University of Messina

Department of Economics

LOGISTICS AND SUPPLY CHAIN MANAGEMENT. FOUR PAPERS ON ECONOMIC GROWTH, COMPETITIVENESS AND EFFICIENCY

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SUMMARY

The thesis provides an innovative, comprehensive and structured path to understand how the analysed logistics phenomenon affects different economic aspects of economic growth. We aim to study the macroeconomic and microeconomic phenomena related to the goods and people flow. The thesis demonstrates the importance that the logistics sector on the variables that influence a nation-s growth and wealth. The thesis' next step is the willingness to learn what are the internal factors that determine the performance of the entire logistics sector, and identify and figure out the key variables behind a decisive competitive advantage. The study would not be complete without a predominant parses the entire logistics sector sub-sector that is represented by the transport plane, then analyse the efficiency of the Italian airport sector and specifically the airports. Ultimately it was decided to insert a purely microeconomic and managerial study that providing a critical eye on what is the transposition of logistics inside the companies, an a critical analysis of the methods of "Supply Chain Management" and possible development factors due to supply chain inefficiencies.

INTRODUCTION

The thesis presented in fulfilment of this doctoral program is structured by following the "paper" size criteria. The thesis collects four independent papers structured according to the rules dictated by the scientific procedure. Each paper contains a reference literary review so you have worked out the framework in which the work is inserted; key paragraphs explain the chosen methodology and the econometric models used to conduct the study. Finally, ample space is reserved for the paper search results, the reflections that arise and possible future developments. Specifically, the work is composed of four chapters containing innovative and related papers from their general objective of the work outlined in the summary. The first chapter entitled "**Does Logistics Influence Economic Growth: The European Experience**," through the use of three econometric models, aims to demonstrate how the logistics sector is relevant and how it influences economic growth (Rivera et al., 2016; Belumole et al., 2015) in the European Union. **This study was submitted to the scientific journal "Management Decision" (listed as an A journal - ASN) edited by Emerald and is currently is "under review."** In this study after analysing the relevant literature, I was able to identify the most appropriate variables used to the scope: GDP; LPI (Ekici et al., 2016) (index developed by the World Bank that measures the efficiency of the logistics sector); GCI (Korez-Vide and Tominic, 2016) (index developed by the World Economic Forum with the aim to assessing the competitiveness of a nation) and the Export. The reference literature has guided to the choice to use a useful model to achieve its objectives. The aim has been chosen the "Mediator model" of Baron & Kenny (Baron and Kenny, 1986; Mackinnon and Pirlott, 2015; Preacher, 2015) supported by a system of simultaneous equations and panel analysis. The integration of the panel analysis and simultaneous equations were essential, as suggested by scientific publications (Zao et al., 2010), to overcome all the limitations of the "mediator" model (Heckman and Pinto, 2015). The research results have led to evidence that the competitiveness of a nation affects the economic growth but at the same time as the effect is more relevant when the logistics factor work as a mediating variable.

The second paper entitled "**Human Factor: the competitive advantage driver of the EU's Logistics sector**" was produced with the continuous support of Prof. Bruno Sergio Sergi, designated tutor. This work is well framed and placed in the scientific research field suitable to identify the key factors determining the competitive advantage of the logistics sector. **The paper relevance demonstrated by the publication in the "International Journal of**

Production Research" (listed as an A journal - ASN) edited by Taylor & Francis and published in 2016. The aim of the paper is to identify the key that determines the competitive advantage of the predominant European logistics sector in the global system (Coyle et al., 2016; Korinek and Sourdin, 2011). The study, after a careful analysis of the relevant literature, identified variables collected in three clusters (Beaudreau, 2016; Grosse et al., 2015; Puertas et al., 2014). The clusters created and identified with the names of "Infrastructure, Institutions and Human Factor" have been worked by an econometric model (Uca et al., 2015; Ding et al., 2015) in order to assess what more influence the performance of entire sector. The econometric evidence has shown that the human factor is the competitive advantage and how it is essential to invest in this variable.

The third paper analysed a dominant and distinctive sub-sector of the logistics system: the airport sector. The name of the work is "**A dynamic about airport efficiency: the case of Italian airports' technical efficiency**" **This study was submitted to the scientific journal "Journal of Air Transport Management" (listed as an A journal - ASN) edited by Elsevier**. The reference literature is rich and proliferates of studies related to the field, it was easy to understand the methodology to utilize, consistent in an application of the DEA method (Fernandes and Pacheco, 2002; Curi et al., 2011; Lai et al., 2015; Bezerra, 2016). Such a method as shown in academic studies is effective to identifying the airports efficiency. In my case I decided to analyse the Italian system and by identifying the correct inputs and outputs to be included in the model, have been able to rank twenty-six Italian airports according to efficiency criteria. The result shows that the system has a good efficiency rate geographically distributed throughout the peninsula and how the impact of public resources is positive to the Airport efficiency.

The last chapter inserted in the thesis consists in a quality management paper. In order to provide a complete view I analyse the logistics system from a business perspective. This work was published by me with the title "**Supply chain management: overview, competition and competences, how to exploit the hidden capabilities**", in the **International Journal of Management and Network Economics**, **dated 2016, published by Inderscience (inserted in the list of scientific journals**). In this work I decided to do an excursus evolution of managerial flow systems (Halldorsson and Aastrup, 2003; Hult et al., 2006; Lavassani et al., 2008) and then concentrate on the identification of "hidden capabilities" possible evolution of internal inefficiencies (Todorova and Durusin, 2007).

At the end of the first and second paper I thought of adding a cases study to deeper in the topic.

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Does Logistics Influence Economic Growth? The European Experience

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Abstract

This paper sets a new model that includes variables that take account of the mediator effect of global competitiveness index in order to better understand the whole phenomenon behind the relationship between GDP and competition in Europe. We test the consistency of the Baron and Kenny mediator model through an explanatory linear regression model, and then we deploy a panel analysis and a simultaneous equation system to assess the model consistency to bypass much of the endogeneity problem. This paper's findings show a positive influence of global competitiveness index on GDP and this effect is by far more evident when other variables (e.g., the logistics performance index) interact simultaneously.

Keywords: Europe, Panel data, Simultaneous Equation, International business.

1. Introduction

This paper examines the competitiveness of networks and public infrastructure systems, ports, airports and rail networks in Europe. While competitiveness may generate benefits in terms of lower prices and product quality improvement, the globalization process has extended such a competitiveness concept to how competition affects territories, operating systems that create the conditions of economic and social development and attract new entrepreneurship. Porter (1990) firstly emphasized the existence of exogenous factors that allow the creation of the competitive advantage of firms or nations. Exogenous factors that overlap with the "allocation of production factors," which include physical resources and infrastructure in the surrounding area, and the "governance" related to public institutions and territorial policies characteristics become relevant.

The mediator model strives to identify and explain the process that underlines a relation between an independent and a dependent variable through the inclusion of a third explanatory variable. A mediator variable enlightens how an independent variable affects the dependent variable, although not necessarily a causal relationship. A moderator specifies the conditions under which a particular effect occurs, as well as the conditions that vary the direction or strength effect. Therefore, the moderator is a variable that alters the direction or relationship strength between independent or predictor variable and dependent or criterion variable (Baron and Kenny, 1986).

Baron and Kenny (1986) recommend three steps to establish the consistency of mediator model: regressing the mediator on the independent variable; regressing the dependent variable on the independent variable and regressing the dependent variable on both the independent variable and the mediator. This article tests the mediator model that moderate the relationship between the mediator and the dependent variable to emphasize the relations among variables.

Baron and Kenny (1986) found evidence for mediation is strongest when there is an indirect effect, which they call "full mediation." When there are both indirect and direct effects, they call it "partial mediation." Some authors (Dearing and Hamilton, 2006; Gogineri et al., 1995; Frazier et al., 2004) investigated the existing difference related to mediation and moderation models and implement them separately. Others (Edwards and Lambert, 2007; Muller et al. 2005; MacKinnon, 2008) focused on models able to assess both effects (mediation and moderation) and how they work together.

Zhao et al. (2010) identify three patterns consistent with mediation and two with non-mediation: Complementary mediation: Mediated effect (a # b) and direct effect (c) both exist and point at the same direction. Competitive mediation: Mediated effect (a # b) and direct effect (c) both exist and point in opposite directions:

- Indirect-only mediation: Mediated effect (a # b) exists, but no direct effect.
- Direct-only non-mediation: Direct effect (c) exists, but no indirect effect.
- No-effect non-mediation: Neither directs effect nor indirect effect exists.

Heckman and Pinto (2015) do not suggest the use of the mediator model because the mediation literature would achieve its goals under implausibly strong assumptions. However, in our approach the mediation analysis proves to be extremely reliable as the measures employed to assess the mediator and the dependent variable are theoretically distinct one another and the independent variable and mediator cannot interact. Specifically, the two variables used to assess the mediator effect are theoretically distinct, that is, LPI represents an efficiency index of a specific field and sector (logistics sector) while GDP represents a macroeconomic greatness progress.

Some other authors apply the "bootstrapping technique" (Zhao, Lynch and Chen, 2010) as an alternative to the "Baron and Kenny" method. We did not follow the "bootstrap technique" because of some very critical aspects (Athreya, 1987). As an example, if one performs a naive bootstrap on the sample mean when the underlying population lacks a finite variance, then the bootstrap distribution will not converge to the same limit as the sample mean. Confidence intervals on the basis of a Monte Carlo simulation of the bootstrap could be misleading. And unless one is sure that the underlying distribution is not heavy tailed, we should hesitate to use the naive bootstrap, Athreya (1987) states.

In support of this article's methodological approach, there are very recent scientific evidences too. Preacher (2015) described the mediation analysis like as fundamental for many classic and theoretical paradigms, and tried to underline the new developments of the mediation analysis. Mackinnon and Pirlott (2015) drew on new statistical developments in causal mediation analysis. Gobena and Van Dijke (2015) used the model to explore the moderating roles of legitimate and coercive power held by the tax authority in the relationship among procedural justice, trust in the tax authority, and voluntary tax compliance. Nguyen et al. (2015) have conducted a practical guidance for implementing a new technique to estimate

natural direct effects for mediation analyses. Bind et al. (2016) used mediation analysis to examine pathways in epidemiological research.

Our approach initially involves the use of Baron and Kenny technique that shows the logistics performance index (LPI) mediator effect's presence. In order to verify the model to fully explain what really happens between the two variables we need to test the data with a Panel analysis (fixed effect) that show there is a positive influence of CGI on GDP, which goes to confirm the H3 assumption of the Baron and Kenny model. Finally in order to understand the influence of all the considered variables we apply the Simultaneous equation model which confirms the validity of the GCI as a predictor of economic growth, and his influence is greater when into the model takes the LPI variable.

2. Data and variables

In our paper we used GDP, GCI, LPI and Export. The first index is the **GCI** that measures the microeconomic and macroeconomic foundations of national competitiveness to define competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country. GCI use a scale ranges from 1.00 (less competitive) to 7.00 (high competitive). The GCI provides an overview of the competitiveness performance of 144 economies; it's represent the most comprehensive assessment. It contains a detailed profile for each of the economies included in the study, as well as an extensive section of data tables with global rankings covering over 100 indicators. The World Economic Forum defines competitiveness as the set of institutions, policies, and factors that determine the level of productivity of a country (WEF 2014). The concept of competitiveness involves static and dynamic components that are grouped into twelve pillars of competitiveness:

1. Institutions
2. Infrastructures
3. Macroeconomic environment
4. Health and Primary education
5. Higher education and training
6. Labour market efficiency
7. Goods market efficiency
8. Financial market development
9. Technological readiness

10. Market size
11. Innovation
12. Business sophistication.

LPI. Initiated by the World Bank in 2004 to compare 150 countries, the Logistics Performance Index – developed on information collected in a worldwide investigation of the companies responsible for goods carriage and trade – it is the most relevant indicator that assesses logistic competitiveness. The six indicators used by the World Bank are:

1. Customs - Transit efficiency from the border (speed, simplicity, predictability, formalities).
2. Infrastructure - Quality of trade and transport infrastructure.
3. International shipments - Ease of arranging competitively priced shipments.
4. Logistics competence - Logistics services competence and quality.
5. Tracking & Tracing - Ability track shipments
6. Timeliness

GDP and **Export**. The latter two variables are GDP and Export in 2007, 2010, 2012, and 2014. The sample is composed by 41 countries chosen from both the European Area and extra UE (Table 1).

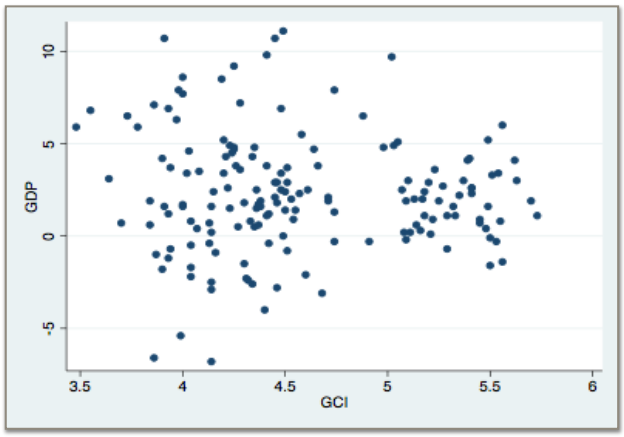
Table 1 - Country			
Albany	**France**	**Moldova**	**Slovak Republic**
Austria	**Germany**	**Montenegro**	**Slovenia**
Belarus	**Greece**	**Norway**	**Spain**
Belgium	**Iceland**	**Netherlands**	**Sweden**
Bosnia and Herzegovina	**Ireland**	**Poland**	**Switzerland**
Bulgaria	**Italy**	**Portugal**	**Turkey**
Cyprus	**Latvia**	**United Kingdom**	**Ukraine**
Croatia	**Lithuania**	**Czech Republic**	**Hungary**
Denmark	**Luxembourg**	**Romania**	
Estonia	**Macedonia, FYR**	**Russian Federation**	
Finland	**Malta**	**Serbia**	

We have a panel data, made from 164 observations, concerning 41 countries and 4 years for each of them. We analysed data for each observation, and we noted that GDP had a mean

value equal to 2,27 (D.S. ± 3,17), but median value is 1,9. This means that there was some data that influenced mean value

Table 2 - Descriptive statistics						
Variable	**Obs.**	**Mean**	**Median**	**Std. Dev.**	**Min**	**Max**
GDP	164	2,271341	1,9	3,169985	-6,8	11,1
GCI	164	4,578415	4,45	0,5606667	3,48	5,73
LPI	164	3,287744	3,23	0,5316721	2,08	4,18
EXPORT	164	352,5975	282,75	178,0812	125,5	891,5

To better understand the relationship between GDP e CGI, we report here two-way graph, in which it is possible to note that there is no determined linear relationship. This phenomenon is justifiable because there are other variable, as LPI or Export that can influence the real relationship between CGI and CGP.



We report now variables values with regard to panel data. In the following table 3, we register that GDP mean value is always equal to 2,27 (S.D. ± 3,17 if we observe overall sample, ± 1,53 if we read between sample and ± 2,79 if we analyse sample with reference to each yearly group).

Table 3 - Descriptive statistics						
Variable		**Mean**	**Std. Dev.**	**Min**	**Max**	**Obs.**
GDP	**Overall**	2,271341	3,169985	-6,8	11,1	N = 164
	Between		1,526726	-1,925	4,9	N = 41
	Within		2,785824	-5,903659	9,921341	T = 4
GCI	**Overall**	4,578415	0,5606667	3,48	5,73	N = 164
	Between		0,556986	3,7775	5,67	n = 41
	Within		0,0991142	4,265915	4,825915	T = 4
LPI	**Overall**	3,287744	0,5316721	2,08	4,18	N = 164

	Between		0,5137867	2,465	4,09	n = 41
	Within		0,1534826	2,847744	3,657744	T = 4
EXPORT	**Overall**	352,5975	178,0812	125,5	891,5	N = 164
	Between		165,2322	146,825	661,7	n = 41
	Within		70,0979	102,9975	582,3975	T = 4

3. Methodology

It is important to capture all possible effects derived from these moderator and mediator variables respectively. To assess the existence of two phenomena, we formulate a set of assumptions that follow the original model by Baron and Kenny.

Assumptions

H1: Global Competiveness Index positively influences Logistics Performance Index.
H2: Logistics Performance positively influences Gross Domestic Product
H3: Global Competiveness Index positively influences Gross Domestic Product
H4: Logistics Performance Index has a mediator effect on the relationship between Global Competiveness Index and Gross Domestic Product.
H5: Logistics Performance Index positively influences Export
H6: Export positively influences Gross Domestic Product
H7: Export moderates the relationship between Logistic Performance Index and Gross Domestic Product.

The hypotheses are tested applying linear and multiple linear regressions. The used time spam covers seven years due to the LPI editions, which saw the first edition in 2007 and the last one in 2014. We used the following regression formula:

$$(a)\ LPI = \beta 0 + \beta 1\ GCI + \varepsilon$$

$$(b)\ GDP = \beta 0 + \beta 1\ LPI + \varepsilon$$

$$(c)\ GDP = \beta 0 + \beta 1\ GCI + \varepsilon$$

$$(\mathbf{t})\ GDP = \beta 0 + \beta 1\ GCI + \beta 2\ LPI + \varepsilon$$

$$(d)\ EXP = \beta 0 + \beta 1\ LPI + \varepsilon$$

$$(e)\ GDP = \beta 0 + \beta 1\ EXP + \varepsilon$$

$$(\mathbf{z})\ GDP = \beta 0 + \beta 1\ LPI + \beta 2\ EXP + \varepsilon$$

After testing the Baron Kenny model, the methodology in this study adopts a general equation that in its more simple form is written as:

$$y_{it} = \alpha_{it} + \beta_{it} \cdot x_{it} + \varepsilon_{it}$$

where:

- y_{it} is dependent variable;
- x_{it} is independent variable or repressor;
- $\alpha_{it} + \beta_{it} \cdot x_{it}$ is regression straight line;
- α_{it} is intercept of straight line;
- β_{it} is slope of straight line;
- ε_{it} is statistical error.

This defined model is one that regards different forms of heterogeneity: the parameters α_{it} (intercept), β_{it} (slope) and ε_{it} (statistical error) can change among countries (i = 1,…,N) and in time (t = 1,…T). The heterogeneity of each country is important to determine economic causality and we can explain coefficients that change per country and per time (α_{it} e β_{it}). Setting restrictions on parameters α_{it} e β_{it}, it is possible to resume used methodology in three steps.

In the first step we have implemented an econometric analysis, fixing $\alpha_{it} = \alpha$ and $\beta_{it} = \beta$, in the other words we have set that the intercept and the slope of straight line are constant and so that ε_{it} is able to capture possible differences among countries and years; the following model is estimated using Ordinary Least Squares (OLS):

$$y_{it} = \alpha + \beta \cdot x_{it} + \varepsilon_{it}$$

The suitability of Linear Regression model is verified using three different tests:

- Wald's test, that refuses as null hypothesis the absence of significativity of parameters;
- Breusch-Pagan's test, that refuses as null hypothesis of statistical error heteroscedasticity;
- Test RESET (Regression Equation Specification Error Test), called Ramsey's test too, that refuses as null hypothesis that the specification of the model is right.

The OLS presents problems of heteroscedasticity and omitted variables, so it is necessary to use a model of Panel Analysis. Since the dataset is a panel data, we can carried out an econometric analysis based on estimate for two different models: Fixed or Random Effects.

Generally, the FE model is created setting $\alpha_{it} = \alpha_i = \alpha + \mu_i$ e $\beta_{it} = \beta$, in other word we impose that the intercept of straight line changes only for countries and the slope remains constant:

$$y_{it} = \alpha_i + \beta \cdot x_{it} + \varepsilon_{it}$$

The same model can be rewritten as:

$$\boldsymbol{y_{it} = \alpha + \beta \cdot x_{it} + \sum_{j=1}^{N-1} (\mu_j \cdot D_{ji}) + \varepsilon_{it}}$$

where D_{ji} are N-1 dummies so that $D_{ji} = 1$ if $i = j$ and $D_{ji} = 0$ if $i \neq j$, while the N-1 parameters μ_i measure the deviation of intercepts of N-1 countries from that single intercept, considering as reference base.

Instead, the Random effects, created setting $\alpha_{it} = \alpha + \mu_i + \tau_i$ e $\beta_{it} = \beta$, in other word created imposing that the intercept of regression straight line changed for countries and in the time, while the slope remains constant:

$$y_{it} = \alpha_{it} + \beta \cdot x_{it} + \varepsilon_{it}$$

In particular, the same model can be rewrite as:

$$y_{it} = \alpha + \beta \cdot x_{it} + v_{it}$$

where $v_{it} = \varepsilon_{it} + \mu_i + \tau_i$ is the error term, composed by different stochastic elements.

The FE model, called Dummy Variable Model too, is estimated using Least Squares with Dummy Variables, LSDV, while the RE model, called Error Components Model too, is estimated Generalized Least Squares, GLS. The choice between these two models, in particular to determine what is more able to describe studied relationship between CGI and GDP, is performed using Hausman's test.

In addition, we have formulated a simultaneous equation model (5 equations) to determine all possible and contemporary relationships among considered variables. This model allows evaluating the effective influence of CGI on GDP, observing, at the same time, the relationships and the influences of moderator and mediator variables.
In this third step, we suppose that a model of five simultaneous equation, in which:

- GDP is regressed on CGI, LPI and Export at the same time;
- LPI is regressed on CGI;
- GDP is regressed on CGI;
- Export is regressed on LPI;
- GDP is regressed on LPI and Export.

The first equation allows evaluating what is the effective influence of CGI on GDP, while the following equations allow verifying all influence among variables. This model is estimated using OLS.

4. Statistical Analysis

Table 4 reports Pearson's correlation, and there is no a statistical significance between GDP and GCI and correlation between these variables is close to zero. The low value of correlation from one hand can be determined a lack of significance in the model, from the other hand is a good index of no endogeneity problems between these variables. On the contrary, LPI - moderator variable - has a negative weak significant correlation with GDP (-0,2076, $p < 0,05$): this means that the analysed relationship works out without LPI can be produced bias results. Finally, Export variable has a low correlation with GDP (0,0590) and no statistical significance.

Table 4 - Pearson's correlation

	GDP	GCI	LPI	EXPORT
GDP	1,0000			
GCI	-0,0572	1,0000		
LPI	-0,2076*	0,8823*	1,0000	
EXPORT	0,0590	-0,5280*	-0,5116*	1,0000

4.1 Baron Kenny Model

Table 5. Model summaries				
Model	**R**	**R^2**	**Adjusted R^2**	**Standard Error of the Estimate**
(a)	0,915	0,838	0,834	0,20892
(b)	0,279	0,078	0,054	1,48462
(c)	0,092	0,008	-0 ,016	1,53955
(t)	0,493	0,243	0,203	1,36232
(d)	0,641	0,411	0,396	128,401
(e)	0,483	0,233	0,213	1,35369
(z)	0,485	0,235	0,195	1,36920

As show in Table 5, the difference between R^2 value Model (c) and R^2 value Model (t) was found as 0,235 and the difference between R^2 value Model (f= b) and R^2 value Model (z) was found as 0,157. The determination coefficient, R^2, is a proportion between the data variability and the correctness of the statistical model used. It measures the fraction of the variance of the dependent variable expressed by regression. All the values lean to one whereby the model used.

Table 6 Anova						
Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**p value**
(a)	Regression	8,856	1	8,856	202	4,838
	Residual	1,702	39	0,043		
	Total	10,559	40			
(b)	Regression	7,275	1	7,275	3,300	0,076
	Residual	85,960	39	2,204		
	Total	93,235	40			
(c)	Regression	0,797	1	0,797	0,336	0,056
	Residual	92,438	39	2,370		
	Total	93,235	40			
(t)	Regression	22,710	2	11,355	76,118	0,004
	Residual	70,525	38	1,855		
	Total	93,235	40			
(d)	Regression	449075	1	449075	27,238	6,261
	Residual	642990	39	16486		
	Total	109206	40			
(e)	Regression	21,768	1	21,768	11,789	0,001
	Residual	71,466	39	1,832		
	Total	93,235	40			
(z)	Regression	21,996	2	10,998	5,886	0,006
	Residual	71,239	38	1,874		
	Total	93,235	40			

All the models are generally meaningful as shown in Table 6. The null hypothesis is that the variances are equal among themselves, and that the independent variable does not produce an

effect on the dependent variable. The p-value is the probability of getting the current result or one more extreme given that the null is true.

4.2 Panel Analysis Fixed Effect

Using explained methodology, we found that Hausman's test had reported that difference in coefficients not systematic (28,03, p = 0,0000); this means that we can use Fixed Effects to analyse the relationship.

We carried out following table in which we reported four difference econometric models: with related coefficients, standard errors and level of significance. All models are created with robust standard errors to protect results from heteroskedasticity problems. In fact, our models report a Wald's test for groupies heteroskedasticity equal to 3169,63 (chi^2 value) and p-Value equal to 0,0000 (the Wald test defines as null hypothesis that $sigma(i)^2 = sigma^2$ for all i-units).

Table 7 - Panel Analysis - Fixed effects.

	(1)	(2)	(3)	(4)
GCI	-2,494457 (3,468044)	0,985997 (3,303258)	2,286506 (3,276957)	3,455355+ (2,506685)
LPI		-5,96067*** (2,106134)		-3,135218* (1,705043)
EXPORT			-0,0187391*** (0,0026758)	-0,0161451*** (0,0037073)
cost.	13,692 (15,87814)	17,3542 (14,09272)	-1,589884 (14,67857)	2,451799 (10,95004)
Test F (p-Value)	0,52 (0,4762)	4,34 (0,0197)	26,63 (0,0000)	11,49 (0,0000)
R^2 overall	0,0079	0,1004	0,2013	0,2232
R^2 between	0,0086	0,0981	0,1625	0,1216
R^2 within	0,0033	0,0540	0,0042	0,0004

p-Value *** 1% of significance, ** 5% of significance, *10% of significance, + level of 10% one tail

Regarding the following table, we can see that only model (4) presents a statistical significance for CGI (coefficient 3,455355 with p-Value equal to 0,08 on right tail). We can state that there is a positive influence of CGI on GDP and this impact is equal to 3,455355. That is, if CGI increases its value of one unit, GDP exhibits a growth of 3,455355 x $(CGI)_i$.

The completed model is:

$$(GDP)_{it} = 2,452 + 3,455 \cdot (CGI)_{it} - 3,135 \cdot (LPI)_{it} - 0,016 \cdot (Export)$$

4.3 Simultaneous Equations System

Finally, we made up a simultaneous equations system to calculate coefficients and statistical significances at the same time. Results are reported in the following tables 8 and 9.

Table 8

Equation	Obs	Parms	RMSE	"R-sq"	F-Stat	P
GDP	164	3	3,010521	0,1147	6,91	0,0001
LPI	164	1	0,2510348	0,7784	569,15	0,0000
3GDP	164	1	3,110494	0,0431	7,29	0,0071
EXPORT	164	1	153,4844	0,2617	57,43	0,0000
5GDP	164	2	3,115215	0,0461	3,89	0,0208

Firstly, we find that all equation have statistical significance, reporting a p-Value (from F-test) less to 0,05.

Table 9				
	Coef.	**Std. Err.**	**t**	**P>t**
GDP				
GCI	3,203407	0,9099775	3,52	0,000
LPI	-4,233701	0,9484419	-4,46	0,000
EXPORT	-0,000091	0,0015695	-0,06	0,954
_cons	1,55624	2,629336	0,59	0,554
LPI				
GCI	0,8366607	0,03507	23,86	0,000
_cons	-0,5428358	0,161757	-3,36	0,001
GDP				
LPI	-1,23764	0,4582386	-2,70	0,007
_cons	6,340386	1,526025	4,15	0,000
EXPORT				
LPI	-171,3539	22,61136	-7,58	0,000
_cons	915,9653	75,30027	12,16	0,000
GDP				
LPI	-1,432651	0,5341219	-2,68	0,007
EXPORT	-0,0011381	0,0015947	-0,71	0,476
_cons	7,382808	2,114076	3,49	0,001

From table 9, first equation, we found that GDP is positive influenced by CGI (3,203, $p < 0,001$), while LPI reports a negative influence (-4,234, $p < 0,001$); Export does not report statistical significance.

The second equation (influence of CGI on LPI) reports a positive influence (0,837, $p < 0,001$).

The third equation (influence of LPI on GDP) reports a negative impact (-1,238, $p < 0,01$).

The relationship between Export and LPI is expressed in the fourth equation and from this we note that LPI has a negative impact on Export (-171,35, $p < 0.000$).

Finally, the fifth equation - referred to relationship among LPI, Export and GDP - denotes that LPI has always a negative impact on GDP (-1,433, $p < 0,001$), while Export does not register statistical significance.

5. Discussion

According to the Baron and Kenny model the mediator effect of Logistics Performance Index on the relation between Global Competiveness Index and GDP is statistically significant. LPI and GCI taken together are good predictors of economic growth. It results that a better

logistics system may have a positive effect on economic growth. The first model also demonstrated how Export plays a moderator role between LPI and GDP. When there are both indirect and direct effects, a "partial mediation" operates. There is a complementary mediation: mediated effect (a # b) and direct effect (c) both exist and point at the same direction. The panel analysis and the simultaneous equation model underline the goodness of GCI performance to evaluate the GDP evolution. On the contrary the two models have shown how the LPI taken individually is not a GDP good estimator and the Export is statistically insignificant in our analysis. Our findings show how the Mediator analysis is a useful method in economic studies but it is necessary to accompany this method with others (Panel and Simultaneous equation) in order for a proper data evaluation.

6. Conclusions and research implications

The importance of this study is to evaluate the impact of the role of competitiveness and logistics system on economic growth in Europe. According to our findings, the GCI is a correct variable to assess GDP. The study shows how the crisis has increased the importance of competitiveness for economic recovery as well as all strategic decisions aimed at growth and competitiveness. Europe has to lead all policies to improve the environment in which businesses operate, increase productivity, encourage innovation, exploit the growth potential of both traditional and emerging sectors, hence a strengthening of competitiveness policies. Investment in research and innovation is a proven growth factor and redirecting resources intelligently, especially when we perceive the first signs of recovery, would be essential to improve the efficiency and quality of public spending in Europe.

Finally yet importantly, the future of the European economy will evolve around the ability to maintain higher competitiveness. Above all the recent globalization and the EU's eastward enlargement have placed the European logistics sector in the face of new challenges and the rapid growth of freight transport contributes to economic development, on the other hand it may cause traffic jams, noise, pollution and accidents. An improvement of the entire logistics sector – framed in a general perspective of the competitiveness growth – could become a winning factor for the entire Europe.

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Case Study

The Logistics Performance In The Balkans Area: Trend Evidence

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Abstract

This article, through a critical analysis of one of the most important indices of the World Bank – the Logistical Performance Index – aims to highlight the efficiency of the performance in logistics of the Balkans. The evidence shows that the examined countries follow different efficiency trends but that the levels reached are still inadequate compared to the efficiency average of EU countries. The study shows that the area still needs funding aimed at integrating the entire system into the European continent.

Key words

Balkans, performance, logistics, public policy, EU

Introduction

This article examines the competitiveness of networks and public infrastructure systems – ports, airports and rail networks – across the Balkans. Competitiveness may generate benefits in terms of lower prices and product quality improvement, but the globalisation process has extended the concepts of competitiveness to how competition affects territories and operating systems in terms of creating the conditions for economic and social development and attracting new entrepreneurship. Porter (1990) has emphasised the existence of exogenous factors that allow the creation of competitive advantage for firms or nations. Exogenous factors that overlap with the 'allocation of production factors', which include physical resources and infrastructure in the surrounding area, and the 'governance' related to public institutions and territorial policies are characteristics that have become highly relevant.

'Logistics', as one of the most important elements of productive economic activities, is intertwined with many variables that affect, more or less directly, countries' efficiency and growth. That is, a sustained effort to foster the logistics could help to boost countries' competitiveness while positioning them to tackle structural impediments to productivity. However, logistics might be seen as a complex sequence of co-ordinated activities because they refer to both traditional logistics as well as management across the entire supply chain. That is, logistics:

Encompasses freight transportation, warehousing, border clearance, payment systems and increasingly many other functions outsourced by producers and merchants to dedicated service providers. (World Bank, 2014)

The capacity of developing countries efficiently to move goods and connect manufacturers and consumers with international markets is improving – albeit slowly. However, much more is needed to close the existing 'performance gap' between high and low performers. Supply chains are only as good as their weakest link and sustainable improvements require complex changes in a range of policy dimensions in areas including infrastructure, trade facilitation and services. These efforts require focus and persistence – a combination that few countries have achieved so far, according to a new World Bank Group survey on trade logistics.

Transport is a fundamental sector of and for the economy, since it embraces a complex network of private and public companies which convey goods and services to citizens and businesses in the EU and its trade partners. It also provides mobility for European citizens, thus contributing significantly to the free movement of people within the EU's internal market. Efficient transport services and infrastructure are vital to exploiting the economic strengths of all EU regions and supporting the internal market and growth, thereby enabling economic and social cohesion. They also matter for trade competitiveness as the availability, price and quality of transportation services have strong implications for production processes and choice of trading partners. Given such a central role, transport is, by definition, also inter-related with various other policy areas such as, for example, environmental and social policies.

A road and rail network able to support businesses and links with foreign states is the goal being pursued in Serbia, Albania and Kosovo with the ultimate aim of promoting national economic growth by attracting chains of investment. The Belgrade and Tiranë governments are expected to refer to the European Union an ambitious project for the construction and upgrading of several sections of the road and rail network which interconnect Serbia, Kosovo, Albania and Montenegro; the goal is to establish approval for the plan from Brussels and then an allocation of funds for its implementation, which will require significant funding.

One of the works in question is a road that enables Serbia to have direct access to the Albanian ports on the Mediterranean Sea: this will start from Niš, the southern Serbian city, and will connect with the Albania-Kosovo Highway, completed in 2013, which connects the Albanian coastal city of Lezhë with the Kosovo capital Prishtinë. In this way, Belgrade will see established a faster connection for businesses with the countries of southern Europe while, simultaneously, allowing Albania to become a transit point for trade and additional support. This will aid the central regions of the Balkans peninsula which, in part, suffer from a lack of infrastructure that connects them to European markets.

However, this project does not concern only the road network: existing railway links will also be renewed, strengthened and adapted to the standards of current-day requirements, necessary to make Serbia and Albania attractive to foreign investment. Both being candidates for EU membership, this will allow them to meet the standards imposed by Brussels, which requires further efforts by both governments to improve the quality of infrastructure in the field of

transport. Involvement in this project will be extended to the Belgrade-Bar railway, whose 467 kilometres link the Serbian capital with the port city of Bar in Montenegro. Its construction dates back to the times of Yugoslavia; in fact, it was started in 1952 finally being completed in 1976, 24 years later. Time and the lack of maintenance work, however, have caused the degradation of the line which, in addition to being slow, has also become unsafe; in 1998 and 1999, it was a target of NATO air strikes because of its strategic importance. The damage was later repaired, but its modernisation and, in some places, its reconstruction from scratch are essential conditions to make the Belgrade-Bar infrastructure one that can still be useful to the development of the region.

That a project involving four different countries and, above all, combining Serbia, Kosovo and Albania into a single team, in an area where, after years of war, the relationship has always been tense, represents a big step forward in the difficult normalisation of relations between the different entities that occupy one of the hottest regions of the Balkans.

Literature review

Beškovnik and Twrdy (2015) present a wider perspective on the possibilities of developing a regional strategy for the efficient management of the transport industry in the Balkans. Their focus is mainly on ports – their actual and future role in the transport industry and the regional economy – and they present a complete overview of the actual situation of the port industry and inland infrastructure. Based on a seven-pillar model, other key elements, such as the information technology systems in use, documentary procedures and the management strategies of ports in the Balkans are also analysed. The main proposal of the authors is connected to the development of a regional role for the ports on the eastern coast of the Adriatic Sea in order to secure port regionalisation and specialisation. On this basis, the inland infrastructure and other supporting elements, such as IT platforms and documentary procedures, should be developed accordingly. The entire region and economy should benefit from such co-operation as new supply chains might be attracted.

In further development, Carbone and Stone (2005) report on research into the ways in which European providers of logistics and transport services develop and grow. The strategic behaviour adopted by the leading twenty third-party European logistics service providers between 1998 and 2004 is examined, particularly their approach to mergers and acquisitions

and logistics alliances. It shows that growth among such companies is aimed at providing more cohesive European logistical coverage, but national culture constrains their efforts. Consequently, a greater level of consolidation is expected within the industry. A few market leaders offer a wide range and scope of services, while most other firms have a diversified portfolio of interests.

The twenty-first century has, according to Tatham and Rietjens (2015), seen a significant rise in all forms of disasters, which has resulted in military and humanitarian organisations becoming more frequently engaged in the provision of support to those affected. Achieving an efficient and effective logistical preparation and response is one of the key elements in mitigating the impact of such events, but the establishment of mechanisms to deliver an appropriately integrated civil-military approach remains elusive. Not least because of the high percentage of assistance budgets spent on logistics, this area is considered to represent fertile ground for developing improved processes and understanding. In practice, the demands placed on civilian and military logisticians are broadly similar, as is the solution space. Speaking a common language and using common concepts, it is argued, therefore, that the logistics profession should be in the vanguard of the development of an improved civil-military interface.

D'Aleo and Sergi (2015) aim to test the weight that the main sub-components of the global competitiveness index might have on the logistics performance index. They deploy a novel technique based on three newly-particularised clusters ('infrastructure', 'institutions' and 'human factor') to look at whether such clusters are related to efficiency in the 28 European Union countries. It is manifest that the human factor is far more important in improving the logistics performance index than infrastructure and institutions. It follows that, in this new domain of analysis, all initiatives to prioritise investment in the human factor constitute an appropriate means of stimulating innovation and economic outlook, in the knowledge that the logistics sector accounts for an average of 10% of the European Union's GDP.

Finally in this brief overview, Pupavac and Golubović (2015) analyse how trade between countries is operated within a network of increasingly global logistics operators. However, the ease with which traders can use this network to connect with international

markets largely depends on country-specific factors such as trade procedures, transport and telecommunications infrastructure and the domestic market for support services.

The Logistics Performance Index (LPI) and its component indicators provide a unique global point of reference in which we can better understand these key dimensions of logistical performance. The first worldwide LPI was developed by the World Bank to provide a better assessment of how respective countries rank in the managerial and physical effectiveness of their logistics. At the global level in 2010, Croatia ranks 74th, behind developed EU countries but also behind the Balkan countries which are also members of the EU: Bulgaria, Romania and Greece.

The initial hypothesis of this study is that improving LPI to acceptable levels (to an index level greater than 3.5) would significantly improve trade expansion, the ability to attract foreign direct investment and economic growth. The research results are based on primary and secondary research methods and the findings should provide a realistic way of improving national competitiveness in the European and global logistics market.

Conceptual framework

The Logistics Performance Index measures the competitiveness gaps that exist between various countries, especially with regard to international trade. The construction of the index attempts to identify the key variables that are the basis of a nation's ability to move goods quickly and economically across its borders. The LPI takes account of the efficiency of the national supply chain operation on the basis that good logistics facilitates efficiency. The World Bank's partnership with the International Association of Freight Forwarders, the Global Express Association and the Global Facilitation Partnership has seen the development of the LPI for transportation and trade under which countries are evaluated using six components:

- efficiency of customs and border management clearance
- quality of trade and transport infrastructure
- ease of arranging competitively-priced shipments
- competence and quality of logistic services
- ability to track and trace consignments

- frequency with which shipments reach consignees within schedule or expected delivery times.

International LPI, based on the assessments of foreign operators located in the country's major partners, is a weighted average of these six components (World Bank 2002). The components were chosen based on recent theoretical and empirical research and on the practical experience of logistics professionals involved in international freight forwarding (WTO 2012). Allowing for comparisons across 160 countries, the Index can help countries identify challenges and opportunities and improve their logistical performance (WTO 2014). The index ranges from 1 to 5, with a higher score representing better performance (World Bank 2014).

The LPI consists therefore of both qualitative and quantitative measures and helps build profiles of logistical friendliness. It measures performance along the logistics supply chain within a country and offers two different perspectives: international and domestic.

The World Economic Forum's Global Competitiveness Index measures the microeconomic and macroeconomic foundations of national competitiveness so as to define competitiveness as the set of institutions, policies and factors that determine the level of productivity of a country (WEF 2014). GCI use a scale ranging from 1.00 (less competitive) to 7.00 (highly competitive). The GCI provides an overview of the competitiveness performance of 144 economies and represents a most comprehensive assessment. The concept of competitiveness involves static and dynamic components but we take into consideration here, and for contrast, only the pillar related to infrastructural competitiveness.

Data and Variables

The performance of the Balkan nations is not homogenous and does not by itself exhibit a trend, which the data over a number of years confirms is the case. Below, we analyse specifically all the countries of the Balkans on the basis of the performance score of the efficiency of the logistics system of each one between 2007 and 2016.

ALBANY

Table 1 shows that the performance of the Albanian logistics system was positive from 2007 until 2012; in fact, Albania – occupying 139th position in 2007 – grew in just five years to occupy position number 78, climbing above 61 nations in the logistics efficiency ranking. In 2016, the country was assessed as being in 117th position, with a general worsening in its overall score.

Table 1 – Albania LPI score

Year	LPI rank	LPI score	GCI Infrastructure
2007	**139**	**2.08**	**-**
2010	**119**	**2.46**	**4.0**
2012	**78**	**2.77**	**3.5**
2016	**117**	**2.41**	**3.5**

Analysing the LPI sub-components as regards 'infrastructure' performance highlights that overall quality did indeed reached a peak in 2012, with a score of 2.43, while the worst result was recorded in 2016 with a score of 1.98, showing a clear decline in the quality of infrastructure. The overall figure is, instead, more closely related to trends in human resources – the 'logistical competence' component – which, in contrast to the infrastructure data, records a progressive improvement over the years, reaching in 2016 a score of 2.48. For all the other parameters taken into account by LPI (customs, international shipments, tracking and tracing, and timeliness), 2012 is the year in which Albania recorded the highest score, with a negative trend in subsequent years.

The global competitiveness index related to the infrastructure pillar shows a negative trend.

CROATIA

Table 2 shows that the performance of the Croatian logistical system is more linear than that of Albania. In fact, in 2007 it was positioned in 63rd place, then recording a positive trend until 2012, due to the improvements required for entry in the European Union. The next two

years saw the position worsen and then turn positive but without reaching the efficiency levels recorded in 2012. In 2014, the positive trend stopped, before returning in 2016 to the levels of 2012.

The efficiency of the Croatian logistics system seems to have been positively influenced by entry into the European Union.

Table 2 – Croatia LPI score

Year	LPI rank	LPI score	GCI Infrastructure
2007	**63**	**2.71**	**-**
2010	**74**	**2.77**	**4.6**
2012	**42**	**3.16**	**4.7**
2014	**55**	**3.05**	**4.7**
2016	**51**	**3.16**	**4.6**

If we analyse specifically the LPI 'infrastructure' sub-components, the score remains relatively stable, with a peak reached in 2012 (a score of 3.35) and the minimum score in 2010 (2.36), and a general oscillation which is balanced across the years. Also for Croatia, 2016 saw the best results in the field of human resources, with a score of 3.21 in 'logistical competence'. For all the other sub-components, the trend is positive.

In the Croatian case, the GCI has been steady during these years.

BOSNIA AND HERZEGOVINA

Trends in the Bosnia and Herzegovina data describe that, in the years 2007 to 2012, the country made great strides in terms of the efficiency of its logistics system but, since 2012, the trend has been reversed bringing performance levels in the system of to the worst levels of 2007.

Similar to Croatia, Bosnia and Herzegovina recorded the best efficiency score for 'infrastructure' in 2012 with a figure of 2.86; the figure for 2016, however, shows a

substantial deterioration in infrastructure efficiency (2.61). All sub-components, except 'international shipments' (which recorded in 2010 the highest level of efficiency), confirm 2012 as the year of the best performance for the logistics system.

Table 3 – Bosnia & Herzegovina LPI score

Year	LPI rank	LPI score	GCI Infrastructure
2007	**88**	**2.46**	**-**
2010	**87**	**2.66**	**3.2**
2012	**55**	**2.99**	**3.4**
2014	**81**	**2.75**	**-**
2016	**97**	**2.60**	**3.2**

Again as with Croatia, the Bosnia and Herzegovina GCI for infrastructure has remained steady during the years under consideration.

MACEDONIA FYR

FYR Macedonia, compared to other Balkan countries, shows a trend that tends towards the negative, recording in 2010 its best ranking (73).

Table 4 – FYR Macedonia LPI score

Year	LPI rank	LPI score	GCI Infrastructure
2007	**90**	**2.43**	**-**
2010	**73**	**2.77**	**3.5**
2012	**99**	**2.56**	**3.6**
2014	**117**	**2.50**	**3.7**
2016	**106**	**2.51**	**3.8**

Analysing in detail the sub-components of the logistics system, we can see that performance drawn from the 'infrastructure' components has been relatively stable over the years, with slight deviations being relatively insignificant. The most significant element that is worthy of note is represented by 'tracking and tracing' that, in 2016, recorded its lowest score (2.32). The general index shows a negative trend, but it is more correct to say that the deviation is minimal since, as we report, the general trend in logistics efficiency has been relatively stable.

Macedonia shows a positive trend in infrastructure competitiveness (GCI).

MONTENEGRO

Montenegro showed a steady improvement in logistical performance up to 2014 (2.88), only to suffer a decline in the following two years (to 2.38).

However, the paradox is demonstrated within the 'infrastructure' segment; indeed there is a negative trend in efficiency, with 2016 recording the most negative figure, of 2.07 (it was 2.84 in 2014). For all other components, 2014 was the year of best performance.

For Montenegro, the GCI is now showing a negative trend after a period in which it had been relatively steady.

Table 5 – Montenegro LPI score

Year	LPI rank	LPI score	GCI Infrastructure
2010	121	2.43	3.8
2012	120	2.45	4.1
2014	67	2.88	4.1
2016	123	2.38	3.9

SERBIA

The trend in the Serbian data is positive, with the overall logistical efficiency score showing a progressive improvement and a slight decline recorded only in the most recent set of data.

Table 6 – Serbia LPI score

Year	LPI rank	LPI score	GCI Infrastructure
2007	**115**	**2.28**	**-**
2010	**83**	**2.69**	**3.4**
2012	**75**	**2.80**	**3.8**
2014	**63**	**2.96**	**3.9**
2016	**76**	**2.76**	**3.9**

The performance of the various sub-components records a near-constant positive trend, which sees 2014 as the one in which there was the best performance.

Serbia is, like Macedonia, the only nation to show a positive trend in the Global Competitiveness Index related to infrastructure.

Discussions

Highlighting Table 7, the performance of Balkan countries is below the combined average for countries belonging to the European bloc and for those from central Asia. Croatia, due to be recorded among the western bloc in 2016, saw a value close to the average for the EU/central Asia bloc. However, the physical infrastructure performance level of Balkans states as a whole is far below the Europe and central Asian average.

Analysis of the World Bank's Logistics Performance Index shows a slightly different ranking, but the overall picture is similar. One of the components of this composite index is quality of trade and transport-related infrastructure (e.g. ports, roads, railways, information technology). The index is again the lowest for central and east European countries (Romania, Croatia, Bulgaria and Latvia), but Cyprus and Malta also show a low index. The best performing European countries are Germany, the Netherlands, the UK, Belgium and Sweden.

It is worth adding that, concerning the global Logistics Performance Index, 18 EU member states are ranked in the top fifty of the 160 countries compared by the World Bank, with Germany being first and the Netherlands second, so, despite the increasing challenges, European countries are still performing relatively well.

Table 7 – Regional comparison (2016 data)

Country	World Bank		World Economic Forum	
	LPI rank	LPI score	Infrastructure rank	Infrastructure score
Region: Europe and central Asia		3.23		3.16
Croatia	51	3.16	53	2.99
Serbia	76	2.76	85	2.49
Bosnia and Herzegovina	97	2.60	77	2.61
FYR Macedonia	106	2.51	79	2.58
Albania	117	2.41	148	1.98
Montenegro	123	2.38	138	2.07

Faced with Brexit and geo-political crises spilling over into the region, Europe finds itself in a critical condition in many respects. Nevertheless, the region – which includes the EU-28, Iceland, Norway, Switzerland, the Balkans and Turkey – still performs above the global average in terms of competitiveness. The region's countries are clearly divided, with a significant gap between the innovation assessment for northern and western European countries when compared to central, eastern and southern European ones. This gap has been a persistent challenge, but there are some recent encouraging signs of convergence in certain dimensions.

Meanwhile, the quality of the infrastructure is negatively affected by insufficient investment in the upgrade and maintenance of the transport network. The level of public investment in transport infrastructure has been stagnating since the 1990s. Road and rail infrastructure has been degrading across the continent because of insufficient funding and a backlog of outstanding road maintenance. Maintenance budgets have not evolved in line with the increasing length of the infrastructure and with the ageing of crucial links, often – in contrast – experiencing severe cuts, having a negative impact on the state of roads in many states. Furthermore, the adaptation of the infrastructure to new mobility patterns and the requirement

to deploy the infrastructure for clean, alternative fuels pose additional challenges that require fresh investment as well as a change in approach to the design of transport networks and business models.

Given the regional specificities and differences in transport patterns, a possible indicator to compare the situation among member states is the index of satisfaction with the quality of transport infrastructure produced by the World Economic Forum as regards its Global Competitiveness Index. This points out clearly that overall satisfaction with the transport infrastructure is lowest in central and east European countries (i.e. Bulgaria, Romania, Poland and Slovakia). On the other hand, Spain, the Netherlands, Finland, Austria, France and Germany are ranked highest.

Conclusions

Transport network infrastructures, and in particular the trans-European transport network (TEN-T), require a proper level of investment in new infrastructure, the refurbishment and modernisation of the existing network and increased co-ordination between member states and the Balkans countries affected by cross-border infrastructure projects.

Transport policies in the Balkans are characterised by divergent national priorities, while a fragmentation of the transport market continues negatively to affect the quality of transport services in the Balkans and leaves growth potential untapped. To date, transport is still plagued by technical, legal and administrative barriers which penalise the export performance of companies and their integration in global value chains. In addition, gaps in the social legislation related to transport and divergent national practices have led to a deterioration in social conditions for transport workers and, in some cases, have also negatively affected the quality of transport services. Market opening and social cohesion are thus intrinsically linked.

Meanwhile, the economies of the Balkans are not in good health, despite GDP in the countries of the region having at least returned to pre-crisis levels if not having exceeded them. Otherwise, the mournful notes include: imbalance in the trade balance (partially bridged by remittances); very high, and rising, public debt; unemployment (at least in Serbia and Albania); and the small share of the export of goods and services of a still-too-small GDP for countries intending to make exports the engine of their systems.

The study highlights how necessary convergence is in the region if the further substantial investments aimed at improving and adapting the existing infrastructure are to be delivered. It is clear that the crisis has been a highly depressive element in the performance of the logistics system; at the same time, progress in Croatia shows that the necessary measures for inclusion into the EU system is an effective cure in the sense of facilitating the required level of overall improvement. The amount of investment and the availability of European programmes have had a positive impact on human factors; indeed, the index component of the 'skills' recorded the best performance, with an increasing trend in the last ten years. However, much more needs to be done in terms of the physical infrastructure.

The crisis in the EU has led to a commitment to maintain unity after Brexit, and has forced it to focus on the problems of migration and the financial challenges, leaving room for other players ready to invest in the logistics system of the Balkans. In recent years, China has played an increasingly important role in a depressed region desperate for foreign investment: in 2014, commercial exchange between China and the Balkans reached a figure of $50bn. Beijing has been concerned from the start with ports, highways and railways. Additionally, we find Chinese investment in the construction of a high-speed rail line that would connect Belgrade and Bucureşti (estimated investment value: €800m for the stretch on Serbian territory alone). Another €800m will be invested in the construction of the highway which, in the future, will connect the port city of Bar (in Montenegro) to the Serbian capital. Chinese investment banks will also support the construction of two motorway sections in Macedonia (Kičevo-Ohrid and Miladinovci-Štip).

In the coming years, it will be important to understand whether the logistics system of the Balkans will be more integrated with the EU; or whether the presence of external actors will lead the integration of the system eastwards.

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Human factor: the competitive advantage driver of the EU's logistics sector

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Abstract

This article aims to test the weight that main sub-components of the global competitiveness index might have on the logistics performance index. We deploy a novel technique based on three newly particularised clusters ('infrastructure', 'institutions' and 'human factor') to look into whether such clusters are related to efficiency in the 28 European Union's countries. It is manifest that the human factor is far more important for improving the logistics performance index than infrastructure and institutions. It follows that in this new domain of analysis, all initiatives to prioritise investment on the human factor are appropriate means of stimulating innovation and economic outlook, perceived that the logistics sector accounts for an average of 10% of the European Union's GDP.

Keywords: logistics; competitiveness; performance measures; human factor; operational research

1. Introduction

The logistics sector exhibits a relevant impact on economic growth seen that it accounts for roughly 10% of the European Union's gross domestic product (GDP). But what exactly it is intended for logistics? It 'encompasses freight transportation, warehousing, border clearance, payment systems, and increasingly many other functions outsourced by producers and merchants to dedicated service providers'. At its simplest, 'logistics' as one of the most important pillar of productive economic activities is intertwined with many variables that affect, more or less directly, countries' efficiency and growth (Coyle et al. 2012). That is, a sustained effort to foster the logistics could boost countries' competitiveness while positioning them to tackle structural impediments to productivity (Kumar et al. 2015). To put it more directly, logistics might be seen as a complex sequence of coordinated activities because they refer to both traditional logistics as well as the entire supply chain management.

It is now firmly established the importance of keeping good logistics performance in check and taking next steps to enable countries and businesses to take advantage of future prosperity. If the logistics sector and performing transportation improve a country's competitiveness by costs reduction (Korinek and Sourdin 2011), logistics would be found in the private business sector and also in the public/government and non-profit sectors, Langley et al. state (2009) detects. In addition, the globalisation process has changed the logistics activities (Kleindorfer and Visvikis 2007) and intensified the interconnection between places, exchange and production, all characterised by strong human and spatial interactions (Cabodi 2001).

When addressing a country's logistics system efficiency, importance is given to those infrastructures (we also intend specific firms' facilities or immaterial infrastructures like digital technologies) that mostly allow an economy to well connect with the global system. However, many studies have revealed a number of other key factors that influence the competitiveness of a country logistics system, such as the legislation, that may derive from the nation system or from supranational institutions; the taxation system that may have a direct impact on the economic system, and an efficient labour market for better resources allocation; and corruption, among others. Here, we examine the impact of certain factors on logistics efficiency, by resorting to a scientific method that deter- mines the alpha factor, that is, the driver that allows the achievement of competitive advantage (Beaudreau 2016). Some authors suggest that it might be helpful to assess the logistics system through three main

areas: productivity, utilisation and performance (Kearney 1994). Other studies have attempted to develop a unit to measure the logistics efficiency (Harrington 1991); the complexity of logistics performance measurement has led to the development of numerous performance measurement frameworks and models (e.g. see: Brewer and Speh 2000; Gunasekaran and Kobu 2007; Griffis et al. 2004). One such a model developed by Fugate, Mentzer, and Stank (2010) reflects the interdependence of logistics efficiency, effectiveness and differentiation within the logistics overall organisational performance. This latter logistics model is a multidimensional function of efficiency, effectiveness and differentiation (Bobbitt 2004; Cameron 1986; Fugate, Mentzer, and Stank 2010).

After this introduction, we review the literature in Section 2 and focus on the methodology adopted to create the three clusters in Section 3. Section 4 is devoted to our econometric analysis and elaborates on our policy conclusions. Section 5 concludes.

2. Literature review

We can see that in recent years, the LPI has been a subject of increasing academic interest. Below are shown the most significant works on the subject.

Civelek, Uca, and Cemberci (2015) demonstrate by a regression linear model how the logistics performance index (LPI) plays a mediator role on the relation between global competitiveness index (GCI) and GDP. The study tested the mediator variable analysis method suggested by Baron and Kenny (1986) to a global model that covers 96 countries' data for the years 2007–2010 and 2012–2014.

Uca, Civelek, and Çemberci (2015) regressed some components of LPI (customs and infrastructure) on GDP and they are found statistically significant.

Bizoi et al. (2015) investigated how the logistics performance influenced the economic and social development; they compared former communist countries, now EU members, to other 18 countries. The results showed that the countries that record the best logistics performance are also the countries with the highest social and economic development.

Martì and Puertas (2015) analyse the importance of the standard LPI in those emerging economies that have a maritime border: a gravity model shows how a constant improvement of logistical infrastructure is vital to higher exports.

Schuller and Lidbom (2015) showed that the correlation coefficients between the rankings of GCI, business competitiveness index (BCI) and livings standards are high and positive.

Grosse et al. (2015) underline how human factors are central actors in the order picking process and determine both its effectiveness and efficiency that are essential to logistics operations and drivers of changes in logisticians' occupational profile (Large and Kenner 2012).

Faria, Souza, and Vieira (2015) assess Brazil's LPI in relation to its major competitors in international trade. Their findings identify the bureaucracy as a major obstacle to the logistics performance of the country and reveal logistical large inefficiencies.

Park, Hong, and Li (2015) classify the international agreements like a determinant of competitive advantage in maritime supply chain costs for Korean firms. Case illustrations highlight how Korean firms apply the potential benefits of multi-FTAs for achieving their GSC management strategic priorities and goals.

Kotzab and Wunsche (2015) demonstrate that professional experience is the most important element for employment position in the logistics sector.

Ding et al. (2015) resort to a hierarchical multiple regression analysis to substantiate that not all HRM practices were equally effective in building L&SC competencies. While training and development, and recruitment and selection were significant in contributing to nurturing the three L&SC competencies, both performance management and reward management did not.

Erkan (2014) shows how infrastructure weighted of the GCI affects the LPI: infrastructure (railroad and port) is one of the major determinants of logistic performance for a sample 2014 data from 113 nations.

Puertas, Martí, and García (2014) analyse the importance of logistics performance concerning EU exports over the period 2005–2010 in an attempt to identify possible advances on behalf of member states, concluding that logistics was more important for exporting nations than importing nations.

Grant (2014) synthesises the important trend and issues related to the logistics sector using as a reference point the LPI. The recognition of these trends and issues, and the inherent risk surrounding them present the opportunity to manage them and become leaders and indeed long-term survivors.

Ab Talib and Hamid (2014) reviewed a collection of studies in various supply chain management fields getting 42 success factors in SPM and Logistics sector. From the literature survey, four major success factors are proposed: collaborative partnership, information technology, top management support and human resources.

Oberhofer and Dieplinger (2014) explore several factors that influence the environmental behaviour of transport and logistics companies in Austria. The study demonstrated how the environmental measures contribute to overall business performance in logistics sector.

Mohan (2013) conducted a study about competitiveness related to an Indian logistic sector and revealed that logistics management affects global competitiveness in India. A reduction in the logistic costs together with an increasing in the standard service provides benefits to the customers and efficiency to the system.

Padilha and Ng (2012) investigate about the evolution of dry ports in Brazil and discover how institution and infrastructure represent an obstacle in developing countries with respect to developed economies.

Walker, Di Sisto, and McBain (2008) studied the factors that drive green supply chain management initiatives. They identify main categories of internal and external drivers including regulation, customers, competitors and organisational factor to conclude that external drivers influence the supply chain management more than the internal drivers.

Van Hoek, Chatham, and Wilding (2002) conducted a study related to the human factor. This study focuses on the logistics managers and the capabilities they need. Their paper underlines the importance of the emotional capabilities and when combined with the technical capabilities create a perfect logistic manager.

Sanchez et al. (2003) show and quantify that port efficiency is a relevant determinant of a country's competitiveness. Unlike other relevant variables, port efficiency can be influenced by public policies. They apply a principal component analysis (PCA) in order to incorporate different port efficiency measures.

Fournou (2002) stresses the importance of Information Technology in the logistics sector. This study suggests how the IT system is relevant to create a competitive advantage when there is a strong integration of IT system and strong top management commitment with a clear strategic alignment.

Lai, Ngai, and Cheng (2002) develop a measurement instrument for supply chain performance in transport logistic. A 26-item SCP measurement instrument is constructed, reflecting service effectiveness for shippers, operations efficiency for transport logistics service providers and service effectiveness for consignees.

Beamon (1999) developed a performance evaluation framework for manufacturing supply chains, where resources, output and flexibility are necessary components to assess supply chain performance.

The following table summarises available research, research methodology and results (Table 1).

Table 1: Main Literature List

Authors	Year	Field of Work	Key Words	Research Methodology	Results
Ding M. J. et al.	2015	Logistic and Supply chain	Human resources, Logistics, Supply chain	Hierarchical multiple regression analysis	Results from a hierarchical multiple regression analysis show that not all HRM practices were equally effective in building L&SC competencies. While training and development, and recruitment and selection were significant in contributing to nurturing the three L&SC competencies, both performance management and reward management did not.
Kotzab, H. and Wunsche, S.	2015	Logistics Managers	Logistics, services, professional, employment	Theoretical frame	The paper shows that Professional Experience is the most important element for employment position in Logistics sector.
Civelek et al.	2015	Mediator study	LPI, GCI and GDP	Linear regression model	This study tested the Mediator variable analysis, demonstrates by how the LPI plays a mediator role on the relation between GCI and GDP
Uca et al.	2015	Growth	LPI, GDP	Linear regression model	They studied the effect of LPI on GDP, as a result Customs and Infrastructure dimensions of LPI on GDP are statistically meaningful
Bizoi et al.	2015	Logistics performance and development	Logistics, LPI and HDI	Comparative study	This research compared Eu's former communist countries to other 18 countries, Results showed that the countries that recording the best logistics performance are the most developed countries
Martì and Puertas	2015	Export and Growth	LPI, Export, maritime border	Gravity model	They demonstrate through a gravity model how a constant improvement of LPI is vital to higher exports
Schuller and Libdom	2015	Nation Competitiveness	GCI, BCI, living standards	Linear regression model	Showing that the correlation coefficients between the rankings (GCI), (BCI) and livings standards are high and positive
Nunes De Faria et al.	2015	Logistics Performance	LPI, International trade, inefficiencies	Cluster analysis and multiple comparison tests	The main contribution of this paper is to reveal logistical aspects in which Brazil has shown large inefficiencies
Erkan	2014	Logistics Performance	LPI and GCI	Regression analysis	This study demonstrate how the Infrastructure is one of the major determinant s of logistic performance of the countries
Puertas et al.	2014	Logistics performance, export competitiveness	LPI, EU and Exports	Gravity equations	The study concluding that logistics was more important for exporting nations than importing nations
Grant	2014	Logistics sector trends	LPI	Literature review	The recognition of these trends and issues, and the inherent risk surrounding them, present the opportunity to manage them and become leaders
Ab Talib and Hamid	2014	SPM fields	SCM, LPI	Literature review	He identify four major factors: collaborative partnership, information technology, top management support and Human resources
Oberhofer and Dieplinger	2014	Logistics Performance	LPI, management decision and business performance	Case-based approach; expert interviews	They demonstrate how environmental measures contribute to overall business performance
Park et al.	2015	Maritime supply chain	FTA, LPI, GCI	Competitive perspective analysis	The study highlights how Korean firms apply the potential benefits of multi-FTAs for achieving their goals.

Mohan	2013	Logistics competitiveness	LPI, Competitiveness and Human Factor	Comparative analysis	According to the study a reduction in the logistic costs together an increasing in a service standards provide benefits to the customers and efficiency to the system
Padilha and Ng	2012	Ports development	Logistics, efficiency, Supply chain	Evolution pattern investigation	The most relevant element s is to identify Infrastructure and Institution like possible obstacle of competitiveness evolution.
Walker et al.	2008	Supply chain management	Logistics, GCI,	Expert interviews and literature analysis	Organisations seem to be more influenced by external rather than internal drivers.
Van Hoek et al.	2006	Supply chain management	Logistics, Managers, HR	Literature analysis	They underlines the importance of the emotional capabilities that combined with the technical capabilities create a perfect logistic manager
Sanchez et al.	2003	Logistics efficiency	LPI, Port efficiency, Public policies	Principal component analysis (PCA)	This study show and quantify that port efficiency is a relevant determinant of a country's competitiveness and how is influenced by public policies
Fournou et al.	2002	Logistics sector	LPI, competitive advantage, IT and HR	Position-based and resources-based views	They conclude that IT will contribute to Logistics sector competitive advantage in limited cases
Kee Hung lai	2002	Transport Logistics	Logistics, Supply Chain, Performance	26 Items measurement instruments	The empirical findings suggest that the measurement instrument is reliable and valid for evaluating SCP in transport logistics.
Beamon	1999	Supply chain	Supply chain, Flexibility and Performance measurement	Overview and evaluation of Performance measurement	The study found that resources, output, and flexibility are considered necessary components to asses Supply Chain Performance

3. Conceptual framework

Table 2: Logistic Performance Index and Global Competitiveness index EU rank

EU 28	2014 LPI (rank)	2014 GCI (rank)
Austria	22	21
Belgium	3	18
Bulgaria	47	54
Croatia	55	77
Cyprus	58	58
Czech Republic	32	37
Denmark	17	13
Estonia	39	29
Finland	24	4
France	13	23
Germany	1	5
Grecian	44	81
Hungary	33	60
Ireland	11	25
Italy	20	49
Latvia	36	42
Lithuania	46	41
Luxembourg	8	19

Malta	51	47
Netherlands	2	8
Poland	31	43
Portugal	26	36
Romania	40	59
Slovak Republic	43	75
Slovenia	38	70
Spain	18	35
Sweden	6	10
United Kingdom	4	9

Table 2 shows the European countries' results related to the LPI and the GCI. The LPI measures the competitiveness gaps that exist between various countries, especially with regard to international trade. The index attempts to pick up the key variables that are thought to be the bases of the nation ability to trade quickly and economically across their borders. The LPI takes account of the efficiency of the national supply chain operation and logistics facilities efficiency (Martì et al. 2014). The LPI for transportation and trade is the end result of the World Bank's partnership with the International Association of Freight Forwarders (FIATA), the Global Express Association (GEA) and the Global Facilitation Partnership (GFP).

Countries are evaluated on the following bases:

• Efficiency of customs and border management clearance. • Quality of trade and transport infrastructure. • Ease of arranging competitively priced shipments. • Competence and quality of logistic services. • Ability to track and trace consignments. • Frequency with which shipments reach consignees within schedule or expected delivery times.

The components were chosen upon on recent theoretical and empirical analysis and on the experience of logistics professionals involved in international freight forwarding (WTO 2014). Allowing for comparisons across 160 countries, the index can help identify challenges and opportunities towards improving performance (WTO 2014). The index ranges from 1 to 5, with a higher score representing better performance. As expected, high-income European countries dominate the top-10 rankings (1st Germany, 2nd the Netherlands, 3rd Belgium, 4th the United Kingdom, 6th Sweden and 8th Luxembourg); their ranking has remained relatively unchanged since 2007. Not surprisingly, many of these countries are well-established logistics players with a dominant role in global and regional supply chains. We can see how the wealthy European countries are among the top-20 countries in the world (13th France, 17th Denmark, 18th Spain and 20th Italy), and the European countries that recorded the worst performance do not go down below the 58 position (58th Cyprus). This fact exhibits that

Europe is the most important and efficient logistics hub around the world (considered as a unit).

The GCI provides an overview of the competitiveness performance of 144 economies. It contains a detailed profile for each of the economies included in the study, as well as an extensive section of data with global rankings covering over 100 indicators (World Economic Forum 2014). The World Economic Forum defines competitiveness as the set of institutions, policies and factors that determines the level of productivity of a country. The concept of competitiveness thus involves static and dynamic components that are grouped in 12 pillars of competitiveness:

(1) Institutions: Property rights, Public trusts in politicians, Irregular payments and bribes, Judicial independence, Favouritism in decisions of government officials, Wastefulness of government spending, Burden of government regulation, Efficiency of legal framework in setting disputes, Business costs of terrorism and Organised crime.

(2) Infrastructure: Quality of overall infrastructure, Quality of roads, Quality or rail board infrastructure, Quality of port infrastructure, Quality of air transport infrastructure, Available airline seat kilometres, Quality of electricity supply, Mobile telephone subscriptions and fixed telephone lines.

(3) Macroeconomic environment: Government budget balance, Gross national savings, Inflation, Government debt and Country credit rating.

(4) Health and primary education: Business impact of malaria, Malaria incidence, Business impact of tuberculosis, Tuberculosis incidence, Business impact of HIV/AIDS, HIV prevalence, Infant mortality, Life expectancy, Quality of primary education and Primary education enrolment rate.

(5) Higher education and training: Secondary education enrolment rate, Tertiary education enrolment rate, Quality of education system, Quality of math and science education, Quality of management schools, Internet access in schools, Local availability of specialised research and training services and Extent of staff training.

(6) Goods market efficiency: Intensity of local competition, Extent of market dominance, Effectiveness of anti-mono- poly policy, Effect of taxation on incentives to invest, Total tax rate, Number of procedures required to start a business, Time required to start a business, Agricultural policy costs, Prevalence of trade barriers, Trade tariffs, Prevalence of foreign ownership, Business impact of rules FDI, Burden of customs procedures, Import as percentage of GDP, Degree of customer orientation and Buyer sophistication.

(7) Labour market efficiency: Cooperation in labour–employer relations, Flexibility of wage determination, Hiring and firing practices, Redundancy costs, Effect of taxation on incentives to work, Pay and productivity, Reliance of professional management, Country capacity to retain talent, Country capacity to attract talent and Female participation in labour force.
(8) Financial market development: Availability of financial services, Affordability of financial services, financing through local equity market, Ease of access to loans, Venture capital availability, Soundness of banks, Regulation of securities exchanges and Legal rights index.
(9) Technological readiness: Availability of latest technologies, Firm-level technology absorption, FDI and technology transfer, Internet users, Broadband Internet subscriptions, Internet Bandwidth, Mobile broadband subscriptions, Mobile telephone subscriptions and Fixed telephone lines.
(10) Market size: Domestic market size index and foreign market size index.
(11) Business sophistication: Local supplier quantity, Local supplier quality, state of cluster development, Nature of competitive advantage, Value chain breadth, Control of International distribution, Production process sophistication, Extent of marketing, Willingness to delegate authority and Reliance of management.
(12) R&D innovation: Capacity of innovation, Quality of scientist research institutions, Company spending in R&D, University industry collaboration in R&D, Government procurement of advanced technology products, Avail- ability of scientists and engineers, PCT patent applications and Intellectual property protection.

We note that the European nations' GCI diverges from LPI. In fact, in the GCI top-ten ranking, we found only five EU nations (4th Finland, 5th Germany, 8th the Netherlands, 9th the United Kingdom and 10th Sweden), while other wealthy nations who rank in the top 20 on LPI are only placed below: 23rd France, 35th Spain and 49th Italy); only Denmark (13th) records a better result than the LPI. The EU's less competitive country is Croatia, 77th.

4. Research model

We aim to detect the relationship between the LPI and the relevant factors from the GCI, which are grouped into three clusters: 'Infrastructure', 'Human Factor' and 'Institutions' (Table 2).

The tree-formed clusters are – 15 sub-components from more than 100 available – derived from a careful study of the factors that have been linked to the logistics sector. If the choice of sub-components that make up the 'Infrastructure' cluster was practically direct, the composition of the two other clusters (i.e. Institution and Human Factor) required our careful evaluation and a thorough study of all the indices' components. Through analysing the LPI structure, we noticed that 'Institutions' play a key role in the competition development (Ngo et al. 2016) through national policies with particular focus on procedures, border flows management, infrastructure policies and land transport regulations. The variables used in the LPI that identify the primary role of institutions are in our new approach enucleated in major 'macro factors', namely: 'international expedition', 'domestic logistics competence', 'national logistics costs' and 'timely'; these have been analysed and put into relation to GCI resulting in our new cluster 'Institution'. As for the cluster 'Human Factor', we investigated what the constant element always presents in all the logistics procedures was, and the most understandable answer is the human factor in all its components (i.e. from top managers [Lieb and Lieb 2012] to employees). Trucking companies indicate the use of training as a tool for real business development, well above any other type of structure investment. This vision also incorporates the European guidelines that indicate the training tool as a specific duty of those who govern the country and the human factor as a key element to competitiveness.

However, we perceived that some sub-components have 'hybrid' characteristics that allow them to be placed in more than one cluster. It follows that our grouping methodology boils down to the belief that the intrinsic element of components is closely detectable in one of the three clusters.

The relevance of the used variables is well documented in a time span of 10 years (2006–2016). Scientific works that combine the three clusters with the logistics industry are countless. The terms 'infrastructure' associated with 'Logistics' in 183,000 scientific works; 'Human factor' in 41,000 works; and 'Institutions' in 83,700 works. This shows that the logistics sector, as well as being an element of strong academic interest, is studied through the use of different variables. If we go into the used GCI sub-components, as regards the infrastructure cluster, the 'Roads' variable is used together with the term logistics in 47,800 works; 'Railboards' in 6670 works; 'Ports' in 28,800 works; 'Air transport' in 49,000 works; and 'Electricity supply' in 15,600 works; as regards the cluster 'Human factor', the 'Education system' variable in 270,000 works; 'School management' in 261,000 works; 'Staff training' in 47,000 works; 'Innovation' in 30,600 works; and 'Scientist and engineers' in 16,100 works; as regards the 'Institutions' cluster, the variables 'Trust in politicians' in

21,800 works; 'Irregular payments and bribes' in 4940 works; 'Favouritism in government decision' in 6170 works; 'Efficiency of legal framework' in 18,000 works; and 'Organised crime' in 16,900 works. This simple exercise highlights how the nature of the used variables in our paper is correct and the most significant difference of our analysis compared with the reference literature was the ability to create the three clusters that group differently and rework through a new methodological model to be able to highlight their impact on the sector in a well-defined geographical area.

The first cluster 'model I' represents the 'Infrastructure' and includes the sub-components of GCI: Quality of Roads, Quality of rail board's infrastructure, Quality of port infrastructure, Quality of air transport infrastructure and Quality of electricity supply.

The second cluster 'model II' is the 'Human Factor' and contains the sub-components of GCI: Quality of education system, Quality of management school, Extent of staff training, Capacity of Innovation and Availability of scientist and engineers.

The third cluster 'model III' exhibits the 'Institutions' and groups the sub-components of GCI: Public trusts in politicians, irregular payments and bribes, favouritism in decision government, Efficiency of legal framework in setting disputes and Organised crime.

The ultimate objective is now to recognise which of the three groups most influence the LPI (Tables 3).

Table 3: Variables used in the tree clusters analysis

Clusters	Dependent Variable	Independent Variable
I INFRASTRUCTURE	LPI	Quality of roads Quality of rail boards infrastructure Quality of port infrastructure Quality of air transport infrastructure Quality of electricity supply
II HUMAN FACTOR	LPI	Quality of education system Quality of management school Extent of staff training Capacity of innovation Availability of scientist and engineers
III INSTITUTIONS	LPI	Public trusts in politicians Irregular payments and bribes Favouritism in decision government Efficiency of legal framework in setting disputes Organized crime

For this purpose, the LPI was taken as the dependent variable and the effect of some components of the GCI (Table 4) was measured.

Table 4: Model summary

Model	R	R Square	Adjusted R Square	Std. error of the estimation

I INFRASTRUCTURE	.785*	.617	.530	.24081
II HUMAN FACTOR	.870**	.757	.702	.19162
III INSTITUTIONS	.796***	.634	.550	.22705

*Predictors: (Constant), quality of roads, quality of rail boards infrastructure, quality of port infrastructure, quality of air transport infrastructure and quality of electricity supply. **Predictors: (Constant), quality of education system, quality of management school, extent of staff training, capacity of innovation and availability of scientist and engineers. ***Predictors: (Constant), public trusts in politicians, irregular payments and bribes, Favouritism in decision government, Efficiency of legal framework in setting disputes and organised crime.

When examining the results for the three models (Table 4), it is detected that there is high rate relationship between the LPI and some sub-components of the GCI (i.e. model I R2 = 0617; model II R2 = 0757; model III R2 = 0634).

Table 5: Anova model

	Model	Sum of squares	df	Mean square	F	Sig.
I INFRASTRUCTURE	Regression	2.060	5	.412	7.106	.000*
	Residual	1.275	22	.057		
	Total	3.336	27			
II HUMAN FACTOR	Regression	2.528	5	.505	13.772	3.709*
	Residual	.807	22	.036		
	Total	3.336	27			
III INSTITUTIONS	Regression	1.965	5	.393	7.624	.000*
	Residual	1.134	22	.051		
	Total	3.099	27			

Note: Legend of Anova table: SS = Sum of Squares; Residual MS = mean squared error (Residual SS / Residual degrees of freedom); F: Overall F test for the null hypothesis; Significance F: The significance associated P-Value.
*Predictors: (Constant), Quality of education system, Quality of management school, Extent of staff training, Capacity of Innovation and Availability of scientist and engineers; **Predictors: (Constant), Quality of education system, Quality of management school, Extent of staff training, Capacity of Innovation and Availability of scientist and engineers; ***Predictors: (Constant), Public trusts in politicians, irregular payments and bribes, Favouritism in decision government, Efficiency of legal framework in setting disputes and Organized crime.

When examining the results of ANOVA (Tables 5), the model is significant as a whole. Indeed, model I F = 7106; model II F = 13,772; model III F = 7624 (Tables 6).

Table 6: Coefficient models

	Model	Unstandardized coefficient		t.	Sig.
		B	Std. error		
I INFRASTRUCTURE	Constant	1.297	.483	2.680	.013
	Quality of roads	-0.024	.073	-0.325	.747

	Quality of rail boards infrastructure	.080	.076	1.040	.309
	Quality of port infrastructure	.009	.088	.107	.915
	Quality of air transport infrastructure	.083	.100	.824	.418
	Quality of electricity supply	.263	.108	2.423	.024
II HUMAN FACTOR	Constant	1.877	.350	5.357	2.227
	Quality of education system	-0.216	.087	-2.475	.021
	Quality of management school	.185	.079	2.334	.029
	Extent of staff training	.070	.136	.518	.609
	Capacity of innovation	.376	.102	3.680	.001
	Availability of scientist and engineers	-0.051	.075	-0.682	.502
III INSTITUTIONS	Constant	3.292	.423	7.779	9.366
	Public trusts in politicians	-0.087	.143	-0.609	.548
	Irregular payments and bribes	.023	.150	.154	.878
	Favouritism in decision Government	.495	.230	2.154	.042
	Efficiency of legal framework in setting disputes	-0.070	.125	-0.561	.580
	Organized crime	-0.185	.079	-2.336	.028

Table 7: Correlation Coefficient for the tree models

P.CORRELATION	LPI	P.CORRELATION	LPI	P.CORRELATION	LPI
Quality Of Roads	.593	Quality Of Education System	.506	Public Trusts In Politicians	.674
Quality Of Rail Boards Infrastructure	.672	Quality Of Management School	.633	Irregular Payments And Bribes	.679
Quality Of Port Infrastructure	.505	Extent Of Staff Training	.677	Favouritism In Decision Gov.	.726
Quality Of Air Transport Infrastructure	.628	Capacity Of Innovation	.810	Efficiency Of Legal Framework In Setting Disp.	.648
Quality Of Electricity Supply	.725	Availability Of Scientist And Engineers	.367	Organized Crimes	.280

Notes: Standard Error: the least squares estimate of the standard error; T Statistic: The T Statistic for the null hypothesis vs. the alternate hypothesis; P-Value: the p-value for the hypothesis test; Lower 95%: The lower boundary for the confidence interval; and Upper 95%: The upper boundary for the confidence interval.

In Table 7, the positive linear relationship between all variables is presented.

Table 8: Heteroskedasticity and multicollinearity

	chi2	Prob > chi2	VIF (mean)
I INFRASTRUCTURE	.00	.9639	2
II HUMAN FACTOR	.08	.7748	3
III INSTITUTIONS	.01	.9167	14

Table 8 reports two tests. The Breusch-Pagan/Cook-Weisberg test is designed to detect any linear form of heteroskedasticity where a large chi-square would indicate that heteroskedasticity. In our model, the chi- square value is very small, indicating heteroskedasticity is not a problem The VIF (Variance Inflation Factor) tests the multicollinearity: the rule generally applied is that if vif/> 10, then you have collinearity issues and thus further analysis would be appropriate, but otherwise, they do not have; in our model, only the III cluster (Institutions) presents a value >10; I and II clusters do not present multicollinearity problem.

5.Discussion

Notably, the relationship between spending on education and training on an average relative value to GDP is 5.3% (Eurostat), and this demonstrates that countries should allocate a significant higher percentage of national resources on education and training; in countries where the incidence is higher than 6% (i.e. Sweden, the United Kingdom and Belgium), we find a very positive impact on logistics competitiveness indices.

It is important to note that the European Commission has defined the priority of investment in human resources to 'ensure a sufficient supply of science, mathematics and engineering and to focus school curricula on creativity, innovation and entrepreneurship, to prioritise knowledge expenditure by using tax incentives and other financial instruments to promote more private investment'. Also, the transport is fundamental to enhance efficiency. It is expected that by 2050, freight will grow by 80% and passenger transport by more than 50%; then, a focus on human resources with a view to forming appropriate staff for the logistics sector is one of the key factors.

Moreover, it is evident from the literature analysis (Bizoi et al. 2015; Civelek, Uca, and Cemberci 2015; Ding et al. 2015; Lai 2002; Martì and Puertas 2015; Park, Hong, and Li 2015; Puertas, Martí, and García 2014; Schuller and Libdon 2015; Uca, Civelek, and Çemberci 2015) that the impact of certain factors is vital for a sustained growth and relevant for a country's more resilient competitiveness. From our modelling approach and findings, the role of institutions seems not to be a priority, though it would be more appropriate to review the institutions cluster in further studies.

5. Conclusions

In this paper, we have demonstrated a strong mutual relationship between the total score for logistics-related indicators from the GCI and the overall LPI score. We have shown how the relationship between the 15 sub-components of the GCI and the LPI is significant. As we identified the human factor as being the dominant factor in the European logistics system, the investment on the human factor becomes crucial to maintain a high level of competitiveness and competitive advantage. Investing on human resources is adept to increase the whole economic competitiveness through the contribution of new ideas, innovation and the spreading out of working methods. Opportunities in coordination with the private sector as well, skills training and certification programmes to build compatible labour forces could strength productive resources. The importance of human resources as a fundamental element has been discussed and is demonstrated through other methodological approaches (e.g. see: Ab Talib and Abdul Hamid 2014; Beamon 1999); Creazza, Colic- chia, and Dallari 2015; Ding et al. 2015; Grosse et al. 2015; Kotzab and Wünsche 2015; Padilha and Ng 2012; Van Hoek, Chatham, and Wilding 2002), but for the first time, it is detected here in a well-defined geographical context.

In a rich context like the European Union, it is clear from our findings how future investment programming should focus on the human capital formation first, then on the creation of new infrastructure. This study adapts well to corporate decision-making processes, interpreting it as a stimulus to corroborate employee training rather than on new machinery so as to maximise the capacity of human resources to generate competitive advantage.

No doubt, a high efficiency level of infrastructure and institutions must complement the human factor to guarantee a high competitiveness level (e.g. see: Bolumole, Closs, and Rodammer 2015; Ding et al. 2015; Erkan 2014; Founou 2002; Park, Hong, and Li 2015; Walker, Di Sisto, and McBain 2008). An optimal balance of the three elements would be the optimal solution for any economic system in Europe in the long run. Further research could also employ our methodology to weigh the experience in other counties, especially

developing nations, and the procedure of other sub- components that might be grouped into new clusters.

Data appendix

GCI is composed of statistical data and survey opinions. The survey captures the opinions of business leaders around the world on a broad range of topics for which data sources are scarce or, frequently, non-existent on a global scale. It helps to capture aspects of a particular domain – such as the extent of the skills gap, the level of corruption or the intensity of market competition – that are more qualitative than hard data can provide. Thus, it is an indispensable complement to the sources of data made available by international organisations and national statistical offices.

The indicators derived from data and survey are used in the calculation of the GCI; at one end of the scale, 1 represents the worst possible situation; at the other end of the scale, 7 represents the best (Tables 9–11).

Table 9: Subcomponents of GCI - Institutions

EU 28	Institutions				
2014	Public trusts in politicians	Irregular payments and bribes	Favouritism in decision government	Efficiency of legal framework in setting disputes	Organized crime
Austria	3,7	5,5	4	4,9	6,5
Belgium	4,2	5,8	4,1	4,2	6,1
Bulgaria	1,9	4,2	2,1	2,8	4
Croatia	2	4	2,5	2,5	5,4
Cyprus	3,2	5	3,2	4	5,7
Czech Republic	1,7	3,9	2,6	3,3	5
Denmark	4,7	6,2	4,6	5	5,5
Estonia	3,6	5,8	4,1	4,3	6,3
Finland	5,7	6,6	5,3	6	6,6
France	3,5	5,3	3,9	4,2	4,9
Germany	4,7	5,6	4,7	5,4	5,5
Grecian	2,3	3,8	2,6	2,7	5,5
Hungary	2,2	4,2	2,4	3,3	4,9
Ireland	4,5	6,3	4,5	4,9	5,9
Italy	1,7	3,8	2,1	2	3,3
Latvia	2,7	4,8	3,1	3	5,7

Lithuania	2,7	4,6	3,2	3,5	5,1
Luxembourg	5,4	6,3	4,7	5,4	6,3
Malta	3,5	4,1	3	4,3	5,8
Netherlands	5,3	6	5,1	5,5	6
Poland	2,4	4,7	3,1	2,9	5,6
Portugal	3	5,2	3,3	3,1	6,3
Romania	2,3	3,9	2,5	3,2	4,1
Slovak Republic	2,1	3,4	1,9	2,4	4,6
Slovenia	1,9	4,7	2,6	2,6	5,5
Spain	2,2	4,4	3	3,4	5,5
Sweden	5,3	5,7	5	5,4	5,6
United Kingdom	4,5	5,9	4,5	5,7	5,8

Table 10: Subcomponents of GCI - Infrastructure

EU 28	Infrastructure				
2014	Quality of roads	Quality of railroad infrastructure	Quality of port	Quality of air transport infrastructure	Quality of energy supply
Austria	6,3	5,3	4,4	5,4	6,6
Belgium	5,3	4,9	6,4	5,9	6,4
Bulgaria	3,1	3	4,2	4,3	4,2
Croatia	5,6	2,9	4,6	4,2	5,7
Cyprus	5,3	4	4,9	5,1	5,5
Czech Republic	3,7	4,5	4	5,5	6,4
Denmark	5,4	4,5	5,8	5,6	6,7
Estonia	4,4	3,7	5,6	3,8	5,4
Finland	5,9	5,9	6,4	6,2	6,8
France	6,2	5,9	5,2	5,8	6,5
Germany	5,9	5,7	5,7	5,9	6,1
Grecian	4,3	2,9	4,7	5,2	5,3
Hungary	4,2	3,8	3,8	4,1	5,9
Ireland	5,3	4,1	5,3	5,6	6,4
Italy	4,3	4,1	4,5	4,3	5,9
Latvia	3,1	4,1	5,2	5,4	5,5
Lithuania	4,9	4,5	4,9	4,2	5,6
Luxembourg	5,7	5	5	5,4	6,6
Malta	3,7	5	5,5	5,5	4,7
Netherlands	6,1	5,6	6,8	6,4	6,6
Poland	3,5	2,9	4	4	5,5
Portugal	6,3	4,4	5,4	5,7	6,4
Romania	2,8	2,9	3,4	3,6	4,6
Slovak Republic	3,7	4,4	3,5	3,4	6,2
Slovenia	4,9	3,4	5	4,4	6,2
Spain	5,9	6	5,8	6	6,3
Sweden	5,5	5,6	5,6	5,7	6,3
United Kingdom	5,2	4,9	5,6	5,5	6,6

Table 11: Subcomponents of GCI - Human Factor

EU 28	Human Factor				
2014	Quality of education system	Quality Of man. School	Extent of staff training	Innovation	Scientist and engineers
Austria	4,5	4,6	4,8	5	4,3
Belgium	5,3	6	5,1	5,2	4,5
Bulgaria	3,4	3,4	3,3	3,3	3,6
Croatia	3,2	4,2	3,2	3,1	3,9
Cyprus	5,2	5	4,3	3,8	4,9
Czech Republic	3,6	4,3	4,1	4,6	4,5
Denmark	4,8	5,2	4,9	5,3	4,6
Estonia	4,4	4,6	4,4	4,5	3,5
Finland	5,9	5,6	5,3	5,6	6,2
France	4,4	5,7	4,5	4,8	4,8
Germany	5,2	5	5	5,6	4,9
Grecian	3	3,9	3,6	3,3	5,4
Hungary	3,3	4,3	3,6	3	4,2
Ireland	5,4	5,3	4,8	5	5
Italy	3,7	5,1	3,2	4,3	4,8
Latvia	3,8	4,6	4,4	3,6	3,5
Lithuania	3,9	4,4	4,2	4,3	4,1
Luxembourg	4,6	4,7	5,4	5,3	4,3
Malta	5	4,9	4,4	4	4,2
Netherlands	5,3	5,7	5	5,2	4,6
Poland	3,6	4	4	3,8	4,2
Portugal	4,3	5,9	4,2	4,3	5,2
Romania	3,8	4,2	3,6	3,7	4
Slovak Republic	2,8	3,8	3,8	3,5	4
Slovenia	4,1	4,4	3,7	3,7	3,9
Spain	3,4	5,9	3,7	3,8	5,2
Sweden	4,6	5,2	5,1	5,5	4,9
United Kingdom	4,6	5,8	4,7	5,3	4,8

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Case Study: Do Human Factor, Infrastructures and Institutions influence the logistics sector? The case of Africa, Asia and the European Union

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Abstract

This paper analyses the impact that strategic sub-components of the global competitiveness index – grouped here in three new clusters – have on the logistics performance index. The paper finds that the three clusters are related to higher efficiency. While our new methodology makes evident that the three clusters are important for improving the logistics performance index, although different factors might affect the logistics sector performance in the light of both geography and the stage of development. In Europe the human factor is far more important for improving the logistics performance index while "infrastructure" remains the key factor in Asia. Yet it is evident that the all three factors are still central to Africa's logistics development.

Keywords: Transportation and transit; economic growth and development; regional econometric models.

1. Introduction

For some years the logistics has established itself as a competitive weapon, not only for companies but also for the territories, continents, nations, regions, districts and the urban-metropolitan. In an increasingly global world, a territory without an efficient supply logistics, as services such as infrastructure network can see seriously compromise their economic development. The physical space can become one "context infrastructure", which must be planned and designed to create a living environment and more cohesive work, attractive and balanced. But the contribution made by the physical space of the attractiveness and competitiveness of a territory does not end with the strengthening and qualification of infrastructure networks. Indeed the literature reveals how exist factors equally important respect to the infrastructure. The infrastructure is necessary, but not sufficient for the of competitiveness development. While the competitiveness may generate benefits in terms of lower prices and product quality improvement, the globalization process has extended such a competitiveness concept: competition affects territories, defined as operating systems that create the conditions of economic and social development, support local businesses, and attract new entrepreneurship. Porter (1990) firstly emphasized the existence of exogenous factors that allow the creation of the competitive advantage of firms or nations. Exogenous factors that overlap with the “allocation of production factors,” which include physical resources and infrastructure in the surrounding area, and the “governance” related to public institutions and territorial policies characteristics become relevant. Beccantini and Rulliani (1997) emphasize the geographical and infrastructural factor as a determining element to achieve the company competitive advantage, whereby companies’ exogenous elements tied to territoriality and infrastructures, as well as the drivers behind competitive business dynamics eventually become explanatory elements of competitive advantage. We notice a further literature evolution regarding the territory significance in the economic competitiveness. In the 1970s, the territory was reduced to artificial programmable space for logistics purpose. After the 1970s, there was the emerge of the so-called “peripheral development” theory and the organization district and the literature has focused on changes in the configuration between business and local space, by that starting to consider the space not only as accessory element. Finally, with the globalization advent the researchers gave greater weight to local contexts and physical endowment that incorporate the territories. It is understood how

geographical and physical characteristics create competitive differentiation. Natural and artificial facilities of the specific geographic area become a real "productive force" that fuels the ability to achieve a competitive advantage. Maskell and Rulliani (1998) focus on infrastructural facilities and the competitive advantage that companies enjoy through this, defined as positive externalities, it creates an economic advantage until it enhances the competitiveness of an entire nation system.

Other studies reveal other factors beyond infrastructure, Walker at al. (2008) conducted an interesting study a about the factors that drive a logistics management initiatives. They identify main categories of internal and external drivers including regulation and organisational factor. They concluded that external drivers influence the supply chain management and identify other driver respect to the infrastructures. Fournou (2002) also stresses the importance of IT in the logistics sector to create a competitive advantage where exist a strong integration of IT system with a strong top management commitment and with a clear strategic alignment. Van Hoek at al. (2002) conducted a study related the Human factor. This study focuses about the logistics managers and the capabilities that they needs and the importance that they have in the logistics sector.

Our study after identifying the factors that determine logistics sector performance, analyse the performance of 87 countries from three different continents to evaluate if the same determinants affect logistics.

2. Conceptual Framework

In 2007 the World Bank has developed a benchmarking tool, based a six indicators that measure and compare the logistics system performance in over 150 countries. The index allows identifying the strengths and weaknesses logistics system, and set actions to improve it. The index and is estimated according to a worldwide survey aimed to forwarders and express carriers; It relies on the experience and knowledge of professionals (Avis, Mustafa, Panzer, Ojiala 2007).

The six indicators used by the World Bank are: Customs related to the transit efficiency from the border (speed, simplicity, predictability, formalities) by border control agencies, including customs. Infrastructure related to the quality of trade and transport infrastructure (ports, railways, roads, information and communication technologies). International shipments related to the ease of arranging competitively priced shipments. Logistics competence related to the logistics services competence and quality. Tracking & Tracing lead to the ability of track shipments

The international competitiveness drives the countries economic success. The World Economic Forum began issuing its annual World Competitiveness Index in 1980, and the ranking became major criteria to judge a national performance. Global Competitiveness Report has studied and benchmarked the many factors underpinning national competitiveness, is comprehensive tool that measures the microeconomic and macroeconomic foundations of national competitiveness. The concept of competitiveness involves static and dynamic components are grouped into 12 pillars of competitiveness: Institutions, Infrastructure, Macroeconomic environment, Health and Primary education, Higher education and training, Labour market efficiency, Goods market efficiency, financial market development, Technological readiness, Market size and Innovation. They are not independent: they tend to reinforce each other, and a weakness in one area often has a negative impact in others (World economic forum).

Table 1: Logistic Performance Index and Global Competitiveness index rank

EU 28	2014 LPI (rank)	2014 GCI (rank)	AFRICA 33	2014 LPI (rank)	2014 GCI (rank)	ASIA & OCEANIA 26	2014 LPI (rank)	2014 GCI (rank)
Austria	22	21	South Africa	34	56	Singapore	5	2
Belgium	3	18	Egypt, Arab Rep.	62	119	Japan	10	6
Bulgaria	47	54	Malawi	73	132	Hong Kong	15	7
Croatia	55	77	Kenya	74	90	Australia	16	22
Cyprus	58	58	Nigeria	75	127	Taiwan	19	14
Czech Republic	32	37	Côte d'Ivoire	79	115	Korea Rep.	21	26
Denmark	17	13	Rwanda	80	62	New Zealand	23	17
Estonia	39	29	Namibia	93	88	Malaysia	25	20
Finland	24	4	Algeria	96	79	China	28	28
France	13	23	Burkina Faso	98	135	Qatar	29	16
Germany	1	5	Ghana	100	111	Thailand	35	31
Grecian	44	81	Senegal	101	112	Vietnam	48	68
Hungary	33	60	Ethiopia	104	118	Indonesia	53	34
Ireland	11	25	Burundi	107	139	Saudi Arabia	49	24
Italy	20	49	Tunisia	110	87	Bahrain	52	44

Latvia	36	42	Angola	112	140	India	54	71
Lithuania	46	41	Chad	113	143	Kuwait	56	40
Luxembourg	8	19	Mauritius	115	39	Philippines	57	52
Malta	51	47	Libya	118	126	Oman	59	46
Netherlands	2	8	Botswana	120	74	Pakistan	72	129
Poland	31	43	Guinea	120	144	Cambodia	83	95
Portugal	26	36	Zambia	123	96	Nepal	105	102
Romania	40	59	Madagascar	132	130	Bangladesh	108	109
Slovak Republic	43	75	Lesotho	133	107	Lao PDR	131	93
Slovenia	38	70	Zimbabwe	137	124	Mongolia	135	98
Spain	18	35	Tanzania	138	121	Myanmar	145	134
Sweden	6	10	Cameroon	142	116			
United Kingdom	4	9	Gambia	146	125			
			Mozambique	147	133			
			Mauritania	148	141			
			Gabon	150	106			
			Benin	109	119*			
			Liberia	102	111*			

As expected, high-income European countries dominate the top 10 rankings (1.Germany, 2.Netherlands, 3.Belgium, 4.UnitedKingdom, 6.Swedem, 8.Luxembourg); the composition of the 10 has remained relatively unchanged since 2007. Not surprisingly, many of these countries are major and well-established logistics players with a dominant role in global or regional supply chains. The wealthy European countries are among the top 20 countries in the world (13.France, 17.Denmark, 18.Spain, 20.Italy), and still the European countries that recorded the worst performance does not go down over the 58 position (58.Cyprus). This can indicates that Europe is the most important and efficient logistics hub around the world (considered as a unit). As it regards the Asia & Oceania group takes into account only Singapore and Japan, 5 and 10, they are among the top most efficient ten. Is important to emphasize how the Logistics efficiency level is similar to the European Continent for many countries (15.Hong Kong, 16.Australia, 19.Taiwan, 21.Rep.Korea, 23.New Zealand, 25.Malaysia, 28.China.). But the lowest scores come close to African continent performance; it indicates a strong heterogeneity of the sector's development. As for the African continent, except 34.South Africa, the level of the industry efficiency is very low, with 150.Gabon that record the worst score. GCI results of the European nations are different than the results of

LPI, in fact in the GCI top ten ranking we found only five EU nations (4.Finland, 5.Germany, 8.Netherlands, 9.United Kingdom, 10.Swedem). While other wealthy nations who appeared in the top 20 on LPI ranking are placed deeper (23.France, 35.Spain, 49.Italy), only 13.Denmark records a better result than the LPI. The European less competitive country is 77.Croatia. The competitiveness of Asia & Oceania Group efficiency can be subdivided into two subgroups: in one group there are competitive nations headed from 2.Singapore and 6.Japan, in the other group there are the uncompetitive nations with 129.Pakistan and 134.Myanmar in the last two positions. Africa as for the LPI index the GCI performance is very low for all nations.

3. Research Model

We aim to detect the relationship between the Logistic Performance Index (LPI) and the relevant factors that we have selected in the Global Competitiveness Index), which are grouped as it is shown in Table 2. We chose the most significant sub-components of GCI and grouped them into three clusters: “Infrastructure”, “Human Factor” and “Institutions”.

The tree formed clusters (15 sub-components from more than 100 available) derived from factors that have been linked to the logistics sector. If the choice of sub-components that make up the "Infrastructure" cluster was practically immediate, the composition of the two other clusters (Institution and Human Factor) required our careful evaluation and a thorough study of all the indices components. Through the analysing of the LPI structure we noticed that the Institutions playing a key role in the competition development through national policies should particularly focus on procedures, border flows management, infrastructure policies and on land transport regulations. The variables used in the LPI that identify the primary role of institutions, are enucleated in major "macro factors" namely "international expedition", "domestic logistics competence", "national logistics costs" and "timely"; these have been analysed and put into relation to GCI resulting in our new cluster "Institution". As for the cluster "Human Factor" we investigated what the constant element always present in all the logistics procedures was, and the most understandable answer is the human factor in all its components (i.e., from top managers to employees). Trucking companies indicate the use of training as a tool for real business development, well above any other type of structure investment; this vision also incorporates the European guidelines that indicate the training tool as a specific duty of those who govern the country and the human factor a key element of competitiveness.

The first cluster called “model I” represent the “Infrastructure” it contains the sub-components of GCI: Quality of Roads, Quality of rail board’s infrastructure, Quality of port infrastructure, Quality of air transport infrastructure and Quality of electricity supply.

The second cluster called “model II” represent the “Human Factor” it contains the sub-components of GCI: Quality of education system, Quality of management school, Extent of staff training, Capacity of Innovation and Availability of scientist and engineers.

The third cluster called “model III” represent the “Institutions” it contains the sub-components of GCI: Public trusts in politicians, irregular payments and bribes, Favouritism in decision government, Efficiency of legal framework in setting disputes and Organized crime. The ultimate objective in this paper is to understand which of the three groups most influence the Logistic Performance Index.

Table 2: Variables used in the tree clusters analysis

Clusters	Dependent Variable	Independent Variable
I INFRASTRUCTURE	LPI	Quality of roads Quality of rail boards infrastructure Quality of port infrastructure Quality of air transport infrastructure Quality of electricity supply
IIHUMAN FACTOR	LPI	Quality of education system Quality of management school Extent of staff training Capacity of innovation Availability of scientist and engineers
III INSTITUTIONS	LPI	Public trusts in politicians Irregular payments and bribes Favouritism in decision government Efficiency of legal framework in setting

		disputes Organized crime

For this purpose, the Logistics Performance Index (LPI) was taken as the dependent variable and the effect of some of the components of the Global Competitiveness Index (GCI) was measured. We test the effect trough the use of the linear regression model.

Table 3: Model summary (EU, AFRICA and ASIA & OCEANIA)

Model	R	R Square	Adjusted R Square	Std. error of the estimation
I INFRASTRUCTURE	.785* .581* .935*	.617 .338 .874	.530 .216 .843	.24081 .21818 .20285
II HUMAN FACTOR	.870** .687** .869**	.757 .472 .755	.702 .374 .694	.19162 .19485 .28321
III INSTITUTIONS	.796*** .634*** .839***	.634 .402 .705	.550 .291 .631	.22705 .20737 .31128

Note: *Predictors: (Constant), Quality of Roads, Quality of rail boards infrastructure, Quality of port infrastructure, Quality of air transport infrastructure and Quality of electricity supply; **Predictors: (Constant), Quality of education system, Quality of management school, Extent of staff training, Capacity of Innovation and Availability of scientist and engineers; ***Predictors: (Constant), Public trusts in politicians, irregular payments and bribes, Favouritism in decision government, Efficiency of legal framework in setting disputes and Organized crime

When examining the results for the model I, II and III (Table 3), it is expressed that there is high rate relationship between Logistic Performance Index (LPI) and some components of the Global Competitiveness Index (GCI). However it is said that models are descriptive (model I R2 = 0.617, 0.338, 0.874; model II R2 = 0.757, 0.472, 0.755; model III R2 = 0.634, 0.402, 0.705). R2 is a statistical method that explains how much of the variability of a factor can be caused or explained by its relationship to another factor, it is computed as a value between 0 (0percent) and 1 (100 percent). The higher the value, the better the fit. How is show in the table 3, the model perfect fits in the EU and ASIA & OCEANIA group, by contrast the AFRICA group results show how the statistical method is less accurate.

Table 4: Anova model (EU, AFRICA and ASIA & OCEANIA)

	Model	Sum of squares	df	Mean square	F	Sig.
I INFRASTRUCTURE	Regression	2.060 .657 5.747	5 5 5	.412 .131 1.149	7.106 2.764 27.933	.000* .038* 2.255*
	Residual	1.275 1,285 .822	22 27 20	.057 .047 .041		
	Total	3.336 1.943 6.569	27 32 25			
II HUMAN FACTOR	Regression	2.528 .918 4.967	5 5 5	.505 .138 .993	13.772 4.836 1.466	3.709** .002** 1.466**
	Residual	.807 1.025 1.604	22 27 20	.036 .037 .080		
	Total	3.336 1.943 6.569	27 32 25			
III INSTITUTIONS	Regression	1.965 .782 4.631	5 5 5	.393 .156 .926	7.624 3.636 9.560	.000*** .012*** 8.861***
	Residual	1.134 1.161 1.937	22 27 20	.051 .043 .096		
	Total	3.099 1.943 6.569	27 32 25			

Note: *Predictors: (Constant), Quality of education system, Quality of management school, Extent of staff training, Capacity of Innovation and Availability of scientist and engineers; **Predictors: (Constant), Quality of education system, Quality of management school, Extent of staff training, Capacity of Innovation and Availability of scientist and engineers; ***Predictors: (Constant), Public trusts in politicians, irregular payments and bribes, Favouritism in decision government, Efficiency of legal framework in setting disputes and Organized crime.

When examining the results of Anova (Tables), the model is significant as a whole. Indeed in model I F= 7.106, 2.764, 27.933; model II F= 13.772, 4.836, 1.466; model III F= 7.624, 3.636, 9.560.

Legend of Anova table: SS = Sum of Squares; Residual MS = mean squared error (Residual SS / Residual degrees of freedom); F: Overall F test for the null hypothesis; Significance F: The significance associated P-Value. From the Anova table is evident how the infrastructure cluster in statistical significant and accurate to define the Logistics performance of the ASIA & OCEANIA group; in the same way the Human Factor cluster is statistically significant and accurate to define the Logistics performance of the EU group. For the African group is evident how the tree clusters are statistically insignificant.

Table 5: Correlation Coefficient for the tree models (EU, AFRICA and ASIA)

P.CORRELATION	LPI	P.CORRELATION	LPI	P.CORRELATION	LPI
Quality Of Roads	.593 .454 .814	*Quality Of Education System*	.506 - .191 .697	*Public Trusts In Politicians*	.674 .072 .592
Quality Of Rail Boards Infrastructure	.672 .251 .523	*Quality Of Management School*	.633 .229 .751	*Irregular Payments And Bribes*	.679 .253 .742
Quality Of Port Infrastructure	.505 .370 .864	*Extent Of Staff Training*	.677 .294 .749	*Favouritism In Decision Gov.*	.726 .063 .719
Quality Of Air Transport Infrastructure	.628 .531 .893	*Capacity Of Innovation*	.810 .300 .809	*Efficiency Of Legal Framework In Setting Disp.*	.648 .371 .730
Quality Of Electricity Supply	.725 .175 .767	*Availability Of Scientist And Engineers*	.367 .272 .808	*Organized Crimes*	.280 - .181 .562

In the table 5 it is show the positive linear relationship between all variables. Also in this case the statistical performance is better in the EU and ASIA & OCEANIA groups, while the correlations in the AFRICA group are irrelevant.

Table 6: Descriptive statistics

Descriptive statistics cluster Infrastructure						
Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
LPI	28 33 26	3,57 2,56	3,52 2,55	0,3515 0,2464	3 2,2 2,2	4,12 3,43 4

		3,18	3,11	0,5126		
Quality Of Roads	28 33 26	4,87 3,31 4,48	5,25 3,3 4,6	1,0710 0,8610 1,1628	2,8 1,9 2,4	6,3 5,2 6,1
Quality Of Rail Boards Infrastructure	28 33 26	4,42 1,73 2,74	4,45 2 2,55	0,9983 1,1757 2,1507	2,9 0* 0*	6 3,4 6,7
Quality Of Port Infrastructure	28 33 26	5,04 3,48 4,45	5,1 3,4 4,55	0,8672 0,8523 1,2831	3,4 1,8 1,7	6,8 5,2 6,7
Quality Of Air Transport Infrastructure	28 33 26	5,07 3,63 4,66	5,4 3,4 4,9	0,8579 0,9554 1,1599	3,4 2,1 2,5	6,4 6 6,8
Quality Of Electricity Supply	28 33 26	5,96 2,99 4,88	6,2 2,9 5,1	0,6789 1,0410 1,5418	4,2 1,3 1,8	6,8 5,5 6,8

*Absence of Rail Board infrastructure

With attention to descriptive statistics, primarily we analysed data for each observation, and we noted that LPI Asia & Oceania mean value 3,18 approaching the EU LPI 3,17 mean value; this means that the Logistics sector has similar development level for the two groups. If we examine the variables that make up the Infrastructure cluster, the average value rewards the EU group, but in two variables (quality of rail board infr. and quality of air transport infr.) the MAX value, thanks to the Japan and Singapore, Asia & Oceania records the best results. The African group records the worst result in all five variables

Table 7: Descriptive statistics

Descriptive statistics cluster Human Factor						
Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
LPI	28 33 26	3,57 2,56 3,18	3,52 2,55 3,11	0,3515 0,2464 0,5126	3 2,2 2,2	4,12 3,43 4
Quality Of Education System	28 33 26	4,25 3,28 4,05	4,35 3,2 3,95	0,8212 0,7302 0,8607	2,8 1,9 2,7	5,9 4,5 5,8
Quality Of Management School	28 33 26	4,84 3,69 4,28	4,8 3,8 4,2	0,7172 0,8459 0,7985	3,4 2 2,6	6 5,2 5,8
Extent Of Staff Training	28 33 26	4,29 3,66 4,28	4,35 3,9 4,3	0,6546 0,5941 0,6621	3,2 2,6 2,9	5,4 4,9 5,4
Capacity Of Innovation	28 33 26	4,37 3,34 4,11	4,3 3,3 4	0,8272 0,5256 0,7671	3 2,5 2,9	5,6 4,5 5,4
Availability Of Scientist And Engineers	28 33 26	4,5 3,64 4,26	4,5 3,6 4,4	0,6158 0,5517 0,6627	3,5 2,5 3	6,2 4,7 5,6

The table 7 reports the descriptive statistics related to the Human Factor cluster. EU is leader in all five variables, with Finland, Belgium and Luxembourg that master in all five variables. The average of Asia & Oceania group is just below to the EU group and the best performers are Singapore and Japan. For the African group the statistics show how it performs better then in the Infrastructures cluster but the medium value is far from the other two countries group.

Table 8: Descriptive statistics

Descriptive statistics cluster Institutions						
Variable	Obs.	Mean	Median	Std. Dev.	Min	Max
LPI	28 33 26	3,57 2,56 3,18	3,52 2,55 3,11	0,3515 0,2464 0,5126	3 2,2 2,2	4,12 3,43 4
Public Trusts In Politicians	28 33 26	3,55 2,83 3,69	3,1 2,8 3,75	1,2812 0,7069 1,2820	1,7 1,8 1,8	5,7 5,3 6,2
Irregular Payments And Bribes	28 33 26	4,98 3,43 4,35	4,9 3,4 4,1	0,9306 0,8060 1,3426	3,4 2,1 2,3	6,6 5,5 6,7
Favouritism In Decision Gov.	28 33 26	3,48 2,95 3,66	3,2 3 3,8	1,0260 0,5906 1,0197	1,9 2 2,2	5,3 4,5 5,6
Efficiency Of Legal Framework In Setting Disp.	28 33 26	3,92 3,60 4,15	3,75 3,5 4,1	1,1689 0,7828 0,9504	2 2,3 2,7	6 5,2 5,9
Organized Crimes	28 33 26	5,46 4,54 5,05	5,55 4,5 4,7	0,7732 0,7802 1,0969	3,3 3,5 3	6,6 6,4 6,7

The table 8 show the Institutions cluster descriptive statistics. In this case the average values indicate how Asia & Oceania countries perform better then EU group. The biggest surprise we have looking at the maximum values, indeed the African group record the best results in tree variables (Organized crime, Favouritism, Irregular Payment and Bribes and Public trust

in Politicians), the explanation is that these variables are closely linked to the development of democratic institutions.

4. Discussion

In the relationship between spending on education and training between European countries: the average value relative to GDP stood at 5.3 per cent (Eurostat), this indicates that all countries should allocate a significant percentage of national programming. In countries where the incidence is higher than 6 per cent (Sweden, United Kingdom, Belgium) they are having a positive impact on logistics competitiveness indices. It is important to note that the European Commission has defined priority "The investment in human resources, ensure a sufficient supply of science, mathematics and engineering and to focus school curricula on creativity, innovation and entrepreneurship, to prioritize knowledge expenditure by using tax incentives and other financial instruments to promote more private investment (European Commission, 2015).

A recent study by the Institute for Emerging Markets Studies of the Moscow School of Management, points out in Asia in the coming years will focus on infrastructure development, especially thinking of the 350 million people who will be born in the next few years fuelling the demand for transport and communication, especially infrastructure (roads, bridges, power plants and infrastructure networks in general). Infrastructure, physical and digital, for the development of the Asian continent are the foundation of an economic activity that produces and distributes goods around the world, efficiently and effectively. E 'be noted that the infrastructure market is thriving and vibrant in Asia, while in Europe, public investment in recent years have borne the brunt of austerity imposed by the crisis. The marked differentiation from our study highlights the different needs determined mainly by demographic changes of the different continents, the quality of life and the pattern of earnings of these new requirements directly affect the performance of competitiveness. Of course, even in Asia spending on railways, roads or airports it is inherently linked to public finances: why the forecast is that the growth in infrastructure is not accelerated in the more developed with more heavy public deficit and debt economies (Japan). A study by PricewaterhouseCoopers supported by research Oxford Economics points out that "in 2025 the world will come to spend each year more than 9,000 billion dollars in the five key areas of infrastructure: extraction of raw materials, utilities, manufacturing, transportation and social services.

Around an investment of 78 thousand billion, the lion's share held by the Asia-Pacific market, driven by China's growth".

After 15 years of high economic growth rates, well above 5% per year, they say economists in Washington; the African continent has slowed its run due to global economic factors. The IMF provides for only a growth of 3.5% for 2015. A first factor is the drop in prices of raw materials on international markets. The African economy is heavily dependent on it: not only oil, but also minerals such as copper and iron, and agricultural products such as cotton and cocoa, are the basis of exports of African economies. Moreover, Africa is suffering so direct and rapid contraction of the growth of the Chinese giant. China is the largest trading partner on the continent, with exchanges the order of 200 billion dollars. An ever-present threat to economic growth in Africa is political instability in many countries; After a positive phase between ninety and two thousand years, in which many conflicts have been resolved in recent years, violence is again on the rise in many African countries, mainly because of religious conflicts that often resulted in riots in jihadist character. Despite these problems, the IMF and World Bank stimulate economic growth in Africa to more than 5% per year for the rest of the decade, after a protracted slowdown until 2016. In fact, the largest African economies have been able to diversify in many cases and create sophisticated financial mechanisms to cushion the economic contraction in the most unfavourable circumstances.

5. Conclusions

This article demonstrates the competitiveness of the logistics sector depends on different variables, which affect the trend over the time, defining its shape and direction. Though all the identified variables are essential for proper sector development, we have also shown that certain variables or clusters are decisive to influence the performance according to the economic development achieved by the entire region, in this case geographically identified with the continents. The novelty of this paper has been to identify the "Human Factor" as the dominant factor in the European logistics sector; while the "Infrastructure" is the logistics driving force of the Asia & Oceania counties group. The statistical model evidence indicates that the in a context characterized by a strong homogeneity of economic and cultural development the human factor is the element that must be developed to improve the overall performance. Instead in a context characterized by a strong heterogeneity of economic and democratic development, investment in physical infrastructure is the key to bridging the existing gap within the same continent. As regards the African continent, the general context

is characterized by generalized economic and institutional underdevelopment; in this case the statistical model is not useful to identify the Logistics performance drivers, because of the whole sector underdevelopment. In conclusion, this study is useful to address macroeconomic and managerial decisions and to direct investment policies to enhance the logistics sector and more generally to improve the whole competitiveness.

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A dynamic about airport efficiency: the case of Italian airports' technical efficiency

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Abstract

This paper develops a dynamic network DEA framework to investigate the Italian airport system with the aim to elaborate a model of the technical efficiency of Italian airports. Our findings show that few Italian hubs are technically efficient although smaller airports being dominated by low coast companies prove to be efficient too. This paper also highlights how the in the Italian public shareholders system becomes decisive to increase efficiency in a small airports due to the lack of private financing.

Keywords: Airports, efficiency scores, DEA, Italy, shareholders impact, productivity.

1. Introduction

In this work we will analyse a non-parametric method, so-called data envelopment analysis (DEA) to measure the technical efficiency of the Italian airport sector. Objective of the work is to provide the reader with a critical point of view on the sector, pointing out that to a high technical efficiency does not always match an identical economic efficiency. For technical efficiency we mean the capacity of the airport to fully exploit the technical features that have and that are common in the entire infrastructure so that you can compare. Indeed, in this work some of the airports that are technically efficient are economically inefficient and unattractive for investors (Crotone), in other cases the economic inefficiency coincides with the technical inefficiency (Reggio Calabria). The result is that any airport regardless of size or geography position requires different customized policies.

The big air transport infrastructures are one of the most crucial factors for the land area development. They contribute not only to the development of the territory, but involve a number of consequences for all individuals. The presence of an infrastructure as an airport affect the people behaviour and has a particular impact on their career choices, commercials, tourists and residential. If airports contribute to territory local development where they arise, indeed they create great benefits to the regional, national and international economic system, in jobs and wealth perspective. In this context an important role is played by the globalization processes, which have led to the steady erosion of national boundaries towards the creation of trans-national, European and global identity. It appears necessary to maintain stable contact between the global network nodes, airports become the natural allies of this phenomenon, given the speed with which allow you to connect the areas that only fifty years ago seemed unattainable. While a modern airport will increase the competitiveness of the economic system in which it is inserted, it is also true that a territorial economic system with an efficient network of infrastructure and public services and industrial and service functioning is crucial for competitiveness the airport itself. The airport management activities are undergoing a process of continuous transformation. Today's airport is inserted in an increasingly dynamic global environment.

After this introduction, we have a description of Italian airport system and review the related literature, from Section 4 we focus on the methodology adopted and on the materials used. Sections 5 to 8 are devoted to our econometric analysis. The last two sections (9; 10) conclude.

2. Italian airport system

The Italian airport system, like that of other European countries, is characterized by the presence of numerous medium-sized airports. This is due not only to the need to link areas of the peninsula otherwise difficult to reach, but also the inadequacy of the rail and road systems, which require a massive presence of air links. The airport network consists of 112 airports in operation: only 42 airports are open to commercial use (ENAC – Ente Nazionale di Aviazione Civile, 2016).

Italy than in other European countries is the fifth highest number of airport facilities for passenger civil and commercial traffic, after France, Germany, the UK and Spain.

Analysts define the Italian airports system overabundant compared to the number of inhabitants and to the Italian GDP. The presence of numerous islands was the flywheel for the regional airports construction, such as to guarantee easy access to those most isolated territories. Despite the above described fragmentation of the system of Italian airports, stands a figure emerged in 2016: in that year, 55.6% in passenger traffic and 51.1% of aircraft movements were concentrated in the first five airports or in Rome-Fiumicino, Milan-Malpensa, Milan-Linate, Bergamo and Venice

In 2012 the Ministry of Infrastructure and Transport has presented a draft of the National Airports Plan, which provides a systemic view of the Italian airport network. In September 2014 it was then drafted the final version, approved definitively by Presidential Decree 201/2015 (SO-CALLED airports plan, bearing the identification of national interest airports), came into force on January 2, 2016. It includes 38 airports in 4 different air supra-regional of the national territory: North-West, North-East, Centre, South and Islands; identifying 10 areas of traffic: Northwest, Northeast, Central and North, Central Italy, Campania, Mediterranean-Adriatic, Calabria, Western Sicily, Oriental Sicily and Sardinia.

Bacini di Traffico	Gate Intercontinentali	Aeroporti Strategici	Aeroporti d'interesse nazionale nazionale/regionale
Nord Ovest	Milano Malpensa	Milano Malpensa, Torino	Milano Linate, Bergamo, Genova, Brescia, Cuneo
Nord Est	Venezia	Venezia	Verona, Treviso, Trieste
Centro Nord		Bologna- Firenze/Pisa	Rimini, Parma, Ancona,
Centro	Roma Fiumicino	Roma Fiumicino	Roma Ciampino, Perugia, Pescara
Campania		Napoli	Salerno
Mediterraneo/Adriatico		Bari	Brindisi, Taranto
Calabria		Lamezia	Reggio Calabria, Crotone
Sicilia Occidentale		Palermo	Trapani, Pantelleria e Lampedusa
Sicilia Orientale		Catania	Comiso
Sardegna		Cagliari	Olbia, Alghero

Fonte: Ministero delle Infrastrutture e dei Trasporti, 2015

The basins were identified in reference to accessibility infrastructure airport, so that each citizen can reach a strategically important airport with a car route up to two hours. The

strategic airports have been identified based on their role as intercontinental gate and belonging to the trans-European transport network. The 38 airports are considered of national interest such as they meet two requirements: the first is that they play a clear role in the basin and are highly specialized, so as to ensure the presence of all air services within the basin itself (eg. direct flights to tourist, business, city airport, cargo etc.); the second requirement is proof of achieving the economic and financial balance, or to tend to it in a reasonable time frame.

This qualification is also given to infrastructure representing a territorial continuity of developing peripheral areas and regions where there is no other mode of transport for this purpose. Therefore, if there are not two previous conditions, but the airport ensures territorial continuity, it is still ranked in the national interest.

3. Literature review

Airports have become an essential element in transport infrastructure. According to the study "Regulation, privatization, and airport charges: panel data evidence from European airports", the airports are innovative companies which provide services that go beyond those typical as take-off and landing, as well as to provide the parking and retail. They have so many of the properties of the local Monopolies. With regard to airports, there is a trade-off between imperfect competition (or monopolistic) and re-regulation-economic. The imperfectly competitive nature of the airport services market is due to the fact that each company has a market power is not related to the natural monopoly regime, but rather stems from the ability to access the landing sites. Following the economic importance above all that is going through and the contemporary authority on the services it offers, the airport industry has been subject to numerous reflections. Literature and the most consulted essays for this study focus on views of regulation in the airport sector with particular attention to the effects of privatization on the different infrastructures. To estimate the economic and territorial impact of an airport, we take as a guide the established research firm studies, such as the Airports Council International (ACI Europe). According to this study the economic impact of an airport, which generates income and employment, can be divided into four categories: direct impact, indirect, induced and catalytic, the sum of which determines the overall impact of an airport on the territory of reference-chin of the same. There are several examples of socio-economic impact assessment of a national airport in the literature: all are cited the Yao

Yang and studies, that in the Air-port Development and Regional Economic Growth study in China, in 2008, they found a relationship between the growth of passenger volume and growth of the national GDP of 1.3 in the short run and 0.57 in the long run. Most of the literature analysed is concerned with the increasingly widespread practice of benchmarking. Forsyth et al. (2004) provide us such as not only an overview of the history of airport regulation in the world, but also of how the various services are conducted in practice. Other studies address more salient arguments about airports. Czerny (2006), Zhang, Fu et al. (2011) analyse the optimal form of airport regulation; others as Basso and Zhang (2008) deepen the relationship between airport costs rates during peak and low price cases. However, much of the existing empirical literature on airports (Merkert and Pearson 2015; Oum et al., 2003, Oum and Yu 2004 ATRS 2008, Perelman and Serebrisky 2010, Liebert and Niemeier 2010) focuses mainly on benchmarking studies, to examine the factors that determine the productivity of an airport; other sectorial studies tend to also stressed the importance of the supply chain (Nilsson et al 2016).

If benchmarking studies have begun to converge on the factors that increase the productivity and efficiency of the airport, the empirical literature on airport prices is strangely low, tan-to which we can only identify two empirical studies, namely those of Van Dender (2007) and those of Bel and Fageda (2008). The scarcity of studies on prices is all the more surprising when one remembers that the price was in the middle of the first empirical work on the air transport sector (Kaddoura et al. 2015; Keeler 1978, Borenstein 1989; Wer den et al 1991; Brueckner et al. 1992; Kim and Singal 1993). The lack of depth on the issue might suggest that the theory that airports are simple and not infrastructure companies is still prevalent in all respects. And yet, look for evidence of the substantial impact of regulation and privatization policies on airport prices is of particular interest, since many airport authorities of cross-national environment recently deceived dealing with new regimes and with privatization. Many essays browse the existing literature on airport benchmarking. In them, as well as assess the advantages and disadvantages of partial productivity measures (PPM), we discuss the parametric and non-parametric methods, in reference to previous applications to the airport industry. The comparative analysis of the airports has gained considerable interest in both the academic literature and in common practice. Airports and various companies are therefore interested in their performance compared to the competition, while the regulators (regulators) apply benchmarking as one of several tools in the user setting process. Various actors such as transport authorities, airlines and airport groups are increasingly interested in measuring the performance of the airport: this has led to more and

more advanced benchmarking techniques. It is definitely more interested local and regional airports, where public funding is often substantial and each airport must take into account a range of environmental factors. The management of the smaller airports can be driven by political and social objectives, which may affect the efficiency of their operations. So it can happen to re-delay for certain flights hours to give priority to flights ambulance, or in the same way it happens to age-fly certain departures, justifying this practice in the name of regional well-being. Focusing the analysis on the economic literature refers Italians airports; it is observed that the most common analysis methodology was the DEA (Data Envelopment Analysis), which provides a measure of the inefficiency of the airports. Data Envelopment Analysis (DEA) has been employed in various studies in order to analyse the efficiency of numerous airports around the world. DEA is a non-parametric technique that uses linear programming to fit a frontier based on best practices. It is by far the most popular method in airport benchmarking. Some of the studies using this approach for estimating the efficiency of airports include Yang et al. (2015), Sarkis (2000), Martin and Roman (2001), Fernandes and Pacheco (2002), Barros and Dieke (2007), Psaraki-Kalouptsidi and Kalakou (2011) and Adler et al. (2013) and Wanke (2012). In order to overcome these limitations, Barros and Dieke (2008) have applied the two-stage procedure of Simar and Wilson to estimate the determinants of efficiency of 31 airports in the period from 2001 to 2003. In the first stage, the DEA has allowed sorting airports according to their productivity. In the second stage, this procedure enabled a bootstrap using truncated regression of the DEA results. Gitto and Mancuso in 2012 have extended the work of Barros and Dieke, using a DEA of 28 Italian airports on data from 2000 to 2006 from which they derived the Malmquist index adapted to an inferential context. The analysis of Malmquist indices thus indicates that the productivity growth of the Italian airport network is polarized on the Rome and Milan systems, and on a few other airports. and that their ownership structure will not affect the efficiency of management. The analysis also indicates that there are no significant differences in efficiency between the airports managed by a corporate structure by a majority government than those operated with the corporate structure with a public majority.

Wanke et al. (2016), performe a Fuzzy-DEA model to capture vagueness in input and output measurements obtained from Nigerian airports. They are subsequently treated the results by bootstrapped truncated regressions to control the random effects inherent to any sample. Results indicate that the joint use of bootstrapped regressions and FDEA models leads to more robust results, in the sense that fewer significant contextual variables are identified as efficiency drivers. When controlling for fuzziness and randomness, capacity cost

was found to be the only significant variable, in addition to a learning component represented by trend. Policy design for Nigerian airports should focus simultaneously on third-party capacity management – such as privatization - while fostering continuous improvement practices to sustain the learning curve.

Fasone et al. (2016) presents an exhaustive review of approximately 60 peer-reviewed published papers on business performance measurement through DEA applications in the airport industry. The paper analyses the research on DEA technique chronologically and by geography. The paper explores the contribution of research to final value delivered to airport management by describing the main complementary procedures refining DEA technique scores for improving the operational efficiencies of airports through benchmarking.

Kutlu, L., & McCarthy, P. (2016) use stochastic frontier analysis to analyse the efficiency differences for alternative airport ownership types. They find that while form of ownership may matter for cost efficiency, in general its effect is relatively small. Yet type of public sector ownership does have cost efficiency implications in certain environments Liu, D. (2016) in this study evaluates the overall efficiency and the operational efficiencies of aeronautical service sub-process and commercial service sub-process for 10 East Asia airport companies from 2009 to 2013 using Network Data Envelopment Analysis (NDEA) and identifies the key influencing factors of respective sub-processes efficiency by employing the Panel Data model. His find show how non-aeronautical revenues and service quality have significant and positive influences on commercial service efficiency. Örkcü, H. H. et al. (2016) in this paper uses Malmquist productivity index (classical and bootstrapping) to assess the operational performance of 21 Turkey airports during the period of 2009 through 2014. The findings indicated that the efficiency and productivity of the majority of the Turkish airports increased during the period under investigation. Moreover, decomposition of the Malmquist index showed that most Turkey airports experienced losses in efficiency; however, in terms of technology, they have progressed. Two significant factors (i.e. operating hours and percentage of international traffic) were identified by the Simar-Wilson double bootstrapping regression analysis as explaining variations in airport efficiency. Bezerra, G. C (2016) provide a comprehensive overview of the literature related to performance measurement (PM) in airport settings. 380 documents, published between 1970 and 2015 were systematically analysed. The findings of this study have relevant practical implications for the airport industry. In this context, a framework representing a comprehensive approach to airport performance dimensions with impact on external stakeholders is presented. Chang, Y. T (2016) This paper develops a novel dynamic network DEA framework to investigate the

substitutability between PFC and AIP funds. We find that the studied U.S. airports can substitute PFC for 8–35% of the current AIP funds and contribute significantly to the proposed plan of the US congress to cut AIP funding. Chow, C. K. W. (2016) This chapter studies the technical efficiencies of Chinese airports by using a meta-frontier production function model that accounts for airports in different regions accessing different technologies. The empirical results show that the technical efficiency scores of airports and provincial output in the coastal region are higher than their counterparts in the inland region. Olfat, L. et al. (2016) in this paper, sustainability of airports is considered through a multi-perspective, multi-system, and multi-process operation. It is explored how an extension of fuzzy dynamic network performance measurement approach helps to determine the efficiency performance of an airport system. Ferreira, D. C et al (2016) This research compares the efficiency of holding business model to individual management model of airports, employing some robust non-parametric partial frontier-based methods to compare the statistical distributions of efficiency, under different scenarios, to find out which group of airports yields better global performance. The results provide evidence that European airports are the most productive ones, and within this cluster, the individual management model presented a significant frontier shift with respect the holding cluster frontier, meaning that the former is much more productive than the latter Abbruzzo, A. et al. (2016) provides evidence on the relationship within a set of financial and operational indicators for Italian airports over 2008–2014. Results suggests that the effect of low cost carrier has been heterogeneous throughout the sample, which may suggest new opportunities to expand the business in order to intercept the consumer surplus of this category of travellers.

4. Methods

Data Envelopment Analysis – abbreviated as DEA – is a method for measuring efficiency of DMUs - Decision Making Units – using linear programming techniques to envelop observed input-output vectors as tightly as possibly (Boussofiane, Dyson, & Thanassoulis, 1991). DEA allows multiple inputs-outputs to be considered at the same time without any assumption on data distribution. In each case, efficiency is measured in term of a proportional change in inputs or outputs. A DEA model can be subdivided into an input-oriented model – which minimizes inputs while satisfying at least the given output levels – and an output-oriented model – which maximizes outputs without requiring more of any

observed input values (Ji & Lee, 2010). DEA models can also be subdivided in terms of returns to scale by adding weight constraints. Charnes, Cooper, and Rhodes (1978) originally proposed the efficiency measurement of the DMUs for constant returns to scale (CSR), where DMUs are operating at their optimal scale (Charnes, Cooper, & Rhodes, 1978). Later Banker, Charnes, and Cooper (1984) introduced the variable returns to scale (VRS) efficiency measurement model, allowing the breakdown of efficiency into technical and scale efficiencies in DEA (Banker, Charnes, & Cooper, 1984). The efficiency is an operational concept that mirrors the accountant's idea of value for money, whereby the best achievable relationship is maintained between actual infrastructure and services delivered and the potential that could be delivered. In this study we are going to follow that of Coelli (1996) and Coelli et al. (2005), using the output-oriented DEA model, where the objective of the DMU is to maximise outputs given the available level of inputs (Coelli & Perelman, 1996) and (Coelli, Rao Prasada, C.J., & Battese, 2005).

First consider the constant-returns-to-scale (CRS) model. Let there be $4-\text{inputs}$ and $4-\text{outputs}$ on each of $32-\text{DMUs}$. For the i^{th} DMU these are represented by the vectors x_i and y_i respectively. The $4 \cdot 32$ input matrix X and the $4 \cdot 32$ output matrix Y represent the data of all $32-\text{DMUs}$. The purpose of DEA is to construct a non-parametric envelopment frontier over the data points such that all observed points lie on or below the production frontier.

The mathematical form of this problem is:

$$\max_{\theta,\lambda}\theta \text{ s.t. } \quad -\theta y_i + Y\lambda \geq 0, x_i - X\lambda \geq 0, \lambda \geq 0$$

where θ is a scalar and λ is a $32 \cdot 1$ vector of constants. The value of $1/\theta$ obtained will be the efficiency score for the i^{th} DMU. It will satisfy $\theta \geq 1$, with a value of 1 indicating a point on the frontier and hence a technically efficient DMU; that is, a DMU where the outputs cannot be increased without an increase in inputs. The linear programming problem must be solved for each DMU in the sample and a value of θ obtained for each DMU.

However, the CRS assumption is only appropriate when all DMUs are operating at an optimal scale. The use of CRS specification when not all DMUs are operating at the optimal scale will result in measures of technical efficiency that are confounded by scale efficiencies. The use of the variable-returns-to-scale (VRS) model will allow the calculation of technical efficiency excluding these scale effects.

So, the CRS linear programming problem can be modified to account for VRS by adding the convexity constraint $N \cdot 1'\lambda = 1$ to equation seen above to provide:

$$\max_{\theta,\lambda}\theta \text{ s.t. } \quad -\theta y_i + Y\lambda \geq 0, x_i - X\lambda \geq 0, N \cdot 1'\lambda = 1, \quad \lambda \geq 0$$

where $N \cdot 1$ is vector of ones. This approach forms a convex hull of intersecting plane which envelop the data points more tightly than the CRS hull and thus provides technical efficiency scores which are greater than or equal to those obtained using the CRS model.

Finally, if the technical efficiency scores for a DMU are different between CRS and VRS models, this indicates that the DMU has scale inefficiency, and the scale inefficiency can be calculated from the ratio of the CRS and VRS technical efficiency scores (Chen & Soo, 2010)

5. Calculation

The data used in this study come from two main sources: AIDA database – Bureau van Dijk – and information raised from airport offices.

To determine how many and which variables considered in the DEA model, we have considered that there is a trade-off between number of used variables and the capacity of the model to distinguish among efficient and inefficient variables. An increase of input and output number is associated with a growth of the units, placed on the efficiency frontier. The estimate of technical efficiency is going to perform using a sample of 32 Italian airports except those airports that had not data because they are very small.

Table 1

Airport	IATA Code	Shareholder	WLU (*)
Alghero, Fertilia	AHO	Mixed by a public majority	1,676,622
Ancona, Falconara	AOI	Mixed by a public majority	585,793
Bari, Palese	BRI	Public	3,975,925
Bergamo, Orio al Serio	BGY	Mixed by a private majority	11,514,488
Bologna, Guglielmo Marconi	BLQ	Mixed by a public majority	7,166,219
Brindisi, Casale	BDS	Public	2,248,987
Cagliari, Elmas	CAG	Mixed by a public majority	3,748,592
Catania, Fontanarossa	CTA	Mixed by a public majority	7,090,302
Crotone	CRV	Mixed by a public majority	280,037
Firenze, Amerigo Vespucci	FLR	Mixed by a private majority	2,366,054
Genova, Cristoforo Colombo	GOA	Mixed by a private majority	1,356,353
Lamezia Terme	SUF	Mixed by a public majority	2,346,186
Milano Linate	LIN	Mixed by a public majority	9,795,903
Milano Malpensa	MXP	Mixed by a public majority	23,556,688

Napoli, Capodichino	NAP	Mixed by a private majority	6,203,397
Olbia, Costa Smeralda	OLB	Mixed by a private majority	2,215,196
Palermo, Falcone Borsellino	PMO	Mixed by a public majority	4,907,025
Parma	PMF	Mixed by a private majority	185,188
Perugia, San Francesco d'Assisi	PEG	Mixed by a public majority	272,235
Pescara, Abruzzo	PSR	Mixed by a public majority	600,071
Pisa, Galileo Galilei	PSA	Mixed by a public majority	4,878,574
Reggio Calabria, Tito Minniti	REG	Public	482,558
Rimini, Miramare	RMI	Mixed by a public majority	158,748
Roma Ciampino	CIA	Mixed by a private majority	5,981,374
Roma Fiumicino	FCO	Mixed by a private majority	41,683,677
Taranto, Grottaglie	TAR	Public	67,756
Torino, Caselle	TRN	Mixed by a private majority	3,666,602
Trapani, Birgi	TPS	Mixed by a public majority	1,586,288
Treviso, Sant'Angelo	TSF	Mixed by a private majority	2,358,222
Trieste, Ronchi dei Legionari	TRS	Public	740,419
Venezia, Marco Polo	VCE	Mixed by a private majority	9,110,975
Verona, Valerio Catullo	VRN	Mixed by a public majority	2,572,838

Table 1 – Source: our elaboration – (*) The WLU – Work Load Unit – tallies with one passenger or with 100kg of commodities

6. Statistical Analysis

In the table below, we have reported descriptive statistics of input and output variables.

Table 2

Variables	Obs	Mean	St. Dev.	Min	Max
Input					
Runway length (m)	32	2763.69	511.89	1750	3920
Check-in Desk (num.)	32	46	79	1	355
Number of Airplane/Hour	32	25	29	1	142
Number of Runway	32	1	1	1	4
Output					
Total number of passengers	32	4,877,739	7,558,033	476	4.02 e^{+07}
Total aircrafts movements	32	41,153.09	60,173.97	345	315,168
Share Low-cost Carrier (%)	32	56.13	29.79	0	99.7

Table 2 – Descriptive statistics – Input and Output variables – Source: our elaboration

Observing the table above, we have seen that runway length was, in mean, equal to 2,763.69 meters: this means that the major part of analysed airports was made to take-off and landing of airplanes of medium size, as A320 and A360. Only few airports in Italy are arranged to allow take-off and landing of giant airplanes, as A380 or 747 Boing.

With reference to number of check-in desks, we have registered that in mean Italian airports have 46 (S.D. ± 79) desks, and this is related with the necessity to accommodate

different airline companies, as flag and low-cost carriers, other than carriers of different European Countries.

To allow a correct direction of air traffic control, although some airports – as Milano Malpensa and Roma Fiumicino - have more than one runway, in mean, however, Italian airports have 1 runway.

Each apron can accommodate, in just an hour, 25 airplanes in mean (S.D. ± 29): all small airports have no possibility to accommodate a big number of airplanes simultaneously.

With reference to outputs, we have considered three variables: total number of passengers (mean value equal to 4,888,739, S.D. ± 7,558,033), total aircrafts movements (41,153.09 in mean with S.D. ± 60,173.97), and Share Low-cost carrier (in mean low-cost carriers have a percentage equal to 56.13% with S.D. ± 29,79%, although some airports have no low-cost carriers).

At this point, we can analyse the percentages about passengers, cargos – measured as cargo hold – and movements.

Table 3

Airport	% movements	% passengers	% cargo (ton)	% transits
Alghero, Fertilia	0,91	1,07	0,00	0,19
Ancona, Falconara	0,78	0,33	0,72	0,18
Bari, Palese	2,43	2,53	0,22	2,07
Bergamo, Orio al Serio	5,65	6,60	13,03	1,22
Bologna, Guglielmo Marconi	4,57	4,39	3,32	4,79
Brindisi, Casale	1,29	1,44	0,00	0,91
Cagliari, Elmas	2,24	2,38	0,35	0,26
Catania, Fontanarossa	4,14	4,50	0,67	1,94
Crotone	0,14	0,18	0,00	0,00
Firenze, Amerigo Vespucci	2,31	1,52	0,01	0,01
Genova, Cristoforo Colombo	1,06	0,87	0,03	0,54
Lamezia Terme	1,28	1,49	0,15	1,94
Milano Malpensa	11,89	11,82	55,08	25,30
Milano Linate	7,29	6,18	1,69	0,46
Napoli, Capodichino	3,94	3,92	0,91	3,79
Olbia, Costa Smeralda	1,42	1,42	0,03	1,24
Palermo, Falcone Borsellino	3,16	3,14	0,13	2,74
Parma	0,17	0,12	0,00	0,00
Perugia, San Francesco d'Assisi	0,34	0,17	0,00	0,06
Pescara, Abruzzo	0,55	0,38	0,00	0,05
Pisa, Galileo Galilei	3,03	3,08	0,84	0,90
Reggio Calabria	0,31	0,31	0,01	0,00
Rimini, Miramare	0,16	0,10	0,00	0,38
Roma Ciampino	3,60	3,73	1,70	0,00
Roma Fiumicino	23,93	25,77	15,62	45,50
Taranto, Grottaglie	0,03	0,00	0,72	0,03
Torino, Caselle	2,67	2,34	0,13	0,93
Trapani, Birgi	0,87	1,02	0,00	0,13
Treviso, Sant'Angelo	1,22	1,51	0,00	0,11
Trieste, Ronchi dei Legionari	0,70	0,47	0,01	0,17

Venezia, Marco Polo	6,04	5,56	4,60	1,33
Verona, Valerio Catullo	1,84	1,65	0,03	2,83

Table 3 – Percentages of movements, passengers and cargo of each airport

7. Results

The table 3 represents the percentage of airplanes movements, passengers, ton-cargo and transit in each airport: Roma Fiumicino and Milano Malpensa registered values higher than other airports.

At this point, we can introduce results of DEA model, in which we have performer both CRS model and VRS model, calculating Scale and Return to scale, in which Scale is equal to ratio between CRS and VRS. In the following table 4, we have reported rank for each airport, and in particular we have noted that for 26 airports mean values of both of CRS and VSR technical efficiency is high, that is higher than 0.500. The efficient airports have a value equal to 1.000 and in this study we have identified 9 efficient airports: BGY, CIA, FCO, TAR, LIN, PEG, MXP, CRV, TSF.

At the second place, we have found BLQ, which has a TECRS equal to 0.961295, while is considered efficient for TEVRS. The same trend is noted about CTA (TECRS = 0.953208 and TEVRS = 1.0000).

Table 4

	IATA	**Rank**	$\boldsymbol{\theta}$	$\mathbf{TE_{CRS}}$	$\mathbf{TE_{VRS}}$	**Scale**	**Return to scale**	**RTS**
Bergamo, Orio al Serio	BGY	1	1	1.000000	1.000000	1.000000	0.000000	-
Crotone	CRV	1	1	1.000000	1.000000	1.000000	0.000000	-
Milano Linate	LIN	1	1	1.000000	1.000000	1.000000	0.000000	-
Milano Malpensa	MXP	1	1	1.000000	1.000000	1.000000	0.000000	-
Perugia, San Francesco d'Assisi	PEG	1	1	1.000000	1.000000	1.000000	0.000000	-
Roma Ciampino	CIA	1	1	1.000000	1.000000	1.000000	0.000000	-
Roma Fiumicino	FCO	1	1	1.000000	1.000000	1.000000	0.000000	-
Taranto, Grottaglie	TAR	1	1	1.000000	1.000000	1.000000	0.000000	-
Treviso, Sant'Angelo	TSF	1	1	1.000000	1.000000	1.000000	0.000000	-
Bologna, Guglielmo Marconi	BLQ	2	1	0.961295	1.000000	0.961295	1.000000	IRS
Catania, Fontanarossa	CTA	3	1	0.953208	1.000000	0.953208	1.000000	IRS
Trapani, Birgi	TPS	4	0.976386	0.976386	0.976386	1.000000	0.000000	-
Parma	PMF	5	0.972456	0.972456	0.972456	1.000000	0.000000	-
Napoli, Capodichino	NAP	6	0.910305	0.834252	0.910305	0.916453	1.000000	IRS
Venezia, Marco Polo	VCE	7	0.842559	0.748417	0.842559	0.888267	1.000000	IRS
Pescara, Abruzzo	PSR	8	0.83737	0.837370	0.837370	1.000000	0.000000	-
Pisa, Galileo Galilei	PSA	9	0.823125	0.608235	0.823125	0.738934	1.000000	IRS
Palermo, Falcone Borsellino	PMO	10	0.750087	0.573101	0.750087	0.764046	1.000000	IRS
Brindisi, Casale	BDS	11	0.722193	0.501945	0.722193	0.695030	1.000000	IRS
Alghero, Fertilia	AHO	12	0.720168	0.720168	0.720168	1.000000	0.000000	-
Bari, Palese	BRI	13	0.697094	0.697094	0.697094	1.000000	0.000000	-

Lamezia Terme	SUF	14	0.665317	0.665317	0.665317	1.000000	0.000000	-
Firenze, Amerigo Vespucci	FLR	15	0.654591	0.654591	0.654591	1.000000	0.000000	-
Torino, Caselle	TRN	16	0.643171	0.618961	0.643171	0.962359	1.000000	IRS
Cagliari, Elmas	CAG	17	0.599741	0.589310	0.599741	0.982607	1.000000	IRS
Ancona, Falconara	AOI	18	0.570873	0.570873	0.570873	1.000000	0.000000	-
Olbia, Costa Smeralda	OLB	19	0.453542	0.453542	0.453542	1.000000	0.000000	-
Verona, Valerio Catullo	VRN	20	0.449358	0.423261	0.449358	0.941924	1.000000	IRS
Genova, Cristoforo Colombo	GOA	21	0.413412	0.413412	0.413412	1.000000	0.000000	-
Trieste, Ronchi dei Legionari	TRS	22	0.343385	0.343385	0.343385	1.000000	0.000000	-
Reggio Calabria, Tito Minniti	REG	23	0.129749	0.129749	0.129749	1.000000	0.000000	-
Rimini, Miramare	RMI	24	0.116002	0.116002	0.116002	1.000000	0.000000	-

Table 4 – DEA models of the technical efficiency of Italian airports

For simplicity it is important to note that the first 9 airports (Table 4) for this model are the most efficient. The first fact that emerges is that the geographic factor is significant in the upper positions indeed we account 4 airports from north Italy (GGY; LIN; MXP; TSF); 3 from central area (PEG; CIA; FCO) and 2 from south Italy (CRV; TAR). Second element that seems relevant is represented by the airport size; in the north of Italy are the large airports (LIN; MXP; GCY) to be efficient than the south where small airports (CRV; TAR) are the masters. The major international hub for passengers and goods (FCO; MXP) are efficient. In the last 3 position we found 1 airport from north Italy (TRS); one from central Italy (RMI) and one from south Italy (REG); in this 3 airports the public shareholders is dominant.

Finally, other information about technical efficiency is worked out through estimation of slack. In particular, we have noted that for the first three airports, slightly not efficient, it is possible know how much it needs to expand output (or reduce inputs) without change an increase of inputs (or a reduce of outputs). Same values can be read for all airports that are not efficient.

Table 5

Airport (IATA Code)	Runway Length	Check-in desk	Num. of Runway	Total num. of passengers	Total aircraft movements	Share Low-Cost Carriers
AHO	568.845	0.264641	0	2,502,424	22,054.6	0
AOI	686.076	0	0.114175	2,141,066	11,391.8	0
BRI	487.47	0	0	303,812	2,592.46	0
BGY	.	0	0	0	0	0
BLQ	1,165.69	24.98	0	918,187	1,689.25	0
BDS	574.384	0	0.674046	2,172,978	18,580.3	0
CAG	629.582	0	0	705,815	5,825.67	0
CTA	681.756	0	0	345,007	4,355.23	5.19051
CRV	1,118.4	0	0.06	2,049,489	17,125.6	0
FLR	.	0	0	1,369,506	0	13.8939
GOA	355.093	0	0.0275608	893,501	4,390.03	0
SUF	163.212	0	0	1,618,915	15,251.9	0

LIN	1581.89	158.739	0	333,429	0	0
MXP	.	0	0.183062	1,952,315	0	57.225
NAP	956.803	3.05392	0	1,149,157	5,831.56	0
OLB	267.957	0	0	975,165	6,866.75	0
PMO	677.328	0	0.525061	481,610	0	7.99596
PMF	779.521	0	0.388983	3,212,855	25,465	0
PEG	1,905.13	0	0.866667	504,274	1,904.53	0
PSR	1,041.3	0	0.390772	2,001,168	13,984.3	0
PSA	288.917	0	0.32925	2,206,695	12,484	0
REG	0.0008744	0	0.151563	21,738.3	0	8.27208
RMI	224.402	0	0.0618677	156,579	441.425	0
CIA	0	0	0	0	0	0
FCO	0	0	0	0	0	0
TAR	0	0	0	0	0	0
TRN	950.194	5.85682	0	935855	1569.32	0
TPS	1,340.19	0	0.390555	1,825,747	16,374.9	0
TSF	232.658	0	0	3,522,976	31,776.8	0
TRS	424.699	0	0.068677	860,330	3,817.74	0
VCE	572.895	0	0	324,142	0	0.0001127
VRN	575.376	0	0	691,155	1,929.34	0.364168

Table 5 – Slack variables of inputs and outputs of the Italian airports (2015) – Souce: our elaboration

The inefficient units need to be addressed to an improvement of its performance, to have the specific target values to be achieved that have been set on the basis of the levels of inefficiency achieved by the same. The goals represent real benchmark against which, the inefficient units, are called to constantly monitor their activities. Needless to say, the corrections must be made in the manner and in a timely manner so as not to aggravate a situation that is already departing negative. One who analyses the performance should focus attention on those values that differ from expectation. Only in this way the efforts (economic and non-economic) made to perform the analysis brings tangible benefits.

8. Shareholders impact on efficiency score

As the last analysis, we have performed a Tobit regression analysis, in which efficiency score is used as dependent variable; in this way we could understand how much the percentage of public shareholder and transits impact on efficiency score. Results are reported in the following table 6.

Table 6

	Coeff.	**Robust St. Error**
Public shareholders	0.0084241***	(0.0009842)
Transits	4.54 e^{-06}***	(3.75 e^{-07})
Number of obs	32	
F(2,30)	198.93	
p-value F	0.0144	
Pseudo R^2	0,4345	

Table 6 – Tobit regression

From table 6, we have registered that public shareholders have a positive impact on efficiency score (coeff. = 0.0084241, $p < 0.0001$). The same trend is registered about transit ($4.54\ e^{-06}$, $p < 0.0001$). In general, Tobit model is validated by *F-test*, that reports a *p-value* equal to 0.0144. The pseudo R^2 is equal to 43,45%, so showing a goodness of fit significant. To protect the model from heteroskedasticity problems we have performed analysis using errors robust to heteroskedasticity

9. Discussion

The airport sector is increasingly strategic for the economic development of the country and for international connections, despite the reduced volume of cargo handled compared to other types of transport (2% of the total). In Italy it occupies 500,000 people, accounting for more than € 15 billion to GDP and having significant direct economic impacts (mobility, employment, tourism, trade) and indirect on the territories concerned. 2030 will reach 170 million passengers a year, and without an adequate increase in airport capacity will ensue obvious congestion problems of the airports and the deterioration of services. So regional airports are both an essential role of "spare capacity" to allow the entry of new operators in Italy through lower uncongested airports (with more competitive rates but efficient anyway), is a reserve for the excess traffic in major national airports. The data that emerge clearly from the comparison with the major European countries (UK, Germany, France and Spain) show an excessively fragmented industry, with great density tends to smaller airports and a huge investment gap (especially private) which limits the development. Italy there is a shortfall of capital employed, then concentrated only in main assets. The critical financial situation of local authorities reporting the attention the issue of privatization of local assets such as regional airports, both efficiently management at a loss burning public money, both to make the necessary investments in intermodal transport and connectivity ("nodes") and in new infrastructure to develop their business. In the coming years the main Italian airports will be heavily congested due to traffic growth, will be essential that the least efficient airports adopt measures able to increase the capacity to absorb the rising flow passengers, the Public shareholders became essential for the small airport by the financial resources which are able to put in the system. Thus reducing the competitiveness of the sector at international level. The economic and financial situation of the regional airport

management, unlike the big airports (more attractive for private capital), is often critical, with repercussions on strategic investments in infrastructure and especially in rail and road connections. It is necessary to focus on a specialization of airports to attract private capital necessary for investment and to pursue the rationalization of public intervention. The size of regional airports in terms of traffic volumes is the key factor for achieving adequate levels of financial and operational efficiency, this is because in addition to the direct effects on the aviation turnover, increases the bargaining power of management companies to the carriers and allows increasing non-aviation revenues

10. Conclusions

This study provides empirical evidence regard a sample of national and local Italian airports on the effect of variables on ones. Results indicate that efficiency is independent to the concept of size, matters in determining good performance. Specifically, increasing jointly the number of movements with flights that would attract a high number of passengers may improve profitability and revenues generated by the airport's assets. Results stress also that the effect may suggest new opportunities to expand the business in order to intercept the new potential travellers. The study demonstrates how the technical efficiency does not always coincide with a economic and financial efficiency. Indeed, additional studies would be needed in order to test whether these regularities affect airports of other countries, and the extent to which geographical location of airports matters also in a cross-country setting. With regard to traffic it is just the type, the connectivity and the size Airport influence, direct, and often there is a lack of adequate investment. The operating costs of the small airports are characterized mainly by a rigid cost structure for services and personnel (lead vocals), as in the case of the necessary security costs (eg. Specialized personnel), with the margin on operating costs much higher total than the big airports. The strategic and operational solutions to address the problem of low profitability of the regional airport management are enclosed in three main lines of action. First to implement new capital investment and developing the business (new routes or commercial activities): public capital (mainly contributions from local authorities shareholders), but especially private capital.

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Supply chain management: overview, competition and competences, how to exploit the 'hidden capabilities'

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Abstract: The SCM is a subject of great actuality, because it became a way to increase the competitiveness, reducing uncertainty and enhancing the service provided to the customer. The objective of this paper is to go over again the main literature on the 'supply chain management', following a path that will take us to the modern definition and try to make a personal definition. Subsequently analyse the main theories dwelling on the latest evolution. Finally, a brief summary of the historical growth of the supply chain management and conclude with the development of competition in the supply chain management and creation of new capabilities, the target is to give a definition of new asset, created in supply chain competition, and the 'hidden capabilities'.

Keywords: supply chain management; management; competencies; logistics; capabilities; competition.

1 Introduction: what is supply chain management?

According to the *Council of Supply Chain Management Professionals* (*CSCMP*), supply chain management performs the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management. It also includes coordination and collaboration with channel partners, which may be suppliers, intermediaries, third-party service providers, or customers. Supply chain management integrates supply and demand management within and across companies. More recently, broadly speaking, self-organising network of businesses that cooperate to provide product and service offerings has been called the *extended enterprise*.

MIT researchers define SCM like:

"... a process-oriented, integrated approach to procuring, producing, and delivering end-products and services to customers. It includes sub-suppliers, suppliers, internal operations, trade customers, retail customers, and end-users. It covers the management of materials, information, and funds flows."

The concept just described is commonly called the total value chain or the extended enterprise. Supply chain management involves the effective planning and execution of activities and processes across the entire supply chain. The supply chain, also known as value chain is a concept from business management that was first described and popularised by Porter (1985) in his book, *Competitive Advantage: Creating and Sustaining Superior Performance*.

2 Supply chain management overview

We can go over the main theories that led to the most widely accepted definition. Harland in the 1996 describes supply chain management as managing business activities and relationships internally within an organisation, with direct suppliers, with first and second-line of suppliers and customers over the supply chain, and with the entire supply chain. Harland definition was the one of well-defined but before it, Scott and Westbrook (1991) describes supply chain management as the chain linking each element of the production and supply process from raw materials through to the end consumer, encompassing different organisational boundaries. New and Payne (1995) investigating the power interplay in supply chain partnerships. They found that the relationships were asymmetrical, depending on whether it was with upstream or downstream organisations. Basnet and Wisner (2012) define

the supply chain management like a string: starting from the extraction of raw materials or minerals from the earth, through the manufacturers, wholesalers, retailers, and the final purchaser. The 'supply chain' string includes all activities from the planning to the customer support (product design and development sourcing, manufacturing fabrication, assembly, transportation, warehousing, distribution, and post delivery). The integration of the various functional areas within an organisation to increase the goods flow from immediate strategic suppliers through manufacturing and distribution chain to the end user is the interpretation of Houlihan (1987, 1988). Another definition of supply chain managements issue from the transportation and logistics literature of the wholesaling and retailing industry, emphasising the importance of physical distribution and integrated logistics. There is no doubt that logistics is an important function of business and is evolving into strategic supply chain management (New and Payne, 1995). Physical transformation of the products is not a critical component of this definition of supply chain management but probably where the term supply chain management was originally used (Lamming, 1996). In general, most of the relevant literature on supply chain management steer the purchasing and supply perspective (e.g., Farmer et al., 1997; Morgan and Monczka, 1996; Lamming and Hampson, 1996; Kraljic, 1983). This perspective of supply chain management is synonymous with supplier base integration that develops from the traditional purchasing and supply management functions, that purchasing and materials management represents a basic strategic business process, rather than a narrow specialised supporting function to overall business strategy (Reck et al., 1992). Supply chain management attempt to improve performance through elimination of waste and better use of internal and external supplier capabilities and technology to create a seamlessly coordinated supply chain. The advent of supply chain management has led to the displacement of the competition at the supply chain level (Anderson and Katz, 1998; Birou et al., 1998; Lummus et al., 1998; Morgan and Monczka, 1996; Christopher, 1996). Tan (2001) and Tan et al. (2002) review the literature base and development of supply chain management from two separate way that eventually merged into the modern era of a holistic and strategic approach to operations, materials and logistics management; he well describe the major literature around the two most important prospective: purchasing and supply perspective, and transportation and logistics perspective. Another important definition came from Christopher (1996). He defined the supply chain like a network of organisation involved, through upstream and downstream linkages, in the different processes and activities that produce value in the form of goods and services for end customers. The argument over the years has been subject of countless studies, but we decide to choose only those studies that most

resumes the topic covered in this research.

3 Theory of supply chain management

A few authors such as Halldorsson and Aastrup (2003), Hult et al. (2006) and Lavassani et al. (2008) have tried to provide theoretical foundations for different areas related to supply chain by using organisational theories. These organisational theories include strategic choice theory (SCT), knowledge-based view (KBV), materials logistics management (MLM), resource-based view (RBV), just in time (JIT), agile manufacturing, systems theory (ST), transaction cost analysis (TCA), total quality management (TQM), material requirements planning (MRP), quick response manufacturing (QRM), agency theory (AT), time-based competition (TBC), network perspective (NP), institutional theory (InT), customer relationship management (CRM), table of constraints (TOC), etc., however, literature also suggest that currently there is a gap in the literature that is available in context of supply chain management students, and there no general theory that explain the existence and boundaries of supply chain management. We decide to emphasise three theory well studied by Youssef (1992), which contains the major aspect of supply chain: agile manufacturing, SCM theory and responsive supply chain. Youssef (1992) described agile manufacturing as, a "Manufacturing system with extraordinary capability to meet the rapidly changing needs of the marketplace. A system that can shift rapidly among product models or between product lines, ideally in real-time response to customer demands". AM aspect that firms adapt to the strategic exigencies of the supply chain. Strategic agility planning is needed a strong partnership between suppliers and customers, and information systems for effective supply chain management. Agile supply chain sort the capability to survive and prosper in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer designed products and services. SCM theory is defined as the coordination of resources and the optimisation of activities across the value chain to obtain sustainable competitive advantages. From the agile manufacturing and supply chain management theory, he arrives to the responsive supply chain. An RSC can be defined as, "A network of firms that is capable of creating wealth to its stakeholders in a competitive environment by reacting quickly and cost effectively to changing market requirements". If compare the three models, we can note that the responsive supply chain is the sum of the two models (AM, SCM), the objectives of AM are increased speed and flexibility, for SCM are the costs reduction, the focus is on the costs. In the RSC, we have the fusion of the two objective, flexibility and reducing costs. We can found different structure: in

AM there is a focus on a partnership formation based on a core competencies in a SCM there is a focus on a supplier development. RSC focus on supply chain integration and IT development.

4 Historical development of supply chain management

Three major steps can be observed in the evolution of supply chain management studies: creation, integration, and globalisation (Movahedi et al., 2009). The consulting industry has created the term in the 1980s. The characteristics of this first step of supply chain management include the need for large-scale changes, reengineering, downsizing driven by cost reduction programs, and great attention to Japanese management practices. In the second step or integration era, there was an important jump to the IT tools. Supply chain management studies was highlighted with the development of electronic data interchange (EDI) systems in the 1960s and developed through the 1990s by the introduction of enterprise resource planning (ERP) systems. This era has continued to develop with the expansion of internet-based collaborative systems. This era of supply chain evolution is characterised by both increasing value adding and cost reductions through integration. In the third step, the supply chain management gave the attention to global systems of supplier relationships and the expansion of supply chains over national boundaries and into other continents. Although the use of global sources in the supply chain of organisations can be traced back several decades. This step (globalisation) is characterised by the globalisation of supply chain management in organisations with the objectives to increasing their competitive advantage, value adding, and reducing costs through global sourcing. Some resources speaks about ‘specialisation era’, companies focus on the ‘core competencies’ and specialisation. The specialisation model creates manufacturing and distribution networks composed of a individual supply chains specific to producers, suppliers, and customers, they works together to design, creating, distribute, marketing and sell a product.

5 Supply chain competitions

The theory of competition essentially holds two broad ideas: competition as structure, in which firms within an industry struggle for certain amount of control of forces determining equilibrium (demand and supply) within that industry. This type of competition, usually referred to as neoclassical, encompasses four main theoretical competition thoughts: perfect competition, monopolistic competition, oligopoly and monopoly (Lipczynski et al., 2005). Competition as a process, whereby the strive essentially focuses on the behaviour of firms,

actors, within the market, which ultimately establishes how much rivalry exists within the industry (Metcalfe, 2005). Competition between supply chains can be described as essentially multidimensional especially in terms of the relationships it is connected to Lancioni et al. (2000). The main objective of competition in supply chain is to create a competitive advantage. Competitive advantage is the advantage, in value terms, a supply chain creates for its customers that essentially grow up from the competition with other supply chains. Competition, from almost all concepts, essentially remains a process which changes over time, and involves the ability of one entity or subjects or firm, to be more efficient than another in acquiring and using resources (material and immaterial) that are essential to creating value for itself and its ultimate end-customer or users. From literature, we understand that creating value and wealth is the purpose of supply chains (Mentzer et al., 2004), and this is done in a way that suggests that value which surpasses competitors value offerings, essentially make up the competitive advantage of that supply chain our understanding of value with respect to competitive advantage can be distinguished into two categories for competition purposes – competition-based advantage, and a somewhat opposite term, competition-free value. Competition-based advantage is based on the idea that competitive advantage is reached as an outcome of a head-to-head competition for exiguous critical resources between two or more subjects (e.g., Porter, 1985). On the other hand, competition-free value is value created by supply chains in which there is no competitive interaction (competition) from one supply chain to the other (e.g., Grant and Baden-Fuller, 2004). As such, there is no connotation to an advantage within this mode of value creation. The sole purpose of engaging in competition is to achieve and where possible, maintain a competitive advantage over competitors. The opportunities for competitive advantage are significant in fact a industry/academic consortium doing research on SCM best practices, the Supply Chain Council, has estimated that most companies and organisations can realise the following performance benefits from improved SCM: reduce inventory levels by 25% to 60%, forecast accuracy by 25% to 80%, lower supply chain costs by 25% to 50%, reduce fulfilment cycle time by 30% to 50%, upgrade fill rates by 25% to 30%, Improve delivery performance by 16% to 28%. A fundamental aspect of competition in the supply chain is that ‘the supply chains competing against other supply chains’, and this competition assume different forms connected to the supply chain shape. The Integrated Supply Chain Management (ISCM) Program at the Massachusetts Institute of Technology (MIT) conducted a Delphi study with more than 30 supply chain experts. The study found that the great majority of respondents who answered the question (70%) agreed that supply chain vs. supply chain accurately

characterised the competitive future. They observed that the respondents interpreted the SC vs. SC concept in distinctly different ways. Specifically, when asked, 'What does 'supply chain competing against supply chain' mean to you?'

From this question arise three kinds of competition:

. Literally competition on supply chain. This kind of competition will be between groups of firms across the supply network competing as one subject, formally or informally. This is a kind of classic competition that takes place at the level of groups of subjects that compete to arise before the other a preeminent position.

. Competition on capabilities. The kind of this competition will be between individual firms competing on their internal supply network capabilities or competencies. From this point of view, competition will be based on two capabilities: efficiency (in term of supply internal costs and service, capabilities to reduce costs and improve service), and responsiveness of the supply network (the capabilities to well and fast respond to market demand or the capability to make the right configuration of products available.

. Competing on supply network capabilities led by a channel leader. The kind of this competition will centre on the single, most powerful firm of a supply network, which will determine the terms and behaviours of trade across the entire supply network. The single most powerful company is sometimes referred to as the channel master.

5.1 The shape of competition on supply chain networks

Supply chain networks compete against other supply chain networks to a certain boundary. Unless a company is completely vertically integrated, it cannot successfully compete alone. It needs to be part of a wide supply network. If the companies competing in the networks are completely disconnected (no overlaps) at each tier in an industry, these networks do compete against each other. On the other hand, these networks do not compete against each other when all companies compete in each tier of the different supply networks. Each network overlaps the other, with each company at every tier (n) selling goods to every tier (n + 1) company. An example of this would be modular and commodity products being procured efficiently from multiple members in an open market. Competition in an industry is generally somewhere in between these two extremes, reflecting the distribution of flows and relationships. There are some overlaps and some completely disconnected tiers within the networks. In most cases, many of the potential links are eliminated, since there are closer relationships with some

companies, depending on the nature of the product, price, and capacity of the supply network. Examples of supply networks in each category are shown in the chart below. Note that those under the heading 'completely disconnected supply networks' are primarily vertically integrated, or historically or geographically dispersed supply networks. Increasingly, companies are competing on network capabilities. They are expanding the supply network by utilising and integrating the capabilities of other members of the supply network, such as an upstream supplier or a downstream customer, to offer a unique and compelling solution. This ability to integrate capabilities from other supply network participants often can be leveraged for competitive advantage. Companies are integrating additional capabilities from their immediately adjacent upstream (suppliers) or downstream (customers) supply network companies via joint marketing arrangements, joint product development programs, and collaborative initiatives. These are among the compelling advantages of integrating the capabilities: The benefits of one-to-one or next-tier coordination are quantifiable. Successful one-to-one relationships add value. Data and information sharing is more immediate and useful. Relationships with adjacent upstream or downstream companies are more manageable and controllable than those with more distant participants in the supply network. It may be possible to develop unique added value by working closely with one supplier, developing a unique relationship, a unique product or service, a unique contract, or a unique combination of these. It is harder to do this with multiple companies in the supply network across multiple tiers. This entails competing by focusing on your company's own capabilities rather than attempting to build extended relationships with distant members of the supply network. It is important that the company's own capabilities be developed not just by adding capabilities but also by integrating them into the business. Integrated capabilities are not readily copied and can provide some measure of competitive differentiation, whereas capabilities that are just added offer little competitive differentiation. In short, the development of integrated supply chain capabilities needs to be an important part of a company's go-to market effort. Good examples of such capabilities can be seen in the following activities: early supplier engagement on product development, supplier and customer involvement in critical decisions, and the commingling of supply network operations between two adjacent-tier companies.

6 How to create new capabilities, definition and exploitation of 'Hidden capabilities'

Knowledge derived through supply chain activities is recognised as a critical component of managing supply chain performance (Hult et al., 2003, 2004, 2006) and the capacity to generate new knowledge within the supply chain have been shown to positively affect both

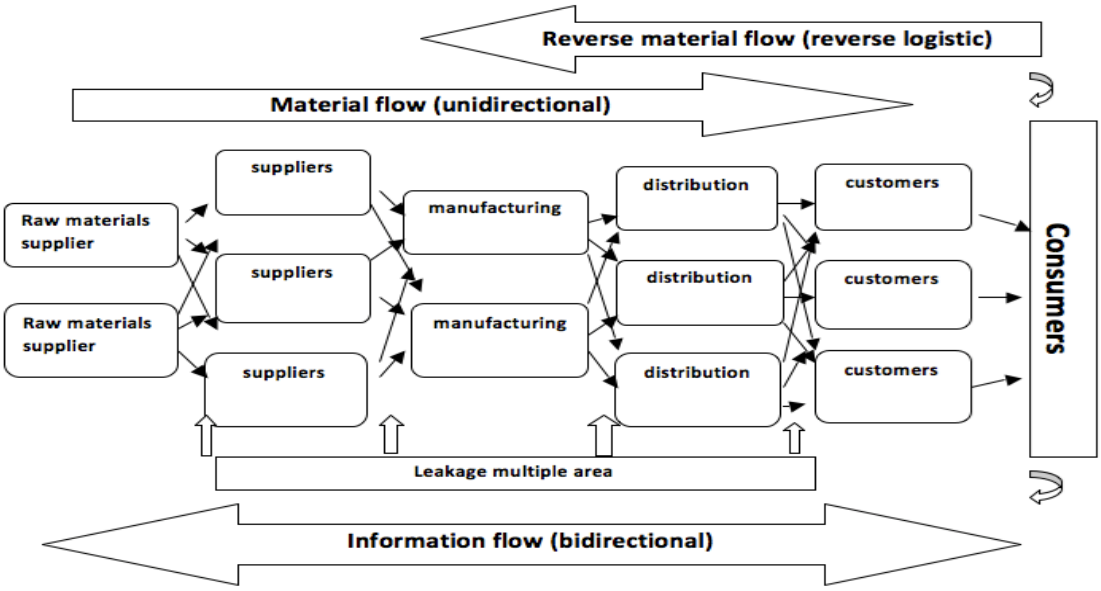
supply chain and firm performance (Craighead et al., 2009). These findings are consistent with the KBV of the firm which considers knowledge as a strategic resource which is developed cumulatively and is therefore complex and difficult to imitate (Grant, 1996; Nonaka, 1994; Nonaka et al., 2000; Spender, 1996). The definition of dynamic capabilities proposed by Teece et al. (1997) is adopted here: dynamic capabilities are "the firm's ability to integrate, build and reconfigure internal and external competences to address rapidly changing environments". Absorptive capacity, as a measure of a firm's ability to learn, to create advantage from learning, and potentially also to survive radical industry change is a dynamic capability which can only be developed with long-term investment (Todorova and Durisin, 2007). Consistent with Todorova and Durisin (2007), we define assimilation and transformation in the supply chain context as follows: assimilation is the manufacturer's ability to create an understanding of new supply chain knowledge and to interpret it for implementation where the new knowledge fits within existing organisational cognitive schema and current organisational structures. Transformation is conceptually and operationally distinct from assimilation; we define it as the manufacturer's ability to alter existing knowledge structures and combine new supply chain knowledge with modified cognitive schema (Todorova and Durisin, 2007). The last studies demonstrate like some companies recur to moves like seek a big merger or skip into a new market. But others firms use an unconventional strategies, have found a far less risky alternative – uncovering hidden capabilities that have been overlooked, undervalued or underutilised and redefining their company or their competition around them. Most hidden capabilities fall into three categories – untapped customer insights, undervalued business platforms and underexploited capabilities. Each can provide the foundation on which a company can redefine its competition or competitive advantage. Untapped customer insights can help companies that have taken customers for granted. Many executives readily admit to losing touch with customers. Undervalued business platforms also can fuel a transformation. Underexploited capabilities represent the last and often the most obscure hidden asset. Given resources and time, companies can combine capabilities to create new properties and powers, with enormous commercial power for change or renewal. Finding hidden capabilities for growth may also require new ways of looking at business and the environment in which it competes.

7 Conclusions

The supply chain is a flow that arises from the interaction of various parties, united by the common interest of creating wealth and well-being. Supply chain management is the

management science that seeks to dominate and make efficient this flow so that you do not create warp points and inefficiencies. This flow may be born or from the end of the supply chain (from consumers demand) that dates back to guide the flow through the input of the consumer what will be the future choices, that will determine the following flow, or may arise from an intermediate point in the supply chain presumably by the manufacturer that seeks, through market research or laboratory research to predict what may be the future demands.

Figure 1 Leakage areas



There are two fundamental characteristics of this flow:

- The material exchange, goods from one (n) point to (n + n) point, to get to the a end point (the consumer).
- And the immaterial exchange, the exchange of knowledge, information, data.

As regards the material flow, over time the supply chain has tried and also successfully implemented techniques and methods to make this flow efficient and extremely traceable, essential step were the IT programs (EDI, ERP, SAP, etc.), which began to develop during the 'integration era' of the supply chain. Surely logistics science, essential branch of the supply chain and highly innovative, thanks to engineering sciences, has played an essential role in the

development of techniques more and more innovative concerning the traceability and forecasting of material requirements. Regarding the immaterial flow is clear that the situation becomes more fluid and less clear. In fact this flow, which is not unidirectional, is fed by various types of data and from various types of sources, if this huge data or information are not guided or interpreted in the correct manner may create distortions in the flow material, and then problems of efficiency throughout the supply chain. In a supply chain where is a completely disconnected networks where there is no overlap with other networks is more easier to control the flow of data and information, limit distortions, inefficiencies and at the same time protect and nurture their strengths by focusing on what are their core competencies. In this type of supply chain, disconnected and isolated is much more is easy to work on the core competencies and compete in the marketplace outside of the supply networks, without the need to develop new skills or capabilities. Subjects who find themselves in this type of 'isolated' flow can focus their resources to protect their market and raise barriers to entry to other subjects who may get itself into the flow. These subjects thanks to the isolation of the flow and a strong integration of the networks of supply chain arise a competitive advantage, difficult to reach from the subjects who operate in a non-isolated and overlapping supply chain networks. But in the other hand, these subjects that operate in a flow isolated and in a non-overlapping supply networks, is difficult to create new capabilities or combinative capabilities or discover 'hidden capabilities', not having easy access to information since the flow raincoat to external contingencies, for these subjects if they wanted to, or need to, develop to stay competitive or just stay on the market, new capabilities and competencies, they needed a large investments and long periods to permit him to skip in a new core competencies and create a new competitive advantage. The problem of the protection and control of the information flow, finds in an impressive manner in the overlapping systems of supply chain networks, where there is an intense competition within the stream. May happen that various manufacturers, active in the same market, uses the same goods or services suppliers, and therefore very easy that create risk of loss of information or imitation. Although there are several methods of protecting sensitive information and data, the risk of creating leakage spaces is easy, which may be accidental or intended. These spaces we create the point in the stream in which cross the various parties involved in the same flow at these points of intersection, and is easy that small amount of information and data are lost, wrong point of arrival or mixing. As a result, of these 'leakage multiple areas' on the materials flow may be create a quantitative error in the incoming material, or logistical error, or an error in the delivery, or time delays. But the most significant and interesting results probably occur

when there is a mix of information; in fact, this could lead to an effect of imitation, emulation, or even innovation. It is easy that it creates an effect of imitation and that some subjects exploit in a positive manner the effect of these 'leakage multiple areas' to create spill combinative capabilities that could lead them to a position of advantage or create a competitive advantage compared to other competitors. Absorptive capabilities and dynamic capabilities are another possible outcome, then the chance to recombine information to reshape capabilities already owned. A new aspect not know is the exploitation of 'hidden capabilities', or not known ability, secondary ability, minimal or not exploited capabilities. These types 'of capacity' are hardly recognisable and not easily exploitable, if not discovered by accident, it could allow a subject to move from core competencies, exploited and not able to provide an adequate competitive advantage. The displacement of these 'hidden capabilities' of course would lead to proper investments and long periods of adaptation. Finally, the basic idea is that the competition within a supply chain networks while creating distortions in the flow of information, it can have the positive effect of bringing, marginal subjects or not marginal, in the chain to develop thanks to the discovery of the 'hidden capabilities' and advantageous positions and develop new core competencies.

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CONCLUSIONS

The work presented at the end of this path doctoral wants to be understood as the beginning of possible future investigation. But though incomplete, the papers presented detect innovative scientific evidence and well classifiable in defined paths. From work can be seen, in fact, the fundamental role played and will continue to have the logistics sector within the European Union; it is essential to invest in the future of this crucial and complementary sector for proper growth of the total wealth. In fact, the work has shown that the logistics combined with an overall competitiveness of the system, become an important engine of economic growth especially in the European Union. At the same time so that this growth is sustainable and continues over time, it is essential for countries to invest in key factor of the logistics system, represented by the human resources. Nations and the European agenda should invest more financial resources in training in order to make the productivity of the resources employed in the sector even more effective. Resource efficiency, in fact, is the competitive advantage of European logistics. In the big picture it wanted to analyse the pivotal sub-sector of the entire sector, represented by the airport system. The study shows how the efficiency is very widespread, but the financial sector requires public intervention especially for the economic sustainability of the micro aero regional ports. In a context such as the Italian characterized by strong regionalization of air transport public intervention does not represent an economic distortion but a source of sustainability and systemic efficiency. At the conclusion of the work he described the main flow management techniques used in businesses, offering an innovative search inspiration, bringing out how the inefficiencies that can be created in the flow the consequences can be positive leading to the discovery of hidden skills or never exploited.

Aware of the quality of work, I hope it is used both for academic purposes in future research; for both public policy-makers and managers in order to undertake streamlining routes and overall growth.

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