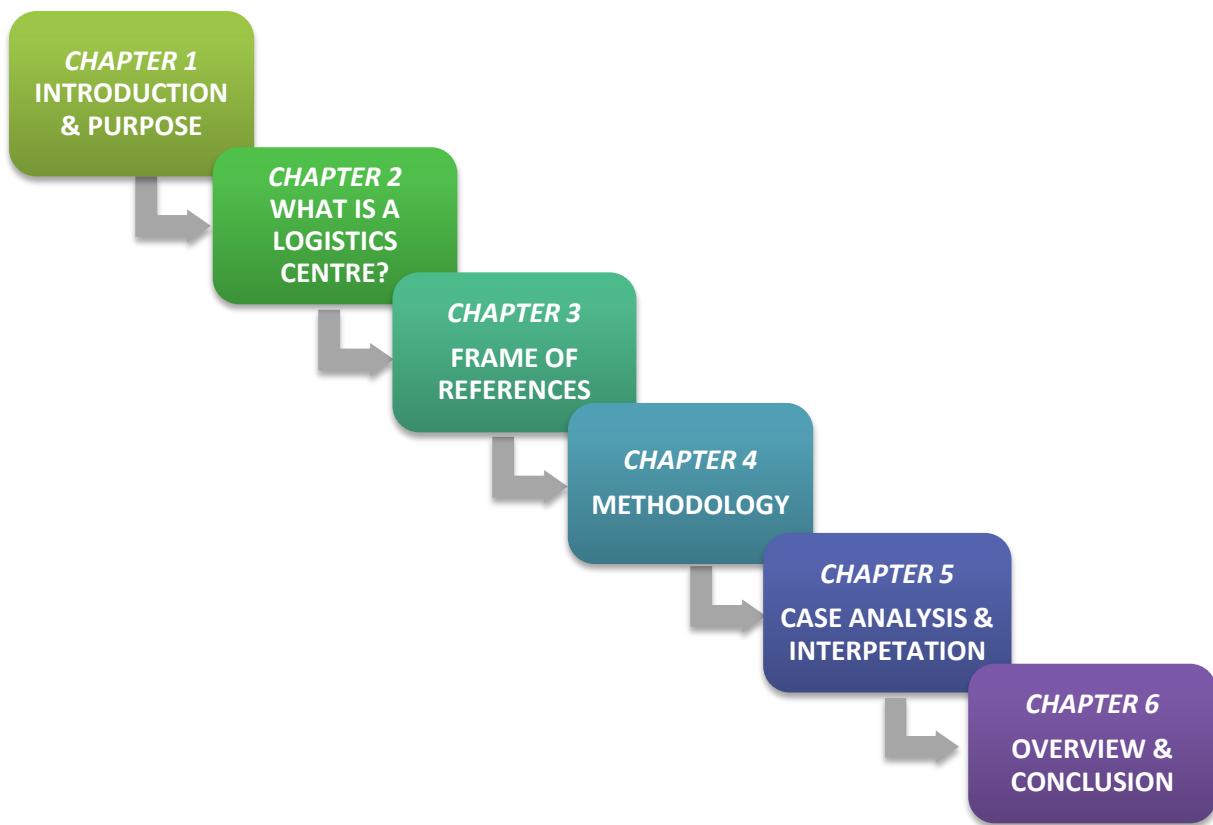


Figure 1.1: Structure of Research

## CHAPTER 2

### What is a Logistics Centre?

Due to the great variety of different versions and definitions, this chapter aims to define all diversifications of used terminology and to conclude at a specific type of logistics centre which will be used as the main point of this research. In addition, it has included the historical development of logistics centres as well as a brief overview of their contemporary frame and functional features.

#### 2.1 Varieties of Logistics Centre

Taking into consideration the corresponding literature, there is a wide range of definitions about logistics centres and some of them do not represent the same meaning. These are: logistics centre, distribution centre, central warehouse, freight/transport terminal, transport node, logistics platform, freight village, logistics depot, distripark, etc. The combination of these various terms with the countless researchers and scientists creates difficulties for the clarification of logistics centre's meaning for this research. Consequently, there is a primary need for this study to conclude on a specific definition for logistics centres, before starting the investigation of their regional economic impacts. For an easier continuation of this further analysis of logistics centres, the initial aim of second chapter is the establishment of a useful typology and, eventually, to decide what type of logistics infrastructure would best suit the needs of this survey.

Despite the fact that logistics centre as a facility for transport and distribution operations is not a new concept, advanced research for the definition of logistics centre has not been implemented extensively and it could be easily characterized as a relatively new area of study (Higgins & Ferguson, 2011). According to a survey of Rimienė & Grundey (2007), there are not only differences between the terms but also the concepts differ. For instance, Rodrigue et al. (2010) argue that the term of "dry ports" does not include the inland terminals served by barge and for this reason this kind of ports is called as "dry". But, according to the definition of Roso et al. (2009), all of these terminals which have directly established connections with a major seaport, by rail or barges, combined with cargo handling offerings and a wide range of other added value activities can be characterized as "dry ports". Concerning to the major definition of logistics centres, noteworthy discrepancies are also represented between different countries. More specifically, similar facilities are named as Gueterverkehrszentren (GVZ) in Germany, Interporti in Italy, Plateformes Multimodales/Logistiques in France, Zonas de Actividades Logísticas (ZAL) in Spain and freight villages in the United Kingdom. Therefore, there are essential differences among the broadest meaning of logistics centres as clusters of companies participating in transport and logistics related activities (Meidutė, 2005, p. 106). Also, the definition of freight villages and logistics centres in Europe, Japan, Singapore, China, and USA is quite different by the corresponding one of Europlatforms (2004) or Rimienė & Grundey (2007).

As an attempt to present a more comprehensive terminology and hierarchy, the Figure 2.1 has been generated in order to simplify the varieties of European logistics infrastructures. As these facilities move up, the range of transport and logistics services increases as well as the scale of functionality and the scope of value added activities expand and each level usually embodies all features of lower ones. It should be noted that these classifications does not cover all existing transport and logistics

facilities due to the fact that there are various European cases which combine two or more types of these six broad categories.

**Figure 2.1 Functional Hierarchy of European Logistics Facilities**

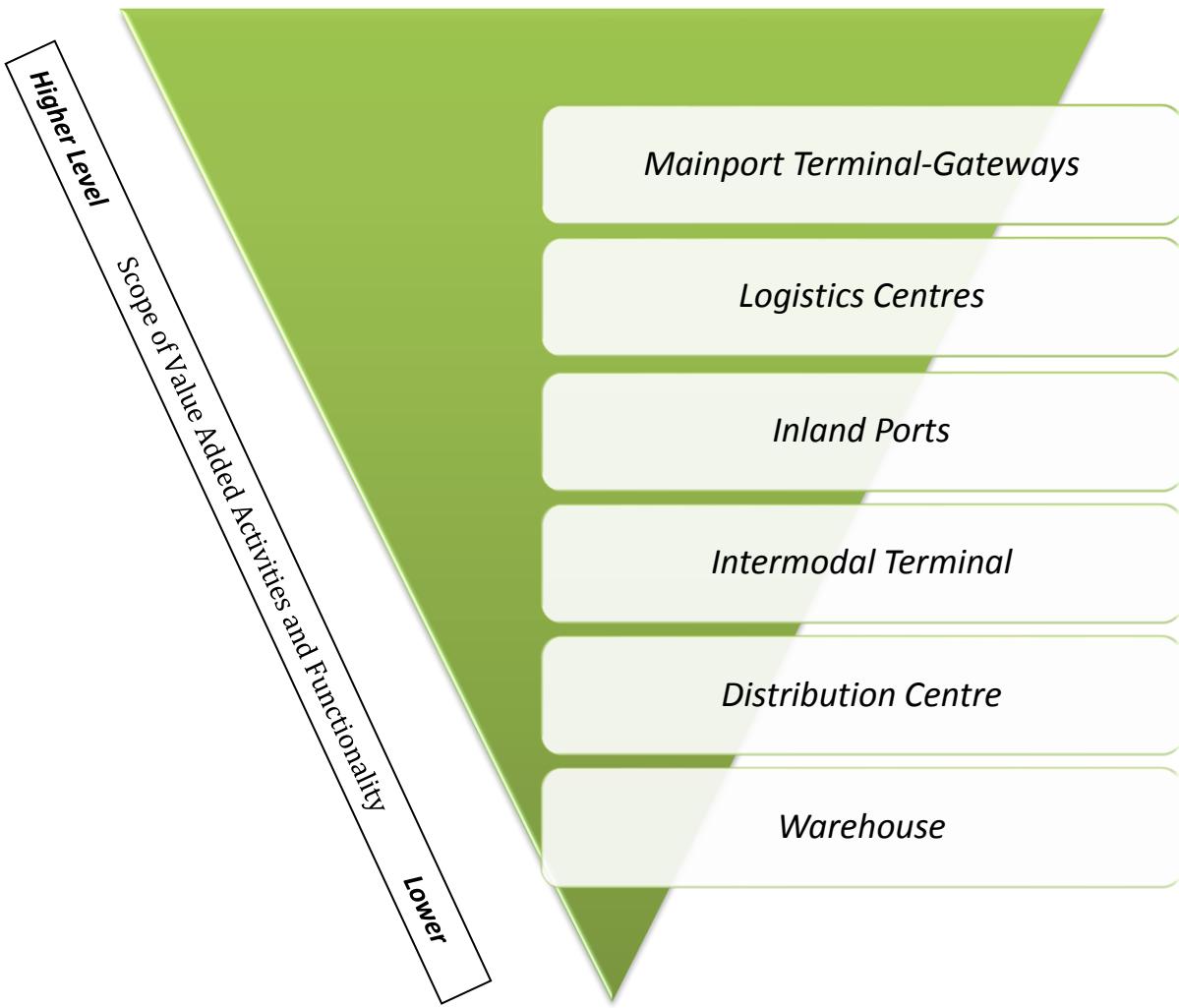


Figure 2.1: Hierarchy of European Logistics Facilities

Source: Based on Higgins & Ferguson, 2011

#### 1<sup>st</sup> Level: Warehouse

At the first level, there is the category with smallest scope of consolidated activities and the general term of "Warehouse" has been adopted because this level includes all places which are specialized in storage and inventory. In some cases, there are warehouses with more complicated activities like distribution and maintenance, and generally the 1<sup>st</sup> level comprises facilities which operate as regulators between suppliers, freight forwarders and customers in order to improve the cost-efficiency of supply chain (Rimienė & Grundey, 2007).

### 2<sup>nd</sup> Level: Distribution Centre

The second level of hierarchy refers mainly to a larger type of warehouse or a land of agglomerated warehouses. Having as main purpose the rapid movement of goods, distribution centres offer not only warehousing, cross-docking and loading/unloading services but also some auxiliary value added services such as sampling, labeling and barcoding. There is also a specific category of distribution centres which serves urban areas exclusively and they aim to reduce the growth rates of road haulage with the avoidance of unnecessary truck trips at city centre. Known as "City Logistics Centers<sup>2</sup>" or "Urban Distribution Centres", these facilities enable the consolidation and deconsolidation of shipments into fewer trucks such as the example of City GVZ Behala Westhafen in the region of Berlin-Brandenburg. Finally, there are some conceptions of distribution centres that could be classified in a higher level of this hierarchy due to the fact that these broader facilities offer similar services to logistics centres like repair, returns and packaging/repackaging.

### 3<sup>rd</sup> Level: Intermodal Terminal

Having as major activities the freight handling, consolidation/deconsolidation and the transshipment of goods between different transportation modes (road, rail, inland shipping), intermodal terminals could be referred as facilitators of freight flows without any commercial or supporting activities. Similar to distribution centres, some of these facilities could be categorized at a higher level as they offer a wider range of value-added activities.

### 4<sup>th</sup> Level: Inland Port

Strongly connected with the seaport terminal through various rail or barge connections, these facilities could be characterized as an extension of traditional seaport which is dedicated to the consolidation and delivery of freight flows to the hinterland. Furthermore, this 4<sup>th</sup> level of hierarchy also includes these facilities which offer custom-related services such as customs clearance and inspection. All of these additional services have been done the last decades and they aim to minimize the congestion and pollution at the area of port in parallel with the benefits of possible economies of scale and scope that could be generated.

### 5<sup>th</sup> Logistics Centres

Being a strategically located and actively transport hub where all activities relating to transport, logistics and distribution of goods are carried out by various operators and actors of supply chain, there is no doubt that the 5<sup>th</sup> level of functional hierarchy is the type of logistics facilities which could fulfill more appropriately the needs of this research. The major reason of this choice is the fact that logistics centres are the largest inland facilities in combination with the multimodal, commercial and value added services that their tenants have the opportunity to utilize. In parallel with the multimodal services, logistics centres also consist of intermodal facilities which connect the different transport modes and facilitate the reliable and cost-effective transshipment of goods. As a result, this category can have a large impact on the regional economic growth and to generate high levels of employment because they influence the economic performance of numerous companies. An equally

---

<sup>2</sup> City Logistics are transport and logistics services in urban areas which especially aim to synchronize the urban conveyance of goods, to minimize risks of accidents and pollution of metropolitan areas, to reduce noise congestion and to deplete the traffic volume of highly populated cities.

important reason, which justifies this choice, is the higher economic efficiency of larger agglomerated logistics infrastructures in comparison to the facilities of the other hierarchical levels (Boile et al. 2008). Accordingly, the term of “Logistics Centre” is not differentiated by this one of “Freight Village” for that research and, as a result, the next parts of Chapter 2 will turn to a deeper conceptualization of logistics centres/ freight villages.

#### 6<sup>th</sup> Level: Mainport Terminal /Gateway

The final and higher level of this hierarchy consists of gateways or mainport terminals which operate as the major intermediaries of large freight flows between seaports and inland locations. Moreover, gateways are located in the surrounding area of large transport hubs and mostly seaports and airports. The fierce interdependency of gateways with other transportation nodes (seaports or airports) makes this category to be less appropriate for this research in comparison to the previous level of logistics centres. Their size requires a great amount of investments and their main task is to complement the inadequate functions of inland/intermodal terminals, especially in the case of gateways which are established around the biggest European seaports. Concerning to the high quality of services and the consolidated scope of activities, there is not any noticeable difference between the biggest logistics centres and gateways in Europe. On the other hand, gateways have usually a private ownership structure, in contrast to the majority of logistics centers, such as the example of London Gateway which is owned by DP World and the European Gateway Services of ECT<sup>3</sup> in Rotterdam.

In order to succeed a better clarification of this terminology, a brief presentation of some European cases for each one of these levels seems to match appropriately with Figure 2.1. As a result, the following table illustrates some European examples of logistics centres, distribution centres, intermodal terminals and inland ports because the distinction of logistics centers with the rest 3 categories are usually most complicated and difficult. For this reason, the selection of the following examples has not made by accident but it aims to compare various facilities in the same countries for a better understanding of their differences. The only limitation for the creation of Table 2.1 was the continuing evolution of logistics facilities which impedes a permanent classification of any European case. On the other hand, this shortcoming could be exacerbated more if the previous analysis of features and conceptualizations for each different level has not been done.

---

<sup>3</sup> European Container Terminal (ECT) offers efficient services through European Gateway Services to shipping companies, freight forwarders, carriers and shippers for the optimal and direct transport of containers between the deep-sea terminals in Rotterdam and the European hinterland.

**Table 2.1: Examples of Logistics Facilities**

<b>Types</b>	<b>Distribution Centres</b>	<b>Intermodal Terminals</b>	<b>Inland Ports</b>	<b>Logistics Centres</b>
<b>Spain</b>	<ul style="list-style-type: none"> <li>▪ Centro de Transportes de Benavente</li> <li>▪ Cimalsa</li> <li>▪ Ciudad del Transporte de Zaragoza</li> </ul>	Barcelona CIM Vales	<ul style="list-style-type: none"> <li>▪ Zaragoza Maritime Terminal</li> <li>▪ Zona Franca de Barcelona</li> </ul>	<ul style="list-style-type: none"> <li>▪ Centro de Transportes de Irun (CTI)</li> <li>▪ Centro di Transporte de Vitoria (CTV)</li> <li>▪ ZAL Port de Barcelona</li> <li>▪ Plataforma Logistics Zaragoza (PLAZA)</li> </ul>
<b>Denmark</b>	<ul style="list-style-type: none"> <li>▪ Denmark Transport Centre (DTC)</li> </ul>			<ul style="list-style-type: none"> <li>▪ Hoeje Taastrup Transport Centre</li> <li>▪ Nordic Transport Centre (NTC)</li> <li>▪ Skandinavisk Transport Centre</li> </ul>
<b>Germany</b>		<ul style="list-style-type: none"> <li>▪ GVZ Kassel</li> <li>▪ GVZ Koblenz</li> <li>▪ GVZ Frankfurt</li> <li>▪ GVZ Weil am Rhein</li> </ul>	<ul style="list-style-type: none"> <li>▪ Logport, Duisburg</li> </ul>	<ul style="list-style-type: none"> <li>▪ GVZ Bremen</li> <li>▪ GVZ Hamburg</li> <li>▪ GVZ Nuremberg</li> <li>▪ GVZ Freienbrink</li> <li>▪ GVZ Wustermark</li> </ul>
<b>Italy</b>		<ul style="list-style-type: none"> <li>▪ Interporto Marche</li> <li>▪ Interporto Rovigo</li> </ul>		<ul style="list-style-type: none"> <li>▪ Interporto Bologna</li> <li>▪ Interporto Torino</li> <li>▪ Interporto Verona</li> <li>▪ Interporto Nola Campano</li> </ul>
<b>France</b>		<ul style="list-style-type: none"> <li>▪ Europort Vatry</li> </ul>	<ul style="list-style-type: none"> <li>▪ Lyon Terminal</li> </ul>	<ul style="list-style-type: none"> <li>▪ Roissy-SOGARIS</li> <li>▪ Eurocentre Toulouse</li> </ul>
<b>United Kingdom</b>		<ul style="list-style-type: none"> <li>▪ Birch Coppice Business Park</li> <li>▪ Port of Tyne</li> </ul>		<ul style="list-style-type: none"> <li>▪ DIRFT Logistics Park</li> <li>▪ Kingmoor Park</li> <li>▪ Wakefield Europort</li> </ul>

Source: Based on Higgins & Ferguson, 2011

## 2.2 Evolution of Logistics Centres

Just before the determination of logistics centre's definition, it would be more comprehensive to analyze briefly the evolution of this concept and to generate a classification of 3 different evolutionary generations. During the late 1950s, physical distribution and its management began to be considered as an essential business activity (Rimienè & Grundey, 2007) and the first years of 1960s, French public-sector in cooperation with local policymakers and Chambers of Commerce established some of the first logistics centres in Europe (Kapros et al, 2005). In the late 1960s and 1970s, similar strategic steps were followed and adopted by German and Italian governments which pursued to invest at the extension of their rail infrastructure and at the development of their intermodal terminals. Since the 1980s, the importance and usefulness of logistics centres has become widely accepted and consequently their number has multiplied, until the era of 21<sup>st</sup> century, not only at North-Western European countries (France, Germany, Netherlands, Denmark, Belgium,

and Great Britain) but also in the Mediterranean ( Spain, Italy, Portugal) and Eastern ones (Bulgaria, Hungary, Lithuania)(Kapros et al, 2005).

Historically, the most conventional logistics functions were: shipping, receiving and storage, order picking, break-bulk, freight consolidation and containerization. Nowadays, cutting-edge technological and handling equipment not only contribute on the already executed operations and functions of logistics centres but they also create the appropriate opportunities for the promotion of new value added services such as inventory control and tracking, repair, labeling , rework, bar coding, returns, packaging etc. (Rimienè & Grundey, 2007). Assessing all of these value-added services and functions, the concept of logistics centres has significantly changed and gradually developed through the following time scales of Table 2.2. The main criteria to correspond are operations performed and services offered:

**Table 2.2: The Evolution Stages of Logistics Centres**

1960s - 1970s	1980s - early 1990s	Mid 1990s - present
-	-	Materials management Distribution services(national/global)
-	Bonding	Import clearance Bonding Inbound transportation
Receiving	Receiving	Receiving
-	Cross-docking	Cross Docking
Storage	Storage	Storage Inventory management and control Shipment scheduling
Order processing Reporting Picking	Order processing EDI* Reporting Picking	Order processing EDI* Reporting Picking
Order assembly (Re) packaging	Order assembly (Re) packaging Stretch-shrink wrapping	(Product) subassembly Order assembly (Re) packaging Stretch-shrink-wrapping
Palletizing/unitizing Label/mark/stencil	Palletizing/unitizing Label/mark/stencil	Palletizing/unitizing Label/mark/stencil
Shipping Documentation	Shipping Documentation Outbound Transportation	Shipping, Freight claims handling Safety audits/reviews, Carriers selection, Performance measurement Outbound Transportation, Freight payment Export documentation, Customer invoicing FTZ* operation, Returns from customers JIT/ECR/QR* services, Documentation

Source: C.D. Higgins & M.R. Ferguson (2011)

Abbreviations\*: EDI – Electronic Data Interchange, FTZ – Free Trade Zone, JIT – Just-In-Time, ECR – Efficient Customer Response, QR – Quick Response

## **2.3 Definition of Logistics Centre**

Initially, it has to be determined that “logistics centre” is not only a new term but also the combination of this two words have not been made by accident. The first term “logistics” covers all of the appropriate activities and operations of transport, distribution and warehousing, while the second term “centre” refers to the organized, concentrated and coordinated execution of similar activities at a specific area (Baudin 2004, American Heritage Dictionary 1992). From all of the aforementioned and differentiated definitions of logistics clusters, the author of this research determine and conclude to the following definition by Europlatforms <sup>4</sup> and “Best Practice Handbook for Logistics Centres in the Baltic Sea Region” (2004):

**“Logistics Centre (LC) is a hub in a defined area within which all activities relating to transport, logistics and distribution of goods, nationally and internationally, are carried out by various operators and supply chain’s actors on a commercial basis. In order to protect and ensure the fair competition, cooperation and free rules for the main operators of “LC’s”, it is important for these centres to be managed by a single and neutral legal body, usually a Public-Private Partnership. Logistics Centres must also be offer the appropriate public facilities and services for the effective implementation of all relevant operations. Furthermore, this specific type of centre focus on the enhancement of intermodal transport around ports, and generally in hinterlands, due to the fact that a wider range of used transport modes would reduce the 2 major problems of 21<sup>st</sup> century’s port regions, pollution and congestion”.**

Similarly, the definition of ‘Freight Villages’ does not seem to present any remarkable differences and the most interesting element is the embodiment of term “Logistics centre” in this definition, as a synonym: **“Freight Village is a defined area within which all activities relating to transport, logistics and the distribution of goods, both for national and international transit, are carried out by various operators. It is run by a single body, either public or private, and it is equipped with all the public facilities to carry out the above mentioned operations. In order to encourage intermodal transport for goods handling, a Logistics Centre should preferably be served by a variety of transport modes”** (Europlatforms, 1999). Based on Higgins & Ferguson (2011) reference, a freight village could be characterized as an actualization of a logistics centre and, as a result, the words “logistics centre” and “freight village” are used as synonyms in the following analysis.

In order to identify which are the main roles and functions of logistics centres, the adoption of a combined structure seems to be quite imperative. Also, it could include not only the most important and conventional operators of logistics centres but also their most essential and value-added services. Consequently, the major purpose for the creation of the following table is the illustration of the entire framework of logistics centres and their operations.

---

<sup>4</sup> EUROPLATFORMS is the only European Association of Freight Villages and Logistics Centres. The organization was established December 18th 1991 and has since worked in the field of transport and logistics. The main purpose of EUROPLATFORMS is to promote and expand the concept of Logistics Centres in Europe and worldwide and to create and develop relations among existing Logistics Centres in Europe and with similar groupings internationally.

Additionally, the diversification into 4 separated categories (Broad and intermodal functions, Transport and independent companies, Transport and logistics services, Value-added and ancillary services) has been made in order to minimize misclassification errors and to determine the “different shades of grey” within logistics centres:

**Table 2.3: Logistics Centres Features**

			
<b>Broad &amp; Intermodal Functions</b>	<b>Transport &amp; Independent Companies</b>	<b>Transport &amp; Logistics Services</b>	<b>Value-Added &amp; Ancillary Services</b>
<ul style="list-style-type: none"> <li>•On-site manufacturing</li> <li>•Container freight station</li> <li>•Distribution services</li> <li>•E-commerce</li> <li>•Facilitation of 3PL-4PL activities</li> <li>•Industry integration</li> <li>•Warehousing and leasing</li> <li>•Cargo handling</li> <li>•Container terminal</li> <li>•Combined Terminal</li> <li>•Rail link to nearby airport or port</li> <li>•Transshipment/Transloading</li> </ul>	<ul style="list-style-type: none"> <li>•Carter</li> <li>•Transportation carriers</li> <li>•Freight Forwarders</li> <li>•Warehousing companies</li> <li>•Shipping firms</li> <li>•Shipbrokers</li> <li>•Stevedores</li> <li>•Hauliers</li> <li>•Rail operators</li> <li>•Shipowners</li> <li>•Air freight operators</li> <li>•Terminal operators</li> <li>•Distribution Centres</li> <li>•Storage Hotels</li> <li>•Technical equipment</li> <li>•Service centres</li> <li>•Computer and communication centres</li> </ul>	<ul style="list-style-type: none"> <li>•Load/unload ships/trains/trucks</li> <li>•Storage</li> <li>•Transshipment to secondary modes</li> <li>•Freight forwarding</li> <li>•Cross-docking / merge-in-transit</li> <li>•Freight consolidation / deconsolidation</li> <li>•Distribution / final delivery</li> <li>•Cold storage areas</li> <li>•Packaging/repacking</li> <li>•Quality Assurance and control</li> <li>•Container depot (load, unload, repair, inspect, clean)</li> <li>•Roll-on/Roll-off infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>•Customs clearance</li> <li>•Palletizing</li> <li>•Hazardous materials services</li> <li>•Veterinary authorities</li> <li>•Weights and Measures</li> <li>•Insurance &amp; Legal</li> <li>•Performance analysis</li> <li>•Sampling</li> <li>•Trainer rental</li> <li>•Filling Station</li> <li>•Repair facilities</li> <li>•Residential development</li> <li>•Hospital/Bank/Restaurant/Hotel</li> <li>•Conference centre</li> <li>•Barcoding</li> <li>•Labelling</li> <li>•24-hour accessibility</li> </ul>

## 2.4 Main characteristics/features of Logistics Centres

Except for the differentiation of logistics centres from all kinds of warehouses, distribution and intermodal centres, the following section has as main purpose to present the most common features and characteristics of logistics centres. Additionally, the agglomeration of these features can be used as a supplementary extension of logistics centre definition and it could determine sufficiently the conceptual framework of logistics centre for this research:

- *Transport quality*

The increased quality of transport services cannot only be recognized as one of the most important and distinctive element of logistics centres but also as the main challenge in order to be significantly competitive against their risky globalized environment. Furthermore, the execution of accumulated activities generates benefits for the operators and companies of logistics centres such as the optimized utilization of warehouse and available human resources, alliances, economies of scale and scope, operational benefits of resource sharing like modes and terminals, joint ownerships etc.

- *Territorial planning/infrastructure rationalization*

All European logistics centre is located in a specific and demarcated area within all the activities relating to transport, logistics and distribution of goods are carried out by various companies. As a result, the exclusive usage of an area for specific operations improves the “territory planning and infrastructure rationalization”, the optimized exploitation of this area and the protection of environment (NeLoC- Best Practice Handbook, 2004). Moreover, the size of logistics centres can be fluctuated between 100-1200 acres (50-800 hectares) depending on their operations and functions. More specifically the Italian and UK logistics centres are larger in size, ranging from 59 to 3212 acres and from 220 to 498 acres respectively. Also, Spanish logistics centres seems to be the smaller ones with an average size of 133 acres but with some isolated cases such as Plataforma Logistica de Zaragoza or PLAZA (3290 acres) which is the largest logistics facility in Europe.

- *Handling freight*

There is a wide range of equipment and facilities for freight handling like loading ramps, transport and right-angle roller decks, stacker cranes, elevating transfer vehicles (ETVs), turntables, and drive-on conveyors transfer vehicles (TVs), etc. Most logistics centres promote usually all of the above necessary equipment with a high level of automated supporting services.

- *Intermodal Infrastructure/Modal shift/Multimodal access*

The main task of logistics centres is the promotion and enhancement of intermodality, as a combination of different transport modes, through the provision of the appropriate infrastructure in order to offer a more multi-dimensioned transfer of goods (short-sea-shipping/rail/road). Increasing the available transport options, “intermodality” facilitates decision makers(shippers, freight forwarders, suppliers, etc.) to choose the most profitable combination of different transport modes in order to enhance the quality of logistics services with a simultaneous increasing potential for lower logistics-transport costs (Cambra-Fierro & Rocio Ruiz-Benitez,2009). Furthermore, all European logistics centres offer synergic solutions of different transport modes (multimodal) and this is why they are strategically located in hub points and in strategic geographical nodes. Apparently, it is clear

that one of the main factors which differentiate logistics centres from the other kinds of transport and distribution centres (Warehouses, Inland Ports, Distribution Centre, etc.) is the promotion of not only multimodal solutions, but also of intermodal transport options by providing dedicated facilities which make easier the transfer of goods between different modes. Last but not least, intermodality is a service which can be succeeded through the coordination and integration of transport modes and supply chain's operators. As a result, logistics centres are the most suitable areas in order to develop an intermodal framework that will be provided to all operators of the supply chain (Cambra-Fierro & Rocio Ruiz-Benitez, 2009).

- *Openness*

The required absence of any commercial barriers generates unique opportunities for both private and public companies to locate and exploit effectively the facilities of logistics centres (NeLoC- Best Practice Handbook, 2004).

- *Handling information technology systems*

Concerning to the improvement of cooperation that can be succeeded in logistics centres, their operators can take advantage from the advanced IT infrastructure and solutions which usually are considered as crucial and exorbitant barriers for an individual company. One of the most imperative factors for an effective handling of goods is the adoption and settlement of well-structured information and communication technology (ICT) systems. Various kinds of upgraded systems can be used in order to improve the level of synchronization and to reduce opacity in transactions between the companies involved. For instance, the technologies of track-and-tracing, EDI systems, RFID<sup>5</sup> and barcode can contribute significantly to a better exploitation of existing capacities and to enhance the level of internal logistics network between tenants and operators of logistics centres (Herwig Winkler, 2011).

- *Free Trade Zone / Foreign Trade Zone (FTZ)*

In order to be adapted and participate efficiently on the conditions and requirements of international trade, the majority of developed logistics centres have already incorporated the well-known "Free Trade Zones" (FTZs). Initially, this differentiated kind of "customs district" contributes to the elimination of potential impediments in international trade. Secondly, this initiative generates all appropriate conditions for logistics centres in order to act as international multimodal hubs (Rodrigue et al, 2010).

## 2.5 Advantages of Logistics Centres

- *Multifunctional*

The agglomeration of differentiated firms such as stevedores, freight forwarders, agents, custom brokers and authorities in the same logistics centre with interconnected relationships and interdependencies (both vertical and horizontal integration/synergies) reveals the multi-functionality

---

<sup>5</sup> Radio-frequency identification (RFID) is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags also introduces electronically stored information and some of them offer more upgraded services due to the fact that they can be powered and read at short ranges via magnetic fields.

of these centres. A so intersectional character contributes to highest levels of productivity and profitability for the whole system. Thanks to the synergy effect, the financial situation of logistics centres is very difficult to be jeopardized because if there are so many differentiated firms, the possibility for their simultaneous economic recession decreases (NeLoC<sup>6</sup>- Best Practice Handbook, 2004).

- Clustering

As one of the major reasons for the establishment of a logistics centre can be characterized the creation and development of synergies between manufacturing, industrial, and logistics firms in order to enhance the effectiveness and sustainability of freight and logistics processes. Similarly, Porter (2000) supported that “A system of interconnected firms and institutions whose whole performance is more than the sum of its parts”.

- Specialized advanced education

One of the most important challenges for each logistics centre is the development of dedicated education facilities or research laboratories around them. However, only few logistics centres have exploited appropriately the chance to cooperate with global specialized institutes of excellence and eventually to generate multiple educational initiatives and research projects. Moreover, some of the most distinctive European examples are: “Dutch Institute for Advanced Logistics” (Dinalog) in Netherlands, “Zaragoza Logistics Centre” (ZLC) in Plataforma Logistica Zaragoza as a collaboration between University of Zaragoza, Aragón Technology Institute (ITA) and Massachusetts Institute of Technology (MIT) and the Master program in Logistics Integration - Supply Chain Management (known as LogiMaster) at the University of Verona.

- Flexibility

Logistics centres enable companies to maintain higher flexibility due to the value added operations that can be performed within these centres. Being the most vital part of logistics centres, companies increase the possibilities to cope effectively either with the continuously volatile trend of market demand or the 21<sup>st</sup> century’s challenge of “mass-customization”. These generated opportunities rely on the flexible logistics solutions which can be offered particularly by logistics centres such as the “last-minute” modification, configuration or customization of products (NeLoC- Best Practice Handbook, 2004). In other words, logistics centres displace “customer order decoupling point”<sup>7</sup> which is moving backwards. As particularly distinctive can be characterized the example of “Nikon” which exploits effectively UPS Supply Chain Solutions in order to customize properly (the manuals, plugs, cables, chargers) its products according to customers’ latest requirements. Apparently, “Nikon” has not only the opportunity to distribute in time its photographic equipment but also to perform the last necessary configurations in order to fulfill its retailers’ needs (Yossi Sheffi, 2012).

---

<sup>6</sup> Networking Logistics Centres in the Baltic Sea Region (NeLoC):“NeLoC” provide a networking forum for existing and planned logistics centres in the Baltic Sea Region and it has enabled the exchange of experiences in planning and operating logistics centres. The project promoted the role of logistics centres in regional development as well as national and international logistics chains with emphasis laid on intermodal solutions.

<sup>7</sup> Customer order decoupling point is the point on which there is the segregation of individual customer order’s production from production to stock.

- Cost sharing

Storage, IT facilities, knowledge and initiatives can be used by all centre's firms. This particular initiative can operate as a useful convenience especially for smaller and medium enterprises (SMEs). Taking advantage from shared knowledge and joint investments, all operators of logistics centres acknowledge the importance of cost sharing, especially for the investments and initiatives which cannot be implemented individually.

- Reverse Logistics

One of the biggest challenges for supply chain operators is to increase the profitability of returned products and materials at minimum cost. According to some recent surveys, a percentage of 4% to 6% of all retail purchases are returned, costing approximately \$40 billion per year and only 5% of products have an actual defect. On the one hand, these results demonstrate that buyer's remorse is usually the main reason of returned products and on the other hand it is more than obvious that logistics centres can play a vital role in order to facilitate the procedure of products' eventual return. The Figure 2.2 has been generated in order to illustrate better the whole process of reverse logistics and its internal operations:

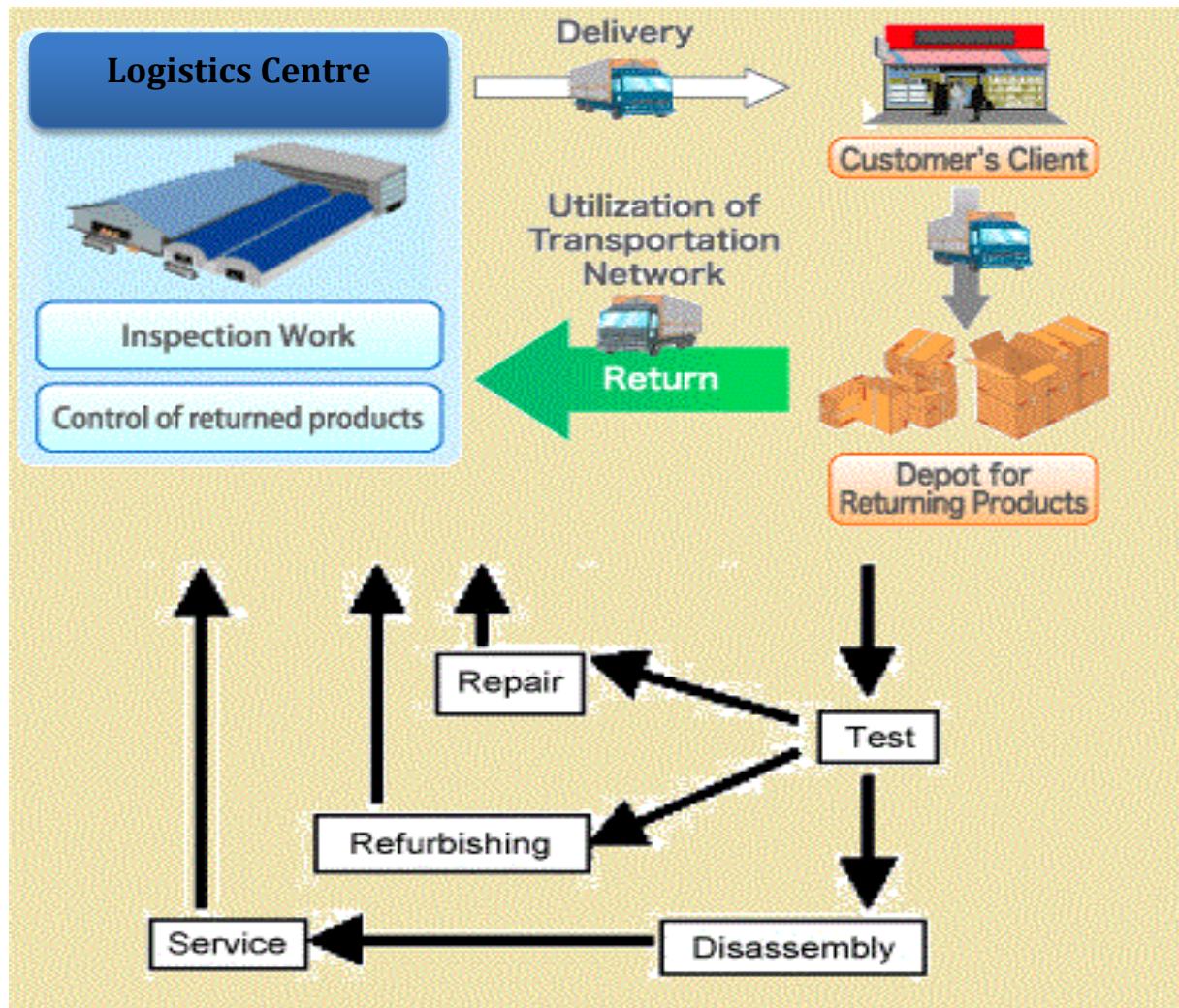


Figure 2.2: Reverse Logistics Procedure

Source: Based on Otsuka Warehouse Co., Ltd

According to Sheffi (2012), logistics centres perform various and useful activities behalf of manufacturers such as repairing, relabeling and refurbishing returned merchandise. For instance, Neptune Lines is a quite vicarious case because this specific company is a forwarder which is specialized in refurbishing secondhand pieces of heavy equipment for its main customers, Caterpillar and Komatsu. Implementing all of the necessary reverse logistics activities, logistics centres seems to be strongly relevant with this field of supply chain which is also proved by the fact that an average percentage of 12% to 15% of 3PL's profits are generated by reverse logistics. Finally, the general benefits of logistics centres' contribution in this field becomes more comprehensive if we realize that 0.5% of World's total GDP is spent on reverse logistics.

Apparently, different logistics centres at different locations and with different missions may offer a differentiated range of functional operations. Seeking competitiveness and the satisfaction of customers, the management of logistics centres has to generate a consistent framework or a geographical, economic and political context. This strategy will turn each logistics centre into an effective network for multimodal transport services in order to deal with international traffic and goods flow (Kristina Rimienè et al, 2007).

- Joint Marketing

As the major operators of logistics centres, all companies develop joint marketing services and, as a result, smaller and medium firms would take the biggest advantages from this kind of situations (NeLoC- Best Practice Handbook, 2004).

## 2.6 General attributes of logistics centres

According to the features of logistics centres that mentioned above, we can also conclude to some general observations for this kind of transport and logistics hubs:

- No one model /Neutral organizational structure

Logistics centres/freight villages don't have any specific and well organized model of development. Some of them have been constructed from the beginning in order to play the role of "Logistics Centre" or "Freight Village". On the other hand, there are also some other cases of current logistics centres that have been developed gradually the last decades. Furthermore, the majority of these latter cases have usually adopted and followed the path of evolution from their initial scope as "Warehouses" or "Distribution Centres".

- Importance of public-private support

Generally speaking, it has been proved that private logistics centres have been developed and adapted more appropriately on their environment's risks and difficulties. But the importance of public sector's contribution either as indirect assistant or as a regional supporter cannot be neglected. The engagement of public sector at the functional management of logistics centre can be justified by the vital role that this centre can play to the territorial and economic development of the region. Irrespective of the finally chosen organizational structure, cooperative relationships between public and private stakeholders seem to be essential for the efficiency and economic success of logistics centres (Boile et al., 2008). On the one hand, this argument could be easily supported by the fact that public sector can adopt essential policies for the enhancement of logistics centres'

competitive advantage, such as land discounts, tax incentive, road tolls, infrastructure development, etc.

On the one hand, the management of logistics centres is usually influenced, either directly or indirectly, by the decisions and strategies of regional/local policymakers (Ministries of Transport, Europlatforms E.E.I.G., Municipalities, etc.). However, public authorities usually lack economic and management experience which is necessary for the effective administration of logistics centers. On the other hand, private sector cannot easily succeed to the development of these projects (freight villages and logistics centres) if there is not any public support, and especially for the anticipation of additional and functional costs. Consequently, a partnership between public and private actors will be support financially and managerially the development and the efficient functionality of logistics centres.

Having presented all distinctive features and functions, this section contributes significantly to the whole understanding and comprehension of logistics centre's concept. According to the definition of logistics centre which was proposed by the author of this research, the second chapter is coming to the conclusion that the term of "Logistics Centres" can be considered as equal to this one of "Freight village". Eventually, it means that both of these terms will be used for serving the same purpose or meaning at the following chapters of this survey.

## CHAPTER 3

### Frame of Reference & Choice of Theories

Beyond the widely accepted impact of transport and logistics sector and especially of logistics centres in national economies, it would be more essential to wade into the contribution of these centres on economic development of regions. Thus, the main purpose of this chapter is to present briefly the background and publications related to the subject of this research which refers to the potential regional economic impact of logistics centres.

#### 3.1 The initiator of thesis statement

Operating as the main motivator of this research, the economic impact technique which was implemented initially by Zaragoza Logistics Center (ZLC) had as main purpose to investigate the contribution of this logistics center to the whole regional economic growth. Despite the fact that this methodology has only been used and applied for port-oriented researches, the operators of this research adopted similar techniques and the diversification of companies' impacts was approximately the same. Concerning to this diversification, there are three different categories of direct, indirect and induced impacts of Zaragoza Logistics Platform (PLAZA) to the Autonomous Region of Aragón. More specifically, the first one comprises of all indispensable activities for the safe operation of platform and the other two ones mention to the regional impacts of businesses whose sustainability relies on the operation and performance of logistics center. Additionally, it is more than obvious that our main thesis topic represents a lot of similarities with the major aim of PLAZA's research which was: "How important is the development of a logistics center for the economic performance of a region, like Aragón, whose geographic location does not permit a logistics infrastructure like a port" (Plataforma Logistica Zaragoza, 2010).

Being similarly inspired by PLAZA's concept and its economic success, Yossi Sheffi (2012) supports that logistics centres has a brighter and long-term future as economic drivers of regions in comparison with other industrial centres and clusters. Beside the vital contribution of logistics centres to the improvement of global trade flows and international supply chains, their establishment has been increasingly funded and supported by regional and national governments aiming to the economic revitalization and development. Furthermore, another interesting element of logistics centres is their general independency of other clusters and industries combined with the fact that a great amount of businesses in multiple industries based economically on logistics centres and sometimes they are located around them. For instance, the extensive and high quality logistics resources of PLAZA have attracted a lot of automotive companies and as a result a well-organized automotive cluster was developed, known as CAAR<sup>8</sup>. The international case of Singapore's logistics center, which have attracted an aerospace maintenance repair and overhaul cluster around of its area, confirms also that this kind of centres influences positively the investment attractiveness of regions.

---

<sup>8</sup> The Aragon Automotive Cluster —CAAR— is an Innovative Business Consortium (I.B.C.) whose main objective is to increase the degree of competitiveness among the companies through the promotion of co-operation, project development and joint ventures.

As an active member of Zaragoza Logistics Center (ZLC), Yossi Sheffi (2010) underlines that logistics centres have a unique ability to create multiple kinds of employment in contrast to the generated employment of other knowledge-based clusters like Silicon Valley and Wall Street. On the other hand, the contribution of logistics centres to the regional employment has been criticized because of the general perception that logistics jobs include only low-skill activities like “moving boxes” and driving trucks which also implies that these activities can mainly be implemented by low-leveled educated and less trained workers. To counter this argument, the following table represents the whole spectrum of jobs that are usually involved in European logistics centres:

**Table 3.1: Advanced Operations and Jobs in Logistics Centres**

TYPE OF JOBS	MAIN ACTIVITIES	DISTINCTIVE EXAMPLES
<b>Part-time</b>	<ul style="list-style-type: none"> <li>– Sorting or hand-picking</li> <li>– Transporting boxes</li> <li>– Driving trucks</li> <li>– Repacking</li> <li>– Repair activities</li> <li>– Relabeling</li> <li>– Assembling &amp; Consolidation of cargo</li> </ul>	In UPS <sup>9</sup> , a percentage of about 50% of its personnel is working in this type of job. Many of these part-time jobs in UPS are both internships or graduate programs and part-time projects or temporary positions which are usually filled by students.
<b>Professional</b>	<p>Various operations of machinery such as:</p> <ul style="list-style-type: none"> <li>– forklifts</li> <li>– cranes</li> <li>– trucks, trains and airplanes</li> <li>– advanced innovative equipment</li> </ul>	Robotics equipment and state-of-the-art fiber optic and energy supply facilities in Plataforma Logistics Zaragoza (PLAZA)
<b>Information Technology</b>	<p>Advanced IT services :</p> <ul style="list-style-type: none"> <li>– Remote and real-time control of materials and finished products</li> <li>– Quality control</li> <li>– Specialized supply chain software applications</li> </ul>	Concerning to transport and logistics companies, the annual expenditures and costs for the acquisition of information technology equipment are often three or four times higher than the corresponding ones for buying trucks.
<b>Executive</b>	<p>Managerial and executive jobs associate with logistics operations such as:</p> <ul style="list-style-type: none"> <li>– shippers consulting &amp; planning,</li> <li>– supply chain management</li> </ul>	As subsidiary, UPS Supply Chain Solutions offers additional supply chain services including visibility, tracking, tracing, trade compliance, network design

Source: Based on Yossi Sheffi (2010). *Logistics-Intensive Clusters: Global Competitiveness and Regional Growth*

As supplementary of the above table, Yossi Sheffi (2012) acknowledges that job creation is the most important political incentive to establish a new logistics center because “logistics centres create jobs that are difficult to move offshore and lead to economic growth in multiple sectors”. Generating a wide range of blue collar, white-collar and no-collar jobs, the establishment of logistics centres can

<sup>9</sup> UPS (United Parcel Service) is a post & mailing company headquartered in Atlanta. As the third largest employer in the US with over 400,000 employees, UPS offer well-advanced and global logistics and transport services and it operates on a system hub, known also as Hub & Spoke distribution System

be easily characterized as one of the most applicable and effective policies for job creation whereas the majority of other industrial clusters influences only the employment rates of highly skilled engineers and scientists (Yossi Sheffi, 2012). For instance, Interporto Bologna was reliable for about 8.6% of direct employment in the transportation and logistics sector in 2005 for the region of Bologna and the three different logistics centres in the Berlin-Brandenburg region of Germany, in turn, accommodate 85 firms and have generated approximately 4,800 jobs (Hesse, 2004). Apart from the role of logistics centres as employment generators, they can attract growth-oriented companies and increase significantly the levels of foreign trade in order to improve the regional competitive advantage in global supply chains.

In addition to our main thesis statement, this research attempts to prove how important is for regional and local policymakers to acknowledge the impact of logistics centres to the economic performance of their regions. It was a recent collaborated research between the University of Southern Mississippi and University of Memphis (2012) that motivates this additional objective of our research. According to the authors of the above research project (Chad Miller et al. & Martin Lipinski, 2012), regional governments are seeking to attract logistics centres in order to foster economic development, local entrepreneurship and the rates of employment. Concerning to the policies that could be adopted and implemented by regions, Michael Porter (2003) defined clearly the importance of these policies as he concerned that “The prosperity of a region depends on the productivity of all its industries” and “The most important sources of prosperity are created, not inherited”. To conclude public sector can play an essential role in developing logistics centres in order to ensure the investment return, to reverse potential economic recessions and to achieve better employment outcomes for regions.

### **3.2 Major Findings**

One of the first efforts for the investigation of this topic belongs to Fechner (2010) who, initially, tried to distinguish logistics centres into local, regional, national and international level depending on their influence at the economic growth of regions. According to his research about logistics centres as transport nodes in Poland (Fechner, 2010), he concluded that these centres can influence positively and variously the economic development of regions and metropolitan areas. Following the steps of Weisbrod et al. (2002, p. 4-5) who defined logistics centre as “a cluster of quality industrial-intermodal-distribution-logistics buildings located within a secure perimeter where a range of support services are provided and synergistic relationships among companies are developed”, Ireneusz Fechner (2010) argued that this kind of centres increase the level of production, trade and services which in turn enhances the investment attractiveness of regions. Furthermore, he supported profoundly that the social and economic impact of logistics centres is often confirmed through the increased regional funds from taxes paid by newly established companies and also by the generation of new available job positions as well as the general enhancement of local economy and regional freight transportation infrastructure (Fechner, 2010).

Referring to a more national approach of logistics centres’ economic impacts, Kabashkin (2012) didn’t differentiate considerably from the previous researchers. Concretely, he supported that policymakers have to implement the appropriate logistics strategies in order to enhance the level of local entrepreneurship, to promote regional inter-modality patterns and to position their regions

strategically among the overall international transport and logistics networks. Beside the simple implementation of these logistics and transport strategies, the most necessary step is the acknowledgement of logistics centres' contribution either to the whole national and regional economic performance or to the competitive transport services, in comparison to other neighbor regions or countries (Kabashkin, 2012). Furthermore, Kabashkin (2012) supported that a modern logistic centre can be characterized as an important transport node in a learning region and also he cannot comprehend why there is not the same perception about the contribution of logistics centers as regional economic assets. Despite the fact that an attractive and competitive port can often be considered as a regional or national economic asset, this is not usually the case for a corresponding successful logistics center.

As the main authors of FAL Bulletin (ECLAC<sup>10</sup>, 2009), Erick Leal and Gabriel Pérez Salas identified all contingent dimensions of logistics centres/freight villages. Beside the functional dimension, they also analyzed and focused on various other dimensions of these infrastructures such as industrial, financial, geographic-economic and economic-commercial one. The last two broad dimensions seem to include the main topic of our research and generally the regional economic impact of logistics centres. Continuing the overview of ECLAC's research, the absence of well-organized and intermodal transport and logistics infrastructure usually impedes the future economic growth of regions and reduces the possibilities to attract further commercial and business activities. This model has been observed in various regions, especially in those which based on exports, because the low-leveled provision of agglomerated logistics and transport activities operated as an obstacle for the future development of regional economies (Erick Leal & Gabriel Pérez Salas, 2009).

Taking into consideration the two different conceptualizations of logistics centres as intermodal transport infrastructure and as promoters of business and economic activity, the latter has been presented by Meidutė (2005) as equally important and essential with the former. According to her literature review of various Asian (Japan, Singapore, China), American and European cases, the role of logistics centres as intermodal transport nodes could be more feasible to be characterized as a supplementary role of the second one of economic/business generator, and vice versa (Meidutė, 2005). In the same way of thinking, Wagner (2010) supported that job and value creation usually have high political significance as the main incentives for the development of logistics centres and, generally, as facilities for logistics-related land use. The combination of intermodal transportation and value added services almost ensures and increase the possibility for logistics centres to act as economic initiators of regions (Wagner, 2010).

Similarly remarkable is the reference of Higgins & Ferguson (2011) who determine that sustainability of freight transport, urban development, employment and economic growth are the main objectives for the establishment of first European logistic centres/freight villages of Roissy-SOGARIS (France),

---

<sup>10</sup> The Economic Commission for Latin America (ECLA) -the Spanish acronym is CEPAL- was established by Economic and Social Council resolution of 25 February 1948. ECLAC, which is headquartered in Santiago, Chile, is one of the five regional commissions of the United Nations. Moreover, it was founded with the purpose of contributing to the economic development of Latin America, coordinating actions directed towards this end, and reinforcing economic ties among countries and with other nations of the world.

Interporto Bologna (Italy) and GVZ Bremen (Germany). Besides, there have been a great amount of other European logistics centres which initially involved both the promotion of regional economic development and job creation in their main objectives. Combining references and outcomes from various researches of the last decade, the following table depicts quantitatively the generated employment and the number of accommodated firms of largest European logistics centres. It also indicates that “logistics centres should not be a field of dreams approach to job creation” (Chad Miller & Martin Lipinski, 2012).

**Table 3.2: Examples of European Logistics Centres in the literature**

Logistics Centres	Size in Acres	Number of Employees	Transport & Logistics Firms
<b>GVZ Bremen (Weisbrod et al. 2002,Boile et al, 2008, Wisetjindawat, 2010)</b>	895	8,000	150
<b>GVZ Dresden (Boile et al., 2008)</b>	61	410	4
<b>GVZ Hamburg (Boile et al., 2008)</b>	138	450	6
<b>GVZ Nuremberg (Boile et al., 2008)</b>	833	5,500	260
<b>Interporto Bologna (Boile et al, 2008, Wisetjindawat, 2010)</b>	1,055	1,500	81
<b>Interporto Padova (Boile et al., 2008)</b>	3,212	1,200	80
<b>Interporto Parma (Boile et al., 2008)</b>	618	1,300	60
<b>Interporto Rivalta Scrivia (Boile et al., 2008)</b>	556	490	40
<b>Interporto Torino (Boile et al., 2008)</b>	889	3,000	200
<b>Interporto Quadrante Europa (Boile et al., 2008)</b>	618	1,800	110
<b>Interporto Verona (Boile et al., 2008)</b>	605	1,800	110
<b>Bilkakobo-Aparcabisa (Boile et al., 2008)</b>	49	800	40
<b>Centro de Transportes de Irun (Boile et al., 2008)</b>	99	2,100	107
<b>Centro de Transportes de Madrid (Boile et al., 2008)</b>	84	8,000	150
<b>ZAL Gran Europa (Boile et al., 2008)</b>	237	>1,000	100
<b>Ciudad de Transporte de Pamplona(Boile et al,2008)</b>	150	1,000	50

Source: Based on C.D. Higgins & M.R. Ferguson (2011)

As detailed above, logistics centres create also the appropriate conditions for regions in order to be highly competitive in international trade (Thill & Lim, 2010), but it initially requires regional and national policymakers to activate and facilitate all necessary processes for the accomplishment of such risky and complicated investments(Hesse,2004). Keeping also pace with the aforementioned reference of Higgins & Ferguson (2011), D.A. Tsamboulas & I. Dimitropoulos (1999) underline that the contingent regional impact of logistics centres does not involve only environmental protection and congestion but also they can play a vital role to the enhancement of income, economic development and employment. In a more quantitative and statistical approach, the outcome of their methodological research indicated that the economic objective named as “promotion of local and regional economic development” collected the most acceptances/votes in the category of “very” or “fairly important” macro- and socio-economic objectives. Moreover, another noticeable result of this research is the fact that the above objective was chosen by more logistics centres (39) than the second one, named as “promotion of intermodality/combined transport” (37) (D.A. Tsamboulas & I. Dimitropoulos, 1999).

Furthermore, the main objective of Chad Miller's and Martin Lipinski's (2012) research was the recognition of the factors and characteristics of logistics centres that could be influence and generate higher impacts to the regional employment. As a result, they underline that logistics centres can be demonstrated as major catalysts for regional economic growth. Concretely, the agglomeration of well-organized and advanced logistics & transport activities in a defined area can generate both essential advantages and long-term economic benefits. The creation of new job positions can be easily characterized as the most tangible of these benefits (Chad Miller & Martin Lipinski, 2012). Local governments have the opportunity to choose by a great variety of economic incentives as a means of attracting companies either private investors for the financing of logistics centres or conventional actors and operators (transport companies, logistics service providers, freight forwarders, etc.). In addition to these incentives, policymakers have not only to ensure the existence of necessary transport infrastructures for their regions but also to promote the enhancement of their quality in order to meet properly the expectations of the newly established logistics centres (Banister & Berechman, 2001). Concerning to the private investors, the most usual economic motivations are free land, tax abatements, bond financing, and grants such as tax incremental financing (TIF) support of million Euros which have been observed in various cases, especially in UK (Chad Miller and Martin Lipinski, 2012).

Without any noteworthy differentiation in her approach, Boile et al (2011) implemented an enormous methodological research in order to analyze and testify the main key objectives of logistics centres development. Having initially recognized some different objectives among international logistics centres that have been established by private and public actors, they underlined the incentives of "regional economic development" and "job creation" among the three major drivers of logistics centres establishment. Based on their quantitative results, Boile et al (2011) have determined that the size of logistics centres and the professional "maturity" of their tenants influence positively and proportionally the density of employment that can be generated by logistics centres construction. This argument has also been supported by several surveys which indicated that the density of logistics centers' employment was lower in 1992 (3 employees/acre) than in 1999 (8-9 employees/acre) at the same logistics centres in Germany. Recognizing finally the participation of regional governments as determinant factor, Boile et al (2011) point out that a special legal framework could be generally contribute on a further economic success of logistics centres' concept.

Beyond the borders of previous references, Peters et al (2008) stated that it should not be ignored the contribution of generated employment to the regional economy during the construction stage of logistics centres. Despite the temporary nature of this employment type, the research of Peters et al (2008)<sup>11</sup> concluded that "the investment multiplier on the local economy is about three times the size of the investment", which practically means that if the establishment of a logistics centre costs 10 million €, the total generated economic profit for its corresponding region will be approximately 30 million €. Consequently, a regional economy has the chance to gain not only significant long-term economic benefits from the improvement of regional competitiveness through the operations of a logistics centre but it can also be directly benefited in a short-term manner from the construction of this centre.

---

<sup>11</sup> Peters, J., R. Paaswell and J. Berechman (2008) Project # C-06-28: **Economic Competitiveness Performance Measures for Transportation**. Task 2 Report: Review of Literature and Best Practices p.7

Similar to the pursuit of companies which adopt logistics and supply chain strategies in order to increase their competitive advantage, regional governments could promote various projects for the development of logistics centres enhancing their attractiveness to global carriers. Furthermore, logistics centres keep also the role of continuous suppliers and providers of their regions for various and countless types of commodities, especially for the time-critical ones (Boile et al., 2008). According to the same author, the regional indicators of labor income and tax revenue seem to be importantly influenced by both logistics centres development and the efficiency of their functions. Apparently, the construction of logistics centres creates unique opportunities especially for less geographical advantaged regions due to the fact that these centres usually contribute on freight performance improvement and enhancement of regional and other economic benefits. As Kyriazopoulos (2006) has also referred, the majority of surveys prove that there is not any quantitative difference between the work positions that are created by the added value services of logistics centres in comparison with them which are generated by the industrial production processes. Despite the wider acceptance of regional economic returns from logistics centres, there is eventually a detrimental absence of well-structured and economically feasible policies by regional and national government authorities (Kyriazopoulos, 2006).

Finally, it is imperative to refer that OECD<sup>12</sup> (2002) has acknowledged the essential contribution of logistics centres to the regional economic competitiveness and, more analytically, it has been referred that “the incorporated commercial infrastructures to the transport and intermodal hubs (Freight Villages, Logistics Centers, etc.) are the basic premises for a higher attractiveness of companies and for this reason they should be financing by the state”. To conclude, logistics centres contribute to the economic exploitation of several challenges that many regional economies face. Concerning to all aggregated theories that have been generated by a wide range of scholars, the main thesis statement can obviously be characterized as an inspired combination of those past references. Consequently, the major aim of this research is to continue and to broaden the horizons of qualitative and quantitative analysis of the regional economic impact of logistics centres.

---

<sup>12</sup> The OECD Regional Database and OECD Metropolitan Database provides a unique set of comparable statistics and indicators of about 2 000 regions in 34 countries and they could be characterized as particularly useful tools including approximately 40 different regional indicators.

## CHAPTER 4

### METHODOLOGY

After the accomplishment of literature review, the major task of this chapter is to define all necessary steps that will be followed by the statistical part of this research. Firstly, it is quite interesting to determine the economic and regional indicators which will be used in order to identify and prove statistically the quantitative relationships between the presence of a logistics centre in a region and the regional economic development. A brief presentation of data availability and statistical resources was also introduced in this section. Furthermore, the sample of the 5 European cases (logistics centres-regions) and their selection criteria will be presented as the final stage before the extent presentation of each logistics centre.

#### 4.1 Determination of Regional and Economic Indicators

Except for the general shortage of studies about the role of logistics centres as economic and business generators, the absence of standard methodologies or decision criteria is the principle shortcoming of the already implemented appraisals of these centres (D.A. Tsamboulas & I. Dimitropoulos, 1999). Aiming to operate as an intermediate and explanatory part of the main statistical analysis, this section presents the multi-criteria approach and its macro-economic and financial parameters, which will be used for the evaluation of logistic centres' economic impacts. As mentioned briefly in Chapter 1, five logistics centres have been selected in order to facilitate the qualitative and quantitative investigation of their role as regional economic generators. As far as the qualitative method is concerned, there is a summary matrix of information for each one of the selected logistics centres which depicts a general framework of their major features and characteristics. To be more specific, these developed summaries are detailed descriptions of logistics centres including various information such as: primary purpose, overall strategic mission available warehouse space, transport and logistics services, provided size of facilities, geographical location, different transportation modes and intermodal infrastructure, role and organizational contribution of public and private sector, value-added and ancillary services.

Concerning to the methodology of quantitative analysis, a careful consideration and a determination of regional economic indicators matching more appropriately at this survey, have to be done. Their vital role can be easily explained by the fact that they have chosen carefully by a wide range of economic and financial indicators in order to represent not only the regional economies but also the regional economic wealth contributed by logistics centres. Apparently, the selection of these measurements has been done in order to succeed two different aims; the first one is to determine which regional and economic indicators will be finally used for the creation of the necessary graphs and charts which compose the main part of quantitative analysis. Secondly, it facilitates a further classification of indicators in two different categories in order to generate a more conceivable separation between the indicators which are strongly related to the transport and logistics sector of region and these ones which depict the regional economic performance.

#### 4.1.1 Economic Variables of Regions

- *Regional Unemployment rate (%)*
- *Regional GDP (Gross Domestic Product) Per Capita*

Generally speaking, the unemployment rate and GDP could be characterized as the most distinctive measurements for the economic performance of regions and nations. In that research, both of these indicators will be presented in comparison with the corresponding national ones. This differentiated approach has been adopted in order to reduce significantly any potential influences of the general national economic development and recession. For instance, the unemployment rate of Spain and Italy has been increased the last decade due to the fact that these two European countries have dealt with severe and problematic economic situations. As a result, it is not possible for the Spanish and Italian regions to have not been influenced by this economic crisis. Consequently, when analyzing the regional GDP and the unemployment rate of the last 10 years it is imperative to be more careful with the interpretation of results. To conclude, the comparison of these regional measurements with the corresponding national ones aims to increase the reliability of statistical findings.

- *Business Investment Rate (BIR)*

As an indicator of regional investment, BIR illustrates the general attractiveness of domestic and foreign direct investments for each region of our sample. Also, it includes all investments that have been made from 2000 to 2011 either by newly-established companies or by the already existing ones in order to improve their economic performance. Finally, it is measured in thousands of euros (€) per employee.

- *Total Number of Patents by priority year -*
- *Number of Patents in Transportation and Logistics sector of Metropolitan Regions*

Either the cooperation between transport and logistics operators located at a specific area or generally the rapidly diffusing knowledge, among them, can influence significantly the level of regional innovation. Being recognized as the most appropriate indicator for the measurement of innovation, the number of patents has been used in order to illustrate the inventive performance of selected regions. Due to the fact that the indicators of annual transportation volumes and regional workforce can represent the regional image of transport and logistics sector, the measurement "Number of patents" was adopted in order to reveal the performance level of this sector at each specific region.

#### 4.1.2 Economic Variables related to Logistics Centres

- *Annual road freight transport by region of loading/unloading*

Most freight cargoes are transported by truck either in developing or developed European countries. In order to improve the utility of this indicator, it will be illustrated both in millions of ton-kilometres transported and in thousands of transported tons.

- *Annual national and international railway goods transport by region of loading/unloading*

It examines how the settlement or the presence of a logistics centre could influence the usage rate of railway transportation of goods and consequently the general modal split of region for the freight transportation. In addition, this indicator presents the regional imports and exports of railway transported goods either from the same country's regions or from other European ones. It is also measured in tons.

- *Air transport of freight in thousands of tons*

This measurement depicts the total loaded and unloaded goods of regions by the transportation mode of aircraft. Not only the European, but generally the world's air cargo delivery system introduces two forms of air-cargo transport, known as "belly-cargo" and "freighters of all cargo aircraft", which also utilize different air networks. Concerning to the first form, passengers are carried above and cargo is carried below in the belly of the aircraft in contrast to the second one as it refers to the aircrafts which are dedicated only to the cargo freight transport. Last but not least, this indicator has not been calculated and investigated for only one logistics centre of sample due to its lack of data for air freight transport.

- *Maritime transport of freight in thousands of tons*

As the last regional transport indicator, maritime transport of freight introduce both the deep-sea and inland transportation of goods. The presence or the establishment of a new logistics centre cannot only enhance the competitive advantage of each region but also to improve its role as an effective and attractive hinterland for a wide range of transport and logistics companies. Apparently, this indicator has been adopted only for one out of five cases (Bremen) because the rest 4 selected regions are land-locked without direct connection to any sea or navigable rivers on their territories. As a result, maritime and inland waterways transport does not apply to these specific regions.

As mentioned in the previous chapter, logistics centres can play a vital role both at the enhancement of regional imports-exports and at the expansion of regional trade volume. To infer, the adoption of those four transport indicators made because they will give good insight into the general trade volume of regions and they indicate how this volume could be influenced by the integrated services of logistics centres.

- *"Direct" and "Indirect" employment (Number of persons employed)*

In general, the number of employees is defined as the "total number of persons who work (paid or unpaid) in the observation unit, as well as persons who work outside the unit but who belong to it and are paid by it" (Eurostat regional yearbook 2012). The development of logistics center does not generate only direct employment but also it can provide additional indirect employment opportunities in the broader region, because logistics activities do not include only handling of goods, transport and storage activities. Also, logistics companies have significantly increased the range of their services provided. As a result, a logistics centre with this kind of tenants could influence not only the regional number of employees related to transport and logistics operations but also various employees from a wider range of working activities. Furthermore, the summary of employees at industries which are both directly and indirectly dependent to the logistics centres' activities could be characterized as an important component of the whole regional workforce. Concretely, "direct"

employment includes the total number of persons employed in transportation, logistics and warehousing sector and the “indirect” one contains the industries of:

- Manufacture of motor vehicles, trailers and semi-trailers
- Manufacture of other transport equipment
- Repair and installation of machinery and equipment
- Waste collection, treatment and disposal activities; materials recovery
- Wholesale and retail trade and repair of motor vehicles and motorcycles
- Wholesale trade, except of motor vehicles and motorcycles
- Retail trade, except of motor vehicles and motorcycles
- Telecommunications
- Computer programming, consultancy and related activities
- Rental and leasing activities

Both indicators of direct and indirect employment introduce various kinds of employees ranging from low paying to high-salary ones and from working proprietors to part-time and temporary workers. Despite the fact that logistics centres can enhance the total regional employment, it is more statistically correct to adopt these two sub-categories of “direct” and “indirect” employment in order to examine with higher reliability the role of logistics centres as job generators.

- *Number of local (business) units in transportation and logistics sector*
- *Number of trucks registered in NUTS-2 or NUTS-3 regions*
- *Number of local (business) units in indirect related sectors*

As one of the most meaningful statistical unit of research, the first indicator refers to the amount of transport and logistics enterprises or part of enterprises (warehouse, office, factory etc.) which are situated in a specific region. As a result, if this number has been significantly increased the last decade, it is very difficult to have not been influenced by the establishment or the presence of a logistics centre in the same region. In the same way of thinking, the number of trucks registered in regions has also been used because it is possible for logistics centres to attract more trucks, road tractors and lorries at the surrounding region due to the various and numerous clustered activities related to transport. Consequently, these two measurements represent also the investment attractiveness of region in transport and logistics sector.

According to Sheffi (2012), logistics centres serve and attract thousands of businesses in multiple industries, and especially these ones whose logistics and distribution operations influence significantly their total costs or the quality of services to their customers. In the same line with the previous indicator, the number of local units in industries which are indirectly related with transport and logistics sector seems to be similarly useful. This measurement also plays a complementary role of the first indicator because it sheds some light on how logistics centers have influenced the wider regional investment attractiveness. Finally, the indirect industries which were adopted for the indicator “number of local (business) units” are the same with these ones of the previous measurement of “indirect” employment.

- *Location Quotient (LQ)*

Arguably, both unemployment rate and direct/indirect employment could be generally characterized as accepted indicators for the investigation of logistics impact to the employment of region. Besides, Location Quotient (LQ) has been used by this research in order to calculate the employment concentration in the transport and logistics sector for each selected region. As a differentiated assessment tool, LQ illustrates the share of employment in transport and logistics sector of the total regional industries in comparison to the same share of an indicative area. There are various reference areas to be chosen but finally the total employment of EU-27 was selected, instead of the national one, because the five cases of sample are originated by 4 different European Union's countries. Consequently, it would not be applicable to compare the regional employment concentration of this sector with the corresponding national one because the scope of statistical results would be less broad and also it could not be suitable for a European approach (SoCool@EU<sup>13</sup>, 2012). The main mathematical formula of this measurement can be written as:

$$LQ = \frac{ai/a}{Ai/A}$$

Where:

*ai = Regional employment in industry i (Transportation & Logistics)*

*a = Regional employment in total (all industries)*

*Ai = Reference area employment in industry i (Transportation & Logistics)*

*A = Reference area employment in total (all industries)*

The general evaluation of this indicator focuses on the value "1.00". If the location quotient is bigger or lower than "1", it indicates that the share of employment in transport and logistics sector is above or below the average of European regions, respectively. Moreover, the four variables ( $\alpha_i$ ,  $\alpha$ ,  $A_i$ ,  $A$ ) includes only absolute employment figures without any rates or other percentage values. Concerning to the interpretation of LQ, the years of 2002, 2004 and 2010 has been chosen as the only available reference years due to the time lags and missing values of the other years (2000-2011). In addition, the selection of 2004 could be also justified by the fact that the development of two chosen logistics centres-cases was started in 2003. Apparently, regional economic impacts could be measurable and noticeable for the logistics centres of PLAZA (Plataforma Logistica de Zaragoza) and BILK (Budapest Intermodal Logistics Centre) only one year after of their establishment.

Also, an additional overview of all European regions was generated in order to depict the positive or negative change of regional location quotient through a comparison between the values of this indicator in 2004 and in 2010. This overview presents a more straight illustration of how the regional location quotient has been changed in a specific time period and as a result it gives the chance for more comprehensible and easier estimations.

---

<sup>13</sup> SoCool@EU (Sustainable Organization between Clusters of Optimized Logistics @ Europe) project has as main objective the generation of an open European platform of excellence that will be strongly related to the sectors of supply chain management and logistics in connection with multiple logistics centres and transportation hubs.

- *Wages and Salaries in Transportation and Logistics sector*

As the final economic variable related to logistics centers, the indicator of wages and salaries have been used by various surveys in order to illustrate the nature and performance of regional employment in transport and logistics sector. In the author's view, the analysis of this measurement can yield more conceivable outcomes if it introduces a comparison among the regional and national wages and salaries of the same sector. Additionally, this comparison indicates the presence of attractive transport and logistics jobs at a specific region with increased remunerations and highly-educated or experienced human resources.

In conclusion, the graphical illustration of the above 12 indicators has as major aim to confirm if there are any direct or indirect relationships between the selected logistics centres and their regions. Some of them, such as number of patents and road freight transport, are depicted at the level of metropolitan areas which means that if there are any remarkable changes of these measurements, it will be very difficult to have not been influenced by the presence or the establishment of the logistics centre in the same area. Finally, some general regional indicators which are more indirectly connected with the investigated sector of transport and logistics (GDP per capita, regional unemployment rate in comparison to the national and European one) have also been included in the qualitative-case analysis due to the fact that they could be characterized as the most representative measurements of regional economic development. In addition, it can be explained by the argument of Yossi Sheffi (2011) who supported that some performance indicators of regional economy can be used as a conventional and rough confirmation for the impact of logistics centre.

## 4.2 Data sources and availability

Initially, the information needed for the qualitative presentation and analysis of logistics centres was collected by a wide range of resources such as: official websites of logistics centres, website of the Association of Centres of Transport of Spain (ACTE), and website of the Association of German (DGG) and Italian Logistics centres (UIR). As far as the available resources of indicators are concerned, the majority of data was collected by the section of Regional Structural Business Statistics (Regional SBS) and the General Transport and Logistics figures of Eurostat as well as the official websites of Italian, German, Spanish and Hungarian national institutes of statistics. Also, "Transport and Storage" has been chosen among the other sectors of non-financial business economy, in Eurostat, as the most applicable and representative one for this research. Additionally, there were only a few responses to the e-mails which were sent at the main authorities of logistics centres or regional chambers of commerce. Despite the low response rates, the Spanish case of PLAZA (Plataforma Logistica de Zaragoza) and the Italian logistics centre of Interporto Bologna contributed significantly with their sent files to the collection of relevant databases and statistical figures.

Also, the level of data availability is not the same for all indicators. As for transport indicators, the rail data are quite insufficient (e.g. a few reporting year) in contrast to the respective road and air ones. Also, the published data of employment, GDP per capita, BIR and the main indicator of innovativeness (Number of Patents) could be characterized as quite adequate for the purposes of this research. Finally, the availability of Location Quotient is not feasible to be analyzed because it is a combination of various employment variables which in turn are considerably available. Moreover, the main geographical division level which has been adopted for the needs of this survey is the NUTS-

2 level (Nomenclature of territorial units for statistics), known as the level of sub-country provinces, and it has been determined by Eurostat for all regions of EU-27.

As mentioned above, the indicators of “Number of Patents” and “Annual Road Freight Transport” have been determined at the geographical division level of “Metropolitan Regions” because the availability of their data on NUTS-2 level is problematic. Also, the measurements of “direct” and “indirect” employment has been investigated both in NUTS-2 and NUTS-3 geographical division level in order to improve the reliability of research and to depict more clearly the influence of logistics centre as employment generator. Finally, there are available data for the indicators of GDP per capita and Number of trucks in NUTS-3 level for the cases of metropolitan regions: Bremen, Zaragoza and Budapest. As a result, the term of “region” will be the same with the geographical division level of NUTS-2 and NUTS-3 for this research, in order to be unambiguous for the reader.

### 4.3 The sample of selected logistics centres-European cases

Taking into consideration the selection criteria of sample, the final cases were mainly chosen because they introduce all supporting services and functions of a typical European logistics centre. More specifically, the provision of multimodal/intermodal services in parallel with the presence and implementation of industrial and commercial support activities within the site of logistics centres contributed importantly to the decision making of the final sample. Apparently, all selected cases promote an interface between at least three modes of transport (road/rail/air) and they also provide integrated transport and logistics services whose level of quality is above the European average. Furthermore, the wide spectrum of tenants could also be recognized as another determinant factor because the following logistics centres includes both local/regional and global transport and logistics service providers. Additionally, an equally important factor which influences considerably the choice of these five European cases is the pursuit to have as much national diversity and variety as possible in order to succeed the highest possible reliability and national representativeness.

Eventually, the sample of this research will comprise of the following European logistics centres:



Figure 3.1: European Logistics Centres

As far as the quality of transport and logistics services provided is concerned, it has to be mentioned that the cases of Interporto di Verona, GVZ Bremen and Interporto Bologna were ranked in 2010 as the three most important and well-structured intermodal nodes in Europe (DGG, 2010)<sup>14</sup>. Concerning to the other two ones (PLAZA & BILK), they were chosen not only because they are two representative examples of Spanish and Hungarian logistics centers, respectively, but they also belong to the limited number of European logistics centres which were established the last decade. Consequently, the five regions where the above logistics centers are located represent some of the most essential areas of transport and logistics activities in Europe.

Generally speaking, all European logistics centres differentiate greatly: on their management and organizational structure, in size, container volume and other physical characteristics. The five cases of this research could not be excluded by this functional specificity of logistics centres. Taking into account the different current nature of the above logistics centres relating to the great variation of their activities and services, the interpretation of statistical results and the evaluation of quantitative relations need to be treated with caution. In conclusion, the following chapter applies the aforementioned methodology and investigates, through a case-study analysis, the role of the five European logistics centres as economic developers of their regions.

---

<sup>14</sup> Deutsche GVZ-Gesellschaft mbH (DGG) supports the cooperation of German Logistics Centres/Freight Villages (GVZ) and its main aim is to transfer the positive effects which these logistics centres generate on local and regional level to the national and European level. DGG implemented the first ranking of Logistics Centres throughout Europe, in 2010, using various indicators and methods for the reliable and unbiased assessment of these centers.

## CHAPTER 5

### CASE ANALYSIS AND INTERPRETATION

The fifth chapter presents empirical study of thesis and its main objective is to analyze the selected cases studies as a whole. In addition, this section aims to identify and statistically prove all possible qualitative and quantitative relationships among the regional economic development and the establishment or the existence of a well-structured logistics centre in the same region. Initially, an overview of all EU-27 regions was generated in order to illustrate a wider image of their logistics activities and their regional workforce in transport and logistics sector. Using as major variables the indicator of location quotient and the number of transport and logistics enterprises in region, two general European overviews depicts the employment and firms concentration of all European regions in transport and logistics sector, and it finally concludes to the five selected regions of this research's sample. The qualitative presentation of those case studies and the interpretation of their statistical figures, using graphs and charts, have been set as the final parts of Chapter 5.

#### 5.1 European Overview

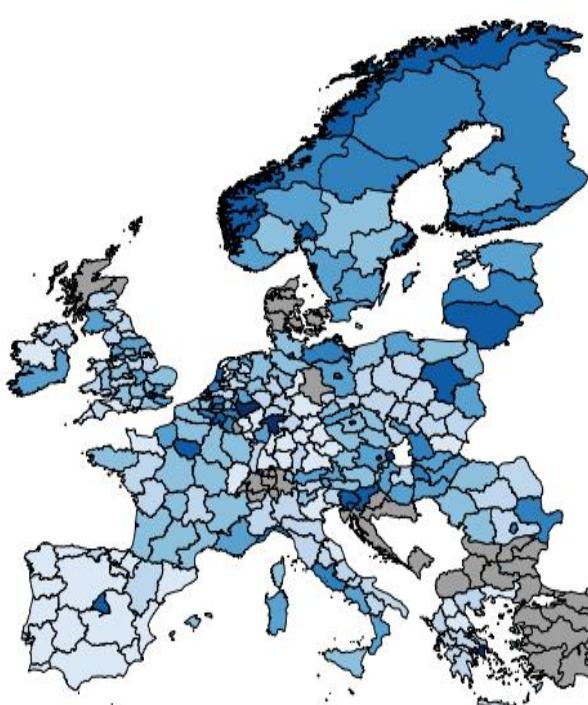
Generally speaking, Europe can be easily recognized as one of the most important leading players in the worldwide flows of transport, logistics and supply chains. Also, some regions of European Union have already been persuaded by the statement that logistics centres can attract enterprises from various sectors. The last decade, it has been observed various cooperative relationships among some European regions in order to promote the development of a logistics centre and as a result to improve the level of their local entrepreneurship. Before the presentation of the separate case studies/logistics centres, a general overview would contribute to a better understanding of the whole European level of transport and logistics sector. For this reason, the following maps have been generated and the indicators of location quotient and number of local units were selected in order to overlay the development of transport and logistics sector in European regions. Also, the two aggregated maps of Figure 5.1 led to the creation of Figure 5.2 because the remarkable and differentiated changes of employment concentration (location quotient) in European regions seem to be quite interesting and more suitable for a deeper interpretation. Additionally, the creation of these figures made using the software of QGIS<sup>15</sup>, as a quantitative data analysis tool. A more detailed presentation of this software is too far from the purpose of this research.

Concerning to the illustrated outcomes of the following figures, the regional employment concentration of transport and logistics sector (Location Quotient) was calculated according to the already mentioned methodological guidance in Chapter 4 ( $LQ = \frac{a_i/a}{A_i/A}$ ). The availability of data was quite sufficient and the selected years for the statistical analysis were eventually 2004 and 2010, as the most applicable ones. The general European results of this indicator are depicted below:

---

<sup>15</sup> Quantum GIS (QGIS) is a cross-platform, geographic information system (GIS) application which provides data viewing, editing, and analysis capabilities.

European Location Quotient in 2004



European Location Quotient in 2010

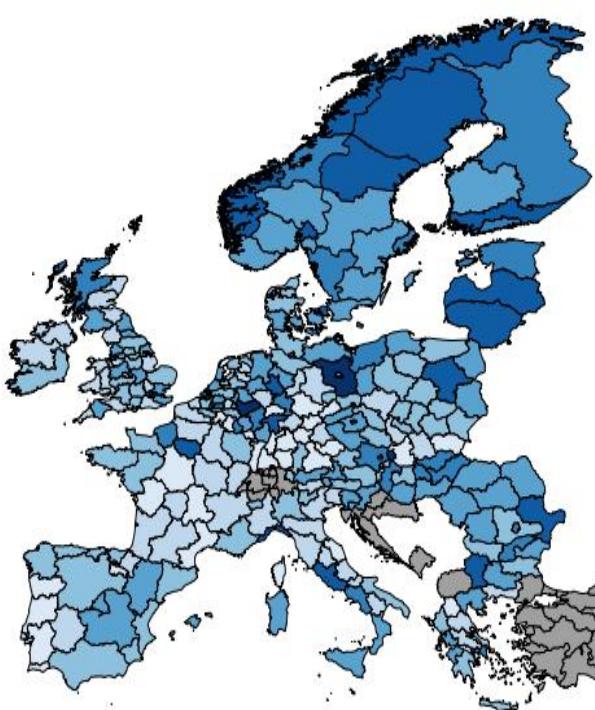


Figure 4.1: European Overview of employment concentration in transport & logistics

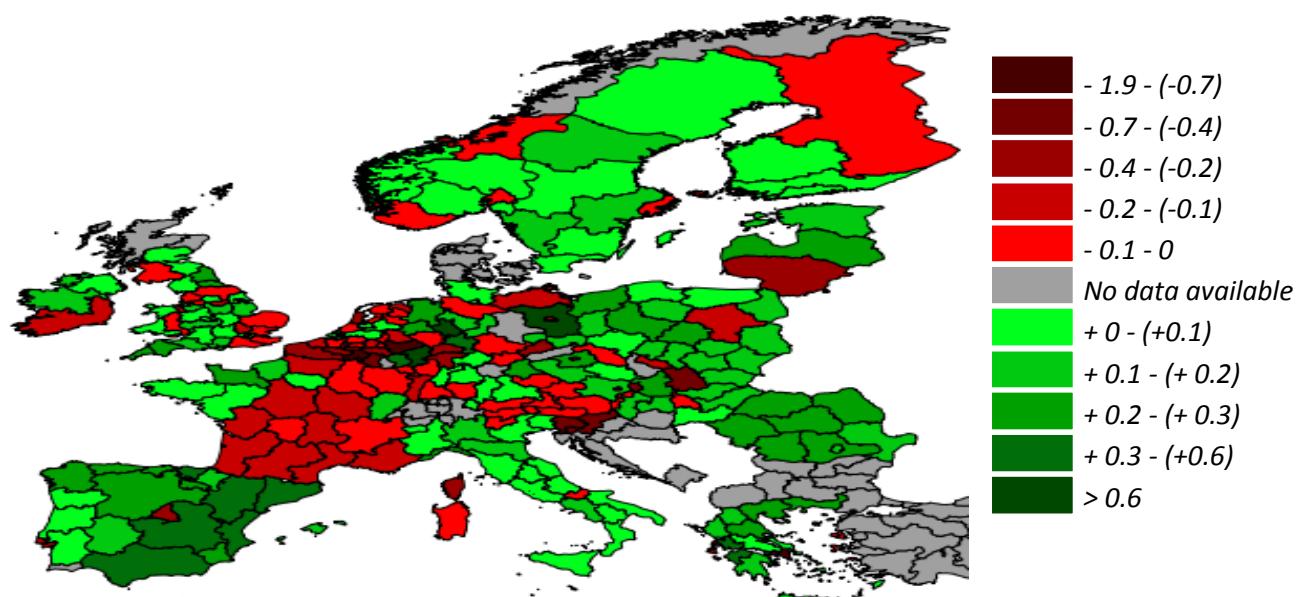
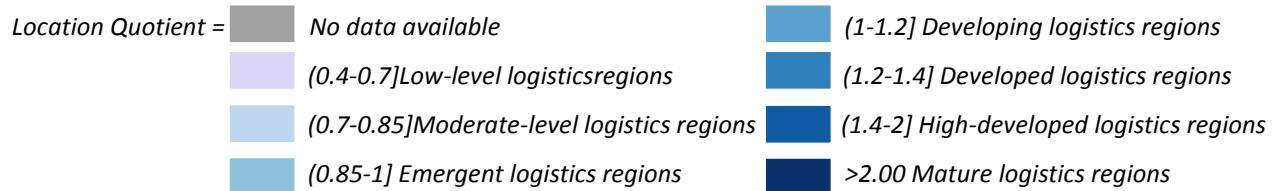


Figure 5.2: European Overview of change in employment concentration

After careful consideration, it can be confirmed a general increase of the employment concentration in transport and logistics sector for the majority of European regions. More specifically, the average European value of location quotient increased from 0.96(2004) to 1.03(2010). On the one hand, most regions in Spain, Italy, Hungary, Sweden, United Kingdom and Balkan Countries contribute significantly and positively on the total positive change of European regional employment concentration in transport and logistics sector. On the other hand, some regions of France, Belgium and other Central European countries influence negatively this change and they may be responsible for the low-leveled positive rate of the average European location quotient. Regarding the index of Figure 5.1, eight categories were generated and they were also named by author according to the level of regional logistics activities. As can be easily observed by the double map of this figure, the majority of regions (67% in 2004, 63.1% in 2010) have been concentrated to three specific categories; “Moderate”, “Emergent” and “Developing” logistics regions, which means that the employment concentration of most regions are between 0.70 and 1.20. Furthermore, the proportions of these categories have interestingly changed between 2004 and 2010. The following table verifies the initial statement that the location quotient of most European regions has been improved (from 0.96 to 1.03) because the percentage of moderate-level logistics regions and emergent logistics regions were decreased in parallel with a simultaneous increase of the percentage of developing logistics regions:

**Table 5.1: Classification of European logistics regions**

Category/Years	2004	2010
Moderate-level logistics regions	25.2%	18%
Emergent logistics regions	26.3%	20.6%
Developing logistics regions	15.5%	24.5%
Total	67%	63.1%

Continuing with the analysis of Figure 5.1, the observed high-level of location quotient in the majority of Scandinavian regions in comparison to the other European regions seems to be quite strange and not easily interpreted. In order to avoid any misunderstandings and non-reliable assumptions, the number of logistics enterprises (or parts of enterprises in transportation and logistics sector) has also been adopted as an additional indicator. As illustrated in Figure 5.3, the number of transport and logistics units for European regions in 2010 has been classified in eight categories which are the same with the explanatory index of Figure 5.2, because this second indicator was mainly used in order to verify or to supplement the outcomes of location quotient's figures. Despite these similarities, the following figure has been developed only for a specific year due to the fact that its main purpose is to present the most recent volume of logistics activities at EU-27 regions. Additionally, the shortage of available data for the period 2000-2010 combined with the pursuit of author to depict all European logistics hotspots conclude to the development of Figure 5.3 which represents the number of regional local units for the reference year of 2010.

Concerning to the number of logistics and transport companies registered as indicators of regional logistics activities, the majority of coastal European regions concentrate particularly high numbers of

enterprises. More specifically, all coastal Italian, Spanish, French, British and North Sea regions (Bremen, Hamburg, Brandenburg, Zuid-Holland, Province Antwerpen etc.) seems to have the largest numbers of logistics and transport registered firms. In addition, most land-locked capital regions (Comunidad de Madrid, Île de France, Berlin, Attiki, Mazowieckie etc.) have also been classified to the high-developed or mature logistics regions because it is quite justifiable and logical for high-level economic activities in transport and logistics sectors to be concentrated on each country's capital region.

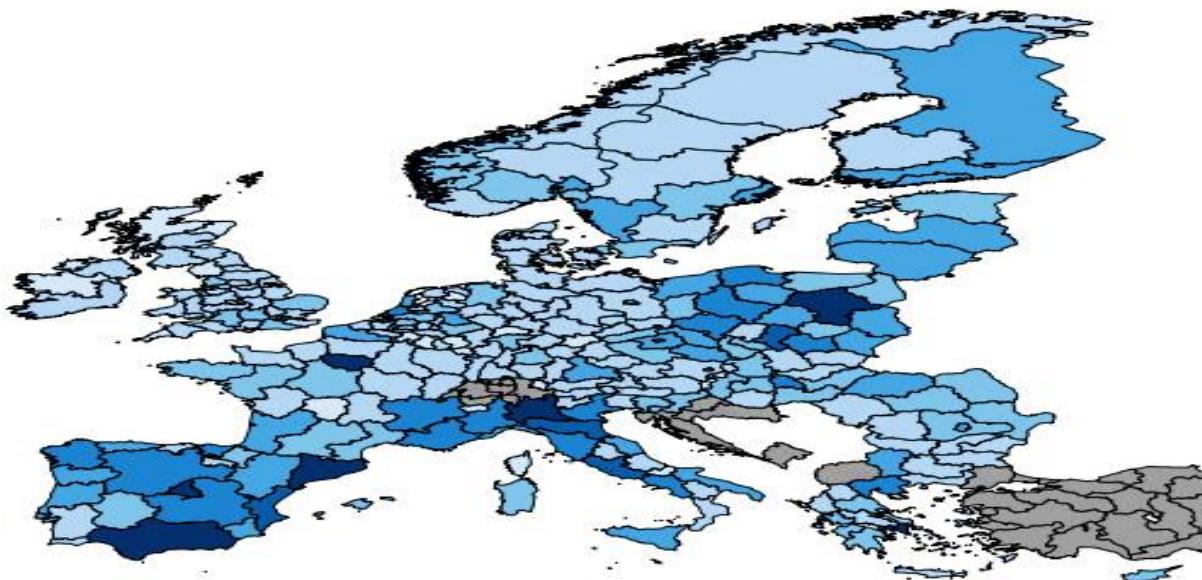


Figure 5.3: The volume of logistics in European regions



In addition to the selection criteria that were referred in the previous section of methodology, Figures 5.1, 5.2 and 5.3 contribute also on the final choice of examined cases (regions-logistics centers). Concerning to the final selected sample of this research, the regions of Aragón, Bremen, Veneto, Emilia-Romagna and Közép-Magyarország (Central Hungary) were selected. Apart for the region of Bremen, 4 out of 5 selected regions for this research are not coastal regions and this selection has not been made by accident. Concretely, it serves one sub-purpose of this research which is to recognize *“how important could be a logistics centre, which can attract more transport and logistics firms, for a land-locked region whose geographic location does not permit a logistics infrastructure like a seaport”*. As far as the number of local enterprises registered in transport and logistics sector (Figure 5.3) is concerned, Aragón belongs to the “Developing logistics regions” with 7.131 firms registered, Veneto and Közép-Magyarország to the “Developed logistics regions” with 14.832 and 13.111 companies registered respectively, as well as, Emilia-Romagna was classified to the “High Developed logistics regions” because the absolute number of transport and logistics enterprises at this region was equal to 16.047 in 2010.

Except for the above classification regards to the volume of regional logistics activities, these five regions have been chosen as the most appropriate representatives for all European regions (Figure 5.4). More specifically, Bremen represents all of these European regions for which the sector of transportation and logistics is not only well-structured and developed but it is a continuous motor of economic growth. It can be justified by the fact that Bremen's location quotient was equal to 1.68 (High-developed logistics regions) in 2002 and it was finally reached on 2.13 (Mature logistics regions) in 2010. Secondly, Közép-Magyarország (Central Hungary) seems to represent all of these regions which play a vital part to both national and European logistics networks and their logistics performance has been slightly increased or decreased during the selected period (2004-2010). Concerning to the Italian regions of sample, Emilia-Romagna and Veneto could be characterized as the representatives of those low-leveled logistics regions whose transport and storage activities have been started to be improved constantly. According to the outcome of Figure 5.2, this argument could be easily supported by the fact that the region of Emilia-Romagna succeeded to be classified from low-leveled to emergent logistics regions (thanks to a change of its location quotient for 0.12), and the employment concentration of Veneto increased the same period from 0.67 to 0.77. Last but not least, the region of Aragón represents all of these European sub-provinces which have recognized the significance of transport and logistics activities for their economic redevelopment and they adopted some well-organized strategies in order to exploit these opportunities. Finally, the first significant and positive results have already started to be detected on local employment and economic figures of Aragón after the implementation of these policies.

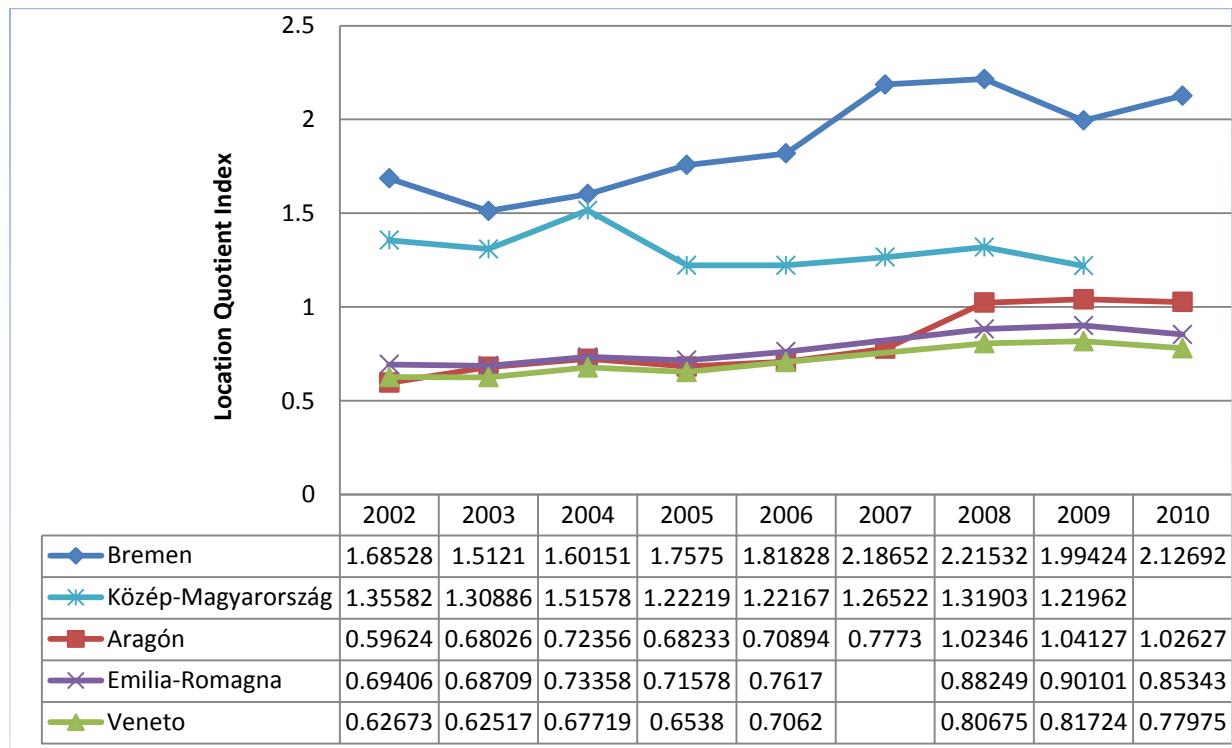


Figure 5.4: Comparison of selected logistics regions

After the accomplishment of argumentation, the following Figure 5.5 illustrates exactly and accurately the geographical locations of the five selected regions and the corresponding logistics centres which are established on these regions:



Figure 5.5: The five selected European logistics centres-regions



## 5.2 Interporto Bologna (Case 1)

### 5.2.1 General Information and Ownership Structure

Being the second established logistics centre in Europe after Roissy-SOGARIS in France, Interporto Bologna was developed as an initiative of Municipality and Province of Bologna, Chamber of Commerce and various road haulage associations. It started as Autoporto Bologna SpA in 1971 and the name of its current management company, known as Interporto Bologna SpA, was adopted in 1973 in order to reflect its new intermodal orientation. Nowadays, the same company is still the main administrator of logistics centre. More specifically, three sub-companies/departments of Interporto Bologna SpA has been developed in order to manage and promote effectively all logistics and intermodal services (GESTIONE SERVIZI SRL), to offer advanced consulting services through research and innovation projects (CONSORZIO IB INNOVATION) and also to undertake real estate planning and building of logistics centre's infrastructure (SERVIZI REAL ESTATE SRL). As a joint-company with a stock capital of 22.436.766€, the ownership structure of Interporto Bologna has the form of public-private partnership and its main shareholders are illustrated in Figure 5.6. The management board of directors consists of 4 members from the Municipality of Bologna, 2 from the Province of Bologna, and 1 each from the Chamber of Commerce, Banks, Trenitalia SpA, Industry Associations, Insurance Companies and the Association of Bolognese Road Transport (Interporto Bologna SpA, 2013). As it can be observed by the following figure, the majority of stock (52%) belongs to public authorities and the rest one to various private operators.

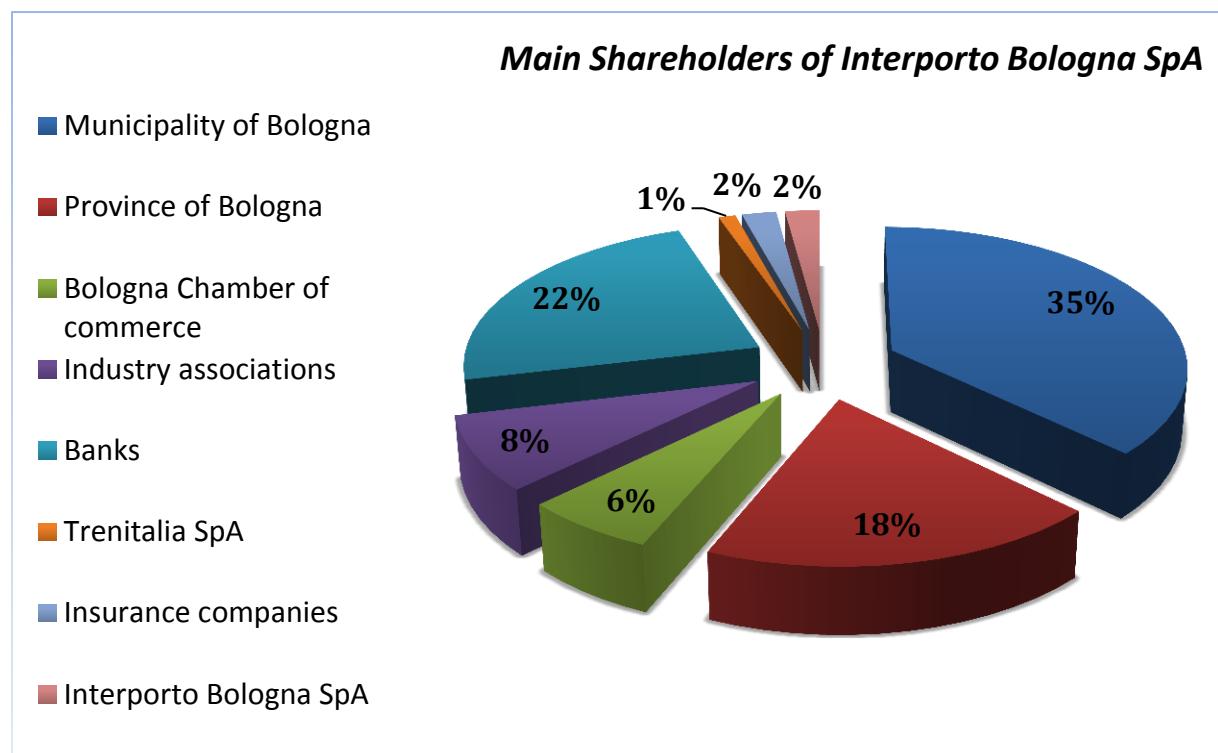


Figure 5.6: Main Shareholders of Interporto Bologna SpA

Source: [www.bo.interporto.it](http://www.bo.interporto.it)

Strongly connected with various road and railway transport connections, the location of Interporto Bologna has not been chosen by accident. Regarding the selected site, it contributes significantly to the main objectives of this logistics centre which are: the promotion of road-rail intermodality, the rationalization of urban goods distribution and the exemption of freight transport from the city's centre, the enhancement of regional economy's competitiveness and the attractiveness of national and international companies. Concerning to the geographical location of this platform, it is located in the centre of Emilia Romagna region, only twelve kilometres from the city centre of Bologna. Additionally, Interporto Bologna is directly connected to the north with Milan, Verona and Padua, to the west with La Spezia and Parma and to the south with Florence, Rome, Ancona and Bari. All of these connections have been achieved through the national rail network and they are supported by the adoption of an automatic block system, known as GSM-Railway and SCMT (ERTMS system), by Interporto Bologna. In the same line, this logistics centre is connected with: the A13 motorway Bologna-Padova through a dedicated highway toll gate, the A1 Milan-Naples motorway and the A14 Bologna-Taranto. This highway network serves approximately 75% of all goods exchanged in Italy. Interporto Bologna offers also an access to both European Ten-T corridors "Baltic-Adriatic (European Corridor 1)" and "Helsinki-Valletta (European Corridor 5)" which enhance the promotion of qualified international transport services to the major tenants of logistics centre. All these highways and railway lines of Interporto Bologna are shown in Figure 5.7.

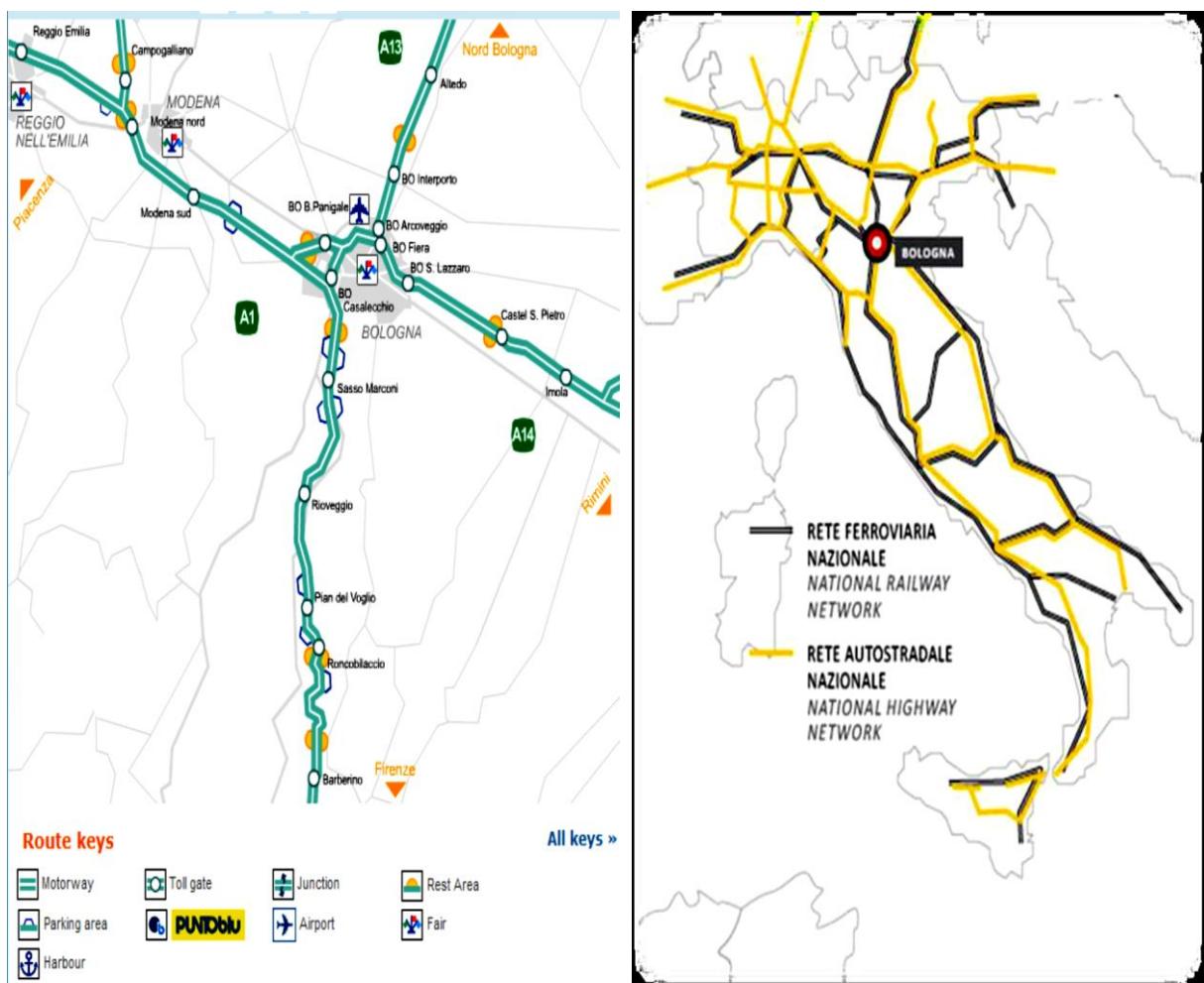


Figure 5.7: Road and Rail Network of Interporto Bologna  
Source: Interporto Bologna SpA, 2013

## 5.2.2 Facilities and Services Provided

Interporto Bologna covers a total fenced area of 4.194.000 m<sup>2</sup> which can be divided with multiple criteria either in some infrastructures according to their functions or in 4 logistics areas according to their different tenants. In addition, the logistics centre of Bologna can be characterized as one of the most integrated logistics platforms in the European-Mediterranean area, due to the disposal of high-quality services provided to its companies-tenants such as: customs, handling and storage services, logistics and railway services, refueling station and maintenance workshop for locomotives and railcars, multimodal and commercial support activities (banks, restaurants, etc.), repairing and maintenance/inspection of containers, 2 access gates equipped with ICT control system INTERPASS (the second one is open since end of 2012), centralized 24-hour security system with 45 cameras and 9 lanes with 20 cameras, deposit for hazard goods, post office, 2 lines of local public transport, areas for parking and loading/unloading operations, totally wired area of 13 km optic fiber etc. The whole layout of Interporto Bologna and its main services has been illustrated in Figure 5.8:



Figure 5.8: Layout of Interporto Bologna

### 5.2.3 Major actors and commodities handled

Concerning to the companies located in Interporto Bologna, their number has significantly changed the last decade. More specifically, this number was 85 in 2003 and 87 in 2004 but nowadays the total number of customers-companies of Interporto Bologna is 107 (Interporto Bologna SpA, 2013). This noteworthy change verifies also the positive influence of logistics centres to the investment and business attractiveness of regions. In addition, it confirms the significant impact of logistics centres to the number of local units-enterprises in transport and logistics sector. As a result, Figure 5.9 classifies the main tenants of Interporto Bologna according to their core business activity. Regarding the 1<sup>st</sup> category, there are some freight forwarders which provide customs clearance service but they are listed exclusively as “freight forwarders”. In addition, the category of “producers and commercial operators” introduces manufacturers which operate a warehouse in logistics centre in order to perform their transport and logistics activities. This clarification made because it has to be mentioned that no production activities can be performed within the logistics centre of Bologna.

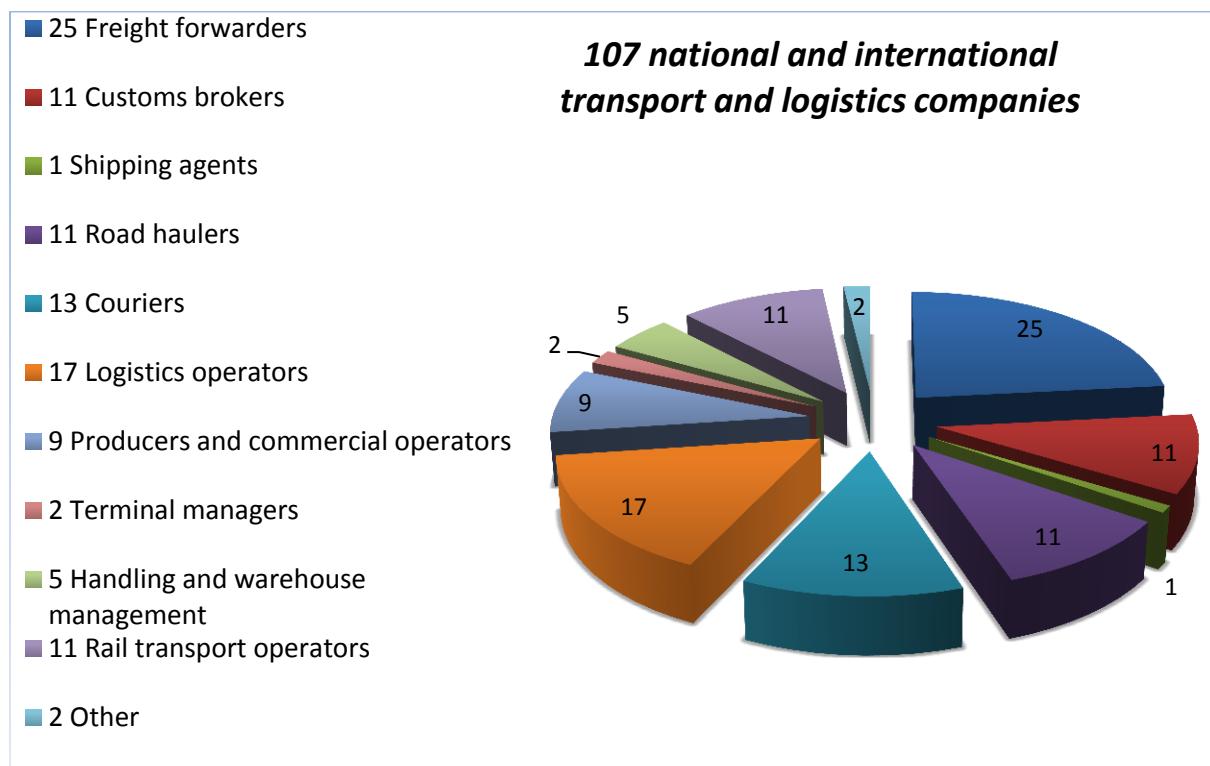


Figure 5.9: Main operators of Interporto Bologna

Source: Interporto Bologna SpA, 2013

Due to the fact that the logistics warehouses of Interporto Bologna having as customers retailers, they handle a wide range of products such as: articles of wood, packaged food, textiles and textile articles, tobacco and manufactured tobacco substitutes, beverages, spirits and vinegar, paper, paperboard and articles (Boile et al., 2008). However, the intermodal terminals which mainly serve industries and manufacturers handle different commodities such as: ceramic products, base metals, plaster, clay minerals, cement, machinery and mechanical appliances, mineral products, polypropylene and miscellaneous manufactured articles. Moreover, it could be mentioned that Interporto Bologna does not handle any fresh products due to the shortage of cold storage facilities and this policy was adopted by Public Authorities from the inception of logistics centre in 1971.

### 5.2.4 Measuring the Impact

Many figures and tables have been developed in order to investigate the economic impact of Interporto Bologna to the region of Emilia-Romagna. Following the same line with the section of methodology, the presentation of indicators starts with the illustration of regional Gross Domestic Product (GDP) per capita and regional unemployment rate (%). First of all, GDP of Emilia-Romagna was higher than the corresponding national and European one and it was significantly increased from 26.900€/habitant to 32.200€/habitant during the decade of 2000-2010. Concerning to the unemployment rate of this region, it was always lower or a little over half of the average unemployment in Italy as Figure 5.11 presents. More specifically, the regional unemployment rate was approximately 33% and 65% of the national one in 1999 and 2010, respectively. The most possible reason of this increased proportion may be the sharp rise of the national unemployment rate after the beginning of economic crisis in 2008.

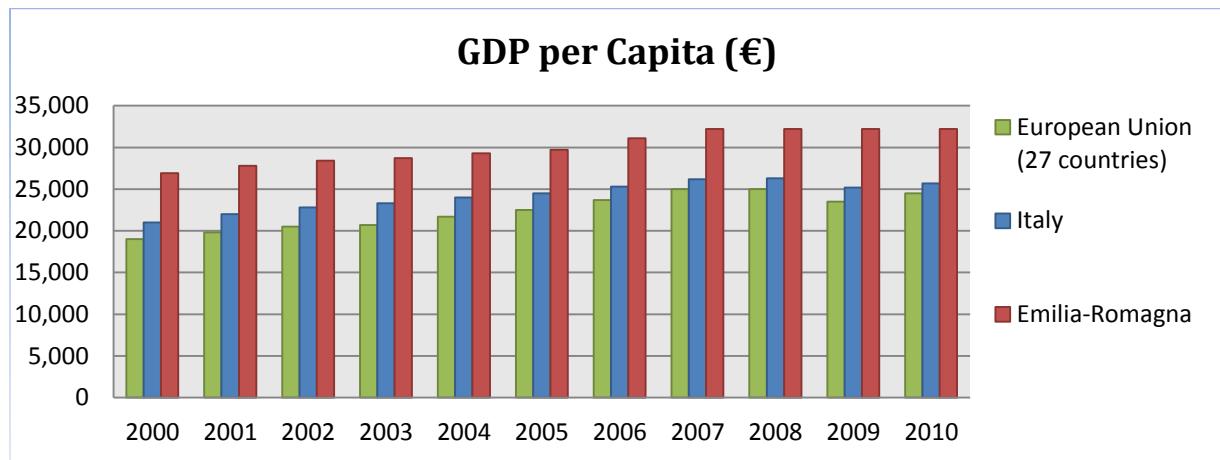


Figure 5.10: GDP per capita of Emilia-Romagna

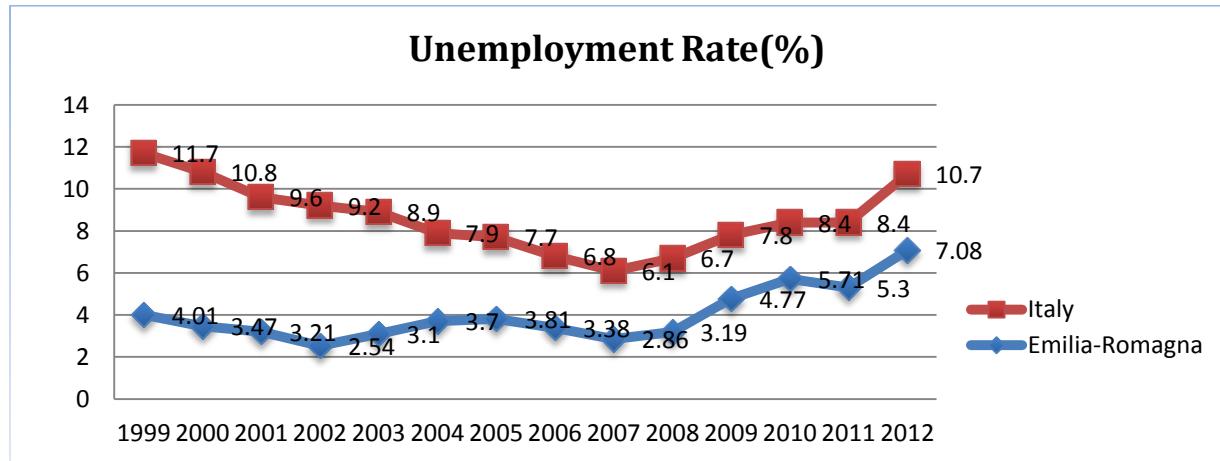


Figure 5.11: Unemployment rate of Emilia-Romagna

After the graphical illustration of these indicators, it can be observed a slightly positive welfare in the region of Emilia-Romagna. Despite the contribution of these indicators to the final conclusions, the investigation of some other measurements, which would be more strongly related with the business and economic development of this region, seems to be quite imperative. As a result, Business Investment Rate (BIR) and Number of patents provide useful insights and indicate the continuing

positive rate of investment attractiveness and innovation performance for this specific region, respectively. Concretely, BIR reached a peak equals to 20.78 in 2006 and the decline which followed depicts the crucial impact of global economic recession to the investment attractiveness. But, the general high level of investment rate in Emilia-Romagna cannot be neglected due to its recovery only 2 years after, in 2010, and because of its augmentation from 17.88 to 18.22 during 2000-2010. In the same route, the number of patents not only in transportation and logistics sector but also the total regional ones has been ascended linearly the last 3 decades. Also, a higher and more remarkable upward trend can be recognized for the total number of patents in comparison with the aggregated ones in transport and logistics sector.

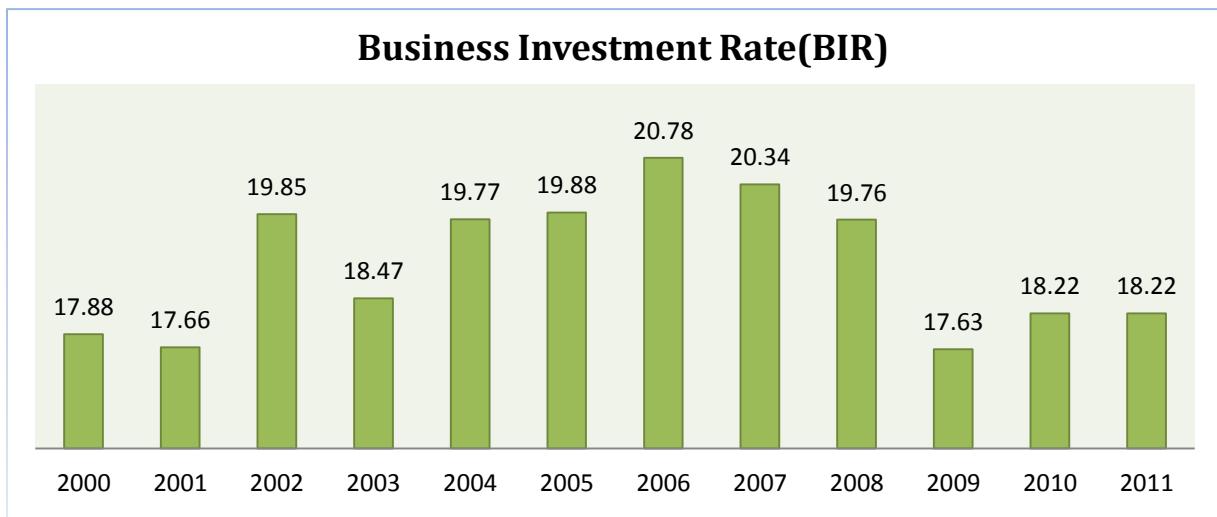


Figure 5.12: Business Investment Rate in Emilia-Romagna

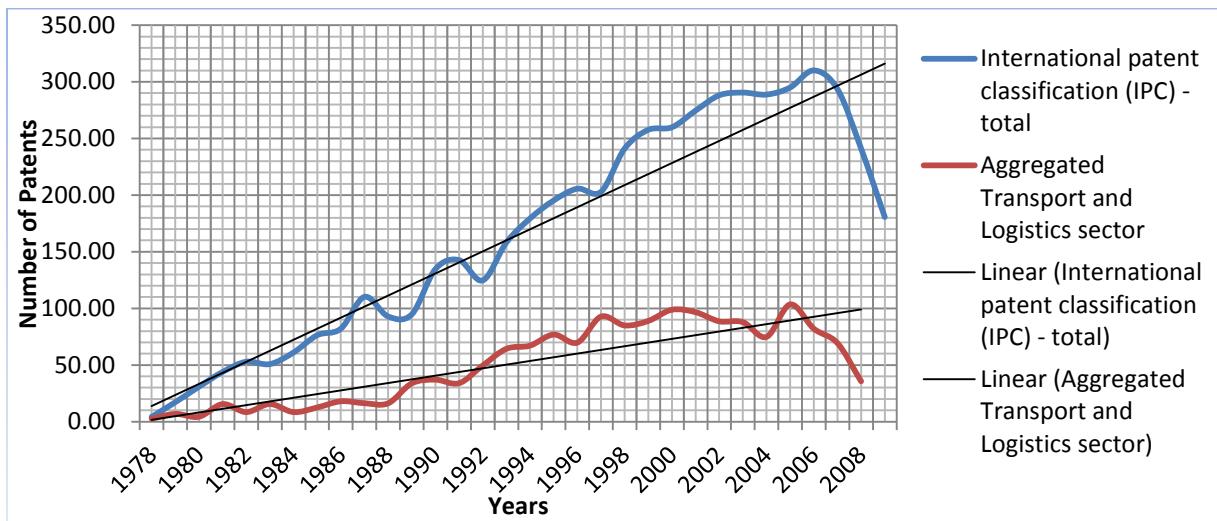


Figure 5.13: Number of Patents by priority year in Bologna

As far as the number of patents is concerned, it is more than obvious that this indicator can be connected and related with the establishment of Interporto Bologna much stronger than the previous ones. It could be easily justified by the fact that the available data of Figure 5.13 have been presented and depicted only 5 years after the establishment of logistics centre (1973) in parallel with the continuous rise of patents in transport and logistics sector not in a large region such as Emilia-Romagna but in a much smaller one, the metropolitan area of Bologna. Last but not least, the

number of patents in transport and logistics sector seems to be influenced also by the fluctuations of total regional number of patents. To conclude, the above figure verifies that the establishment or the presence of a logistics centre can eventually enhance both the total regional number of patents and the amount of patents in transport and logistics sector.

As for road and rail transport, there are all available data not only in regional level but also in the level of logistics centre. According to the Table 5.2, the total transported goods of Interporto Bologna by road have increased from 4.379.171 tons in 2004 to 9.177.300 tons in 2012 in contrast to the corresponding rail indicator which significantly declined by approximately 16.6% the same period. The entire framework of rail traffic volume has been also presented (Table 5.2) in order to illustrate the exact proportion of the 3 different types of rail freight and the number of inbound wagons as additional and quite meaningful information about the performance of logistics centre's rail operators and services. Combining Table 5.3 with Figure 5.14 which indicates the broader regional imports and exports of transported goods by road, a considerable growth can be observed at metropolitan region of Bologna similar to this one of logistics centre's road freight volume.

**Table 5.2: The entire rail framework of Interporto Bologna**

Year	Rail traffic (ton)			Number of inbound rail wagons
	Swap bodies	General cargo	Containers	
2004	796.000	95.908	1.086.050	41.806
2005	795.000	383.000	1.032.000	43.212
2006	1.059.000	375.000	1.372.000	52.619
2007	771.000	316.000	1.138.000	48.166
2008	725.322	303.225	967.370	43.037
2009	314.134	172.153	824.277	28.447
2010	304.490	292.413	785.518	29.724
2011	783.518	477.277	754.773	37.872
2012	791.000	331.500	527.500	34.263

Source: Interporto Bologna SpA

**Table 5.3: Traffic volumes of Interporto Bologna**

Year	Road transport (ton)	Rail transport (ton)	Total traffic (ton)	Modal Split	
				Road Ratio	Rail Ratio
2004	2.400.000	1.979.171	4.379.171	54,80%	45,20%
2005	2.300.000	2.208.225	4.508.225	51,02%	48,98%
2006	2.570.000	2.432.000	5.002.000	51,38%	48,62%
2007	2.600.000	2.225.000	4.825.000	53,89%	46,11%
2008	2.600.000	1.974.091	4.574.091	56,84%	43,16%
2009	2.280.000	1.310.564	3.590.564	63,50%	36,50%
2010	3.289.000	1.382.421	4.671.421	70,41%	29,59%
2011	5.203.130	1.744.938	6.948.068	74,89%	25,11%
2012	7.527.300	1.650.000	9.177.300	82,02%	17,98%

Source: Based on Interporto Bologna SpA

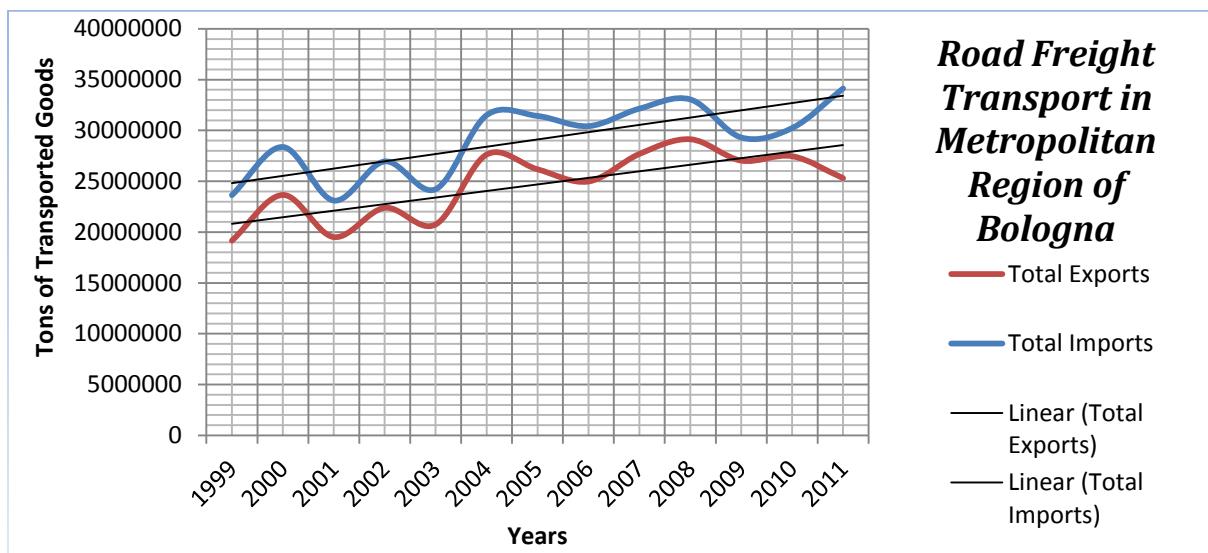


Figure 5.14: Annual Road Freight Transport in Bologna

The simultaneous and constant ascent at the road freight transport of both Interporto Bologna and its region indicates the impact of logistics centre's traffic volumes to the regional imports and exports. In the same way of thinking, the railway goods transport of Bologna followed the negative rate of logistics centre's rail traffic, as the regional rail freight imports decreased for 21.5% and the exports for 23.7% from 2005 to 2010 (Eurostat, Regional Transport Statistics). Consequently, the calculated change of modal split (Road ratio, Rail ratio in Table 5.3) in Interporto Bologna in the period 2004-2010 could be characterized as quite reasonable after all of these fluctuations in road and rail traffic of logistics centre. But the most essential inference of regional transport indicators is the impact of Interporto Bologna to the general trade volume of its region and this argument can also be verified by the following bar chart of air freight transport. More specifically, the total goods loaded and unloaded by aircraft in the broader region of Emilia Romagna raised 700% from 1993 to 2002 and its sharp increasing trend continued until 2011 reaching to 34 thousand tons. Except for the general rapid growth of air freight transport globally, the considerable increase of this transport indicator in Emilia-Romagna cannot be ignored and it is very difficult to not be influenced, at least indirectly, by the presence of a logistics centre in the same region.

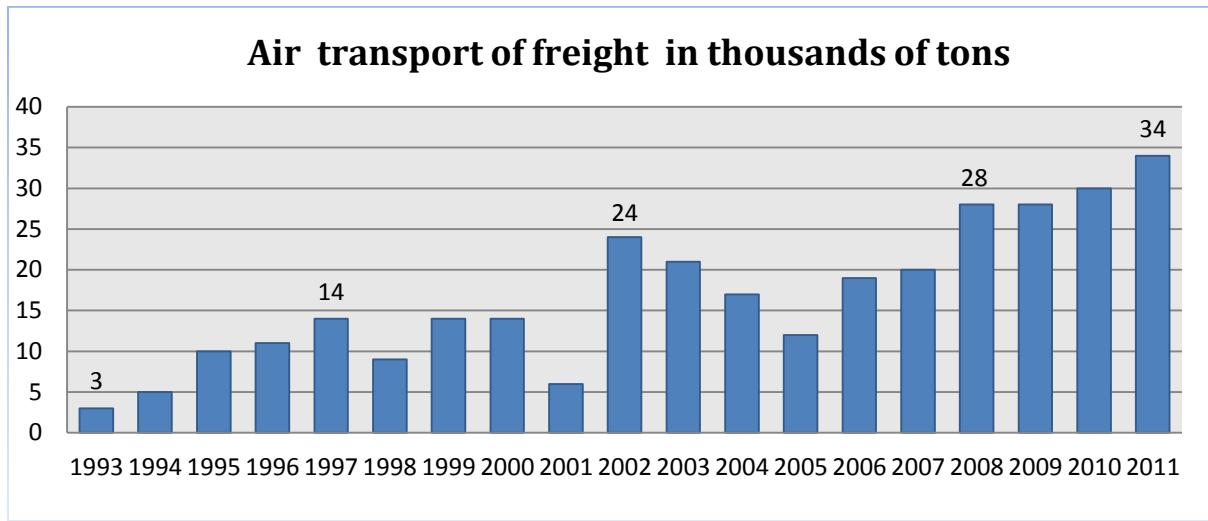


Figure 5.15: Air freight transport in Emilia-Romagna

Keeping pace with the indicator of location quotient, the number of persons employed both in transport & logistics sector (named as Transportation and storage) and in other indirectly related sectors have significantly grown from 1996 to 2010 in Emilia-Romagna. As have been mentioned, these two numbers occupy generally a large share of the whole regional workforce and they are the most suitable measurements for the evaluation of logistics centres as employment generators. In addition, number of employees in directly and indirectly affected sectors of transport and logistics activities in Emilia-Romagna captured an average of 8.7% of the corresponding national ones. The on-site companies of Interporto Bologna employ approximately 2500 people and the summary of this number with the regional number of employees from other transport and logistics firms, outside of Interporto Bologna, compose the brown line of Transportation and storage at Figure 5.16. The indirect influenced sectors introduce industries or sub-industries which have been already referred. The line graph illustrates a higher augmentation of "indirect" employment from 301.859 in 1996 to 374.962 employees in 2010 (+24,2%) in comparison with the "direct" employment of transportation and storage which increased from 90.362 to 102.234 employees (+ 13,1%) the same period. Consequently, Interporto Bologna seems to contribute both directly and indirectly at the creation of new jobs at its region due to the fact that this logistics centre is the largest and most developed transport and logistics site of Emilia-Romagna.

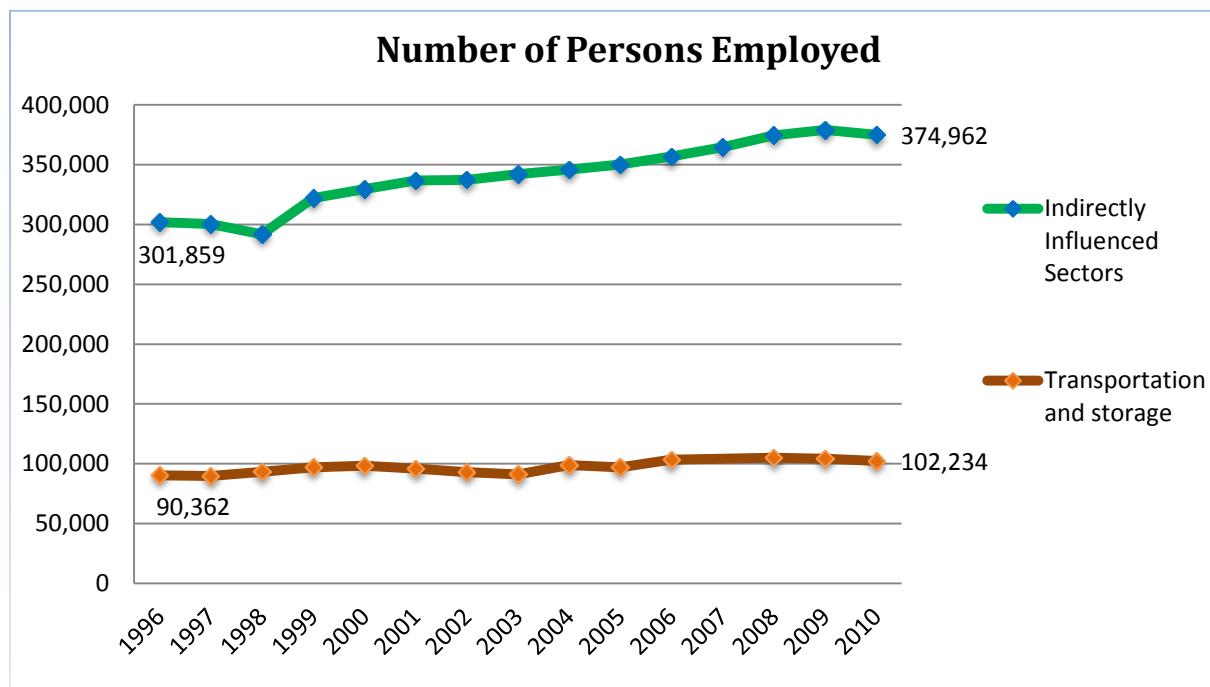


Figure 5.16: Number of Persons Employed in Emilia-Romagna

As the last indicator, the Number of local units was investigated in order to illustrate how have been increased the registered enterprises or part of enterprises during 1996-2010. Firstly, the following chart shows that both the number of enterprises in indirectly related sectors and in transportation and storage have changed with the same rate but in different directions. More specifically, the first one increased by 16.8% during 1996-2010 in contrast to the number of local units in transport and logistics sector which declined from 19.264 to 16.047 enterprises (-16.9%) in the same period. After careful consideration, there are some difficulties to interpret the number of directly and indirectly related enterprises which have been founded from 1996 to 2010. Irrespective of these difficulties, both categories indicates generally all of these various firms which can be attracted by a logistics

centre in a region. But the calculated outcomes of Table 5.4 cannot conclude to any clear and comprehensive interpretation. As a result, the Interporto Bologna's impact to the investment attractiveness of Emilia-Romagna could not be examined or acknowledged reliably through this indicator.

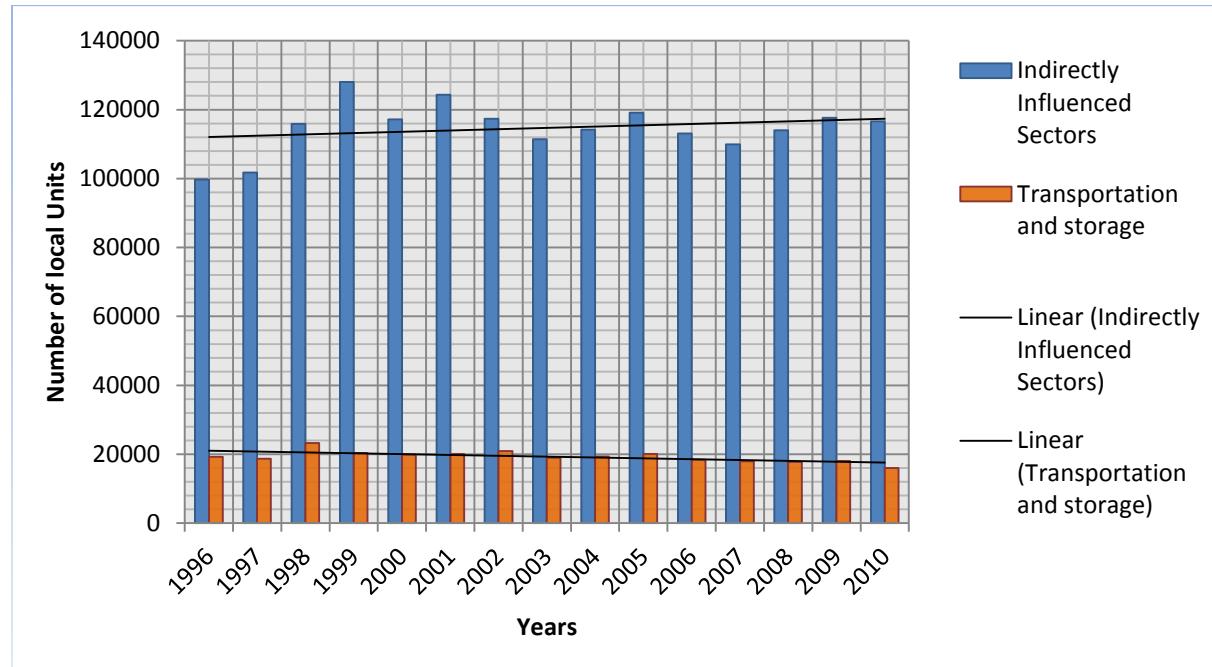


Figure 5.17 Number of local units in Emilia-Romagna

**Table 5.4: Number of directly and indirectly local units in Emilia-Romagna**

Years(i)	Categories	Indirectly Influenced Sectors(a <sub>i</sub> )	Transportation and storage(b <sub>i</sub> )	Difference= (a <sub>i</sub> -a <sub>i-1</sub> ) - (b <sub>i</sub> -b <sub>i-1</sub> )
1996		99716	19264	-
1997		101791	18742	1553
1998		115864	23228	18559
1999		128058	20358	9324
2000		117181	19941	-11294
2001		124331	20054	7263
2002		117319	20951	-6115
2003		111405	18992	-7873
2004		114186	19317	3106
2005		119139	20124	5760
2006		113115	18463	-7685
2007		109925	17995	-3658
2008		114013	17735	3828
2009		117603	18082	3937
2010		116631	16047	-3007

Source: Based on Interporto Bologna SpA

Finally, the results and quantitative elements of all above charts, graphs and tables increase the possibilities for the acceptance of Interporto Bologna's economic impact to its region. Except for the last indicator of local units, all other measurements confirm that the last 3 decades Emilia-Romagna has presented a positive rate of all regional economic activities which are directly or indirectly related to transport and logistics sector. Moreover, Interporto Bologna is undoubtedly the largest logistics centre of the area and one of the most important and profitable logistics centres in Italy. Generally speaking, it is logical and acceptable for the abovementioned economic activities of Emilia-Romagna to be influenced either positively or negatively from this logistics centre. As the final conclusion of investigated "Case 1", the strong economic influence of Interporto Bologna has been confirmed by the quantitative results of this section which also proved that this economic impact of Interporto Bologna to the region of Emilia-Romagna and to the metropolitan area of Bologna was remarkably positive the last 2 decades.



## 5.3 GVZ Bremen (Case 2)

### 5.3.1 General Information and Ownership Structure

Not only as the first established logistics centre in Germany but also as the most profitable and effective one with the highest rates of transport and logistics performance, Güterverkehrszentrum (GVZ) Bremen could be characterized as national and regional asset from a logistics point of view. The establishment of GVZ Bremen in 1985 was an initiative of national transportation ministry which had as main objectives: to reduce the heavy truck traffic and to encourage the modal shift, to resolve the land use problems, to mitigate urban traffic through consolidated deliveries and to promote intermodal transportation and regional economic development (Nobel, 2011). Without having any unified landlord, the development company, known as GVZe, is responsible for the management and the administration of logistics centre in conjunction with an ancillary advisory council. In fact, the management company is a joint-venture between all companies which are included in logistics centre and the City of Bremen (Kuhn et al, 2012). At meetings of GVZe, each private company has only a vote and there is an exception only for activities related to investments at which the two public representatives of logistics centre, federal state of Bremen and national rail company Deutsche Bahn (DB), have six votes. Concerning to the second management tool which is known as "advisory council", it consists of 9 representatives: four from the companies located at the facility, three from State of Bremen, one from the DB railway, and one independent expert (Higgins & Ferguson, 2011).

The main aim of this differentiated public-private partnership was initially to enhance the collaboration between companies in order to ensure their contribution to the joint investments of logistics centre. According to the already existing results, this ownership structure is more than effective because private companies recognize that they can take significant advantage from the improved performance of logistics centre, and for that reason they accept to share the costs of investments for the establishment of new infrastructure and telecommunication system, promotion, political lobbying, etc. The development of GVZ Bremen was completed to its current size 10 years after of its initial establishment (1995) and it was mainly supported by the City of Bremen which investigated approximately 30 million €. Moreover, it holds the largest share of GVZe (25%) and the rest 75% is separated between many different private companies. The total investments reached on the remarkable amount of 160 million € which covered by private resources, especially for the investments referred to the machinery equipment and facilities such as customs and intermodal rail/road terminal.

A more illustrated framework of the "limited company"<sup>16</sup> (GVZe) and the advisory council, which are liable for the management and development of GVZ Bremen, has been generated below:

---

<sup>16</sup> The "limited company" concept means that each participant's risk is proportional to its share of invested capital. A business structure used in Europe and Canada, in which shareholder responsibility for company debt is limited to the amount he has invested in the company.

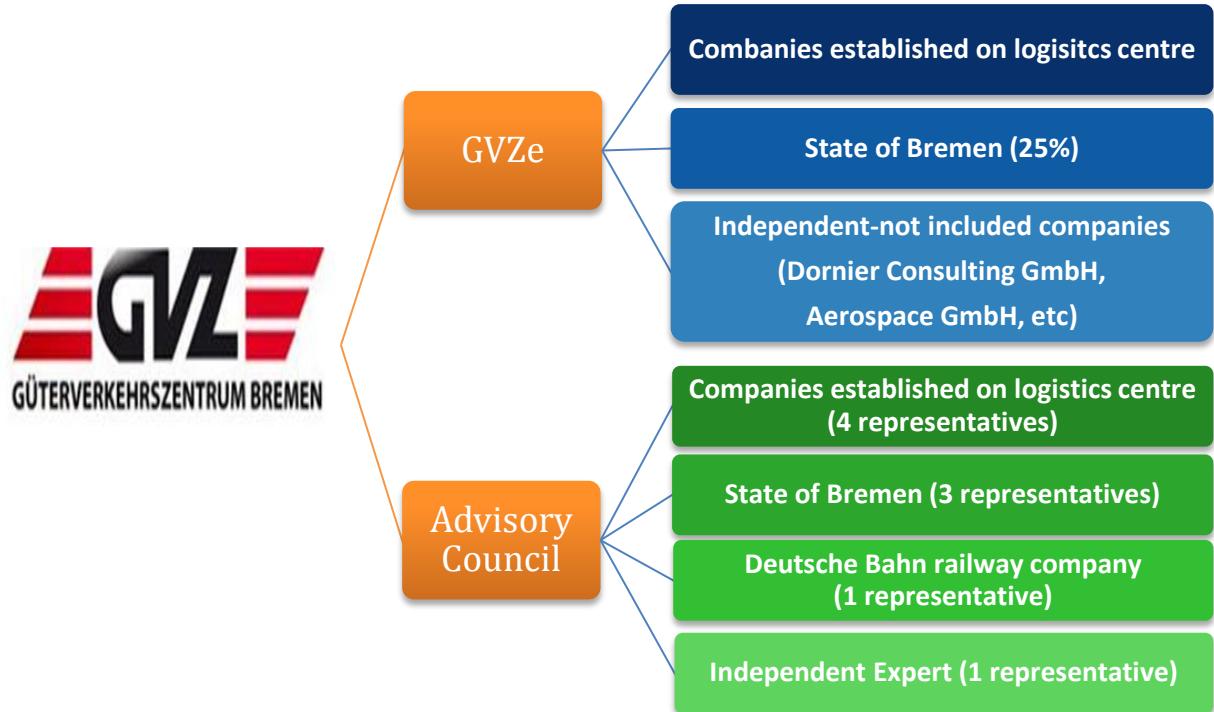


Figure 5.18: The organizational and management structure of GVZ Bremen

Source: Based on Higgins & Ferguson (2011)

Having as main purpose to enhance the developing logistics sector of Bremen during 1980's, GVZ Bremen was established in order to exploit effectively the strategic hinterland position of Bremen and its proximity to various overseas and inland waterways. Furthermore, the geographical location of GVZ Bremen has offered the chance to this logistics centre to operate also as transport hub or terminal because it connects various other logistics centres from Germany, Central and Western Europe. The multimodality offered by GVZ Bremen can be initially verified by the rich rail links, which rely on the presence of Deutsche Bahn Rail Company in that logistics centre. Additionally, the availability of advanced rail infrastructure can be also proved by the fact that almost each site in GVZ Bremen has occupied its own rail link (Higgins & Ferguson, 2011). The road connections of this logistics centre improves its accessibility and facilitates cargo flows to and from all potential directions such as: Osnabrück through A1 motorway via the B6 trunk road, Hamburg through A281 motorway, Bremerhaven / Hanover through A27 motorway, Oldenburg / Emden / Leer and Netherlands through A28, Wilhelmshaven/Jade-Weser-Port through A29 and Brake/Nordenham through the new established B212 motorway. The short distance between GVZ Bremen and Bremen International Airport (approximately 6 km) enriches the international expansion of logistics centre offering airfreight services (GVZ Freight Village of Bremen, 2013). The direct link to the Neustädter Hafen (approximately 2 km) offers finally the potential for the provision of complete multimodal services for GVZ Bremen through all existing transport modes (Road, Rail, Water and Near Air). Additionally, the distance from city centre and the major Bremen railway station is only 8 km.

Despite the high-level accessibility of GVZ Bremen to the deep-sea port of Neustädter Hafen, the majority of containers handled at logistics centre are transported by rail and road directly to and from the seaports of Bremerhaven, Hamburg and Jade-Weser-Port at Wilhelmshaven. The main reason is the general low handling rate of containers by Neustädter Hafen which handle mainly

conventional cargo and it is the largest European terminal in this kind of cargo. As a result, the logistics centre of Bremen has not “fully” exploited yet the potential to forward goods by 4 different transport modes (Road, rail, inland shipping, and air). For this reason, GVZ Bremen has been defined by the already existing literature as “tri-modal” facility which promotes mainly the transportation of goods by road, rail and air. The Figure 5.18 depicts the whole transport network of GVZ Bremen and a wider presentation of its geographical location. To conclude, there is a potential for GVZ Bremen (which is illustrated by two purple counterbalanced arrows in Figure 5.18) to exploit more its geographical proximity to the port of Neustädter Hafen. On the other side, one of its stronger competitive advantages is the direct accessibility of GVZ Bremen to seaports of Bremerhaven and Hamburg, the two main Germany’s “Gateways to the World”.



Figure 5.19: Transport Network of GVZ Bremen  
Source: Based on GVZ Freight Village of Bremen, 2013

### 5.3.2 Facilities and Services Provided

The total gross area which is covered by GVZ Bremen is approximately 4.720.000 m<sup>2</sup> (472 hectares/1122 acres) and the immediately available area (free surface) for new tenants is more than 300.000 m<sup>2</sup>. The size of the area which is already developed and dedicated to logistics, production and wholesale operations is out of 1.200.000 m<sup>2</sup> and there are also more than 276.000 m<sup>2</sup> available for future expansion and development (Kuhn et al, 2012). In addition to the general transport and logistics services such as storage and maintenance of trucks or goods, GVZ Bremen offers also to its tenants an integrated intermodal terminal, truck and container terminals, various high-bay warehouses <sup>17</sup> (the largest high-bay warehouse in Europe is located at GVZ Bremen) and various supporting activities such as gasoline stations, truck services, customs, restaurants, a central washing plant, container repair facilities, energy and telecommunication services (Nobel, 2007). The entire layout of GVZ Bremen has been depicted in the following generated figure:

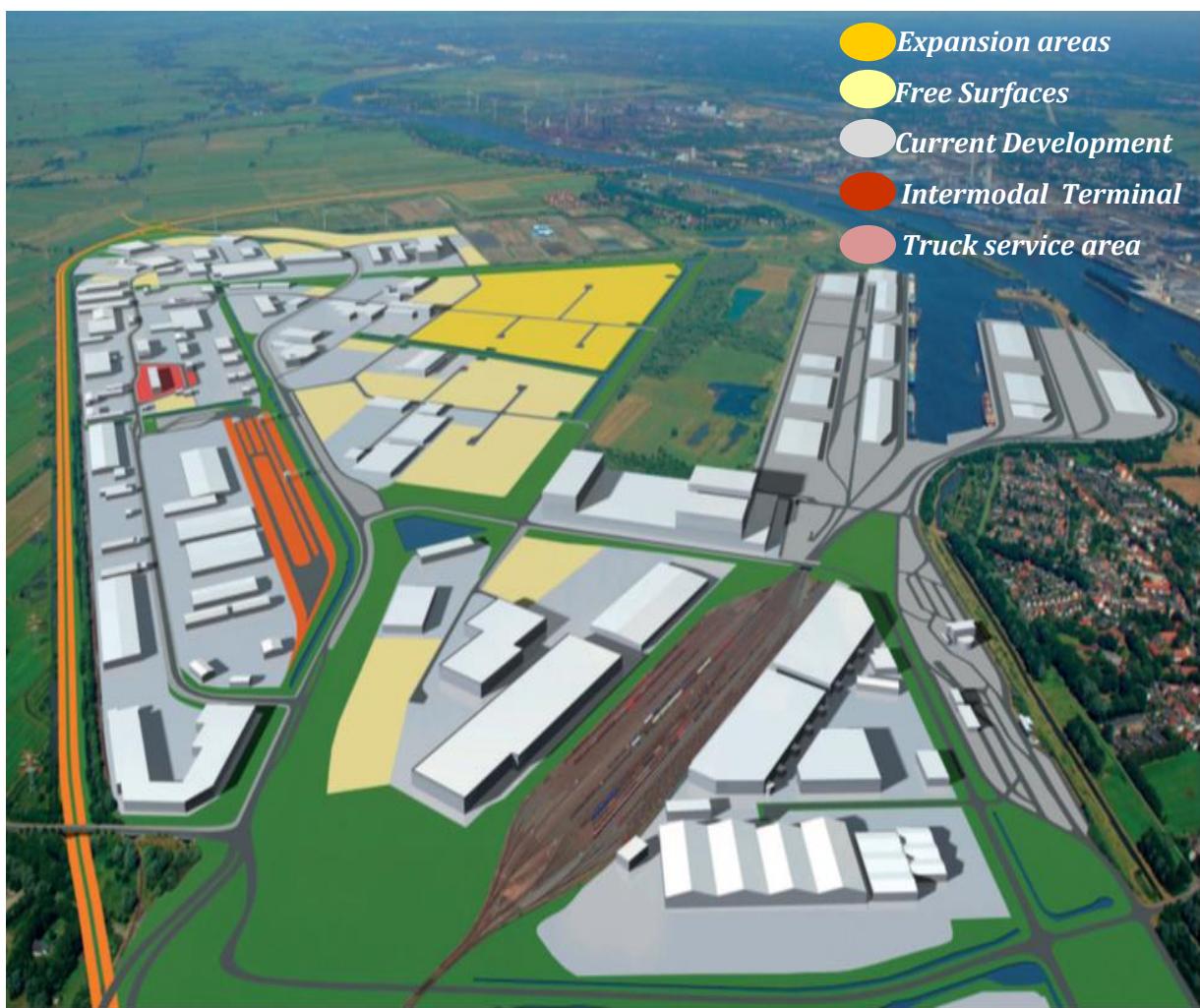


Figure 5.20: Layout of GVZ Bremen

Source: Based on GVZ Freight Village of Bremen, 2013

<sup>17</sup> In a high bay warehouse products can be stored in larger quantities, up to a height of 40 meters. Also, it is possible to use very small/narrow aisles in a high bay warehouse which can, as a result, to improve the effective use of the available floor space and to reduce the number of necessary labor force. Except for personnel costs, heating and lighting costs can be also saved in this kind of warehouse.

### **5.3.3 Major actors and commodities handled**

As far as the institutional framework of GVZ Bremen is concerned, it would be more conceivable to be defined as only a demarcated and jointly managed area where various logistics activities are carried out due to the fact there is not any official or legal management authority. The horizontal relationships between the companies, which are located at GVZ Bremen, indicate clearly the presence of a coordinative cluster. This “Silicon Valley effect” has been considered as the most interesting feature of major actors of GVZ Bremen because the development of mutual and strong relationships between tenants is not so usual at European logistics centres. Generally speaking, there are a lot of difficulties to succeed an effective cooperation between 150 tenants which have also differentiated kinds of activities. This wide range of activities has been referred because there are approximately twenty different types of industrial, logistics and transport companies included in GVZ Bremen. After careful consideration, it can be concluded that the generated synergies between so differently oriented companies is generally a quite challenging and difficult achievement.

Due to the fact that GVZ Bremen is centrally and strategically located, the operators of logistics centre handle a great variety of different commodities. The most distinctive examples are: aerospace, food and beverages, automobiles and auto parts and commodities from the energy and chemical sector (Higgins & Ferguson, 2011). Also, it can be mentioned that the functions of GVZ Bremen are more oriented to break-bulk logistics, to logistics-intensive production and manufacturing and wholesale companies which belongs to the sector of food and beverages. The majority of tenants can be classified to the categories of: logistics services providers, transportation and storage firms, industrial and commercial enterprises and service providers. But, there are also many companies included in GVZ Bremen which can be characterized as project developers and they are responsible for the development of big establishments such as warehouses and terminals. Some of the globally operating logistics companies of GVZ Bremen are: BLG Logistics (the operator of the abovementioned largest European high-bay warehouse), DHL, Dachser GmbH & Co. KG, national rail company Deutsch Bahn, NeCoss (a joint-venture between EVB, Connex, ACOS and Rhenus), Kühne & Nagel, Hellmann, Pan Europa - Rösch GmbH, B&D International, etc.(Kuhn et al, 2012).

According to DGG(2010), GVZ Bremen is ranked between the three most important and effective European logistics centres due to the high number of persons directly employed (more than 8000 employees) in the companies which are located on that logistics centre. Before the following extent analysis of regional economic indicators with charts and graphs, it could be mentioned that the number of companies was 6 in 1985, 60 in 2000, 114 in 2007 and nowadays the number of tenants in GVZ Bremen is more than 150. The same positive rate can be observed to the number of persons employed at these companies which was approximately 3000 employees in 2000, and there are more than 8000 employees today. The positive change of these two indicators confirms that GVZ Bremen has generated at least 8000 new job positions and it is also attract more than 150 new companies registered the last 25 years. The regional economic impact of GVZ Bremen may be higher due to the fact that these two numbers are strongly related with only transport and logistics sector of region, without reflecting the indirect economic effects of logistics centre to its region.

### 5.3.4 Measuring the impact

According to the statistical resources of “The Federal state of Bremen” (WFB Economic Development Bremen GmbH, 2013) the sectors of maritime and logistics are the two most important job creators for this state. In addition, GVZ Bremen has already been recognized not only as “the core of the regional logistics sector” but also as an important economic generator for the state of Bremen and for its metropolitan region. Despite the fact that the importance of GVZ Bremen for the regional economy and labor market has been supported by any integrated research in Bremen and Germany, it is quite difficult to quantify the direct economic effects of logistics centre to its surrounding region. For this reason, it has been adopted one of the lower geographical division levels and as a result the following statistical analysis will be concerned specifically to the economic activities of the State of Bremen which introduces only the cities of Bremen and Bremerhaven. The selected combination of the smallest province in Germany (Bremen) with the most developed and effective German logistics centre (GVZ Bremen) has as main purpose to create more direct links and to make more conceivable the impact of GVZ Bremen to regional economic development.

Concerning to the indicators which depict the general level of regional economic welfare, GDP per capita of Bremen was always significantly higher than the national and European one during 1995-2010. Due to the lack of data, this indicator for EU-27 has been depicted only from 2000 to 2010. As mentioned above, the development of GVZ Bremen was completed at its current size in 1995. Thus, it is logical to be supported that the integrated functions of logistics centre have influenced, at least, partially the continuous increasing rate of regional GDP. This argument can also be enforced because GDP per capita for this case is available also for the smaller and more limited region of Bremen-Kreisfreie Stadt (NUTS-3).Concretely, the regional GDP per capita rose from 32.800€/habitant in 1995 to 42.400€/habitant in 2010 and it had also a higher positive rate (30%) than the national one (28%). As the second indicator of the general regional economic development, the unemployment rate of Bremen was higher than the corresponding national one during the same period. Nevertheless, it has to be referred that the regional unemployment rate was not only decreased from 11.5 to 6.7 but it had also a higher rate of decline (-41%) in comparison to the national unemployment rate (-37%).

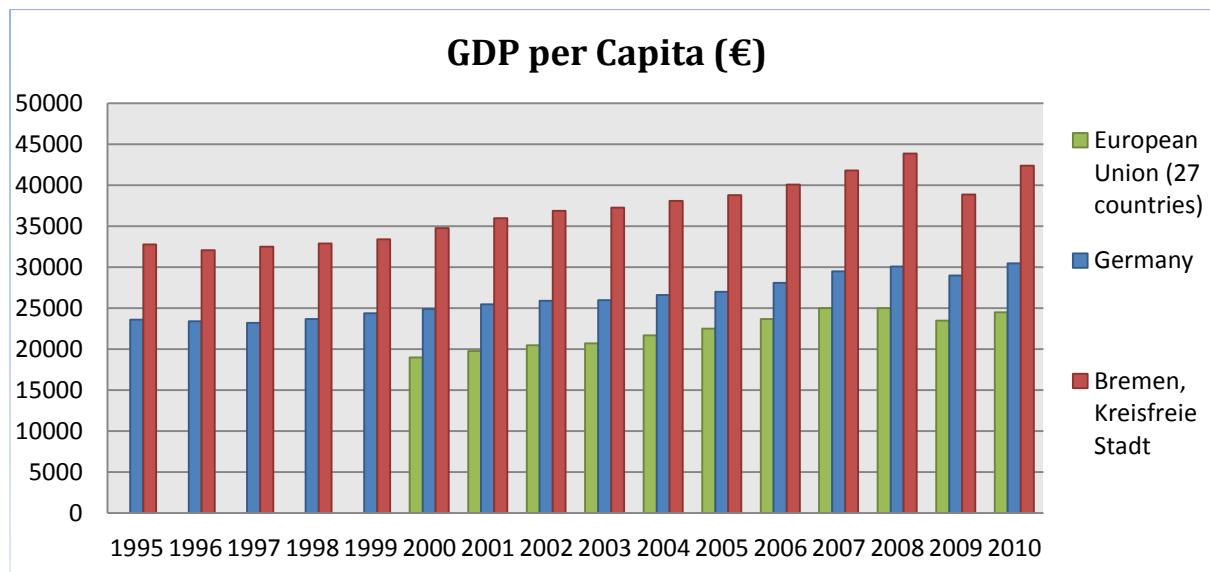


Figure 5.21: GDP per capita of Bremen-Kreisfreie Stadt

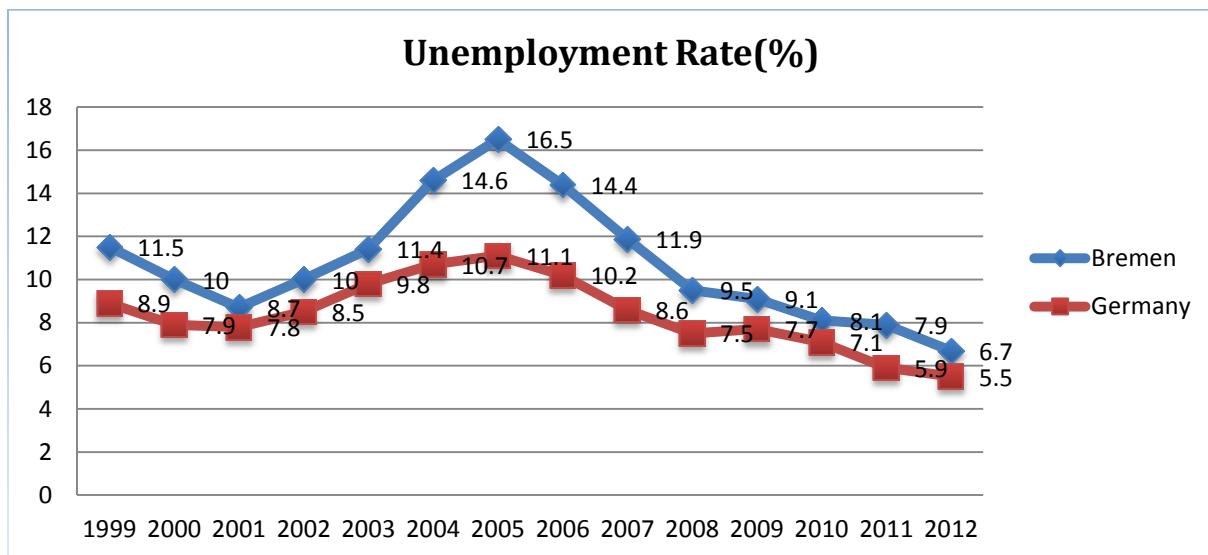


Figure 5.22: Unemployment Rate of Bremen

In addition to the above general economic indicators, the regional BIR of Bremen was slightly dropped from 2000 to 2011 and it would be more statistically safe to interpret that this measurement had a steady rate with various fluctuations. It can be justified by the fact that the value of BIR has been initially decreased from 2000 to 2003 and it has followed a positive route until 2008 when it started again to decline which may also relies on global economic recession. However, the indicator which has been adopted in order to assess the inventive and innovative performance of Bremen (number of patents application) has presented a remarkable upward trend during 1977-2009. Due to the fact GVZ Bremen was established in 1985, the main interpretations have to be made after this year and it is clearly observed that the total number of international patents was increased by 68.2% from 1985 to 2009. In order to evaluate if there is any direct linkage between the regional innovative performance and the establishment of GVZ Bremen, it would be better to focus on the number of patents in aggregated transport and logistics sector. More specifically, it can be mentioned that this number has presented a slow positive and fluctuated start during the period 1985-1995. But after the complete development of logistics centre to its current size (approximately 10 years after of its initial establishment), the previous steady progress was followed by a considerable growth of approximately 57.7% from 1995 to 2009.

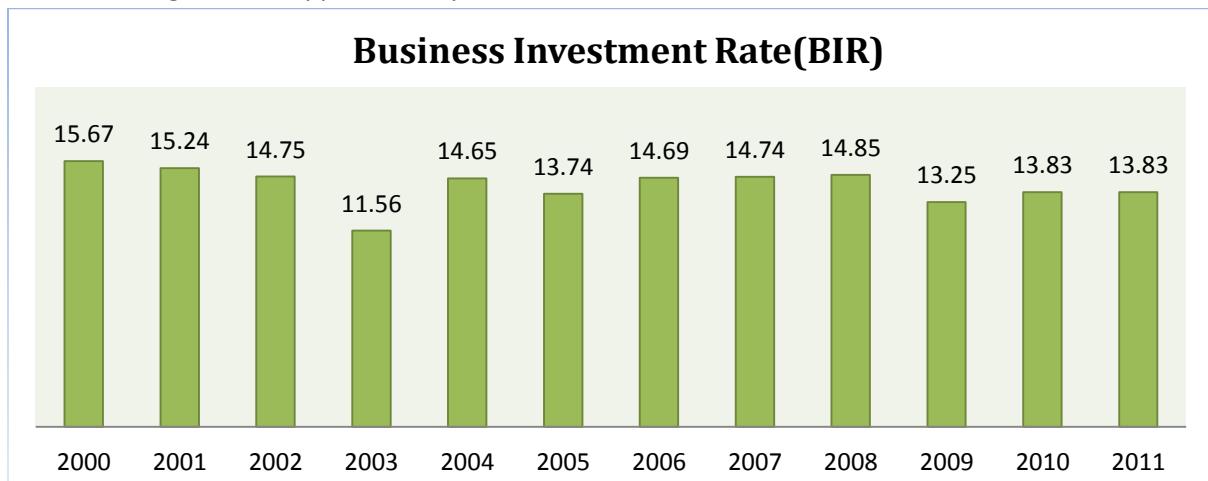


Figure 5.23: Business Investment Rate in Bremen

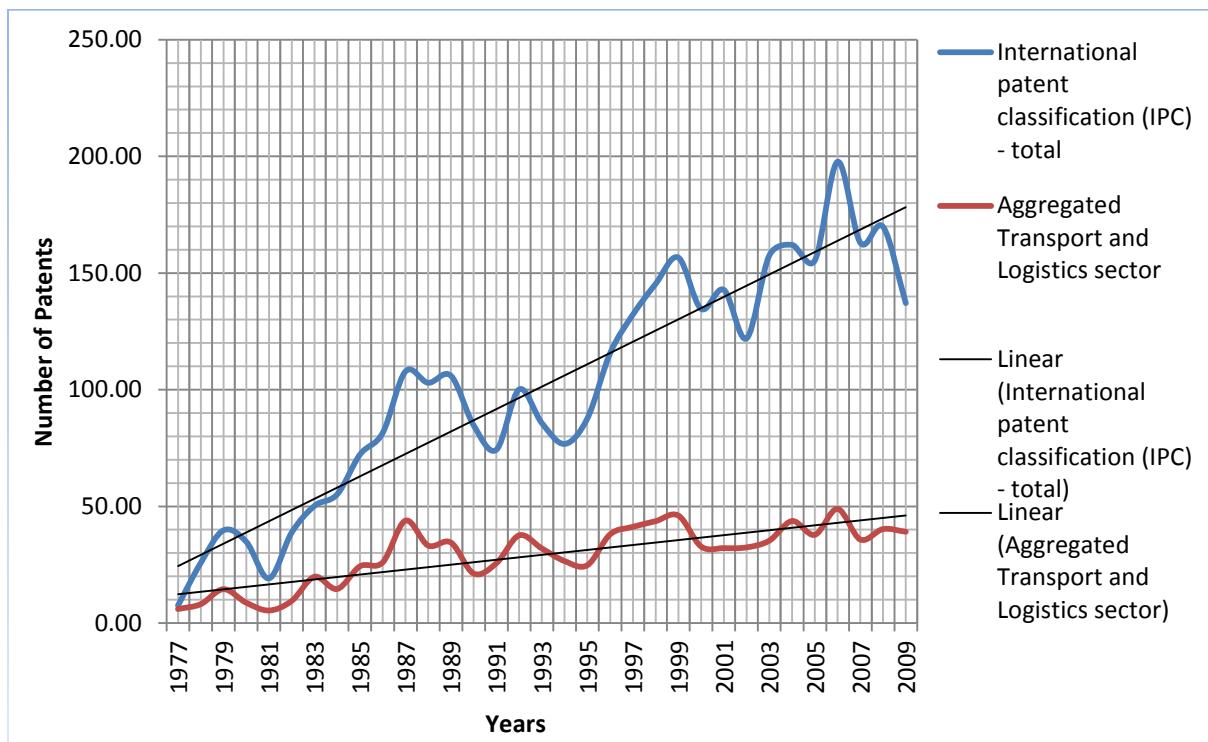


Figure 5.24 Number of Patents by priority year in Bremen-Kreisfreie Stadt

Apparently, the number of total regional patents and mainly the number of patents in transport and logistics sector enforce and verify considerably the impact of GVZ Bremen to the innovative performance of surrounding region (Bremen - Kreisfreie Stadt<sup>18</sup>). Afterwards, the interpretation of the transport related indicators is quite imperative in order to investigate the impact of GVZ Bremen to the regional trade volume. Despite the fact that the 2<sup>nd</sup> case of Bremen is the only one with a direct sea connection through the seaport of Bremerhaven and deep-sea port of Bremen (maritime freight transport), there is no available data about the regional air-freight transportation. As a result, this case does not include any graph of air-freight transportation and it is also the only case out of 5 which introduce a graph related to maritime transport of freight. First of all, total transported goods by road in Bremen have been illustrated in millions of ton-kilometres without any remarkable difference from the similar indicator of “transported goods by road in tons” which adopted at the first case of Interporto Bologna.

According to Figure 5.14, the total ton-kilometres transported to and from the metropolitan region of Bremen, known as Kreisfreie Stadt, increased significantly during 1999-2011. Both the imported and exported ton-kilometres are responsible for this total upward trend. More specifically, the regional annual imports of transported goods by road ascended from 2.801 to 3.425 million of ton-kilometres (+21%) at the surrounding area of Bremen from 1999-2011. Similarly, a rise of the exported total ton-kilometres can be observed from 3305 to 3946 million (+19.5%) during the same period. Consequently, the illustrated outcomes of Figure 5.14 combined with the fact they refer to a more “limited area” (Bremen - Kreisfreie Stadt) than the metropolitan region of Bremen increase the possibilities to confirm that there was an influence of GVZ Bremen to the constant augmentation of

<sup>18</sup> As mentioned at Chapter 4 of methodology, it has been adopted a geographical division level of NUTS-3 for the indicators “Number of Patents” and “Annual Road Freight Transport”. The metropolitan region of Bremen-Kreisfreie Stadt does not even include the city of Bremerhaven.

regional trade volume. Another factor which can verify the positive impact of logistics centre to the regional trade activities is the noteworthy increase of transported goods by rail. The operation of the intermodal road/rail terminal at GVZ Bremen seems to have influenced positively also the regional imports and exports of transported goods by rail which had a steady ascend from 10.706.433 to 12.908.530 tons and from 5.153.677 to 7.357.343 tons respectively during 2005-2010.

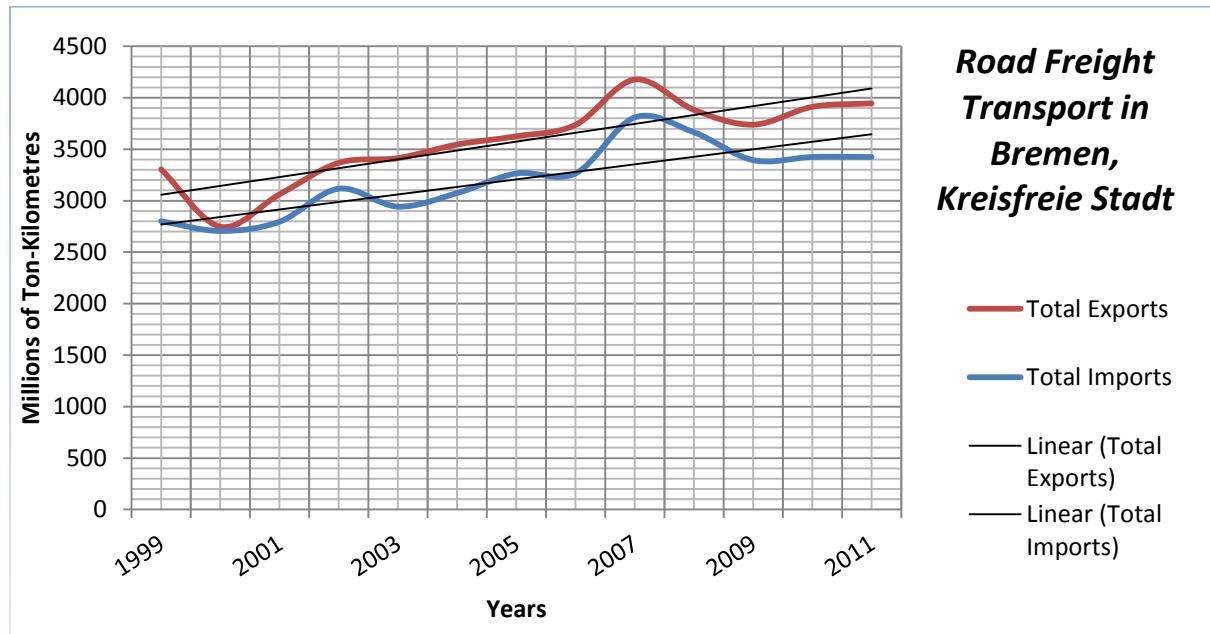


Figure 5.25: Annual Road Freight Transport in Bremen-Kreisfreie Stadt

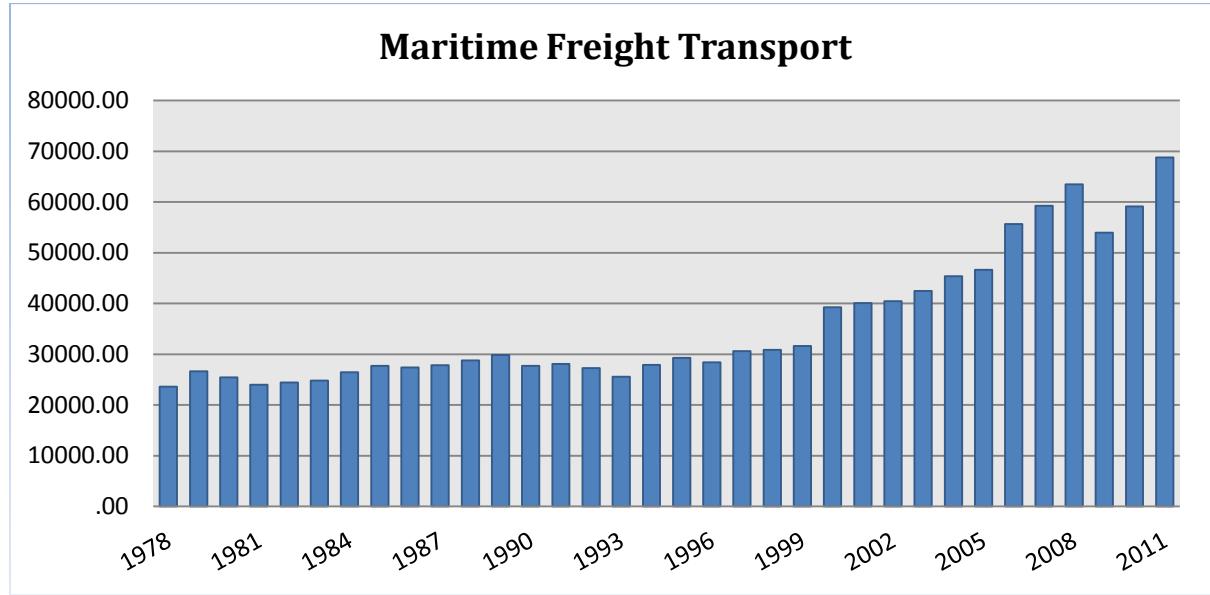


Figure 5.26: Deep-sea and inland maritime transport of freight in Bremen

As the last transport indicator, there was a sharp increase of maritime freight transportation after 1997 and it is difficult to have not been influenced by the development of logistics centre which was completed in 1995. Generally speaking, the presence or the establishment of a logistics centre could enhance both deep-sea and inland maritime transportation of freight (Yossi Sheffi, 2012). According to the same author, it is widely-accepted that the aggregated logistics and transport clusters improve the quality of hinterland and the main hinterland connections, which in turn are considered as the

most important influential factors of the competitive advantage of ports. Apparently, the bar chart of Figure 5.15 depicts that the shared hinterland of Bremerhaven and Neustädter Hafen has been significantly influenced by the development of the most effective German logistics centre (GVZ Bremen) and, as a result, the total amount of cargo handled by these ports increased suddenly after 1997.

Another confirmation about the important role of GVZ Bremen as economic generator of its region is not only the number of persons employed in transport and logistics sector but also in indirect related sectors (including Manufacture of transport vehicles equipment / Sale, maintenance and repair of motor vehicles and motorcycles / retail sale of automotive fuel etc.) because both of them were significantly increased from 2002 to 2010. During a period of only 8 years, the number of employees in transport and logistics sector has presented a meaningful ascent of approximately 37.5% which means also that they were generated 12.259 new job positions that were strongly related with transport and logistics sector. These estimations combined with the augmentation of employees in sectors which are indirectly related to transport and logistics, (+20.989 new positions) conclude to the final interpretation that 33.248 new job positions have been generated during 2002-2010 in the region of Bremen. All of these positions belong to industries which are attracted by logistics centres or they are related with the functions and operations of these centres (Yossi Sheffi, 2012). After all interpretations, it is more conceivable why the German national institute of statistics argued that the "logistics industry has become a job creator for the state of Bremen". Also, this argument can be supported by the above numbers of new job positions in parallel with some accurate estimations of the same institute which proved that there are generally 174,000 jobs in Germany which are strongly influenced by the performance of port and logistics industry in Bremen. Finally, the presence of attractive transport and logistics jobs in Bremen is indicated also by the fact that the regional average level of wages and salaries in transportation and storage (36.255€) is above the national one (30.837€).

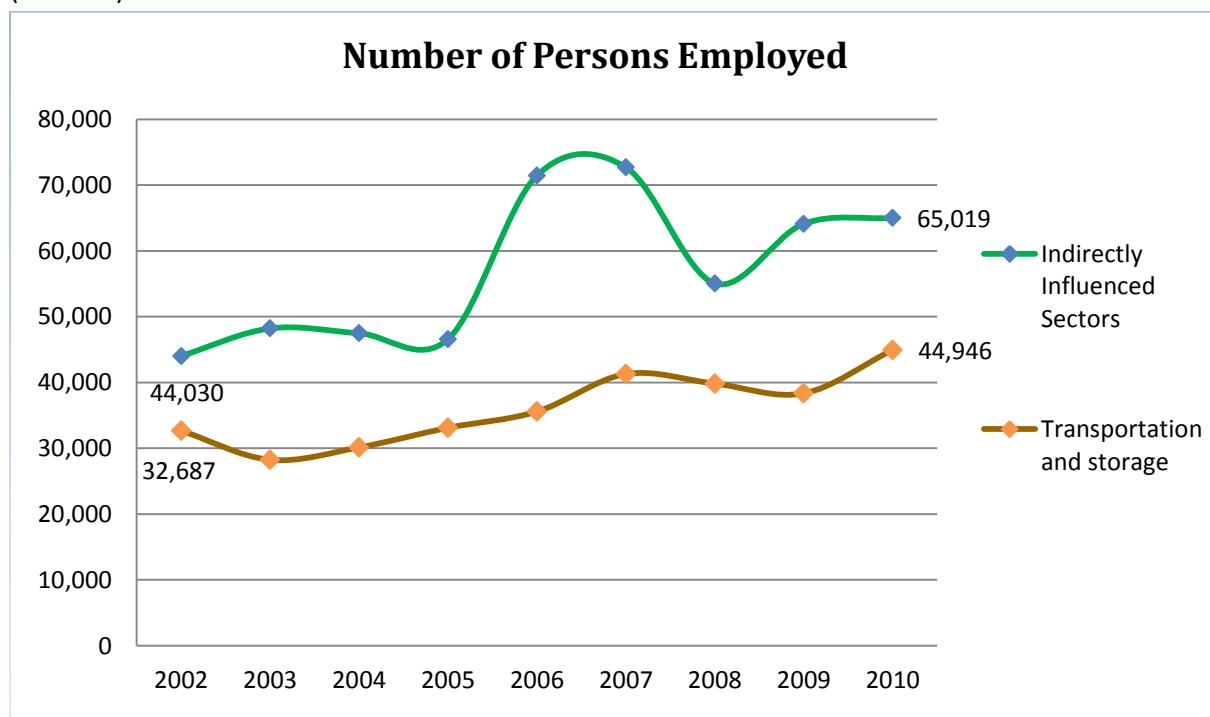


Figure 5.27: Number of Persons Employed in Bremen

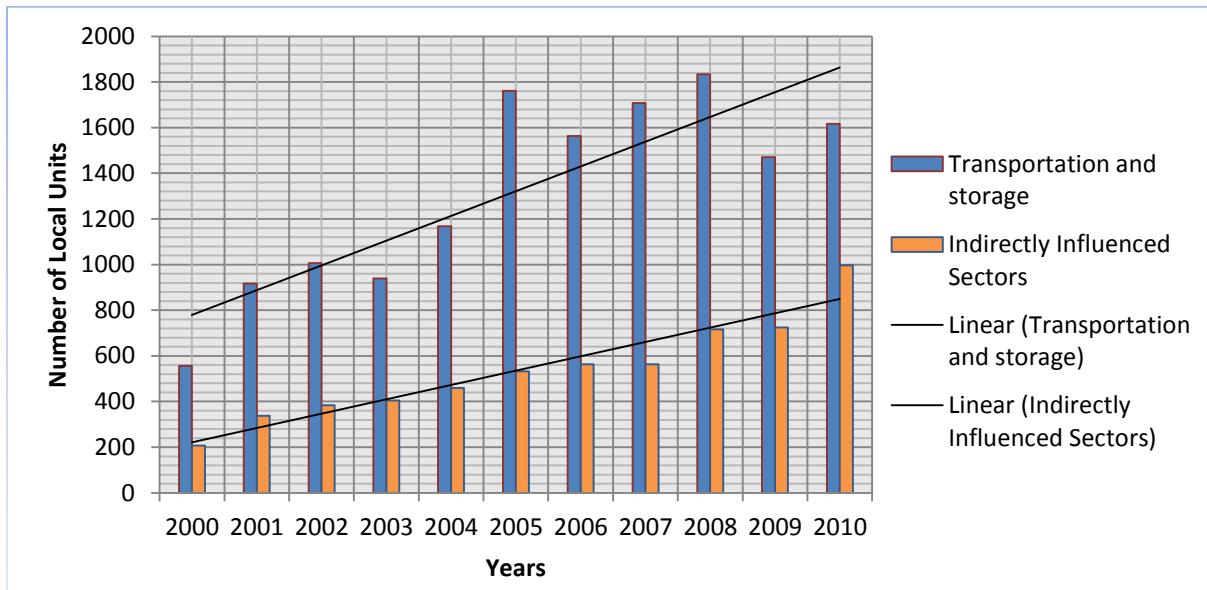


Figure 5.28: Number of local Units in Bremen

The last indicator has been adopted only in order to verify the estimations of all previous graphs and charts which have already indicated the impact of GVZ Bremen to the regional economic growth. According to Figure 5.26, there was a continuing rise of local units and enterprises or parts of enterprises related to transport and logistics sector, and a similar upward trend for local units which are indirectly dependent to transport and logistics sector. Moreover, the most noteworthy estimation that can be extracted by this figure is the fact that the number of local units in transport and logistics sector was not only higher but it also had a higher increasing rate than the corresponding number of enterprises in indirectly influenced sectors. Due to the fact that these two numbers have the “opposite relationship” <sup>19</sup> at the majority of European regions, the main conclusion is the confirmation of a strong dependence between the regional logistics sector, and especially of the GVZ Bremen as the core of this sector, with the economic development and revitalization of Bremen region. Finally, the numerical outcomes included in the above graphs and charts combined with the idea of some local initiatives like “VIA Bremen” <sup>20</sup> confirm the statement that: “the region of Bremen is very important for “GVZ Bremen” but this logistics centre is also important for Bremen”.

<sup>19</sup> Number of local units in indirectly influenced sectors > Number of local units in transport & logistics sectors

<sup>20</sup> “VIA Bremen” brand was founded in order to create and promote synergies between the regional logistics and transport companies either located or not in GVZ Bremen or not.



## 5.4 Interporto Quadrante Europa (Case 3)

### 5.4.1 General Information and Ownership Structure

Not only the most effective logistics centre in Italy (DGG, 2010) but also the best European one regarding to the volume of combined goods traffic, Interporto Quadrante Europa was founded by Consorzio ZAI in 1977. The cooperation between regional Chamber of Commerce, Province of Veneto and Council has generated the initiative of Consorzio ZAI which had as main purpose to exploit creatively the available road, rail and air networks in order to create a “specialized city of goods” in favor of national and international companies. Additionally, Interporto Quadrante Europa was established in order to improve the quality of the production, transport, warehouse and distribution services of the companies which located in the neighboring agro-industrial demarcated zones of Zai Storica (230.000 m<sup>2</sup>) and Zai Due Bassona (750.000 m<sup>2</sup>). Taken this name by its geometric shape, Quadrante Europa was also developed for the enhancement of urban planning and the economic revitalization of Verona and its surrounding region (Quadrante Europa, 2013). As the sole administrator of Quadrante Europa, the company named as Quadrante Servizi(an authorized sub-company of Consorzio ZAI) is a public and private partnership which manages all functions and infrastructures of logistics centre as well as it makes proposals and contributes to the proper functioning of services offered to the tenants of this centre (Quadrante Servizi Srl,2013). Despite the fact that Consorzio ZAI supports financially all departments of Quadrante Europa, the combined transport terminal of this logistics centre is privately managed by Terminal Italia SpA and the available transit-motorway system was developed and managed by Cemat SpA in cooperation with Italian and Austrian railways.

The strategic location of Quadrante Europa justifies appropriately the efficiency and the performance of this logistics centre due to the fact that the main rail and road networks around of Quadrante Europa includes numerous international and national connections. First of all, there is an intersection of the motorways A22 (north-south) and A4 (east-west) which connects the routes from Brenner Pass and Serenissima, respectively, to various seaports such as the port of Ravenna, Brindisi, Livorno, La Spezia, Bari, Trieste and Venice (Quadrante Europa, 2013). Additionally, Quadrante Europa offers a unique access to the European Corridor 5 Lisbon-Kiev on which pass approximately 36% of EU commodities and also it provides an access to the European Corridor 1 Berlin-Palermo-Monaco (European Parliament, 2012). As depicted in the combined Figure 5.27, the road connections of Quadrante Europa is one of its most profitable assets because the entire transport network has developed some differentiated opportunities in comparison to other European logistics centres. More specifically, Figure 5.27 reveals that Quadrante Europa handles road freight mainly from international destinations and especially from north and central Europe as well as from Eastern (Slovenia, Hungary, Ukraine) and Western (Spain, France) territories. Apparently, this logistics centre has developed national and international connections for each possible location between North, South, East and West.

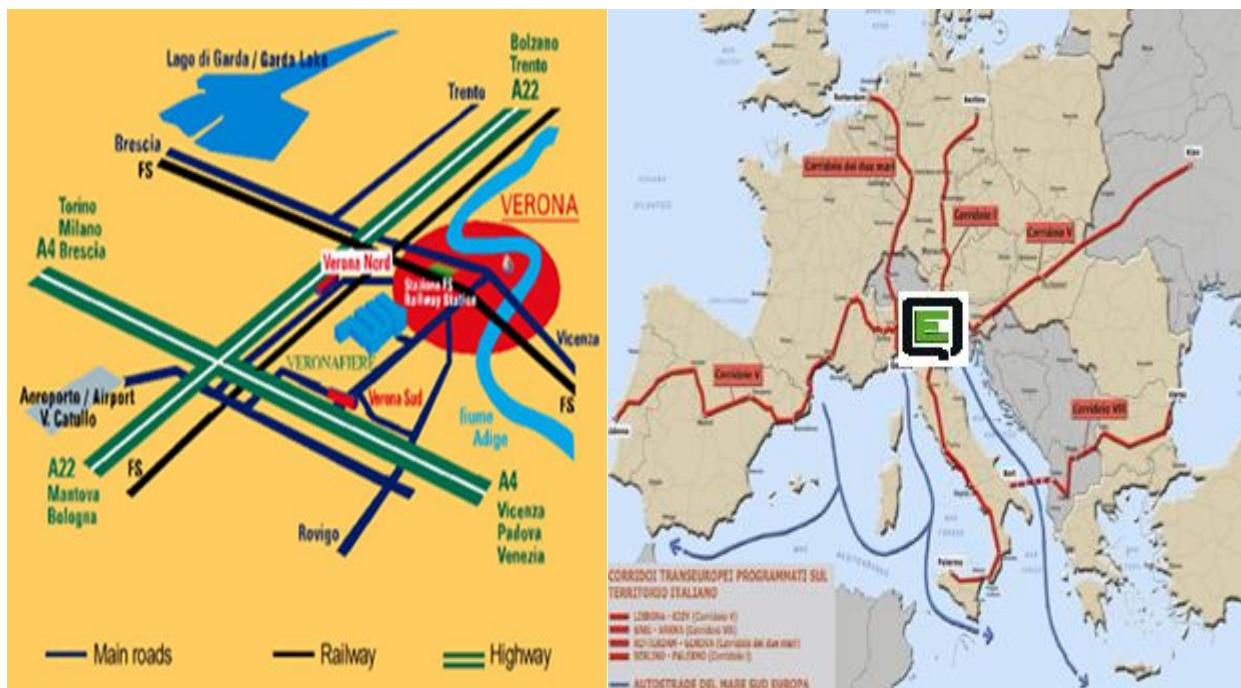


Figure 5.29: Transport Network of Interporto Quadrante Europa

Source: Based on quadranteeuropa.it

In addition to the extended international character of logistics center through European road corridors, the railroad destinations of Figure 5.28 confirms that Interporto Quadrante Europa is more an international or European logistics center than a national one. The direct links among the logistics centre and Verona-Villafranca airport, which is the first airport for air fleets after crossing the Alps, verify that the Interporto Quadrante Europa is an ideal meeting point for transported freight through road, rail and air transport networks. Another new initiative of this logistics centre has already been started from 2011 (Flavio Zuliani, President of Consorzio ZAI) and it aims to connect logistics centre with the largest Italian sea and river canal system of Milan-Cremona-Mantua-Legnago-Rovigo-Po di Levante.

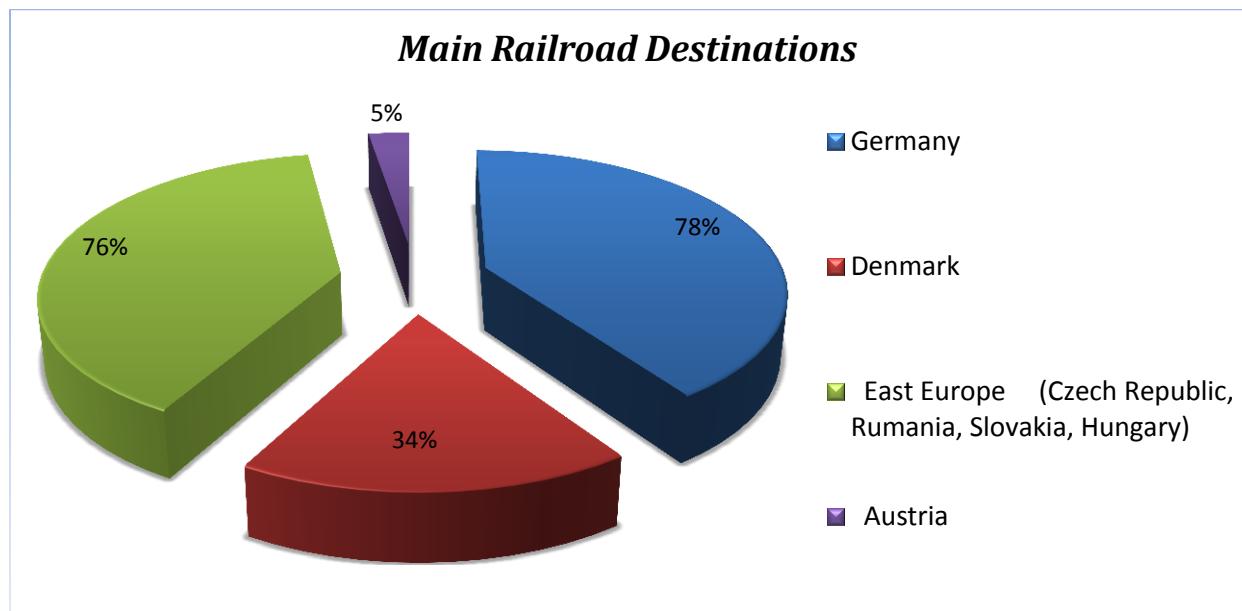


Figure 5.30: Transport Network of Interporto Quadrante Europa

Source: Based on www.quadranteeuropa.it

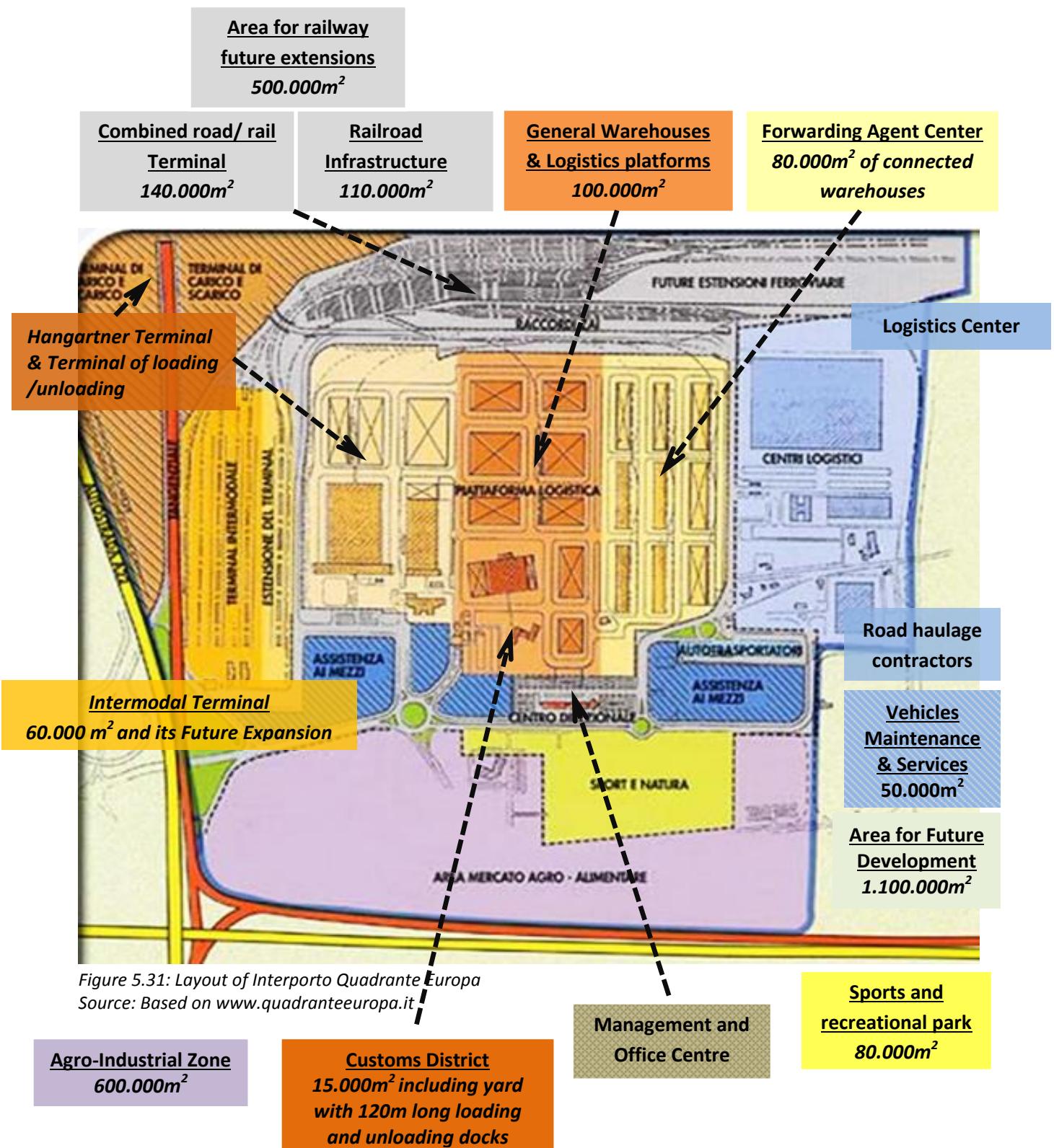
### **5.4.2 Facilities and Services Provided**

The logistics centre of Quadrante Europa occupies a total surface of 4.200.000m<sup>2</sup> and the already exploited area is approximately 2.500.000 m<sup>2</sup>. The largest part of the non-used (1.600.000 m<sup>2</sup>) area is for future expansion (1.100.000m<sup>2</sup>) but there is also an under construction area of 600.000m<sup>2</sup> located in the southern part of logistics centre. It has been planned and determined that this area will be the largest distribution platform in Italy dedicated to the collection, transport and other logistics activities of agro-industrial products with national or international direction. As one of the most attractive Italian and European logistics centre, Quadrante Europa provides a wide range of various services to its tenants such as: railroad system with a combined transport terminal, integrated traditional & cold /refrigerated storage, handling, packaging, picking, railway services (clearing and carriage), phytopathological services, washing services and gas stations, insurance and customs assistance, repair and maintenance services for trucks /semi-trailers/automobiles, public telephone and telefax, veterinary office, semi-trailer and swap bodies depot, post office, bank, restaurants, 24-hours accessibility in parking lots equipped with guardhouse showers and bathrooms for containers (14.000m<sup>2</sup>), trucks (13.400m<sup>2</sup>) and for conventional private cars. Since 2000, the Interporto Quadrante Europa has also developed a telematics network which provides various data-, audio- and video-transmission services to the main operators as well as unlimited access to internet and intranet networks, national and international databases.

Despite the fact that the name of the area “Logistics centre” could be misleading because of its similarity with the major definition of this research (logistics centre), it is one of the most noticeable initiative of Quadrante Europa with a total railroad connected area of 220.000m<sup>2</sup>. In fact, “Logistics Centre” is a demarcated zone that was generated in order to connect production with market. Moreover, Volkswagen Group Italia is the main operator of this zone, it occupies 150.000 m<sup>2</sup> of the dedicated railroad area (220.000 m<sup>2</sup>) and it is also the main distributor of Volkswagen, Audi, Skoda and Seat in Italy (Quadrante Europa, 2013). Generally speaking, Interporto Quadrante Europa cooperates also with other Italian logistics centres such as Interporto Bologna through the national network known as “Assolinterporti” and it also collaborates with a lot of European logistics centres through the widely-known network of Europlatforms.

Concerning to the net railroad system of Quadrante Europa, it covers an area of approximately 370.000m<sup>2</sup> and it has already been separated on three different functional areas. The first one is a combined terminal which occupies the largest part of this system (140.000m<sup>2</sup>) and it provides 12 tracks (650 meters long each one) in order to serve the activities of tenants. Secondly, the complicated railway system of Quadrante Europa introduces also 18 tracks which contribute on the provision of “intermodal services” (60.000m<sup>2</sup>-Intermodal Terminal). The third department including all railroad connections of logistics centre consists of 15 tracks each 600 metres long and it is responsible to pick and deliver wagons which connect the warehouses and other functional establishments of logistics centre (110.000m<sup>2</sup>). Finally, there is a railway area for future expansion which covers approximately 490.000 m<sup>2</sup> and the main connection with the Brenner railroad has already been accomplished, as the first plan of future development. Consequently, Interporto Quadrante Europa has an available area of 800,000 m<sup>2</sup> (310.000 m<sup>2</sup> + 490.000 m<sup>2</sup>) dedicated to railway operations.

The Figure 5.29 has been created in order to depict clearly the entire layout of Quadrante Europa. More specifically, Interporto Quadrante Europa consists of the following departments:



### 5.4.3 Major actors and commodities handled

Interporto Quadrante Europa has been defined as a highly specialized "Park of Logistic Activities" not only due to the available integrated storage services (e.g. cold and refrigerated storage in contrast to Interporto Bologna) but also because the main operators of its facilities are specialized in so differentiated categories of products such as: on the one side vegetables or fruits and on the other side automobiles and automotive equipment (e.g. Volkswagen Group Italy SpA). Another unique element of Quadrante Europa is the combination of 3 different categories of operator which have already developed essential cooperative relations: loaders (production activities), forwarding agents and logistic operators. Due to its role as the main operator of combined transport terminal, Terminali Italia Company contributes significantly at the general performance of Quadrante Europa because it has the main responsibilities for all intermodal and combined road/rail services of this logistics centre. As the manager of a terminal which handles about 260.000 wagons per year, Terminali Italia conduces also to the outrageous numbers of transported goods at Quadrante Europa. More specifically, a representative element of the logistics centre's traffic is the annual amount of 6 million tons of goods by rail which are also subdivided into containers, semi-trailers, mobile and traditional wagons (Quadrante Europa, 2013). Finally there are also other similarly important operators of this logistics centre which have been classified and illustrated at the following table:

**Table 5.5 Companies included in Interporto Quadrante Europa**

<b>Management, Customs and Office Services</b>	<ul style="list-style-type: none"> <li>▪ AM Transport Srl</li> <li>▪ Dino Albrenti</li> <li>▪ Andreetto &amp; Zanon Srl</li> <li>▪ BI Service Srl</li> <li>▪ BEST Logistics Srl</li> <li>▪ CAD INTERPORTO EUROPE Srl</li> <li>▪ CADEuropool</li> <li>▪ Verona Srl</li> </ul>	<ul style="list-style-type: none"> <li>▪ Ministry of Health Uvac</li> <li>▪ Science Park of Verona SpA</li> <li>▪ Veterinary ademp.CE-Min. Health</li> <li>▪ MarSped SaS</li> <li>▪ Chemical Laboratory-Customs Agency VR</li> <li>▪ Computer Gross Italy SpA,</li> <li>▪ CON.SAR consortium cooperative society Mercedes-Benz Italy SpA</li> </ul>
<b>Agents</b>	<ul style="list-style-type: none"> <li>▪ ALPS NORTH EAST LTD</li> <li>▪ Arcese Trasporti SpA BREAKOUT SERVICE SRL</li> <li>▪ Corsi SpA, Geodis Spa</li> </ul>	<ul style="list-style-type: none"> <li>▪ Prisma SpA</li> <li>▪ Schenker Italy SpA</li> <li>▪ Synergy Solution Srl</li> <li>▪ TX Logistic AG</li> <li>▪ Bayernland Ltd</li> <li>▪ Holland Service Srl</li> </ul>
<b>International forwarders</b>	<ul style="list-style-type: none"> <li>▪ Raule International Shipping</li> </ul>	<ul style="list-style-type: none"> <li>▪ Transaldi Srl</li> </ul>
<b>General Warehouses operators</b>	<ul style="list-style-type: none"> <li>▪ Dettendorfer Italy Srl</li> <li>▪ Hangartner Terminal Srl</li> </ul>	<ul style="list-style-type: none"> <li>▪ Polar Srl</li> <li>▪ SIGMA Srl</li> </ul>
<b>Transport carriers</b>	<ul style="list-style-type: none"> <li>▪ Battistolli Ltd – Rangers</li> <li>▪ Cailotto Carts</li> </ul>	<ul style="list-style-type: none"> <li>▪ Savino Del Bene SpA</li> <li>▪ V.S.I. Srl</li> </ul>

Source: Based on Quadrante Europa, 2013

#### 5.4.4 Measuring the impact

According to the European overviews of location quotient and the number of local enterprises in transport and logistics sector (Chapter 5.1), the region of Veneto could be generally characterized as a developing logistics area in comparison to the rest European regions. On the other hand, Veneto seems to have the less well-structured and developed regional logistics sector compared to the other 4 selected cases-regions of this research's sample. Nevertheless, the main aim of this empirical analysis is to investigate if the performance of regional logistics activities has been improved the last decades and how possible is for that improvement to have been influenced by the establishment or the presence of a logistics centre in the same region. First of all, GDP per capita of Veneto was not only higher than the national and European one during 2000-2010, but it had also an upward trend all of these years from 25.300€/habitant in 2000 to 29.600€/habitant in 2010. Due to the global economic recession which has influenced intensively the Italian economy, the regional GDP per capita of Veneto began to fall after 2008, and the regional unemployment rate followed the same negative route. Concretely, the unemployment rate of Veneto was starting to increase after 2008 influenced by the rise of corresponding national unemployment rate. But it has to be mentioned that the unemployment of this region was only a little over half of the total national unemployment during the last 13 years.

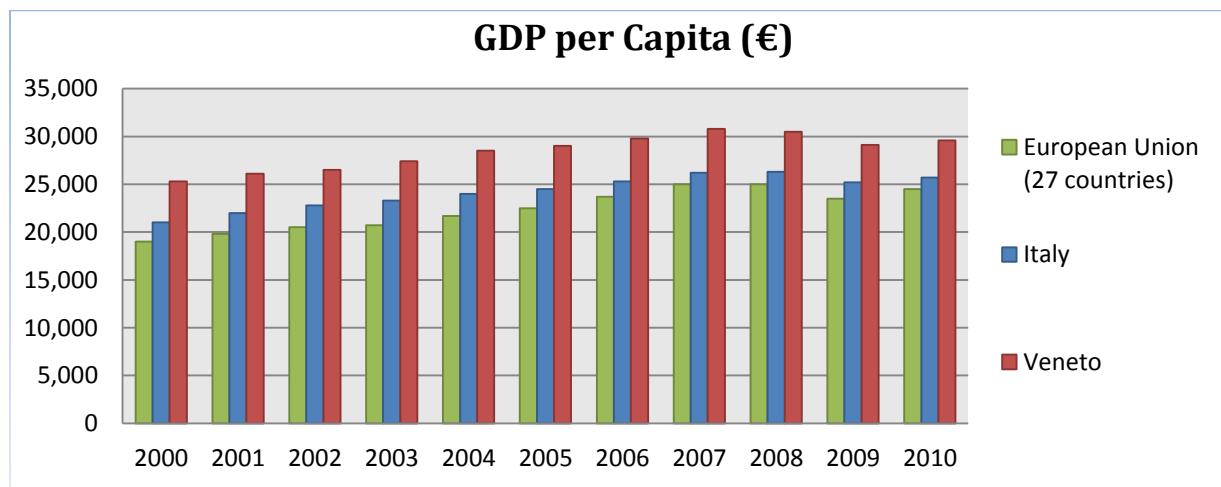


Figure 5.32: GDP per capita of Veneto

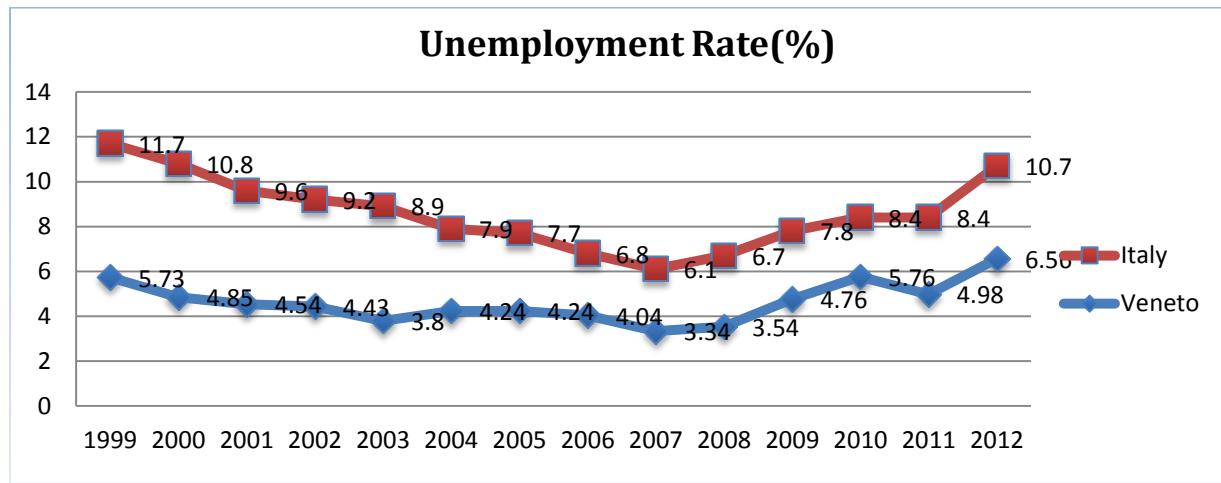


Figure 5.33: Unemployment rate of Veneto

After careful consideration, these two measurements indicate that the economic welfare of Veneto is above the average and, in turn, it implies that the majority of regional industries and sectors are quite developed. In the same line, the indicators of BIR and number of patents have been adopted here in order to observe the performance of regional industries and the progress of transport and logistics sector. Concerning to the Business Investment Rate of Veneto, there was an increasing rate similar to the corresponding BIR of Emilia-Romagna (Case 2) from 2000-2011. Furthermore, it can be noted that it started with an upward trend until 2007 but the investment attractiveness began to decrease after 2008. Finally, BIR was presented again a slow positive start after 2010 which verifies the general increased economic prosperity of region Veneto. As one of the most representative indicators for this research, the total number of patents and the number of patents in transport and logistics sector contribute significantly on the investigation of Quadrante Europa's impact to the level of regional innovation.

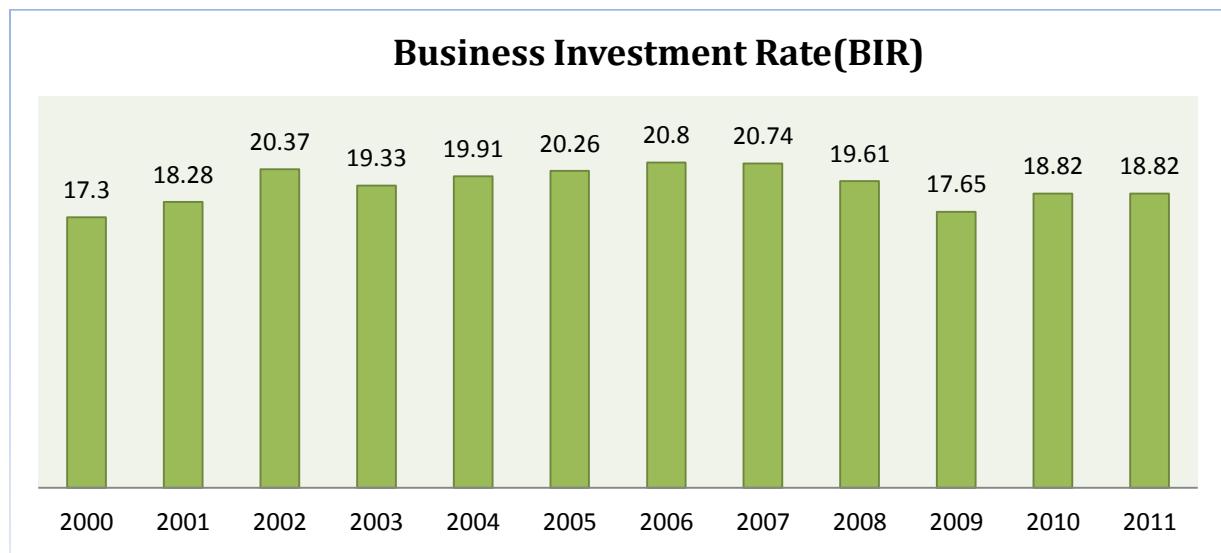


Figure 5.34: Business Investment Rate in Verona

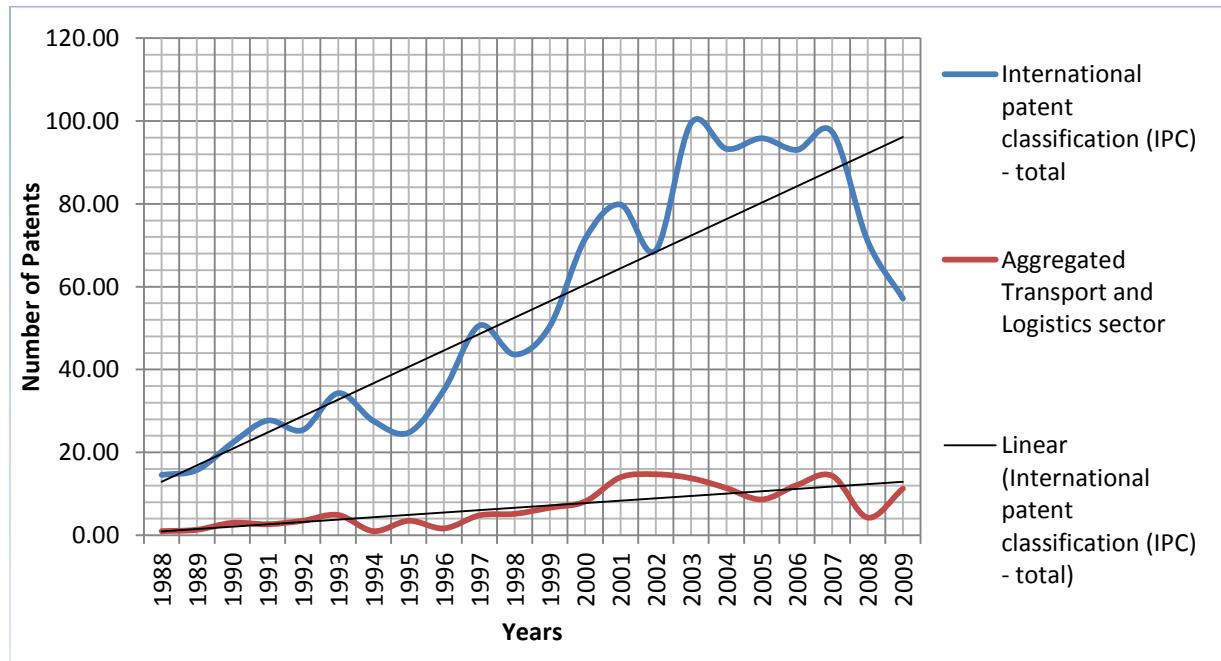


Figure 5.35: Number of Patents by priority year in Verona

As far as the total number of patents is concerned, Figure 5.33 illustrates a meaningful growth during 1988-2009 with a higher positive rate in comparison to the “number of patents in transport and logistics sector”. However, the final outcome of this figure confirms the impact of Quadrante Europa to the regional innovation for 3 main reasons: the simultaneous rise of these two indicators combined with the fact that there are available data for approximately the whole operating period of Interporto Quadrante Europa, and about the fact that these data refer to a smaller metropolitan area (Verona) than this one of Veneto region. Except for the interpretable outcome of Figure 5.33 which could be characterized as the first step for the confirmation of logistics centre’s role as economic generator, the presentation of transport indicators will significantly facilitate this process. Initially, the indicator of total transported goods by road has been depicted on the same geographical division level with “Number of patents by priority year”. As mentioned above, the adoption of this geographical level (metropolitan region of Verona) enforces the reliability and applicability of interpretation.

As a result, the shape of the following line graph demonstrates a steady annual ascent from 30.250.000 tons of imported goods in 1999 to 35.476.000 tons in 2011 (+17%). Similarly, the regional exported goods by road have presented a higher increase (+19.8%) from 32.119.000 tons in 1999 to 38.503.000 tons in 2011. In order to illustrate the regional trade volume, the annual transported goods by rail has also to be referred. More specifically, the imported and exported goods by rail had a simultaneous rise of about 16.6% and 17.9% respectively during 2005-2010. Concerning to the third available transportation mode of logistics centre, the increase of regional air freight (depicted by the bar chart of Figure 5.35) has been influenced by two main factors. As it is the first airport after crossing the Alps, it serves a large percentage of airfreight originated by Europe. Also, the direct link of Verona-Villafranca airport with Quadrante Europa has contributed significantly to the increased volume of regional air-freight because of the airport’s accessibility to this logistics cluster which includes globally-oriented transport and logistics operators. Apparently, it can be easily supported that the rise of regional air freight from 5.000 tons in 1993 to 33.000 in 2011 has been influenced by the presence of the most well-structured and developed European logistics centre, Quadrante Europa, at the same region.

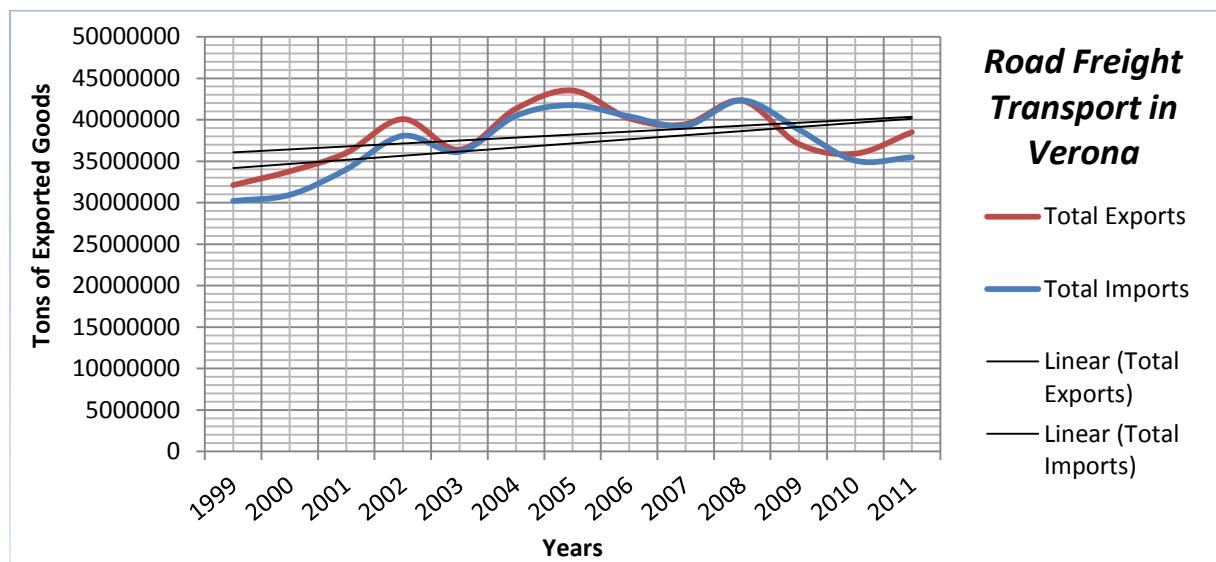


Figure 5.36: Annual Road Freight Transport in Verona

### Air transport of freight in thousands of tons

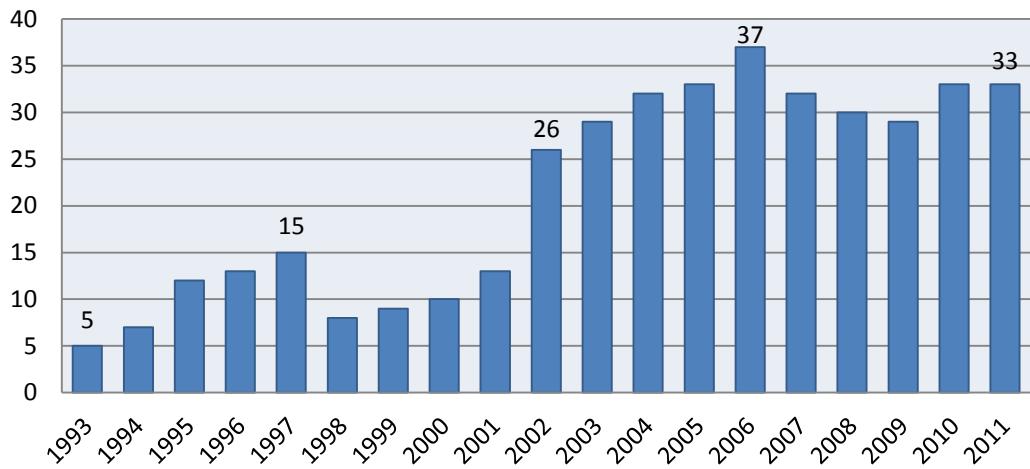


Figure 5.37: Air freight transport in Veneto

After the above extended presentation of transport related indicators, it has to be investigated the impact of Quadrante Europa as regional job creator. According to the line graph of Figure 5.36, both indicators verify the hypothetical role of logistics centre as economic and especially as employment generator of Veneto region. More specifically, there was a remarkable augmentation of new employees not only at the sector of transport and logistics but also at the indirectly related sectors which can be attracted by a logistics centre. In addition, it can be supported that there is an impact of Quadrante Europa to the creation of 85.621 (+27.5%) new jobs indirectly related to transport and logistics sector, and also 12.451 (+14.1%) news job positions in that specific sector during 1996-2010. As a result, it is very difficult to support that there is no connection and influence between the presence of a so developed logistics facility (such as Quadrante Europa) with the generation of about 100.000 new jobs directly or indirectly related to transport and logistics activities.

### Number of Persons Employed

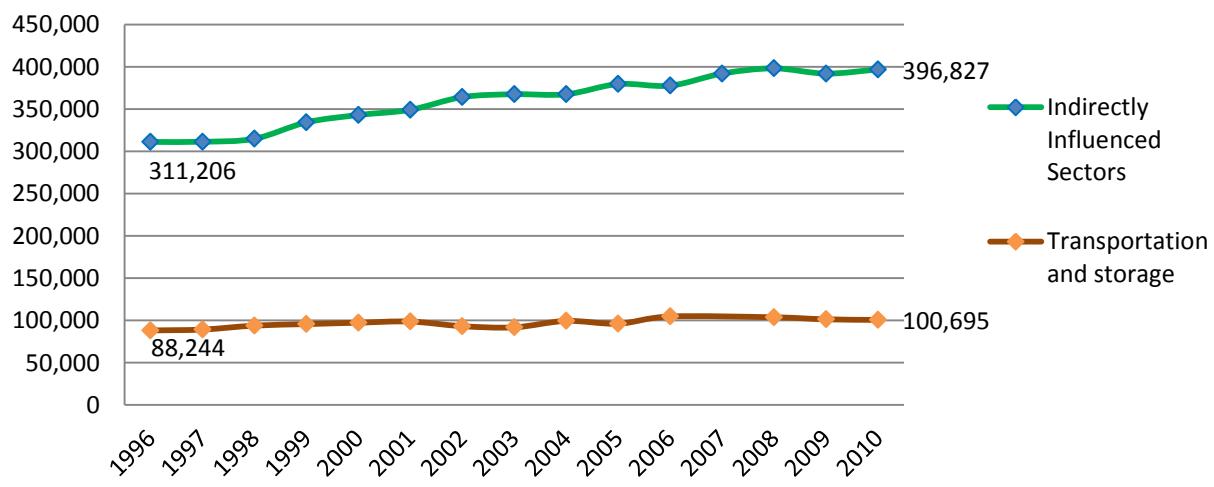


Figure 5.38: Number of Persons Employed in Veneto

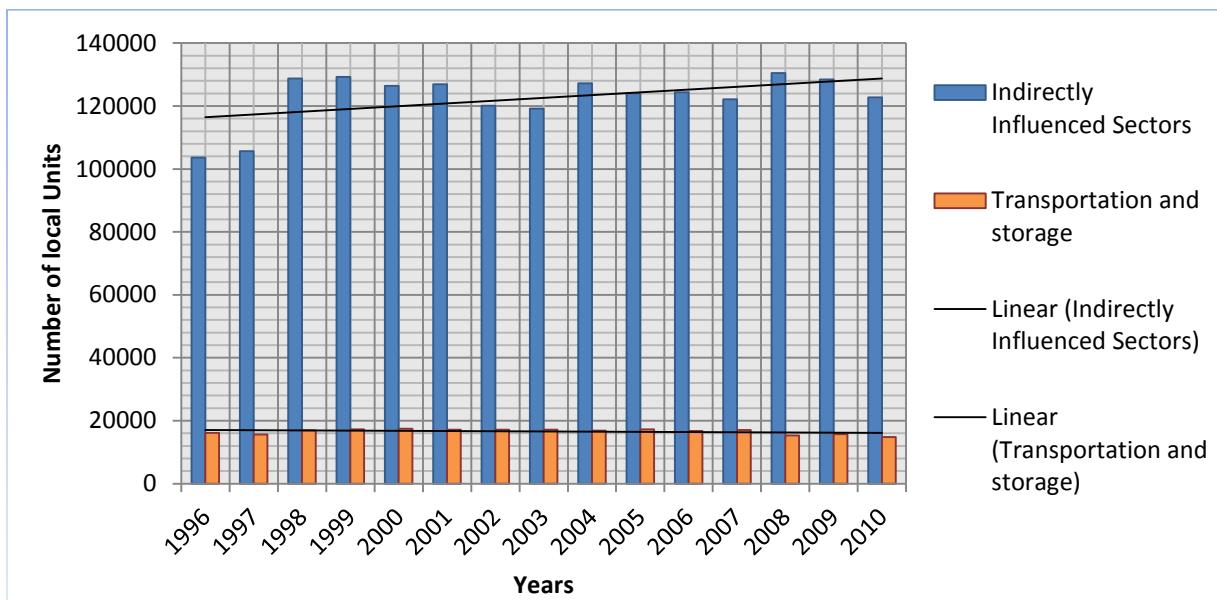


Figure 5.39: Number of local Units in Veneto

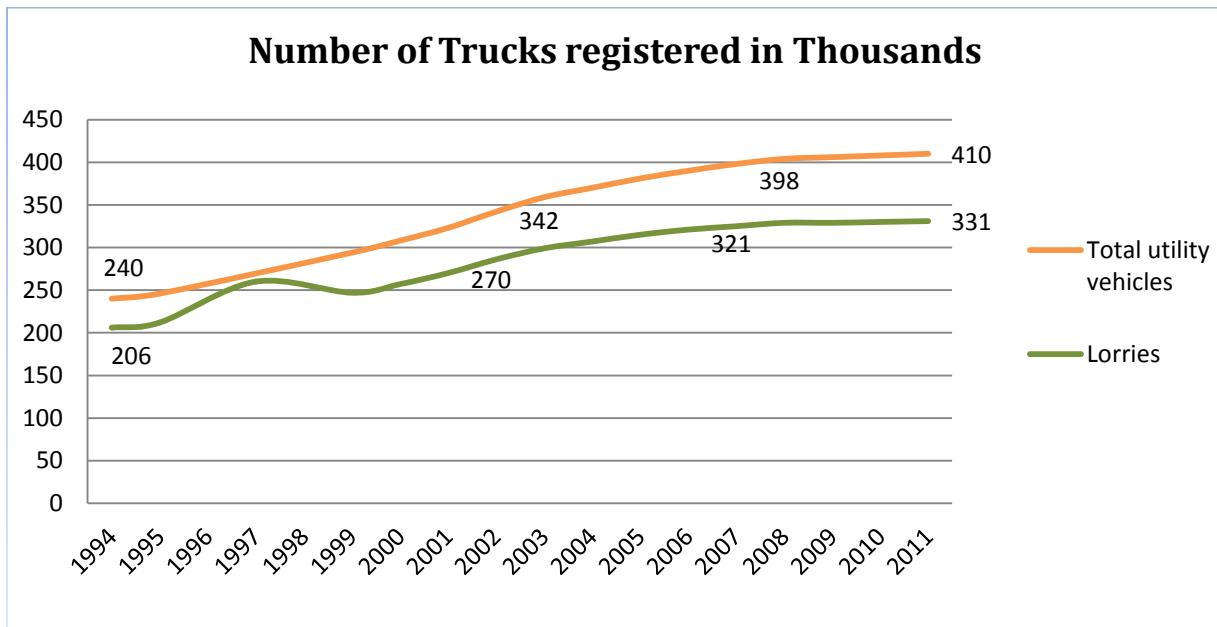


Figure 5.40: Number of Trucks registered in Veneto

Last but not least, the indicator “number of local units” was adopted in order to recognize if there was any influence of Quadrante Europa to the regional business attractiveness. The diagram does not allow any reliable interpretation due to the fact that the number of enterprises in indirectly influenced sectors has been increased and the corresponding number at transport and logistics sector has been slightly decreased during 1996-2010. Despite the absence of any statistically safe results, it has to be referred that the number of local units in indirectly influenced sectors was raised of about 18.4% from 1996 to 2010 but the number of enterprises in transportation and storage had a slow drop of about 7% during the same period. The additional diagram of Figure 5.38 seems to be more easily interpretable due to the fact that the number of trucks registered in Veneto has undoubtedly be influenced by the existence of various transport related activities of Quadrante Europa. Moreover, both numbers of total utility vehicles and especially the number of sub-category

of lorries were considerably increased from 240.000 to 410.000 and from 206.000 to 331.000 respectively during 1994-2011. As a result, the outrageous number of 125.000 (331.000-206.000) new registered trucks in 15 years could not be justified easily if there were not any agglomerated transport and logistics activities in the same region. The last figure combined with the majority of the above graphs and charts has obviously confirmed that the well-structured logistics sector in Veneto and Quadrante Europa as the main core of this sector are two of the most important drivers of regional economy.

## 5.5 Plataforma Logistica de Zaragoza (Case 4)

### 5.5.1 General Information and Ownership Structure

As an initiative of Autonomous Community of Aragón, Plataforma Logistica Zaragoza (PLAZA) was established in 2003 at the outskirts of the city of Zaragoza. Being the largest logistics centre not only in Spain but also in Europe, PLAZA was developed in order to encourage regional and national logistics industry, to exploit the strategic location of Zaragoza which connects the most prosperous and economically vibrant regions of Spain and South-West Europe, and to generate new jobs at the region of Aragón. Also, the management and the economic administration of Logistics Platform of Zaragoza is carried out by PLAZA S.A. which is a limited company established in 2000 as a joint venture between the Government of Aragón, Zaragoza City Hall and two private bank entities ("Ibercaja" and "Caja de Ahorros de la Inmaculada"). The construction of PLAZA began in 2002 and the major transport and logistics function and operations began in 2003 (Zaragoza Logistics Centre-ZLC, 2010). The initial investments of 100 million € were made, until 2005, by the local government of Aragón in cooperation with the national government of Spain. Afterwards, other additional investments have been made in order to support the site development, the installation of companies as well as the construction and expansion of rail infrastructure. As depicted by Figure 5.39, PLAZA S.A. has a share capital of 31,757,824 € and it is distributed to the following shareholders:

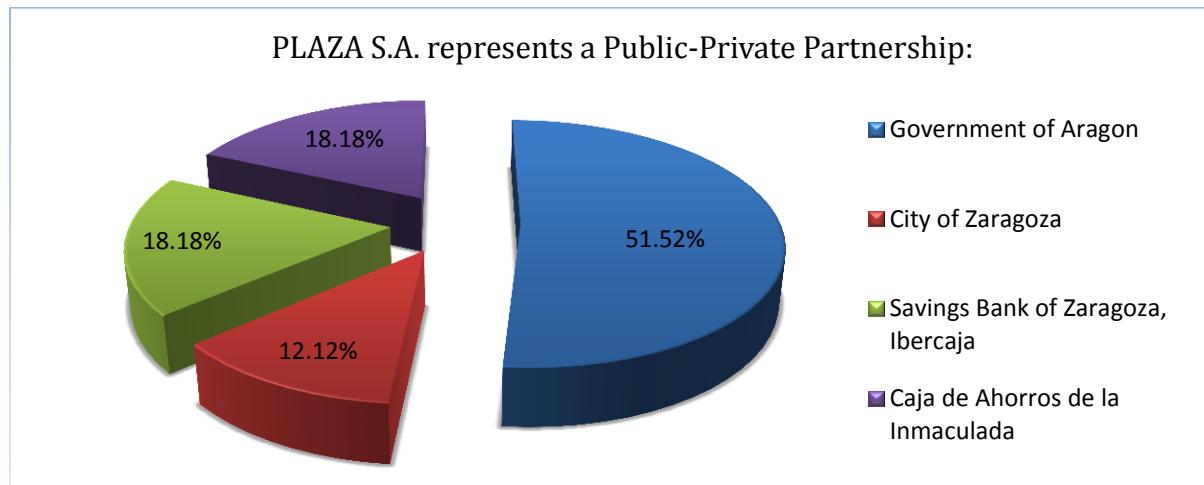


Figure 5.41: Main Shareholders of PLAZA

Except for the major role of PLAZA as intermodal transport centre, it has also the sub-function of dry port. This role depends on its equal distance from three major Mediterranean ports (Barcelona, Tarragona and Valencia) and from the Atlantic ports of Bilbao, Gijon, and Aviles y Sines. As a result, PLAZA has already established well-structured customs and directly rail links to the ports of Barcelona, Valencia and Santander in order to exploit effectively its geographical advantage. Concerning to the strategic position of PLAZA, Figure 5.40 indicates the geographical hexagon formed by Madrid, Valencia, Barcelona, Toulouse, Bordeaux and Bilbao which are among the most important commercial and production centres of South-Western Europe with more than 25 million consumers (PLAZA, 2013).



Figure 5.42: The geo-strategic position of PLAZA

The biggest red cycle of the above figure (Figure 5.40) has a radius of 300km and it concentrates more than 60% of Spain's GDP. The most valuable asset of PLAZA is the direct link to numerous rail and road transportation routes. More specifically, the Zaragoza logistics platform is directly connected with: Madrid through A-2 motorway, Huesca and Teruel through A-23, Barcelona through AP-2, Logrono and Castellon through A-68. Besides, PLAZA is located at the convergence of European trans-corridors which connect this logistics centre with Paris, Milan, Rome, Frankfurt, Amsterdam, Lyon and Brussels (PLAZA, 2013). According to the generated Figures 5.39 & 5.40, PLAZA communicates directly with the North-South Central European Corridor from Bordeaux to Valencia and it connects indirectly with the Atlantic axis entering from the border of Irún and also with the Mediterranean axis entering from la Jorquera. The high-speed railway connection to Madrid and Barcelona combined with the secure and 24/7 accessibility to the three different airports of Zaragoza, Huesca and Teruel enhance the quality of multimodal and intermodal services for companies included in the logistics centre of Zaragoza.

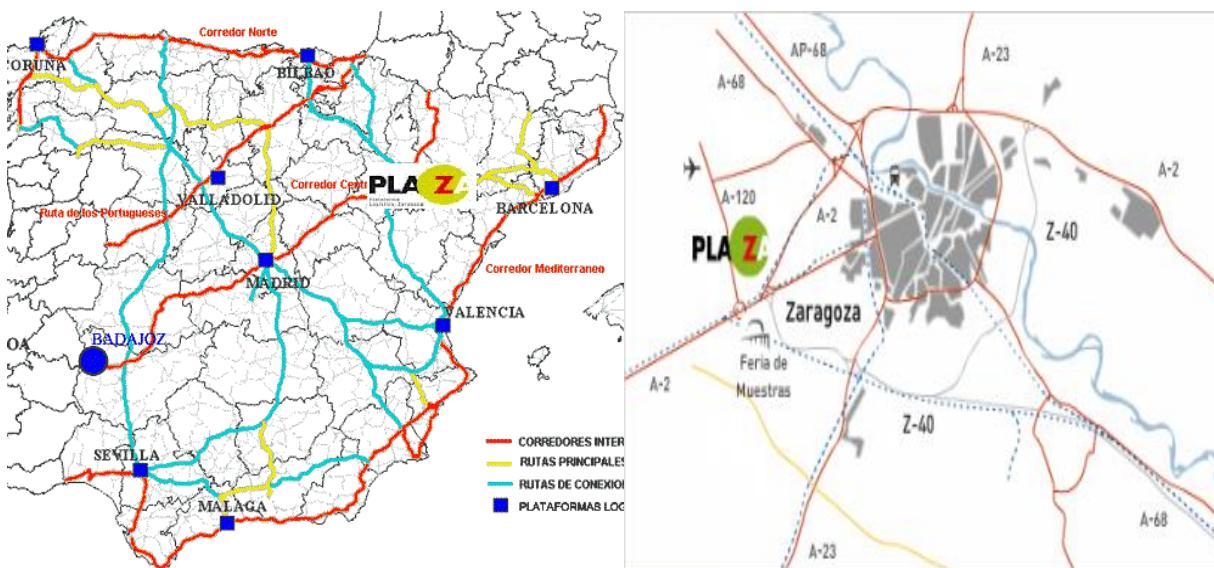


Figure 5.43: Road and Rail Networks of PLAZA

Source: Based on [www.plazalogistica.com](http://www.plazalogistica.com)

### 5.5.2 Facilities and Services Provided

The largest logistics centre on the European continent occupies an area of 13.117.977 m<sup>2</sup> which is mainly dedicated to transport, logistics, warehousing and transshipment operations. The acquisition of cutting-edge equipment, contemporary techniques and advanced infrastructures has significantly contributed on the reputation of PLAZA as one of the most effective examples among the European intermodal logistics centres. As it was established at the first decade of 21<sup>st</sup> century, Zaragoza logistics platform provides various differentiated services to the companies included in comparison to the majority of European logistics centres such as: water supply system, a dedicated area for dangerous goods, custom clearance, safety from natural disasters, high-quality security systems for commodities/goods transported and road safety <sup>21</sup>, purification plant, logistical transformer substation pumping station, autonomous electrical substation, telecommunication network, 24/7 accessibility, commercial services, airport and railway intermodal terminals, catering facilities, integrated business centre and offices, parking and landscaped areas(PLAZA,2013). Furthermore, PLAZA linked with: Aragón Dual Carriageway to the south, Zaragoza airport to the west, Imperial Canal of Aragón to the north and Fourth Ring Road to the East. Concerning to the entire layout of "Plataforma Logistica de Zaragoza", the following combined figure depicts the total surface of logistics centre and how it is distributed to various operations and functional areas:

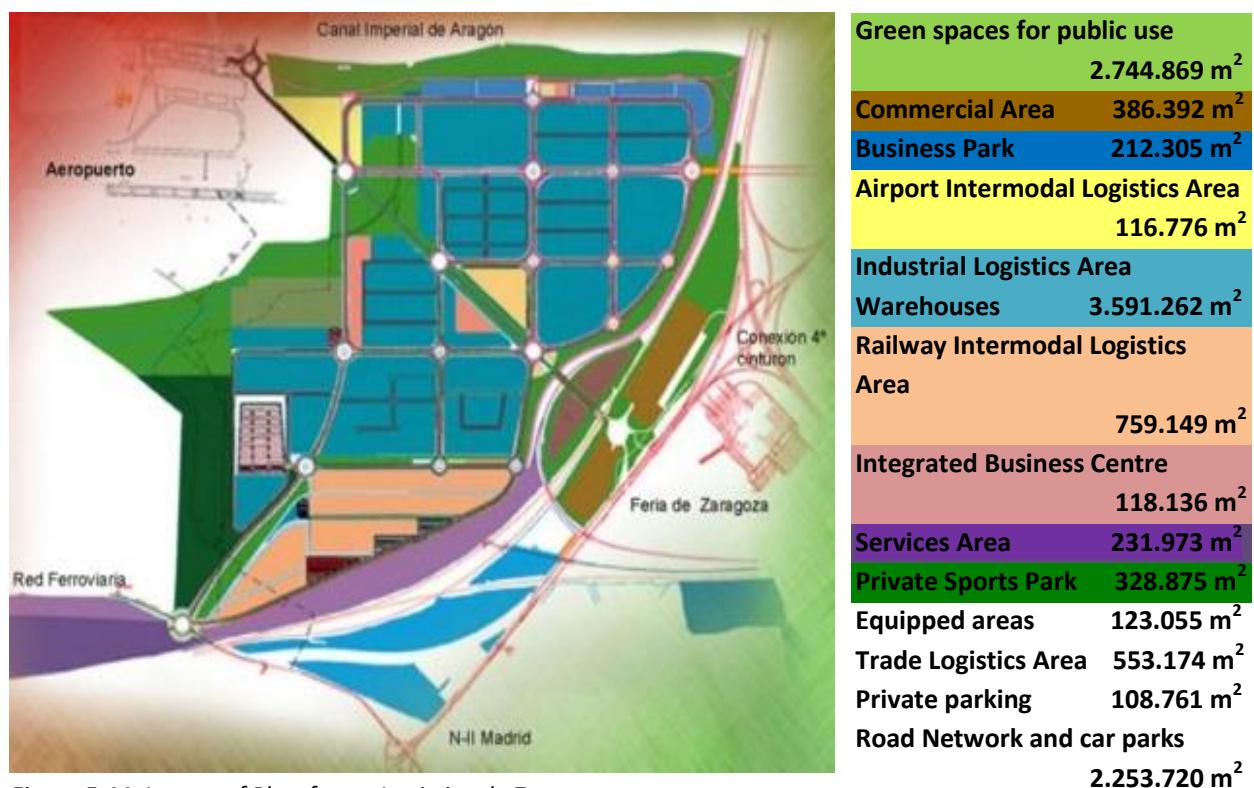


Figure 5.44: Layout of Plataforma Logistica de Zaragoza

<sup>21</sup> The security systems provided by PLAZA could be considered as a competitive advantage of this platform due to the fact that 10% of the products arriving at this time to Europe from the Eastern countries and Asia are stolen. The majority of these products are quite expensive and they belong to the categories of: snuff, alcohol, high-tech products, pharmacists, textiles and perfumes. Concerning to road safety, they have been developed 100 meter diameter roundabouts, streets of two/four/six lanes, yards 22 meters, auxiliary streets, proper signage, and service areas.

### 5.5.3 Major actors and commodities handled

As mentioned above, PLAZA was a project inspired by the Autonomous Community of Aragón and, as a result, one of its key objectives was the enhancement of regional employment and job creation. Additionally, the first confirmation about the economic impact of PLAZA to its surrounding region is the general incorrect predictions of government officials who expected approximately 70 companies to be attracted by this logistics centre in parallel with the creation of 7000 jobs (ZLC-Economic Impact of Plaza, 2010). In contrast to the expected outcome, the level of 70 companies and 7000 employees was exceeded since 2005. Nowadays, the logistics centre of Zaragoza is responsible for the creation of about 12,000 new job positions at companies included without calculating the amount of jobs outside of PLAZA which are strongly related and dependent on the economic activities of logistics centre. As far as the number of tenants is concerned, there were 139 companies in 2009 and nowadays there are currently more than 250 companies installed from which the most widely-known are included in Table 5.6 with a brief reference of their functions.

As one of the world's largest fashion distributors for a wide range of companies, Inditex was the first company established in PLAZA. It could be characterized as one of the most distinctive examples of mutual interdependencies between logistics centre and its tenants. Concretely, Inditex has not only developed in PLAZA its major European distribution centre in order to exploit the excellent infrastructure combined with intermodal and multimodal services, but it has also attracted numerous companies in PLAZA (Fierro, 2009). Except for the most representative examples of companies included in PLAZA, the following table indicates that there is a great variety of commodities handled by this logistics centre. Last but not least, PLAZA has attracted not only various companies but also it has supported the development of demarcated industrial and intermodal parks at the region of Aragón. More specifically, strong relationships and connections have been created between PLAZA and both intermodal parks named as PLATEA (Plataforma Logistica-Industrial de Teruel) and Plataforma Logistics Huesca SUR.

**Table 5.6 Global and European Companies of Zaragoza Logistics Platform**

<b>1. <i>Imaginarium</i></b>	Specialized toy retail company.
<b>2. <i>Aluminios Sopena</i></b>	Aluminum logistics complex
<b>3. <i>Proclinic, S.A.</i></b>	<i>Dental products distribution</i>
<b>4. <i>Automoción Aragonesa, S.L.</i></b>	Volkswagen automobile dealer
<b>5. <i>DHL Express</i></b>	Packaging, transport and logistics
<b>6. <i>BM Sportech</i></b>	Sports material distribution
<b>7. <i>Bodegas Carlos Valero</i></b>	Distribution of wine, champagne-wine and liquors
<b>8. <i>Avitrans</i></b>	International transport
<b>9. <i>Centro Empresarial</i></b>	Computer products distribution
<b>10. <i>Dibus</i></b>	Storage and distribution of kitchens & home equipment
<b>11. <i>Eje del Ebro. S.L.</i></b>	Transports and Logistics
<b>12. <i>Blumaq</i></b>	Delivery of spare parts and maintenance products
<b>13. <i>Esprinet Ibérica</i></b>	IT products, Consumer Electronics and Electronic components.
<b>14. <i>Maderas Izuel, S.A.</i></b>	Wood and related materials distribution

Source: Based on [www.plazalogistica.com](http://www.plazalogistica.com)

### 5.5.4 Measuring the impact

Taking into careful consideration various researches and figures of the Department of Spanish Economy, the region of Aragón is one of the most developed logistics areas in Spain and Europe. More specifically, it concentrates approximately 5% of national logistics turnover, 24% of national freight transport companies and 6% of national employment in transport and logistics sector (ALIA-Innovative Logistics Association of Aragon, 2013). Combined with these rates, the presence of the largest European logistics centre in the same region and the role of this platform as the core of transport and logistics sector in Aragón indicate an initial indirect impact of PLAZA to the regional economic development. As a result, some necessary figures and graphs have been adopted at this section in order to investigate profoundly the potential role of PLAZA as economic generator of its region. First of all, the regional GDP per capita was always higher than the national one during 1995-2010.

As it mentioned in Chapter 4, the indicator of GDP per capita is available for the metropolitan area of Zaragoza (NUTS-3) and not only for the largest region of Aragón (NUTS-2). Concerning to the average regional “income per-capita”, it was increased from 12.500€/habitant in 1995 to 25.300€/habitant in 2010 but the most noticeable result of this figure is the higher rate of regional GDP in comparison to the European one. The available data of the average European GDP per capita indicate that it was higher in 2000 than the corresponding one of Zaragoza (19.000€>16.300€) but it was lower than the regional GDP at the end of 2010 (24.500€<25.300€). Furthermore, the first time that the regional GDP of metropolitan region of Zaragoza exceeded the European one was during the first three operational years of PLAZA (2003-2006).

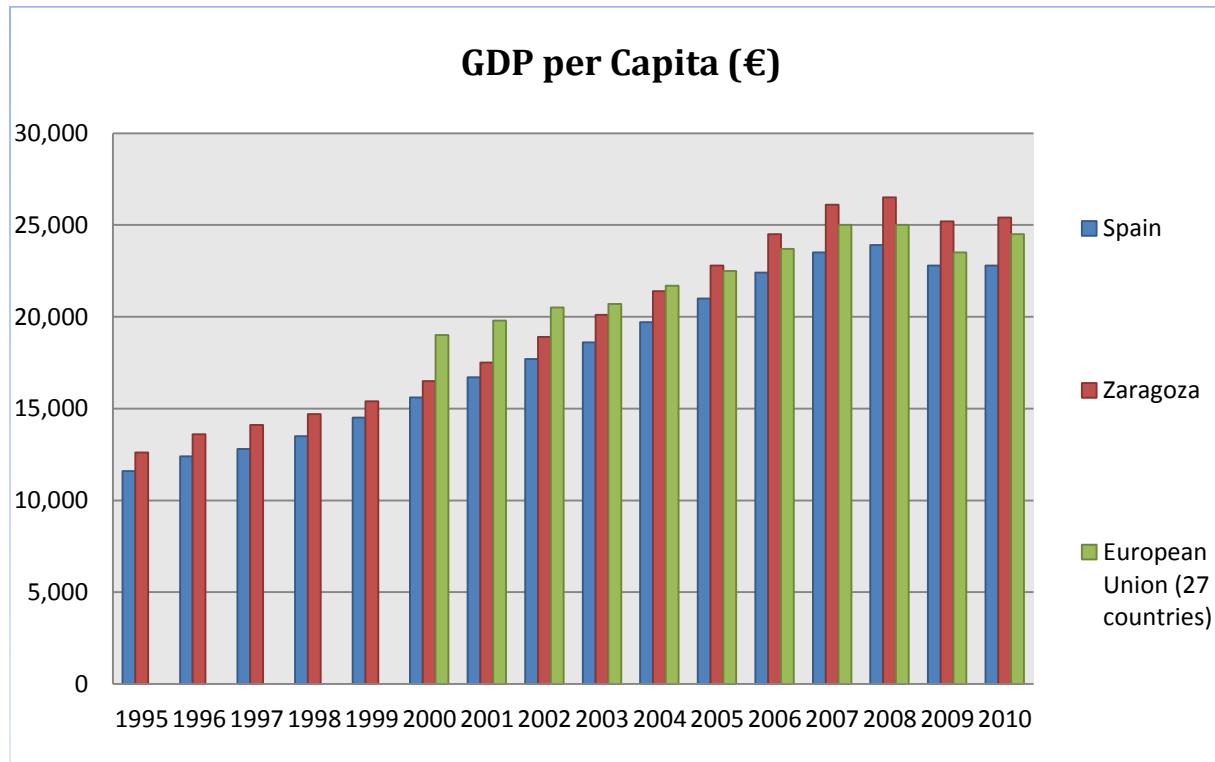


Figure 5.45: GDP per capita of Zaragoza

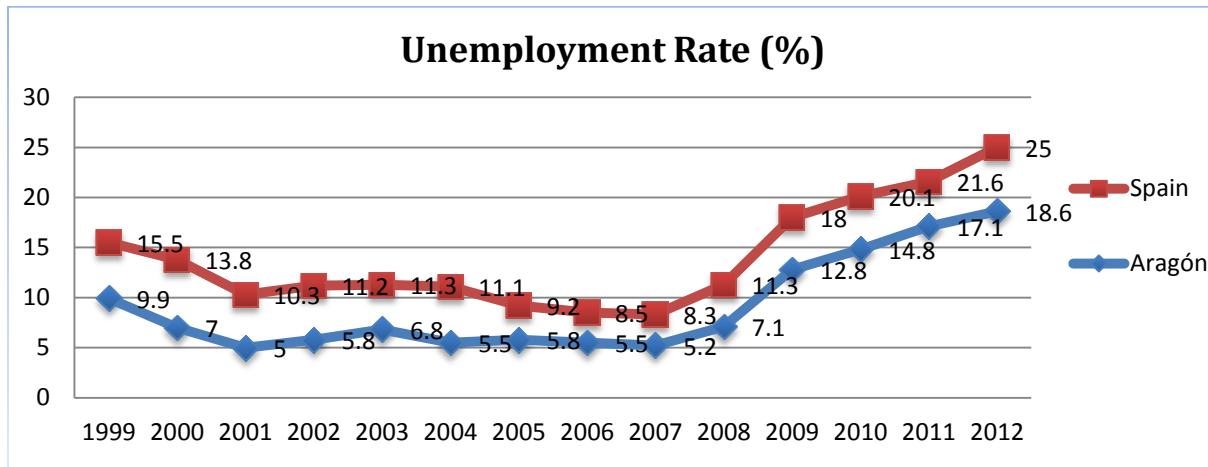


Figure 5.46: Unemployment rate of Aragón

As far as the regional unemployment rate is concerned, it is widely known that the national economy of Spain has been negatively influenced by global economic recession. As a result, the negatively increased national unemployment rate would be very difficult to have not influenced the unemployment rate of Spanish regions like Aragón. Despite the sharp increase of the unemployment rate after 2008, the regional unemployment of Aragón was always lower and equal to 60-70% of national one during the entire period of 1999-2012. Additionally, the investment attractiveness seems to have been influenced similarly by economic crisis due to the fact that the regional business investment rate had a considerable rise from 2000 to 2007 but it followed a slight decrease after 2008. However, the higher increased rate of BIR can be observed from 2003 to 2007 and it is also the most useful recommendation that can be extracted by Figure 5.45 because the operations of PLAZA began at 2003. Apparently, it can be supported that there was an indirect relation between this sharp augmentation of regional investment attractiveness and the establishment of the largest European logistics platform in the same region. Focusing more on the metropolitan and smaller region of Zaragoza, the total number of patents rose significantly from 2003 to 2009 in contrast to the corresponding number of patents in transport and logistics sector which had a non-volatile rate during the same period. The combination of the two following figures led to the conclusion that the fluctuations of regional inventive performance (Total number of patents) and the slight increase of regional investment attractiveness (BIR) until 2003 were followed by a meaningful increase of both indicators during the next 5 years which are also the first 5 operational years of PLAZA.

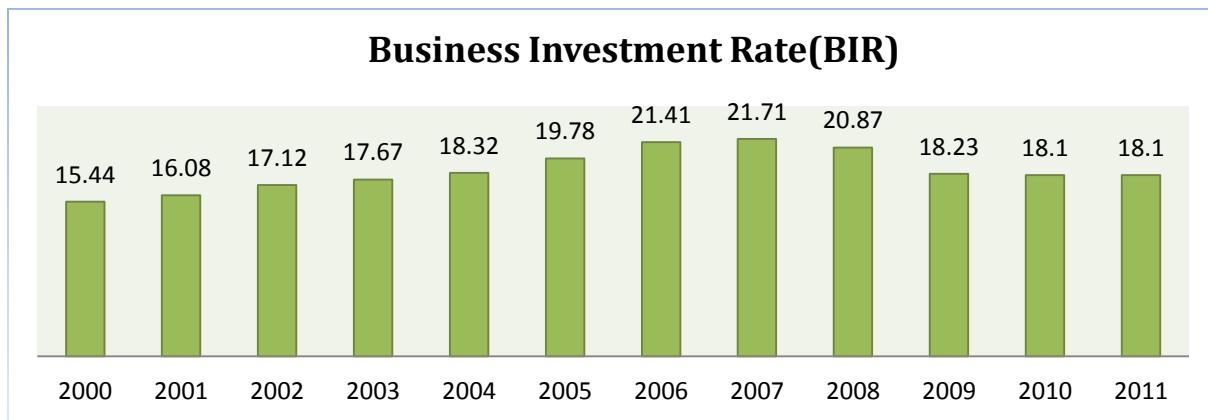


Figure 5.47: Business Investment Rate in Aragón

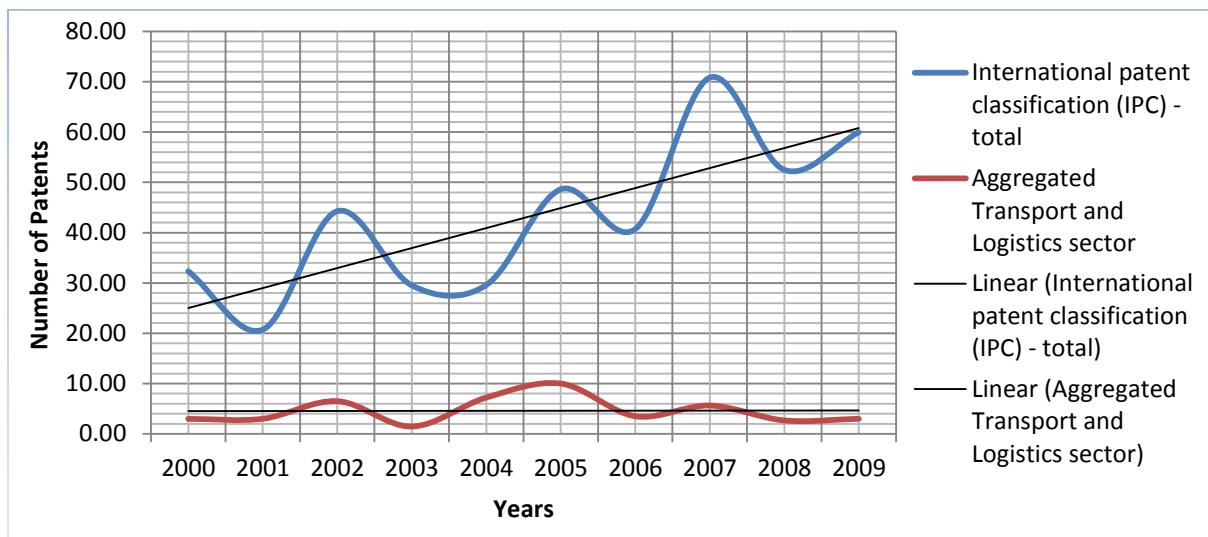


Figure 5.48: Number of Patents by priority year in Zaragoza

After the contribution of previous graphs to the investigation of PLAZA's economic impact to its region, the adoption of transport indicators reveals how the establishment of this logistics centre has influenced the regional trade volumes. Similar to the majority of the above indicators, the imported and exported goods by road were sharply ascended after 2003 with either lower increased rates or negative rates after 2008. Concretely, the regional annual imports by road have followed an upward trend from 4.039 to 5.427 million of ton-kilometres until 2003(+34.3%), there was a higher increased rate until 2008 (+70.8%) and they finally decreased until 2011. In the same way, the regional annual number of exported goods had a general raise during 1999-2011 with different positive rates among the periods 1999-2002 (+25.1%) and 2003-2008 (+66%). Consequently, such a remarkable differentiation between the positive rates of transported goods by road before- and after-2003 combined with the fact that this indicator illustrates the trade volumes of a more limited region (Zaragoza) than Aragón confirms that an initiative like PLAZA can be quite responsible for these changes.

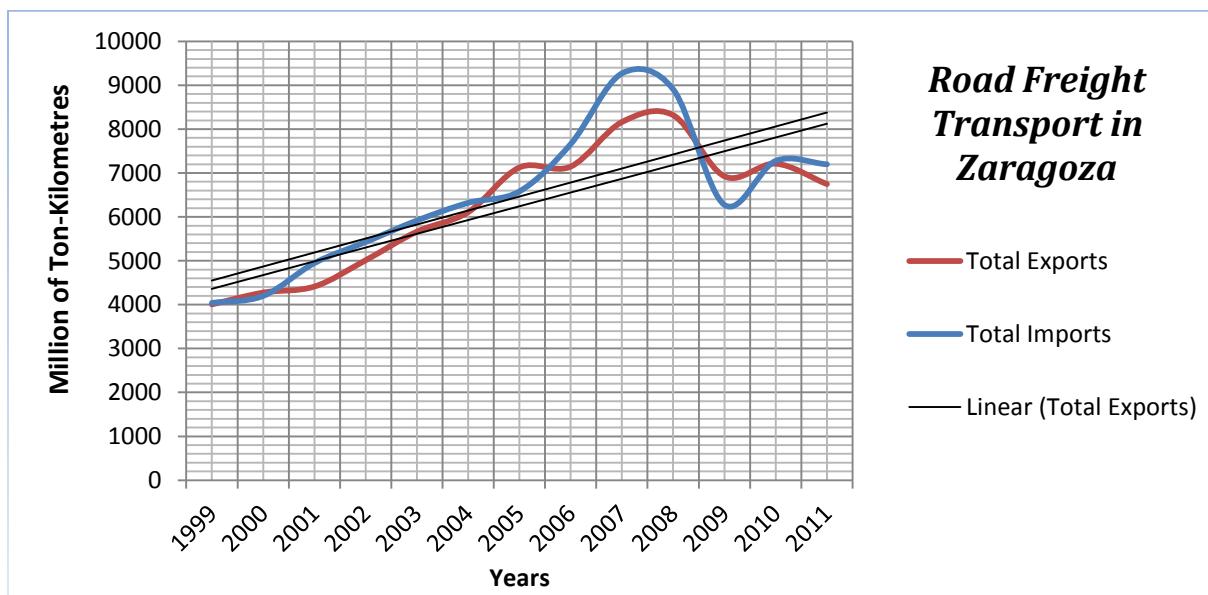


Figure 5.49: Annual Road Freight Transport in Zaragoza

Afterwards, it can be generally referred that the economic welfare of Aragón relies on rail transport for two main reasons: Aragón has two times more rail networks than the capital region of Comunidad de Madrid and the regional total transported goods by rail were always higher than the corresponding average national ones (IAEST-Aragonese Institute of Statistics,2012).Continuing with the investigation of regional trade volume, the annual imported goods by rail presented a slow-down from 2005 to 2011. The annual exported railway goods followed the same “slight” decrease only until 2008. During 2008-2011, there was a steep drop of the regional exported goods by rail which was mainly influenced by the massive reduction of railway exports at metropolitan sub-regions of Huesca and Teruel <sup>22</sup>. According also to the Aragonese Institute of Statistics (2012), the regional rail exports of Aragón declined by approximately 42.2% during 2008-2009 due to the decrease of railway exports in Zaragoza (-21.1%), Huesca (-58%) and Teruel (-63%). Consequently, it can be observed that the slightly decreased railway exports of Zaragoza, where PLAZA is located, did not have the biggest share of responsibility for the dramatic fall of the total regional exported goods by rail.

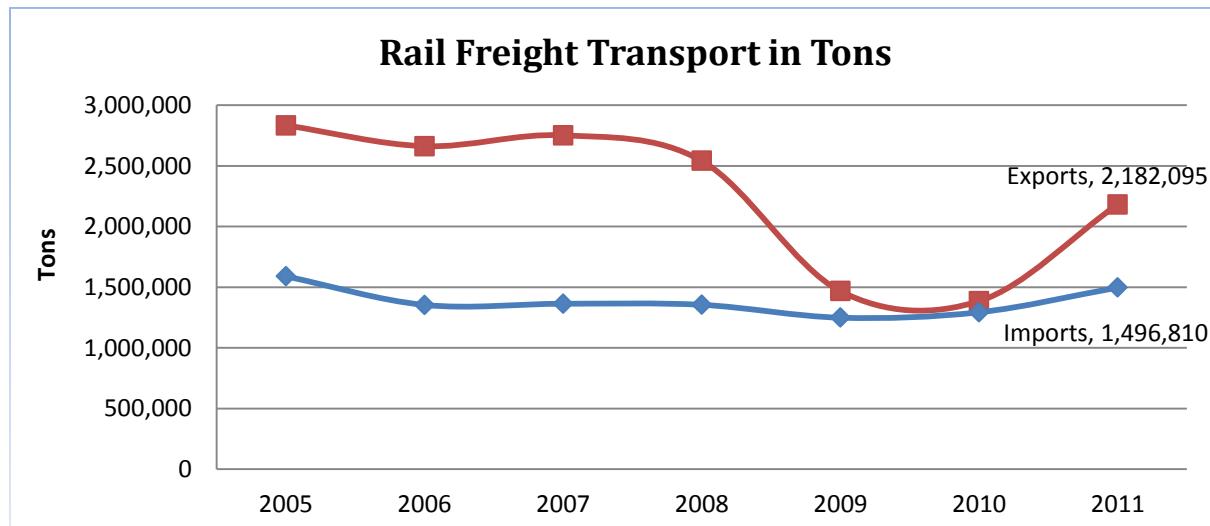


Figure 5.50: Annual national and international railway goods transport in Aragón

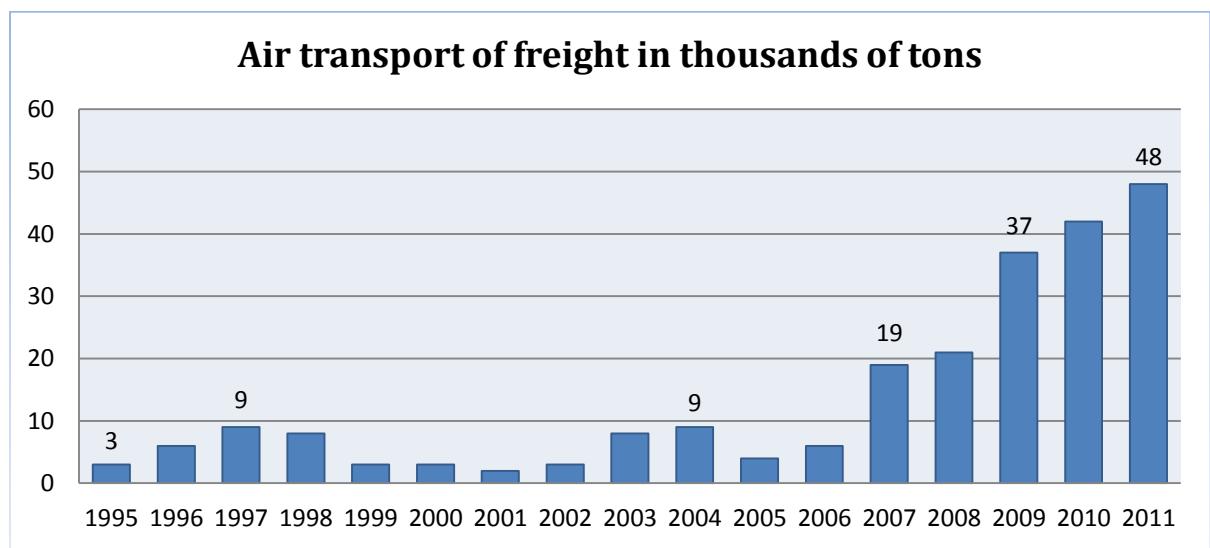


Figure 5.51: Air freight transport in Aragón

<sup>22</sup> The region of Aragón consists of 3 major metropolitan regions: Zaragoza, Huesca and Teruel

As the final measurement of regional trade volume, the above bar chart operates as a confirmation of PLAZA'S impact to the air transport of freight in Aragón. An initial upward trend of regional air freight from 1995 to 1997 was followed by various fluctuations until 2004 when the tons of transported goods by air started gradually to rise until 2011. Concerning to the slight drop of airfreight during 2004-2006, it can be justified by the fact that the provision of air intermodal services of PLAZA did not start immediately after the establishment of logistics centre in 2003 (PLAZA S.A., 2006). The general low volumes of regional air freight from 1995 to 2004 combined with the sharp rise of air-freight the next 7 years from 9.000 in 2004 to 48.000 in 2011 indicates the influence of the first established air intermodal terminal in region. Except for the air intermodal services of PLAZA, the considerable increase of air freight depends on the direct links which have been developed after 2004 between the 3 major airports of Aragón with the largest logistics centre in Europe (PLAZA, 2013).

Regarding to the regional employment concentration in transport and logistics sector, Aragón has been recognized as one of the most important logistics employment hotspots in Spain. Except for these statistically proved arguments of European project "SoCool@EU", Figure 5.50 indicates that the numbers of persons employed in transport and logistics sector increased from 20.026 to 30.706 during 1999-2010. In order to reveal if PLAZA contributes or not on this considerable augmentation, it has to be referred that the number of employees has been ascended from 20.026 to 23.069 employees (15.2%) during the 4 years-period before the development of logistics centre but they increased from 23.069 to 30.706 (33.1%) during the next 5 years after the establishment of PLAZA. The number of persons employed at sectors which are indirectly related to transport and logistics sector has followed a steady upward trend without any remarkable fluctuations before- and after the foundation of PLAZA. As the core of regional transport and logistics sector in Aragón, the logistics centre of Zaragoza seems to have contributed significantly, after 2003, on the creation of 16.536 (7.637+8.899) new job positions directly or indirectly related to transport and logistics operations.

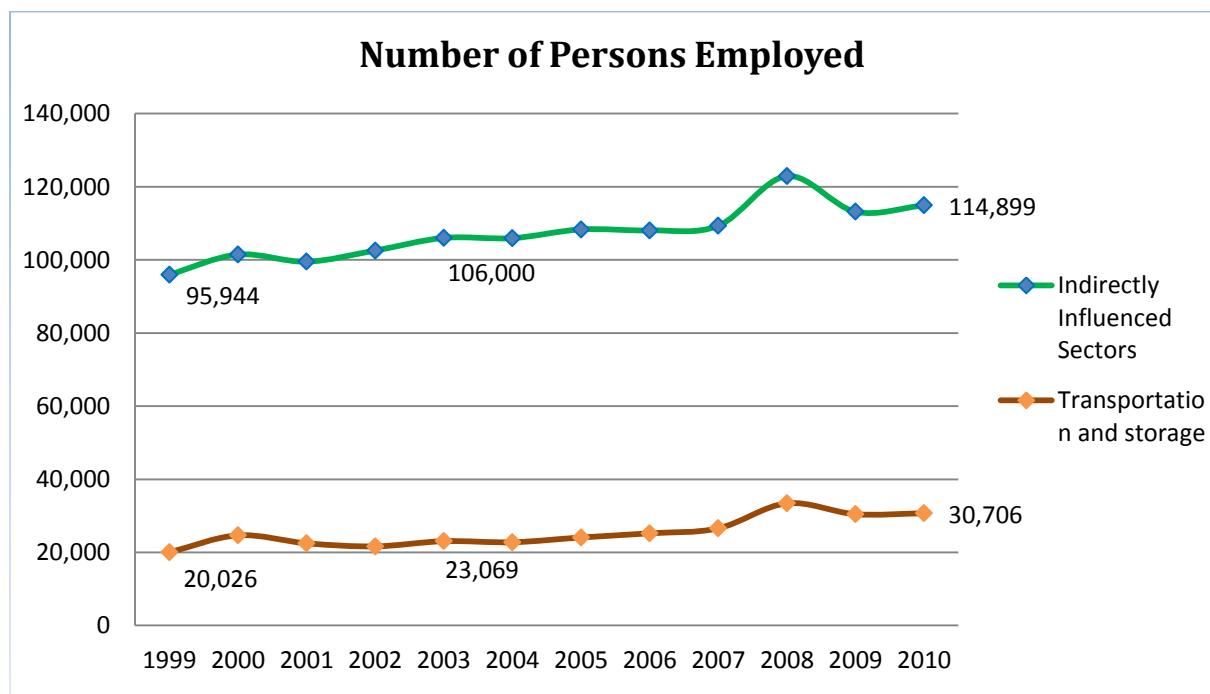


Figure 5.52: Number of Persons Employed in Aragón

As far as the number of local units is concerned, the depicted outcomes of Figure 5.51 are more easily interpretable due to the fact that they indicate clearly and directly the role of PLAZA as economic generator of its region. More specifically, the number of transport and logistics enterprises registered was slightly decreased(-4%) from 1999 to 2003 but it followed a rising trend after 2003 which led to the establishment of 515 new transport and logistics local units in Aragón until 2010. However, the number of enterprises in indirectly related sectors was maintained in the same level without any remarkable fluctuations. As a result, the establishment of PLAZA in Aragón:

1. **Impeded** the dramatic decrease of regional firms whose operations are indirectly related with transport and logistics sector, as it happened at the majority of European regions after 2008,
2. **Changed** significantly the negative regional attractiveness of transport and logistics firms with a gradual positive rate of new firms registered every year.

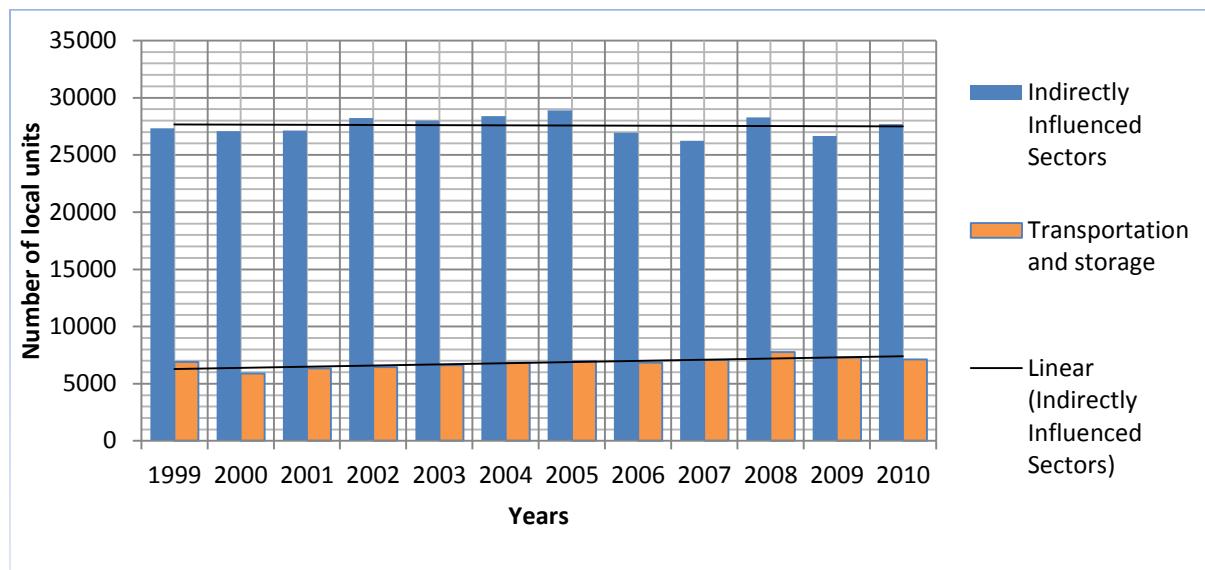


Figure 5.53: Number of local Units in Aragón

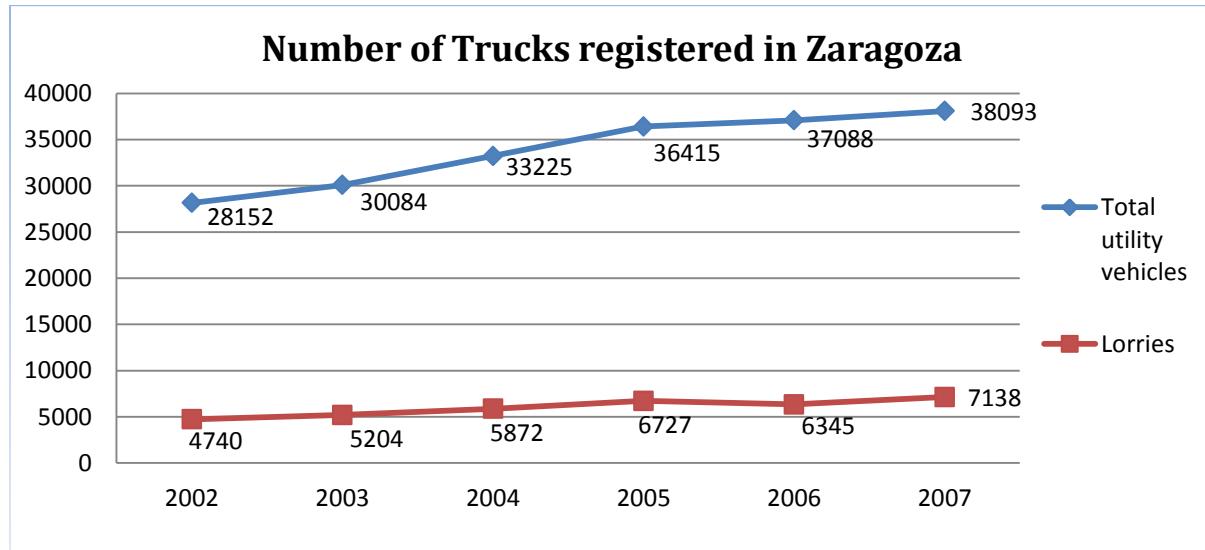


Figure 5.54: Number of Trucks registered in Zaragoza

In the same way of thinking, the available data of the number of trucks registered in the metropolitan region of Zaragoza was adopted in order to verify the paramount role of PLAZA to attract transport and logistics firms at its surrounding region. Having also the chance to investigate these numbers in a more geographically limited area than Aragón, the reliability and the applicability of interpretations are considerably increased. Concretely, there were 8009 new transport vehicles registered and 1934 new lorries registered from 2003 (when PLAZA started to operate) to 2007. In other words, the number of trucks (lorries) registered in the small metropolitan region of Zaragoza increased by 37% only in a 4 years-period (2003-2007). In conclusion, the sharp augmentation of the regional number of trucks registered in Zaragoza combined with all above indicators and graphs confirms the role of PLAZA as an employment generator and, generally, as a regional economic driver which has influenced significantly the investment attractiveness, the purchasing power and the trade volume of its surrounding region.



## 5.6 Budapest Intermodal Logistics Centre (Case 5)

### 5.6.1 General Information and Ownership Structure

As the largest logistics centre in Hungary and Central Eastern Europe, the idea for the establishment of Budapest Intermodal Logistics centre(BILK) was adopted as an initiative of government in 1993 but its construction started in 2002 after the foundation of BILK Logistics Pte. Co. This company is the main administrator of BILK and its major shareholder is the private company Waberer's Holding Logistics Pte. Co. The other two zones of logistics centre are the BILK Kombiterminál and the Soroksár Terminal Railway station. The owner of the former (intermodal-combined terminal) is the Rail Cargo Hungaria Plc and the latter is managed by Hungarian State Railways (MÁV Co. Ltd). Besides, Figure 5.53 indicates not only the public-private partnership project of BILK but also the roles of public and private authorities to the construction, development and function of logistics centre. The initial investments costs were captured by both private and public operators due to the fact that the main objects of BILK's development are: the integration of complex transport, distribution and logistics services and the increase of intermodal transport (private interests) as well as the reduction of urban traffic generated by trucks and the mitigation of negative environmental impacts of this traffic (public interests). Moreover, another reason of public authorities' participation was to stimulate the creation of new jobs and generally of new conditions which support and facilitate the regional economic growth.

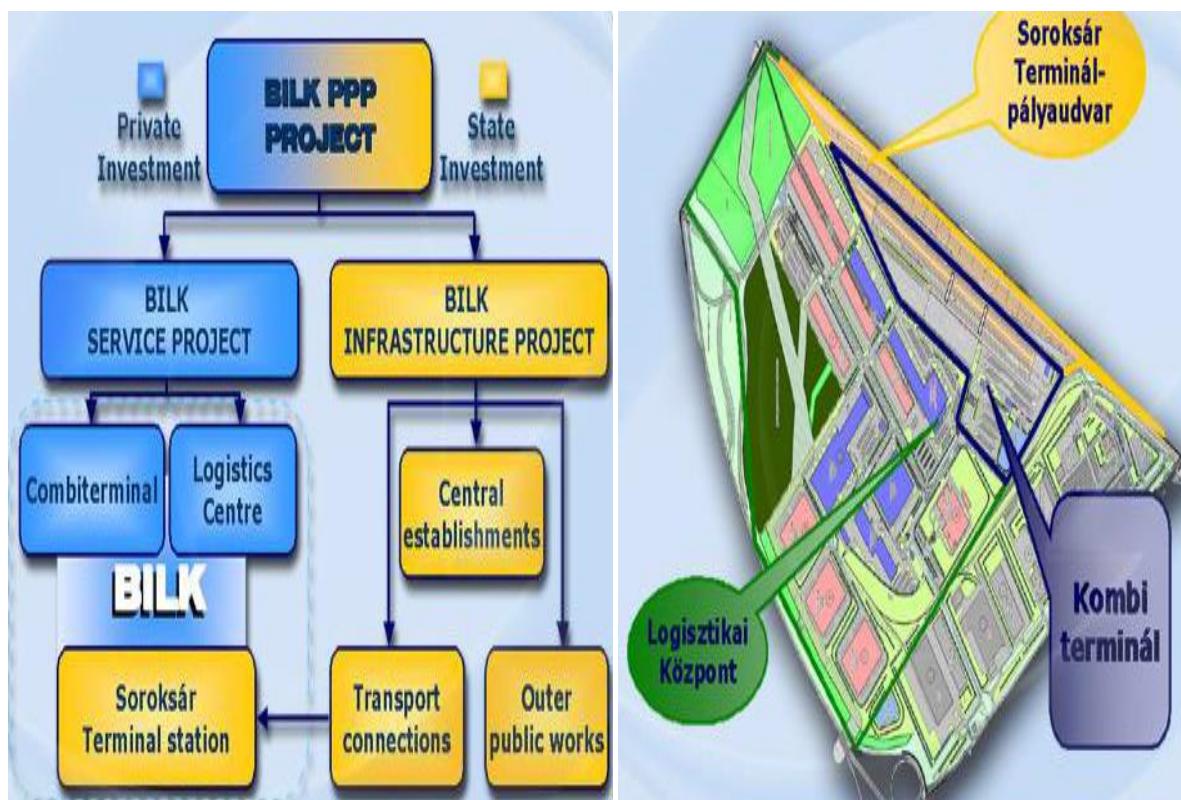


Figure 5.55: The organizational and management structure of Budapest Intermodal Logistics Centre  
Source: [www.bilk.hu](http://www.bilk.hu)

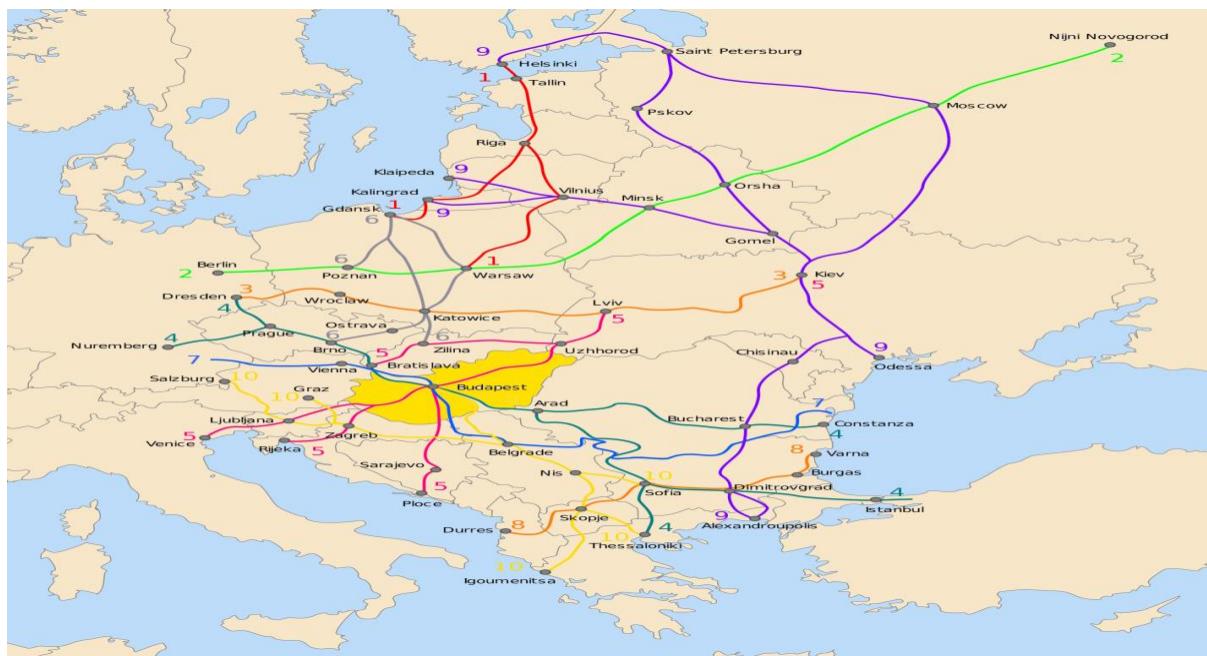


Figure 5.56: European TEN-T Corridors

Source: [www.bilk.hu](http://www.bilk.hu)

Additionally, BILK is located at the south outskirts of Budapest and it has direct or indirect access to various destinations either through national or international connections. The advanced multimodal services offered to the companies included in this logistics centre depend on its own connection with M0 Highway which was established on 2005 and the main road in parallel with the direct access to the railway line of Budapest-Kelebia. Aside from its accessibility to rail and road networks, BILK provides also water and air transport services due to the fact that it is equidistant (approximately 15km) from the Freeport of Csepel and the Ferihegy Airport (Budapest Airport). According to Figure 5.54, BILK is located at the convergence of 4 European TEN-T corridors of Central and Eastern Europe(Corridor 4 “Nuremberg-Istanbul”,Corridor 5 “Helsinki-Valletta”, Inland Waterway Corridor 7, Corridor 10“Salzburg-Thessaloniki”). As a result, this logistics centre can play the role of transport hub between numerous territories of East and West Europe and it can also operate as an eastern-western turning point in order to exploit effectively its geographical advantage. Finally, Figure 5.55 clearly illustrates not only the important geo-strategic position of BILK but also its major inland waterway, road and rail connections.

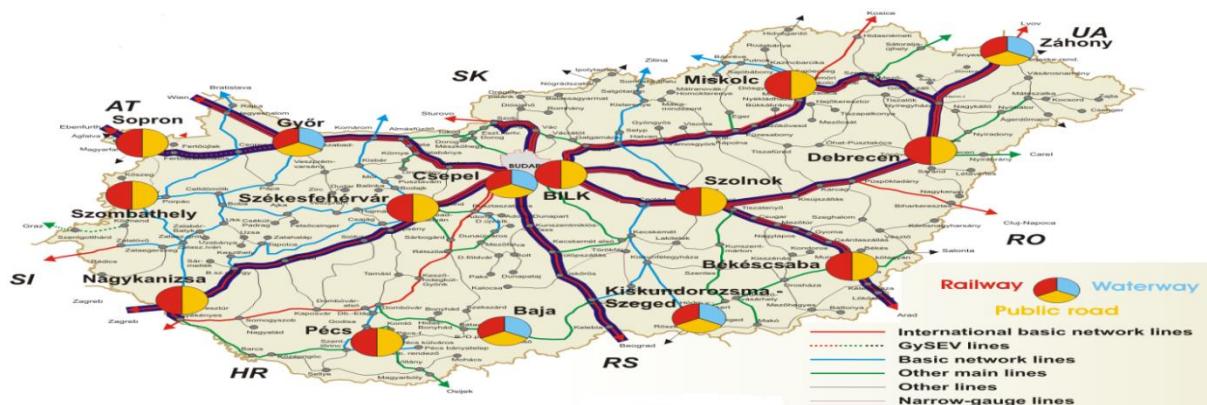


Figure 5.57: Rail/Road/Inland Waterway connections of BILK

Source: <http://www.kti.hu/index.php/services/trends--graphic-database>

## 5.6.2 Facilities and Services Provided

The Budapest Intermodal Logistics Centre is an area of 1.000.000 m<sup>2</sup> which is divided in three different zones with different operators and functions. The largest zone occupies approximately 70% of the total area and it is managed by BILK Logistics Pte.Co. which mainly offers real estate rental and leasing services. As mentioned above, the second largest area belongs to the BILK Kombiterminál Co. Ltd. which operates the main combined terminal of logistics centre and it provides intermodal services. The rest area is known as Soroksár-Terminal railway station or the “marshalling-yard” of BILK which occupies only 10% of the total area and its major operator is the Hungarian State Railways. As a 21<sup>st</sup> century's European logistics centre, BILK provides not only the conventional transport and logistics services but also some differentiated services supported by advanced technological equipment and modern IT systems such as: storage and distribution of pharmaceutical drugs/comestibles/frozen and fresh goods, forwarding dispatching activities, logistics event planning, warehouses of hazardous goods (ADR warehouse) and potentially explosive goods, containers repairing/cleaning/ inspection, postal service networks and distribution, finishing packaging & assembly, Just-In-Time (JIT) supply services for manufacturing systems, pricing, labeling, custom packaging, depot for empty containers and handling of reefer containers, etc. The following figure depicts more clearly the entire layout of BILK:



Figure 5.58: Layout of Budapest Intermodal Logistics Terminal

Source: [www.bilk.hu](http://www.bilk.hu)

### 5.6.3 Major actors and commodities handled

Beside the 3 abovementioned major operators of BILK, there is a wide range of other companies included in logistics centre of Budapest which offer either transport and logistics services or other supporting and administration services. As the founder and manager of BILK Logistics Pte.Co., Waberer's Holding Pte. Co cooperates with various partners in order to ensure the effective and sustainable operation of logistics centre. More specifically, the following table was generated in order to present the major operators of BILK and some of the most important tenants of logistics centre's warehouses.

**Table 5.7: Key Partners of BILK Logistics Pte.Co.**

Transport, Logistics and Distribution Forwarders	Supporting and Administration Services/ Management and Other Functions
Lagermax AED Hungary Kft.	ACCES BUSINESS GROUP
SCHENKER Nemzetközi Szállítmányozási és Logisztikai Kft	Decora Hungária Kft.
Szemerey Transport Zrt.	Papyrus Hungária Zrt.
Agility Magyarország Logisztikai és Szállítmányozási Kft.	NUTRIFER Kft.
Yusen Air and Sea Service (Deutschland) GmbH Magyarországi Fióktelepe	SCA Hygiene Products Kft.
Trans-o-flex Hungary Kft.	SEWS-Components B.V (SUMITOMO)
Lagermax Spedíció Kft.	-

Source: [www.bilk.hu](http://www.bilk.hu)

In the same line with the previous 4 cases of this research, the total storage capacity of BILK has not been created immediately after the establishment of logistics centre in 2003. Concretely, there were some stages before the development of the current storage area which exceeds 169.000 m<sup>2</sup>. As a result, the already constructed warehouses of BILK occupies more than 15% of the logistics centre's total area. Last but not least, Figure 5.57 illustrates the different stages which were followed for the development of BILK's storage area:

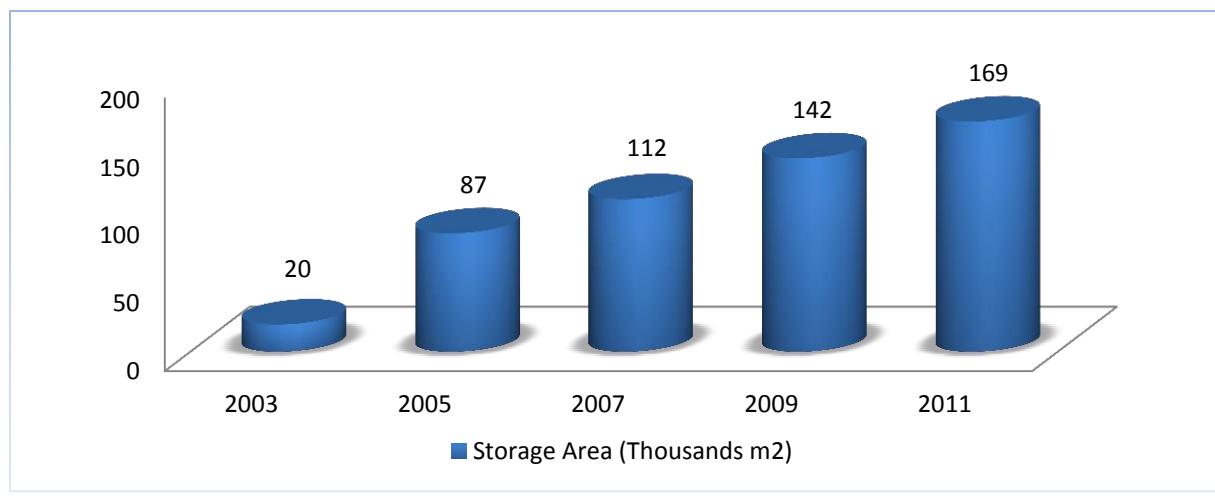


Figure 5.59: The development stages of BILK's warehouses

### 5.6.4 Measuring the impact

Similar to the previous 4 cases of research, the economic impact of Budapest Intermodal Logistics Centre will be examined through various graphs and charts which are either directly or indirectly related to regional transport-logistics sector. Concerning to regional GDP per capita, this measurement is available not only for the region of Közép-Magyarország (Central Hungary) but also for the metropolitan region of Budapest (NUTS-3). As a result, there is a chance to examine GDP per capita for a smaller and more limited area than Central Hungary and it will also facilitate to depict a more direct impact of BILK to the regional economic welfare. Regarding to the availability of data for a lower geographical division level (NUTS-3), the same also happens with the indicators of Number of patents, imported and exported goods by road and number of trucks registered in region which will be presented at the following parts of this section. According to Figure 5.58, both national and regional GDP was always lower than the average European one during 2000-2010. However, the regional GDP per capita of Budapest was not only increased with a higher positive rate than the national one but also it was equal to “51.5%” of the European GDP per capita in 2000 and “86%” of this one in 2010. As it has been referred at section 5.6.1, the construction of BILK started at 2002 but the first advanced functions started after 2003. Consequently, it can be supported that the establishment of the largest logistics centre has influenced considerably the sharp increase of purchasing power (GDP per capita) of a limited region than this one of Budapest.

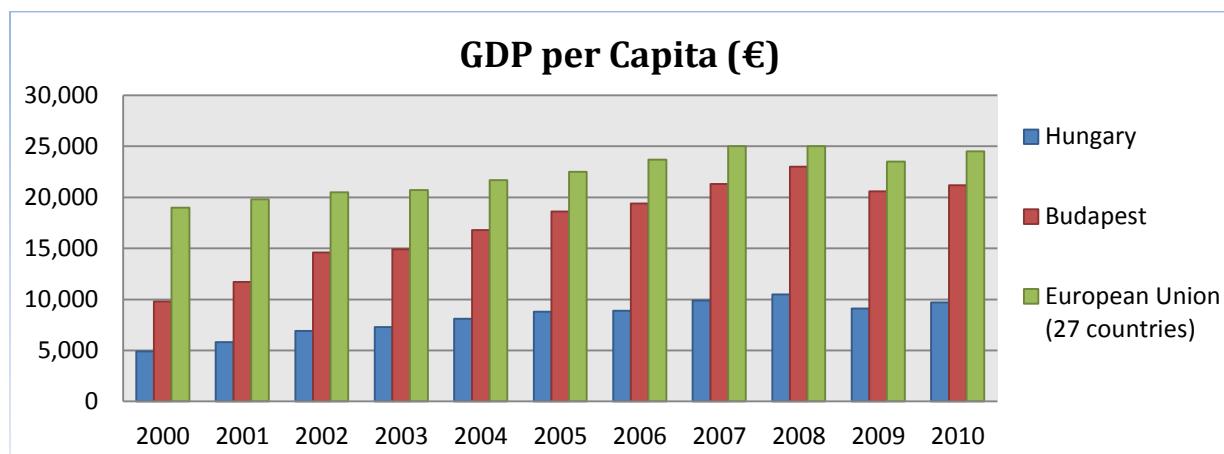


Figure 5.60: GDP per capita of Budapest

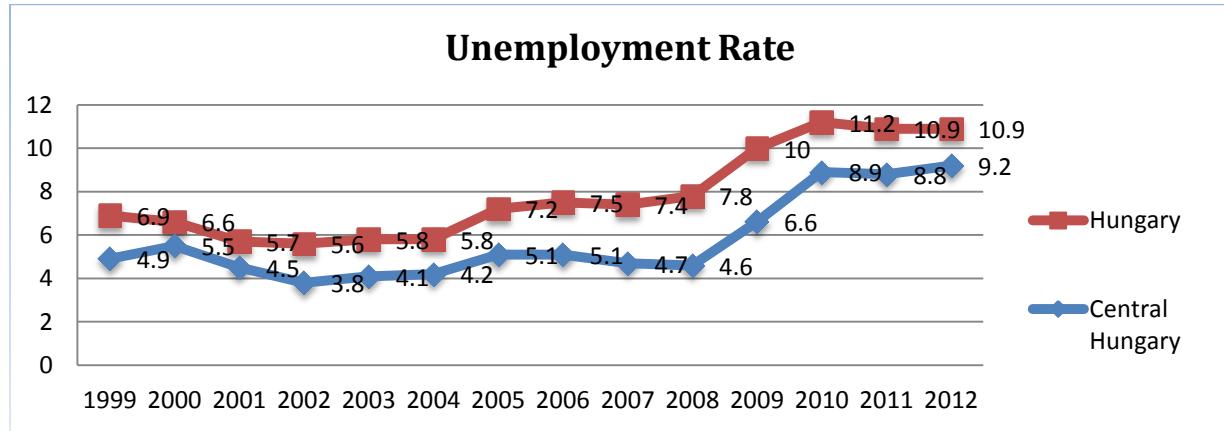


Figure 5.61: Unemployment rate of Central Hungary

In parallel with GDP, the unemployment rate has also been adopted in order to illustrate the regional welfare of Central Hungary. On the one hand, the regional unemployment rate was always influenced by the national one and for this reason it followed its negative increase after 2008. On the other hand, the regional unemployment was only a little over half (55%-70%) of the national one and the only exception seems to be the years of 2004, 2005 and 2012 because the regional unemployment rate (9.2%) reached to be 82% of the average unemployment rate of Hungary during those years. Only during 2006-2008, the unemployment rate of Central Hungary had a different route (negative) in contrast to the national one but this route was ended in 2008 after the beginning of global economic recession. Due to the fact that one of the main purposes of public authorities was to enforce the regional employment of Central Hungary through the development of BILK, the period of 2006-2008 can be identified with the first operational years of logistics centre because the largest part of current storage area was constructed after 2004 (Figure 5.57: The development stages of BILK's warehouses). As the largest logistics centre in Hungary, there are high possibilities for BILK to contribute positively on the different route of regional unemployment in comparison to the national one from 2006-2008.

In the same line with the general economic indicators of Central Hungary, regional business investment rate (BIR) has also been influenced negatively by economic crisis after 2008. Apart from the decreasing trend of BIR after 2008, it was significantly ascended from 2000 to 2008 and especially after 2003. More specifically, there have been some fluctuations of BIR during 2000-2003 but the investment rate of Central Hungary had a steady improvement from 2003-2008 during the first five operational years of BILK. Continuing with the major indicator of inventive and innovative performance of Budapest, the number of total international patents followed an upward trend during 1999-2008 with some negative fluctuations before 2002. The same changeable route can also be observed for the number of patents in transport and logistics sector until 2003. Afterwards, this measurement stayed at the same level from 2003-2008 without demonstrating any impact of BILK to the number of patents in transport and logistics sector. For this reason, the graph line of Figure 5.61 can be used only to predict the impact of logistics centre to the total innovative performance of Budapest. The limited geographical level of the metropolitan region of Budapest combined with the gradual rise of total regional patents from 2003 to 2008 indicates at least an indirect influence of BILK to the total regional innovative and inventive performance of its surrounding region.

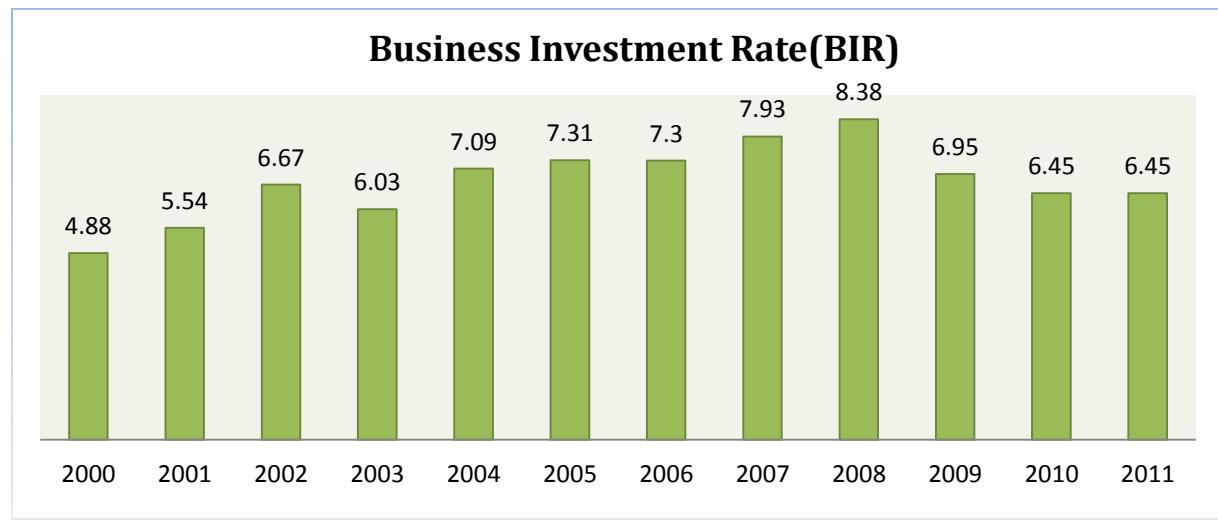


Figure 5.62: Business Investment Rate in Central Hungary

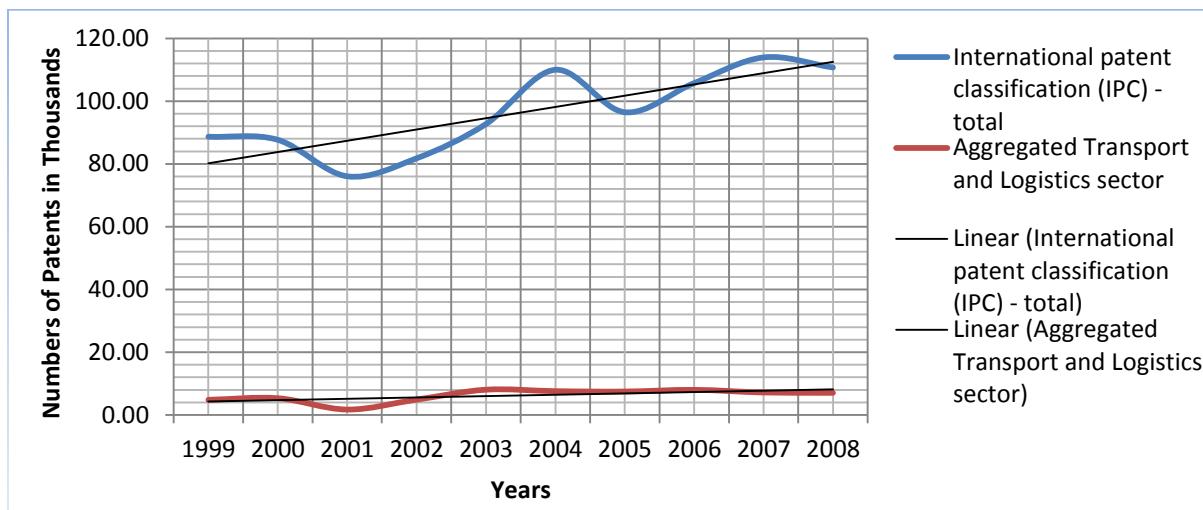


Figure 5.63: Number of Patents by priority year in Budapest

As the first measurement of regional trade volume, the imported and exported goods by road demonstrate clearly the impact of BILK to the improvement of regional trade activities. According to Figure 5.62, the annual road freight transport of Budapest rose significantly from 1269 to 3730 million of ton-kilometres (imports) and from 1022 to 2227 million of ton-kilometres (exports) during only the first five operational years of BILK (2003-2008). Concerning to the steep drop of imported and exported goods by road after 2008, the global economic recession seems to be the main influential factor for their decline. Furthermore, the sharp increase of regional imported goods by road influenced "negatively" the annual imported goods by rail which has been decreased from 3.255.861 to 2.612.504(-19.7%) tons during 2005-2010. Generally speaking, a "considerable" increase of annual transported goods by a specific transportation mode (road) can lead to a "dramatic" decline of transported goods by other available transportation modes (rail) which operate as substitutes, the widely known phenomenon of "regional modal shift". But, a "moderate" change of the transported goods by a specific transportation mode can influence only partially the volume of transported good by another one. This phenomenon can be confirmed by the fact that the "slight" ascent of exported goods by road has not influence negatively the annual exported railway goods, which have been increased moderately from 2.501.893 to 2.900.325 tons during the same period.

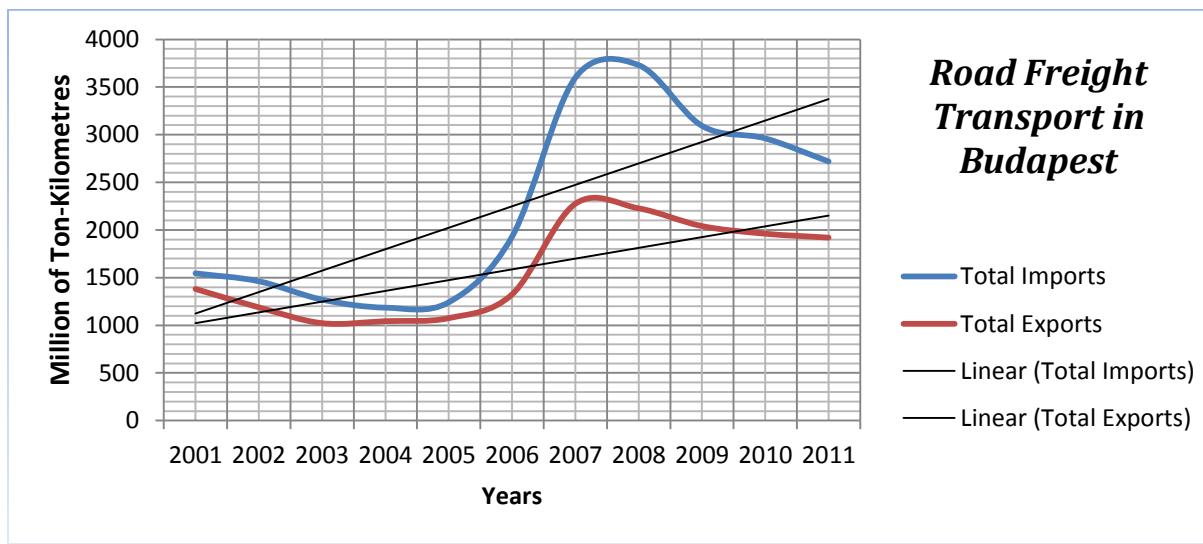


Figure 5.64: Annual Road Freight Transport in Budapest

Following a two-year analysis of the last transport indicator, the total transported goods by air have followed an increasing trend of 13.4% during 2001-2003 and 2003-2005, a higher positive rate of approximately 23.6% from 2005-2007 which has been followed by a negative rate of 20%, and finally the regional air transport of freight continued with a rising trend of approximately 27.8%. Except for the total considerable ascent of transported goods by air during 2001-2011, the impact of BILK to the regional volume of air freight can be confirmed also by another reason. Concretely, the provision of air intermodal services by BILK after 2005 and the direct link between logistics centre and Ferihegy Airport (Budapest Airport) seems to be strongly related and to have contributed on the higher increased rate of airfreight transport during 2005-2007 in comparison to the previous period.

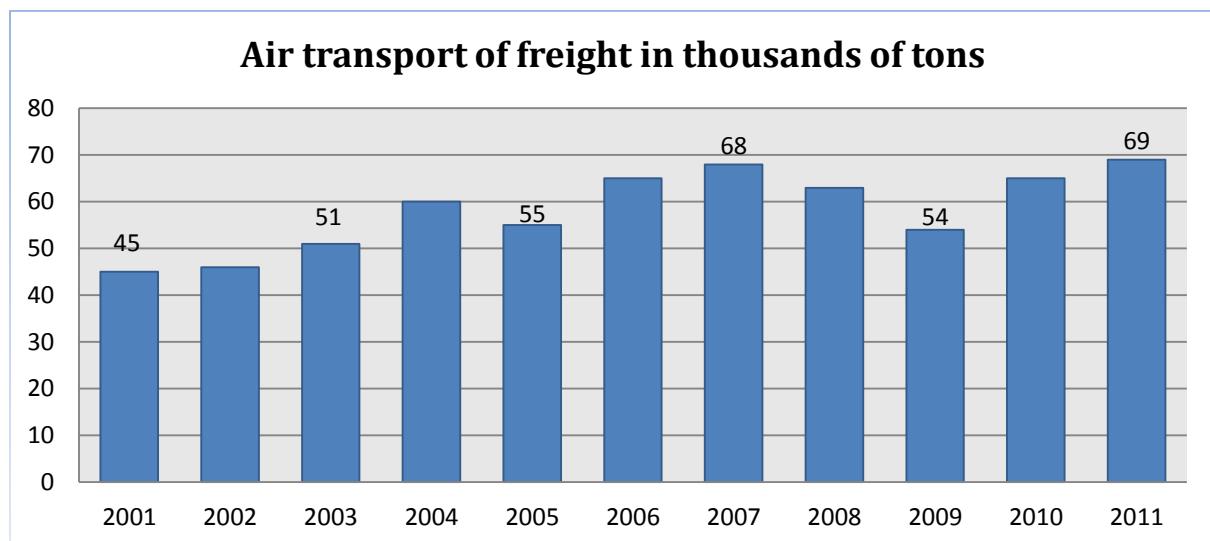


Figure 5.65: Air freight transport in Central Hungary

In the same way of thinking with the European overview of location quotient (Section 5.1), the region of Central Hungary represents all of these European regions which have a developed transport and logistics sector with various fluctuations concerning to the number of persons employed. Furthermore, various national and European economic incidents are the major causes of these fluctuations. The graph line of Figure 5.64 demonstrates that the only remarkable rise of persons employed in transport and logistics sector happened during 2004-2006. More specifically, the number of persons in this sector followed a slight increase (1.5%) from 2001 to 2010 but the numerous fluctuations of this number do not permit any statistically safe interpretations. However, the upper line of indirect influenced sectors is more easily interpretable not only due to its continuing upward trend from 2001 to 2010 but also because the positive rate of indicator was considerably higher (13.4%) during the period 2004-2007 in comparison to the previous period of 2001-2004(4.9%). The number of employees in sectors which are usually attracted by logistics centres was sharply increased from 286.881 to 320.091 in 3 years only. Without taking into consideration the number of persons employed in transport and logistics sector, it can be supported that the development of the largest logistics centre of Central-Eastern Europe was quite responsible for this sudden augmentation of the employment in sectors which are indirectly dependent to transport and logistics operations. Last but not least, the slow drop of total regional employment during 2004-2007 (Figure 5.59: Unemployment rate of Central Hungary) combined with the creation of 38.308 new job positions, during the same period, in industries which are attracted by logistics centres reveals that BILK may operate as at least an indirect job generator of Central Hungary.

Finally, the presence of an attractive transport and logistics sector in Central Hungary, after the construction of this logistics centre, is indicated also by the fact that the regional average level of wages and salaries in transportation and storage (10.431€) was above the national one (9.555€) in 2008.

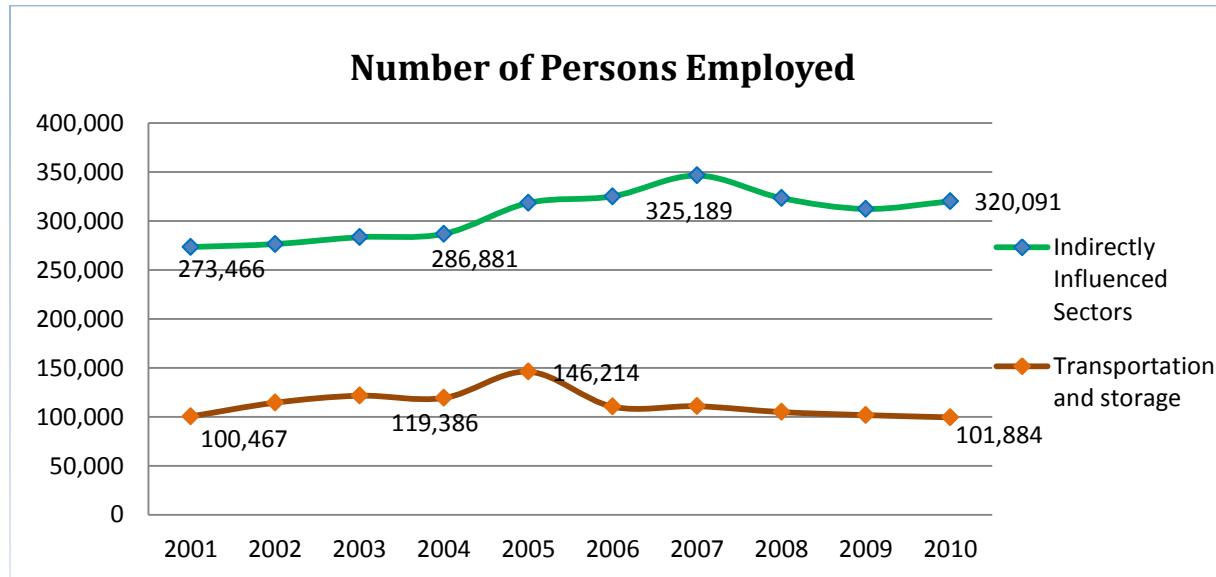


Figure 5.66: Number of Persons Employed in Central Hungary

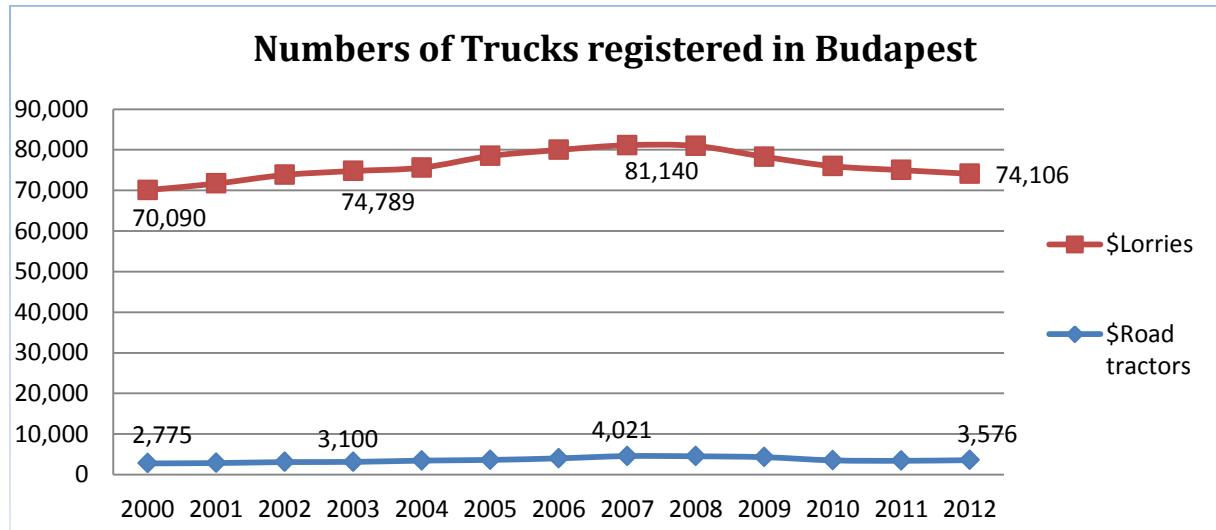


Figure 5.67: Number of Trucks registered in Budapest

As far as the non-available indicator of local enterprises is concerned, the lack of data creates the need for the adoption of a similar measurement which is also more directly related with the operations and functions of BILK. The generated line graph of the last figure illustrates a gradual rise of lorries and road tractors registered in the limited metropolitan region of Budapest during 2000-2012. The remarkable gap among the two lines can be justified by the general high deviation of values. More specifically, the number of lorries registered in Budapest rose from 70,090 to 74,789 (+6.7%) during 2000-2003 and it was ascended with a higher positive rate (+8.6%) until 2007. In the same line, there was an increasing trend of road tractors registered with a higher positive rate during the first 3 operational years of BILK (+29.8%) in comparison to the period 2000-2003 (+11.7%). For one more time, it can be observed a negative rate of these two indicators after 2008 which confirms

the detrimental role of global economic recession to the regional investment and business attractiveness.

To conclude, the majority of charts and graphs, which are included in Case 5, indicate remarkable and positive changes of regional economic performance between the periods before- and after- the construction of Budapest Intermodal Logistics Centre. Only the measurements of “number of patents in transport and logistics sector” and the “number of persons employed in transport and logistics sector” have not contributed to the extraction of useful outcomes. However, the only reliable interpretations for the regional economic impact of BILK have been made from 2000 to 2008 because the most economic measurements followed negative routes after the beginning of global economic crisis (2008). Despite the limited number of years, the adoption of the period 2003-2008 (the first 5 operational years of BILK) as well as the two continuing 3-year periods before and after the development of BILK (2000-2003/2004-2007) contribute significantly to the confirmation of this logistics centre’s role as economic generator of its surrounding region. Finally, the graphs of most measurements (“numbers of trucks registered”, “numbers of persons employed in indirect related sectors”, “BIR”, “annual road freight transport”, “GDP per capita” and “air transport of freight”) reveal that one of the major targets of local public authorities, which was “the enhancement of regional economic welfare through the construction of a logistics centre in Budapest” has already been achieved.

## Chapter 6

### Overview & Conclusion

In this chapter, an accumulated overview of the five selected logistics centres confirms if these centres can operate as economic drivers and job generators of their surrounding regions. The presentation of the main regional economic indicators for each one of the five cases (logistics centres-regions) at the same table contributes on more conceivable and reliable interpretations. Additionally, a simplified comparison between the final results of regional economic measurements has as main purpose to confirm or neglect the already supported argument of numerous scholars about the positive economic impact of logistics centres to their corresponding regions. As the last chapter of this dissertation, Chapter 6 introduces the major limitations of both quantitative and qualitative part of this research in order to enhance its applicability. Last but not least, the author gives also his opinion about the possibilities of further research in the future which may offer a deeper exploration of this topic.

### 6.1 Accumulated results of case-study analysis

As mentioned at the first chapter, this survey has as main purpose to describe and investigate the role of logistics centres as regional economic drivers and job creators. For this reason, five representative European logistics centres and their regions was selected in parallel with the careful collection of economic indicators which have a direct or indirect relevance with the activities and operations of regional transport and logistics sector. At the previous chapter, the examination of these selected cases led to various meaningful outcomes which partially confirmed that the presence or the establishment of a logistics centre at a region can influence positively the exploitation of the economic challenges that this region face. More specifically, the first three cases of Interporto Bologna, GVZ Bremen and Interporto Quadrante Europa have already contributed to the economic revitalization of their regions during approximately the last 3 decades. The generated graphs and charts of this research combined with a wide range of past references revealed that these logistics centres were not only the three most developed and well-organized European logistics centres, but also they are the most important cores of the regional transport-logistics sector. Additionally, the investigation of the other two cases of PLAZA and BILK indicated through the same schematic way (bar charts, graph lines, tables, datasets, etc.) that the majority of examined indicators followed a remarkable positive route after the establishment of these logistics platforms in 2003.

In order to enforce the reliability of the abovementioned numerical outcomes, a summarized table seems to be the most suitable next step which will also play a complementary role for the graphs and charts of Chapter 5. Consequently, the following table includes the five selected logistics centres at its first/upper row and the twelve main regional economic indicators at its left column. Filling also the intermediate cells of this table with symbols, colors and shapes, author attempts through Table 6.1 to present an overview of this research's case-study analysis:

**Table 6.1: Accumulated Overview of adopted regional economic indicators for all selected European Logistics Centres**

Logistics Centres			INTERPORTO BOLOGNA SPA	EGV	INTERMODAL Quadrante Europa	PLAZA	BILK
Current General Characteristics	Size	4.194.000m <sup>2</sup>	4.720.000m <sup>2</sup>	4.200.000m <sup>2</sup>	13.117.977m <sup>2</sup>	12000	1.000.000m <sup>2</sup>
	Number of Employees	2500	8000	1800	-	-	-
	On-site Transport and Logistics Firms	107	150	110	250	-	-
Available Transportation Modes	Road	X	X	X	X	X	X
	Rail	X	X	X	X	X	X
	Air	X	X	X	X	X	X
	Inland Shipping	-	X	-	-	-	X
Regional Economic Variables of Regions	Unemployment rate (%)	< national →	> national →	< national →	< national →	< national →	< national →
	GDP per capita(€)	> national → > EU-27 →	> national → > EU-27 →	> national → > EU-27 →	> national → > EU-27 → <sup>23</sup>	> national → > EU-27 → <sup>23</sup>	> national → > EU-27 →
	Business Investment Rate (BIR)	→	→	→	→	→	→
	Total Number of Patents	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →
	Number of Patents by priority year	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →
	Aggregated Transport & Logistics sector	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →	NUTS-3 →
Indicators of regional trade volume	Annual road freight transport	Imports by road →	Imports by road →	Imports by road →	Imports by road →	Imports by road →	Imports by road →
		Exports by road →	Exports by road →	Exports by road →	Exports by road →	Exports by road →	Exports by road →
	Annual rail freight transport	Imports →	→	→	→	→	→
		Exports →	→	→	→	→	→
	Air transport of freight	→	-	→	→	→	→
	Maritime transport of freight	-	→	-	-	-	-

<sup>23</sup> The regional GDP per capita of metropolitan region of Zaragoza was lower than the corresponding European one from 1995-2003 but it increased significantly during this period. After 2004, it got ahead of the corresponding European one and it has continued to be higher until 2010.

Logistics Centres			INTERPORTO BOLOGNA	GVZ GÜTERVERKEHRZENTRUM BREMEN	INTERPORTO Quadrante Europa	PLAZA Plataforma Logística Paraguaya	BILK
<i>"Direct" &amp; "Indirect" regional employment</i>	Number of persons employed	Indirectly Related Sectors	+73.103 (1996-2010)	+20.989 (2002-2010)	+85.621 (1996-2010)	+8.899 (2003-2010)	+38.308 (2004-2007)
		Transport & Logistics Sector	+11872 (1996-2010)	+12259 (2002-2010)	+12451 (1996-2010)	+7637 (2003-2010)	-8426 (2004-2007)
<i>Regional Business attractiveness</i>	Number of local units (enterprises) registered	Indirectly Related Sectors	↗↗↗↗	↗↗↗↗	↗↗↗↗	↗↗↗↗	-
		Transport & Logistics Sector	↔↔↔↔	↗↗↗↗	↔↔↔↔	↗↗↗↗	-
	Number of Trucks (Lorries) registered		-	-	NUTS-3 +125.000 (1994-2011)	NUTS-3 +1934 (2003-2007)	NUTS-3 +6351 (2003-2007) <b>Road Tractors</b> +921 (2003-2007)
	Wages and Salaries in Transport and Logistics sector		-	Regional (36.255€) > National (30.837€)	-	-	Regional (10.431€) > National (9.555€)

## 6.2 Further Analysis through the comparison of the 5 cases

Except for the presentation of the above numerical outcomes and their separate interpretation at Chapter 5, a comparison of these results can detect easily essential similarities and differences between the five selected cases. In addition, this summarized table (Table 6.1) will confirm how essential and important the contribution of logistics centres to the regional economic growth is. To begin with, the measurement of regional unemployment rate indicates that all selected regions have to cope with the problematic situation of increased unemployment the last 11 years (1999-2012) and especially after 2008. Only the unemployment of Bremen has followed a decreasing trend the last decade but it is slightly higher than the national one. In contrast to Bremen, the rest 4 selected regions had a lower and only a little over half unemployment rate of the national one. Apparently, it is quite logical for the regional unemployment rate to follow the same route with the corresponding national one and this matter can easily justify the negative increase of this indicator for the majority of selected regions. The outcomes of unemployment rate for the Spanish, Italian and Hungarian regions of this research's sample confirm the widely-known negative impact of global economic crisis to these 3 European countries after 2008.

Continuing with the indicator of GDP per capita (€), the availability of a lower geographical level (NUTS-3) for the 3 out of 5 regions led to a more exclusive investigation of regional economic

performance. Moreover, the economic welfare of a smaller region can be more easily connected and influenced by the presence and the operations of a large and important European logistics centre in the same area. More specifically, it can be observed a meaningful increase of regional GDP per capita which was also higher than the corresponding national one at all regions during the last 15 years. Also, the regions of Emilia-Romagna (Interporto Bologna), Bremen-Kreisfreie Stadt (GVZ Bremen), Veneto (Interporto Quadrante Europa) and Zaragoza (PLAZA) had always a higher GDP per capita than the average European one. Only the metropolitan region of Budapest had a lower level of GDP per capita in comparison to the average European one but on the other hand its regional GDP has been increased with a higher positive rate (it was equal to "51.5%" of the European GDP per capita in 2000 and "86%" of this one in 2010). The combination of these results with the corresponding ones of unemployment rate indicates that the general economic welfare of these 5 regions was above the average from 1995-2012. Despite the negative externalities of global economic recession and its negative impact to the regional unemployment rate, the simultaneous increasing GDP per capita of all selected regions and especially of the three metropolitan ones (smaller geographical level / NUTS-3) confirms the existence of developed industries and sectors (like transport and logistics) at these areas. According to various past references and findings, transport and logistics sector has played a paramount role at the economic development and revitalization of these 5 regions the last 2 decades. Also, the logistics centres of this research's sample are the most important cores of regional transport and logistics sector. As a result, it is logical for these centres to have contributed, either directly or not, at the increasing trend of GDP per capita of their surrounding regions (Table 6.1).

Concerning to the first indicator of regional investment attractiveness, there was a meaningful rise of BIR (Business Investment Rate) for the 4 out of 5 regions. Except for the region of Bremen, the measurement of BIR has been significantly increased at the other 4 regions during 2000-2011. Most importantly, it can be observed that there was a higher positive rate of business investment rate at the specific regions of Plataforma Logistica de Zaragoza (Aragón) and BILK (Central Hungary), after the construction of these two logistics platforms in 2003. Even if it is not so statistically safe to support that there was an influence of Interporto Bologna and Quadrante Europa at the general BIR of their regions, the sharp increase of regional BIR at Aragón and Central Hungary, after the establishment of the PLAZA and BILK (the largest logistics centres in Spain and Hungary respectively), indicates at least an indirect positive impact of these centres to the investment attractiveness of their regions.

Both the number of total patents and the aggregated patents in transport and logistics sector confirm more strongly, in comparison to the previous indicators, the role of logistics centres as economic generators of their regions. Concretely, it is not only about the fact that this measurement illustrates the regional inventive performance of a smaller geographical division level than NUTS-2, but it is also about the upward trend of the number of total patents at all examined regions. Similarly, it can be observed a continuing rise of the number of patents in transport and logistics sector at the 3 out of 5 regions. Concerning to the rest 2 ones, the number of patents in transport & logistics sector was not increased at the regions of Zaragoza and Budapest during 2000-2009 and 1998-2008, respectively, but they have followed only a steady route without any negative fluctuations. Last but not least, it can be referred that both indicators are the most easily interpretable and applicable on the expectations of this research due to fact that they are the only

measurements which have available data for the whole operational years of all examined logistics centres (1977-2009).

An additional confirmation of logistics centres' economic impact to their regions can be achieved through the interpretation of annual transport indicators which mainly illustrate the level of regional imports and exports. Initially, both the annual imported and exported goods by road of all regions verify the positive influence of logistics centers to the regional trade volume. From the 5 available cases, the most easily interpretable outcomes for the annual road freight are included in the cases of Interporto Bologna, PLAZA AND BILK. As far as the first case is concerned, the impact of logistics centre can be proved more easily than the other cases due to the available data of transported goods of metropolitan region combined with the availability of imported and exported goods of Interporto Bologna. A simultaneous increase with the same positive rate for these two indicators reveals a strong relation between the trade volumes of Interporto Bologna (which is the 3<sup>rd</sup> most important European logistics centre/DGG, 2010) and its limited metropolitan region of Bologna (NUTS-3). The line graphs of the other two cases, PLAZA and BILK indicate a considerable increase of the regional imported and exported goods after 2004. An initial positive trend of the annual road freight from 1999-2004 was followed by a sharp augmentation of this indicator for the next 5 years which are also the first operational years of PLAZA and BILK. Consequently, the regional trade volumes of the small metropolitan regions of Zaragoza and Budapest have been influenced significantly by the development and the establishment of these enormous and well-structured logistics centres at the same area. Apart from these 3 more distinctive cases of sample, the other two ones of Interporto Quadrante Europa and GVZ Bremen seem to be quite useful but less easily connected with the regional trade volume. Nevertheless, it can be supported through an interpretation of their continuing ascent during the last 13 years that both the most effective European logistics centre (Interporto Quadrante Europa / DGG, 2010) and the biggest German freight village (GVZ Bremen) have influenced at least indirectly the volume of imported and exported goods of their surrounding metropolitan regions.

One of the more significant findings to emerge from this study is to investigate if a logistics centre can influence the major economic indicators of its region. As a result, this impact can also be negative as in the case of the annual rail freight transport of Interporto Bologna whose decreased railway transported goods seem to influence crucially the regional volume of imported and exported goods by rail. In addition to the first case, this measurement provides interpretable results and it also confirms the positive impact of logistics centres only in cases of GVZ Bremen and Interporto Quadrante Europa. However, the complicated fluctuations and steady routes of this indicator at cases of PLAZA and BILK do not permit any statistically safe interpretations. Keeping pace with the previous transport indicators, the air and maritime freight transport enforce the main topic of this survey and they also conclude to easier interpretations. The bar charts of air freight transportation illustrate a significant rise of annual transported goods by air either due to the direct connections of logistics centres with the major regional airports or after the construction of these centres and the provision of air intermodal services by them. Similarly, the maritime freight transport (which is available for the only not "land-locked" case of Bremen) illustrates that the first operations of GVZ Bremen after 1995 influenced considerably the regional transported goods by inland shipping and they also enriched the quality and the competitive advantage of Bremerhaven's hinterland (the major deep-sea port of this region).

As the main components of location quotient, the number of persons employed in regional industries which are directly and indirectly related to transport and logistics sector have been adopted in order to examine the role of logistics centres as job creators of their regions. Approximately all examined cases of this research indicate a strong and positive impact of logistics centres to the regional employment which is connected with transport and logistics operations. Concretely, there was a creation of:

- 84.975 new job positions directly and indirectly related to transport and logistics sector ( $73.103 + 11.872$ ) at region of Emilia-Romagna during 1996-2010,
- 33.248 new job positions directly and indirectly related to transport and logistics sector ( $20.989 + 12.259$ ) at region of Bremen only in 8 years,
- 98.072 new job positions directly and indirectly related to transport and logistics sector ( $85.621 + 12.451$ ) at region of Veneto during a period of only 7 years
- 16.536 new positions directly and indirectly related to transport and logistics sector ( $8.899 + 7.637$ ) at region of Aragón from 2003-2010,

All above numbers confirm the presence of effective and large logistics platforms at these regions. Moreover, it would not be logical for a region to generate these great amounts of jobs related only to a specific sector (transport and logistics) if they were not any agglomerated and clustered transport and logistics operations in the same area. Also, this argument can be enforced more strongly by the fact that the unemployment rate of the 4 abovementioned regions has been negatively increased the last years. As a result, it may be very difficult for a region with an increasing unemployment to generate so many new job positions related to transport and logistics operations in a period of only 7 or 10 years if there is not any developed logistics centre with advanced functions and operations in the surrounding area.

Furthermore, the increased number of enterprises which belong to indirectly related industries indicates how attractive a region is for this kind of companies when there is a well-organized logistics centre at region. Without any available data for the logistics centre of BILK, the graphs of the first 3 centres (Interporto Bologna, GVZ Bremen, Interporto Quadrante Europa) illustrates a remarkable augmentation of the number of indirectly related local units from 1996-2010 and the last one of PLAZA indicates a stable route from 1999-2010. Concerning to the number of transport and logistics enterprises, an increasing trend can be observed at only 2 out of 4 cases. However, the line graphs of Italian logistics centres (Interporto Bologna and Interporto Quadrante Europa) cannot be easily interpretable due to the fluctuations which can be observed on them. To conclude, the indicator of number of local units in transport and logistics sector is generally very difficult to be examined in order to confirm or neglect if a logistics centre can attract numerous transport and logistics firms.

This negative externality led to the adoption of the next measurement, named as "Number of trucks registered" which is available for the majority of selected cases (3 out of 5) and at a smaller geographical level (NUTS-3). Also, the number of trucks registered is a more strongly related indicator to the operations of a logistics centre in comparison to the number of local units in transport and logistics sector. More specifically, there were 125.000 new trucks registered in the metropolitan region of Verona during 1994-2011, 1934 new trucks registered in Zaragoza during the first 4 operational years of PLAZA as well as 6351 new lorries and 921 new road tractors registered at limited region of Budapest during the first 4 years after the establishment of BILK. As a result, the

positive and confirmative outcomes of the number of local units in indirectly related sectors at the previous paragraph combined with the number of trucks registered, conclude that logistics centres can moderately attract new firms and enterprises which are related either directly or not to their operations and functions.

A higher level of regional wages and salaries at a specific sector in comparison to the corresponding wages at national level indicates the strong influence of this sector to the economic development of region (SoCool@EU, 2012). As the last indicator, the wages and salaries in transport and logistics sector can verify that this sector is quite attractive and it is also important for the regional economic performance of Bremen and Budapest. The present study confirms previous findings, contributes additional evidence and suggests to regional policymakers and local authorities that the establishment of logistics centres can influence the economic revitalization of their regions. After a careful consideration and analysis of all examined regional economic indicators, the case-study analysis which was carried out through this thesis project represents successfully all European logistics centres. On the one hand, it is not so statistically safe to support without any limitation the regional economic impact of logistics centres. But, as final conclusion, it can be supported at least that: **“The absence or the sudden shutdown of these logistics centres would influence crucially and negatively the economic performance of their surrounding regions”**.

### **6.3 Limitations**

Finally, a number of important limitations and caveats need to be considered:

1. Despite the fact that they are two of the most important regional impacts of European logistics centres, road congestion and environmental impact have not been introduced to the empirical analysis of this research. The main reason is the social-oriented character of these two regional indicators which is too far from the purpose of this research. But, road congestion and environmental pollution can also influence significantly the economic development of regions. As a result, if logistics centres generally influence the regional traffic or the pollution of their surrounding areas either positively or negatively, they affect indirectly the regional economic performance (Torbianelli, 2009). However, the unavailability of data for the potential economic impacts of pollution and road congestion generates crucial difficulties for their adoption by the author of this research.
2. Concerning to the European overviews which depict the general employment concentration and firm concentration of EU-27 (Figure 5.1/5.2/5.3), these indicators has been illustrated on NUTS-1 level (national level) for Slovenia, Estonia, Latvia and Lithuania because their small geographical size does not permit any separation to more regions or metropolitan areas.
3. At the same European overviews, the unavailability of data for the number of employees and number of local units at Greek regions in 2010 led to the adoption of data from year 2009 only for these regions.
4. In order to meet the expectations of this research, three differentiated measurements have been adopted (Number of employees, Number of local units registered, Number of patents by priority year).More specifically, they consisted of two sub-categories which was named as "direct" and "indirect", and they referred to the regional numbers of employees, the regional number of enterprises and the number of patent applications which are directly and indirectly related to transport and logistics sector. Following the arguments of project "European SoCool@EU (Sustainable Organization between Clusters of Optimized Logistics @ Europe) and the adopted methodology of Eurostat, the "core" sector of transport and logistics and the "indirect" one include some specific industries which have already been presented at Chapter 4 (Methodology). These industries have been defined and determined only by these two organizations and, eventually, they have been used by the author of this research as the most appropriate sectors which can be related to the operations and functions of a logistics centre. As a result, there is not any other kind of authorization for the adoption of these categories and their separation to direct and indirect categories
5. As mentioned at Chapter 4, a sample of 5 selected logistics centres has been adopted in order to contribute on the empirical analysis (case-study analysis) of this survey. Despite its European representativeness and its diversity, this sample is not so large and it could introduce more cases from other European countries.
6. Having as main purpose to investigate the potential economic impact of logistics centres to their regions, this research concludes to some meaningful outcomes which have already been described above. But, it is not easily applicable to match these statistical results at a specific European country or region because of their different economic, social and political background. Due to the fact that the role of logistics centres as economic drivers of their regions was examined at this survey through a European approach, the final outcomes does

not refer at a specific country. They could be characterized as useful conclusions which could generally persuade both local and national governments for the necessity of these facilities' establishment under the appropriate circumstances.

7. As far as GDP per capita is concerned, there was not the available data of this indicator for the region of Emilia-Romagna (Case 1) in Eurostat. As a result, differentiated data resources were used. Concretely, the graph of regional GDP per capita for Emilia-Romagna (*Figure 5.10: GDP per capita of Emilia-Romagna*) has been created by the available and corresponding data sets of Italian National Statistics Office (ISTAT).

## 6.4 Future Research

According to the main findings of this research, European logistics centres can influence, at least indirectly, the economic development and revitalization of their regions. Despite the quite high level of its representativeness, the sample of this research could include cases from other European countries in order to exploit the economic impact of logistics centres from another point of view. For example, the methodology of this dissertation could be adopted for the examination of the same topic in Mediterranean countries of EU-27 or for the most developed ones of Northwestern Europe. Additionally, a similar research could be implemented in order to exploit this topic only for a specific country through the selection of the most important and well-organized national logistics centres of this country. In that case, the indicator of "taxes paid from companies which operate in logistics centre" can be easily examined without any limitations. This measurement was initially planned to be included in this research but the different types of taxes and charges at the regulative and legislative framework of each country impeded eventually the adoption of this indicator. These taxes contribute significantly to the economic performance of a region and it can also be considered as an average rate of return for the public authorities and local policymakers which have already supported financially the establishment of a logistics centre.

Furthermore, there is much to be done in order to explore this topic. More specifically, there is the opportunity to do specific research using only measurements which are directly related to the operations of logistics centres. This type of work was succeeded only at the case of Interporto Bologna due to the availability of data at the level of logistics centre and not only at regional level. Although this article emphasizes on some more general economic indicators, a more exclusive investigation of this topic could be easily carried out by the management companies of logistics centres. Furthermore, it is more possible for the management companies of logistics centres to implement this kind of researches because the public interest of this research is quite obvious, and the majority of European logistics centres are managed mainly by public authorities. Finally, if public shareholders of logistics centres have the available data, there is a unique chance to develop some useful interventions at this topic, in order to investigate profoundly the role of logistics centre as economic drivers of their regions. More research is likely to be worth its cost for the public operators of logistics centres.

