

# TeMA

Journal of  
Land Use, Mobility and Environment

This special issue collects a selection of peer-review papers presented at the 8th International Conference INPUT 2014 titled "Smart City: planning for energy, transportation and sustainability of urban systems", held on 4-6 June in Naples, Italy. The issue includes recent developments on the theme of relationship between innovation and city management and planning.

Tema is the Journal of Land use, Mobility and Environment and offers papers with a unified approach to planning and mobility. TeMA Journal has also received the Sparc Europe Seal of Open Access Journals released by Scholarly Publishing and Academic Resources Coalition (SPARC Europe) and the Directory of Open Access Journals (DOAJ).

# INPUT 2014

papers selected

## Smart City

planning for energy, transportation  
and sustainability of the urban system

## SMART CITY

## PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

Special Issue, June 2014

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# TeMA

Journal of  
Land Use, Mobility and  
Environment

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science, and complex systems.

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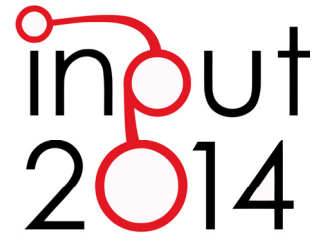
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# TeMA

Journal of  
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This special issue of TeMA collects the papers presented at the 8th International Conference INPUT 2014 which will take place in Naples from 4th to 6th June. The Conference focuses on one of the central topics within the urban studies debate and combines, in a new perspective, researches concerning the relationship between innovation and management of city changing.



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## EIGHTH INTERNATIONAL CONFERENCE INPUT 2014

### SMART CITY. PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM

This special issue of TeMA collects the papers presented at the Eighth International Conference INPUT, 2014, titled "Smart City. Planning for energy, transportation and sustainability of the urban system" that takes place in Naples from 4 to 6 of June 2014.

INPUT (Innovation in Urban Planning and Territorial) consists of an informal group/network of academic researchers Italians and foreigners working in several areas related to urban and territorial planning. Starting from the first conference, held in Venice in 1999, INPUT has represented an opportunity to reflect on the use of Information and Communication Technologies (ICTs) as key planning support tools. The theme of the eighth conference focuses on one of the most topical debate of urban studies that combines , in a new perspective, researches concerning the relationship between innovation (technological, methodological, of process etc..) and the management of the changes of the city. The Smart City is also currently the most investigated subject by TeMA that with this number is intended to provide a broad overview of the research activities currently in place in Italy and a number of European countries. Naples, with its tradition of studies in this particular research field, represents the best place to review progress on what is being done and try to identify some structural elements of a planning approach.

Furthermore the conference has represented the ideal space of mind comparison and ideas exchanging about a number of topics like: planning support systems, models to geo-design, qualitative cognitive models and formal ontologies, smart mobility and urban transport, Visualization and spatial perception in urban planning innovative processes for urban regeneration, smart city and smart citizen, the Smart Energy Master project, urban entropy and evaluation in urban planning, etc..

The conference INPUT Naples 2014 were sent 84 papers, through a computerized procedure using the website [www.input2014.it](http://www.input2014.it) . The papers were subjected to a series of monitoring and control operations. The first fundamental phase saw the submission of the papers to reviewers. To enable a blind procedure the papers have been checked in advance, in order to eliminate any reference to the authors. The review was carried out on a form set up by the local scientific committee. The review forms received were sent to the authors who have adapted the papers, in a more or less extensive way, on the base of the received comments. At this point (third stage), the new version of the paper was subjected to control for to standardize the content to the layout required for the publication within TeMA. In parallel, the Local Scientific Committee, along with the Editorial Board of the magazine, has provided to the technical operation on the site TeMA (insertion of data for the indexing and insertion of pdf version of the papers). In the light of the time's shortness and of the high number of contributions the Local Scientific Committee decided to publish the papers by applying some simplifies compared with the normal procedures used by TeMA. Specifically:

- Each paper was equipped with cover, TeMA Editorial Advisory Board, INPUT Scientific Committee, introductory page of INPUT 2014 and summary;
- Summary and sorting of the papers are in alphabetical order, based on the surname of the first author;
- Each paper is indexed with own DOI codex which can be found in the electronic version on TeMA website ([www.tema.unina.it](http://www.tema.unina.it)). The codex is not present on the pdf version of the papers.

## SMART CITY PLANNING FOR ENERGY, TRANSPORTATION AND SUSTAINABILITY OF THE URBAN SYSTEM Special Issue, June 2014

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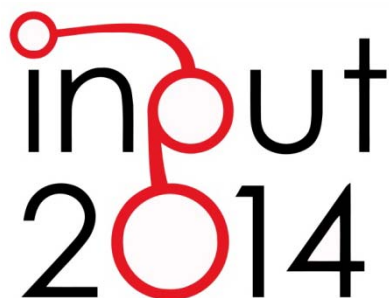
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SPECIAL ISSUE

Eighth International Conference INPUT  
Smart City - Planning for Energy, Transportation and Sustainability  
of the Urban System

*Naples, 4-6 June 2014*

The logo for the INPUT 2014 conference. It features the word "input" in a lowercase, sans-serif font, with the "i" and "n" connected by a red line that forms a stylized shape. Below "input" is the year "2014" in a larger, bold, sans-serif font. The "0" in "2014" is also connected to the red line above it.

## MAPPING SMART REGIONS

AN EXPLORATORY APPROACH

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### ABSTRACT

The paper presents the results of an exploratory approach aimed at extending the ranking procedures normally used in studying the socioeconomic determinants of smart growth at the regional level.

Most of these studies adopt a methodological procedure which essentially consists of the following steps: a) identification of the pertinent elementary indicators according to the study objectives; b) data selection and processing; c) combination of the elementary indicators by multivariate statistical techniques aimed at obtaining a robust synthetic index to rank the observation units.

In the procedure a relational dimension is mainly subsumed in the system oriented perspective adopted in selecting the indicators which would best represent the system determinants depending on the goals of the analysis (step a).

In order to get deeper insights into the smartness profile of the European regions, this study makes an effort to account of the relational dimension also in steps b and c of the procedure. The novelties of the proposed approach are twofold. First, by computing region-to-region distances associated with the selected indicators it extends the conventional ranking procedure (step c). Second, it uses a relational database (step b), dealing with the regional participation to the FP7-ICT project, to modify the distances and investigate its impact on the interpretation of the regional positioning.

The main results of this exercise seem to suggest that regional collaborations would have a positive role in regional convergence process. By providing an opportunity to get contacts with the areas endowed with a comparatively more robust smartness profile, regions may have a chance to enhance their own smartness profile.

### KEYWORDS

Regional smart growth, region-to-region distances, regional collaboration, regional performance indices.

## 1 INTRODUCTION: CONCEPTUAL REMARKS AND AIMS OF THE STUDY

Smartness has become the latest fix in urban and regional studies. In Europe, its popularity owes a lot to the EU 2020 strategy which gave a shake to usual ways to view cities and regions. Eventually, it spurred stimuli to revise conventional thinking about how well behaved notions such as built places, living conditions, information flows, ICT networks and sustainable path of growth stick together and make sense in the everyday life of ordinary people as well as in stakeholders' decision-making.

Broadly speaking, smartness is perceived as a necessary attribute of almost every components and processes meant to set up, by means of modern ICT devices, pro-active and open innovation territorial systems, allowing for greater involvement of more educated and ICT connected people. This notion basically underpins the working definition for smart city lately proposed by the European Union (2014): 'A Smart City is a city seeking to address public issues via ICT-based solutions on the basis of a multi-stakeholder, municipally based partnership' (p.9)

When viewed in the light of the most recent arguments about the evolution of spatial systems, such as cities and regions (Batty, 2013, Portugali, 2000), however, smartness is but an "emergent" property, which results from the complex intertwine of many different cognizant agents, operating in a situated context.

Not unexpectedly, therefore, statements about smart territory require to discuss both the its conceptual understanding and descriptive account, as well as the observer's goal in leveraging that very notion. Making explicit the last aspect, in fact, seems to be what fundamentally distinguishes the current conceptualization efforts from earlier ones which had to deal with different although equally relevant urban and spatial issues.

This undertaking mobilizes an additional and so far largely overlooked perspective, which has to do with the ability of an urban/regional system to develop, thanks to the dramatic progress of ICTs, a so called reflective perspective (see Occelli, 2012) and whose underlying dimension is intrinsically relational. Such a dimension in fact relies on the joint consideration of: a) the ways agents, both as observers and as active participants in the community life interact with and perceive the different components of territorial smartness; b) the acknowledgement of the systemic (networked) nature of the bundle of elementary components which concur to qualify a certain level of smartness..

The former aspect has been recently addressed in a study which argues how by engaging in a learning process which leverages different observation windows, a regional system could acquire new capability and therefore achieve higher smartness levels (Occelli, Poggio and Sciullo, 2013).

The latter topic is at the core of many studies conducted by the Directorates of the European Commission to provide a global (European) perspective for assessing, at the regional level, the various socioeconomics determinants of smart growth (see for example Annoni and Dijkstra, 2013, Charron, Dijkstra and Lapuente, 2014, Hollanders, Rivera and Roman, 2012, Soete, 2011). In this respect, the progress made by some of these institutions for making easier the online access of comparative indicators as well as of the original data (as, for example, in the case of the Digital Agenda dash board, [www.digital.agenda.eu](http://www.digital.agenda.eu)) is certainly to be appreciated.

The core approach of most of these studies relies on a methodological procedure which essentially consists of the following steps: a) identification of the pertinent elementary indicators according to the study objectives; b) data selection and processing to implement the selected indicators for the observation units (e.g. regions, cities); c) combination of the elementary indicators by multivariate statistical techniques aimed at obtaining a robust synthetic index to rank the observation units.



It is worth noting that in such a procedure the relational dimension is mainly subsumed in the system oriented perspective adopted in selecting the indicators which would best represent the system determinants depending on the goals of the analysis (step a).

In order to get deeper insights into the smartness profile of the European regions, this study makes an effort to account of the relational dimension also in steps b and c of the procedure. In the following, section 2 describes the methodological approach which has been developed. Its novelties are twofold. First, by computing region-to-region distances associated with the selected indicators it extends the conventional ranking procedure (step c). Second, it uses a relational database (step b), dealing with the regional participation to the FP7-ICT project, to modify the distances and investigate its impact on the interpretation of the regional positioning. Section 3 presents the main results of the exploratory analysis and section 4 makes some conclusive remarks.

## 2 METHODOLOGICAL APPROACH

The main goal of the approach is to enrich the traditional ranking approach typically used to position European regions. More specifically it aims at extending the utilization of a synthetic index of regional performances by considering region-to-region distances, which in this application are derived from processing a set of indicators representing the regional smartness profile.

The approach builds upon earlier studies which were carried at Ires Piemonte also as a part of the activities of the Piedmont ICT Observatory (IRES, 2013, PICTO, 2013). In those studies, a lot of works has been done to identify and implement measurement indicators allowing for a meaningful account of the Piedmont smart growth profile, at both national and European level. The present analysis takes advantage of the experience gained in those studies and focuses on a set of indicators, selected according to a twofold criterion of regional coverage and temporal updating.

### 2.1 INDICATOR SELECTIONS

The 266 NUTS2 regions belonging to the EU28 member states are investigated. The indicator set consists of 9 elementary indicators, shown Tab.1, organized by three main descriptive profiles of regional smartness: absorptive capacity, innovation system and digital agenda (see, PICTO, 2013).

It is worth noting that the indicator set is rather heterogeneous, both as type of variables included and temporal reference, i.e. the digital agenda profile being the only one recently updated.

To provide comparable measures, the elementary indicators have been normalized between 0 and 1000, by using a MIN-MAX formula. Regional synthetic indices have then been computed by applying two different techniques:

- Simple Averages of the set of normalized elementary indicators. The resulting Synthetic Index is used for ranking the regions;
- Principal Component Analysis, carried out with the STATA software package. Representative indices for the analytic profiles are derived, which are used for computing region-to-region distances among regions (this operation mainly refers to step c of the core approach mentioned in the introduction)<sup>1</sup>.

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<sup>1</sup> The PCs for the Absorptive Capacity and Innovation System profiles accounts for 94 % of the variance of the original indicators. The PCA for the Digital Agenda profile accounts for about 78%.

PROFILE	INDICATORS AND MEASUREMENT UNITS	PIEDMONT	ITALY	EU28	YEAR
Absorptive capacity	A. First and second stage of tertiary education attainment (ISCED 5 and 6) - % of total	15,1	15,7	27,6	2012
	B. Human Resources in Science and Technology (HRST total) <sup>2</sup> - % of total population 15-74 y	21,9	21,2	30,3	2012
	C. Human Resources in Science and Technology (HRST core) - % of total population 15-74 y	7,3	7,0	12,1	2012
Innovation System	D. Total R&D personnel and researchers - % of active population	1,13	0,91	1,08	2011
	E. Total intramural R&D Expenditure - % of GDP	1,88	1,25	2,04	2011
	F. Patents application to the European Patent Office – per million of inhabitants	105,3	72,4	111,4	2009
Digital Agenda	G. Household with broadband access - % of households	65	68	79	2013
	H. Individuals regularly using the Internet (at least once a week) - % of individuals	57	56	72	2013
	I. Individuals who ordered goods or services for private use - % of individuals	19	20	47	2013

Tab.1 List of indicators by analytic profile

## 2.2 CALCULATING THE REGIONAL DISTANCES

The notion of distance is here understood as a two by two measure of regional dissimilarities for a set of selected indicators. In this case, the regional distances are based on the PCA values associated with the three analytic profiles. Let  $X_{ij}$  be the indicator matrix, where  $i$  indicates the region ( $i=1, 1, \dots, N$ , where  $N=266$ ) and  $j$  represents the PC value for an analytic profile ( $j= 1, \dots, K$ , with  $K= 3$ ). Each element,  $d_{i,l}$  of the  $D_{ii}$  regional distance matrix is calculated as:

$$d_{i,l} = \sqrt{\frac{2 \sum_{j=1}^k (X_{ij} - X_{lj})^2}{k}} \quad (1).$$

To visualize the  $D_{ii}$  matrix in a 2-dimensional space a Multidimensional Scaling metric iterative algorithm has been applied using the UCINET software package. This technique permits to map the  $N \times N$  distance values in a 2-dimensional space in such a way that the original distances among regions are preserved as well as possible. Besides making it possible to visualize the original data, the mapping allows us to have a more effective representation of the positioning of regions within the overall European regional space.

<sup>2</sup> HRST is defined according to the Canberra Manual as a person fulfilling at least one of the following conditions: Qualified (successfully completed education at the third level in a S&T field of study; Employed (not formally qualified as above, but employed in a S&T occupation where the above qualifications are normally required). The conditions of the above educational or occupational requirements are considered according to internationally harmonized standards (ISCED and ISCO). The HRST TOTAL indicator measures the percentage of persons qualified OR employed in S&T; the HRST CORE indicator measures the percentage of persons qualified AND employed in S&T.

### 2.3 UPDATING REGIONAL DISTANCE BY RELATIONAL DATA

A strong assumption made in this study is that collaborations or partnerships among regions, whereby these are relational entities by definition, may reduce the regional distances, which in this application, are based on regional structural determinants.

To explore the impact of such an assumption, we made reference to the network of regional collaboration, obtained from the database which records the participations to the FP7-ICT projects (European Commission, 2013)<sup>3</sup>.

Operationally, each cell of the  $D_{ij}$  matrix (1) has been multiplied by a coefficient,  $c_{ij}$ , calculated from the matrix of regional partnerships in FP7-ICT projects as follows:

$$c_{ij} = \frac{1}{1 + \ln(1 + P_{ij})} \quad (2)$$

where  $p_{ij}$  is the number of regional collaborations established in the FP7-ICT projects. From (2) a new distance matrix,  $ED_{ij}$ , is obtained which can be processed to provide and a new visualization of the European regional space.

Making reference to the approach mentioned in the introduction, it is worth underlining that this operation can be viewed as a refinement step b of the procedure.

## 3 MAIN RESULTS

Table 1 lists the best and worst performing regions according to the Synthetic Index. It also displays the values of both the elementary indicators and the regional mean distances as well as the distances to Piedmont from each region.

Rank	NUTS	Name	Ranking									Synthetic Index	Distances	
			Absorptive Capacity			Innovation System			Digital Agenda				Mean value	to Piedmont
			A	B	C	D	E	F	G	H	I			
1	DK01	Hovedstaden	46,2	47,1	24,0	3,68	5,08	293,8	87	94	83	784,1	4,13	5,02
2	FI1B	Helsinki	48,9	50,9	23,6	2,88	4,35	414,4	92	93	73	779,2	4,05	5,01
3	UK11	Inner London	63,0	59,4	28,4	2,04	1,21	89,74	94	93	82	747,6	4,33	5,60
4	SE11	Stockholm	44,4	50	22,6	2,18	3,77	425,4	93	95	77	747,5	3,62	4,65
5	BE31	Prov. Wallon	51,2	47,9	19,6	3,13	8,92	230,0	82	85	52	725,6	4,34	4,94
262	EL24	Stereia Ellada	17,2	15,5	5,8	0,32	0,44	6,61	40	42	15	58,4	2,85	4,37
263	RO22	Sud-Est	12,2	13,4	5,1	0,07	0,11	0,30	56	45	4	49,8	2,86	4,04
264	RO21	Nord-Est	13,1	14,1	6,5	0,1	0,3	0,53	47	43	7	45,2	2,90	4,09
265	EL22	Ionia Nisia	14,7	13,5	5,6	0,13	0,09	3,91	40	42	15	36,6	3,00	4,15
266	RO31	Sud-Muntenia	11,5	12,7	5,3	0,11	0,38	0,39	50	39	6	31,1	3,03	3,58
<b>203</b>	<b>ITC1</b>	<b>Piedmont</b>	<b>15,1</b>	<b>21,9</b>	<b>7,3</b>	<b>1,13</b>	<b>1,88</b>	<b>105,3</b>	<b>65</b>	<b>57</b>	<b>19</b>	<b>221,85</b>	<b>2,05</b>	<b>0</b>
	IT	Italy	15,7	21,2	7,0	0,91	1,25	72,5	68	56	20			
	EU28	Eu. Union	27,6	30,3	12,1	1,08	2,04	111,4	79	72	47			

Tab.1 Elementary indicators, synthetic indices and distances for the 5 top and bottom regions in the regional ranking

(\*) Make reference to Table 1 for the alphabetic encoding of the elementary indicators

<sup>3</sup> A technical note describing this collaborative network for Piedmont is available from the authors upon request.

An examination of the table shows that Piedmont is in lower part of the ranking (it ranks 203 out of 266 regions). Weaknesses are more significant for the Absorptive and Digital Agenda profiles.

It is worth noting that, overall the best performing regions have higher mean distance values than the regions at the bottom of the ranking. This suggests that the best performing regions are relatively more isolated, as clearly shown in the MDS visualization of Fig.1<sup>4</sup>.

Distances from the best performing regions to Piedmont are also greater those from the worst performing ones.

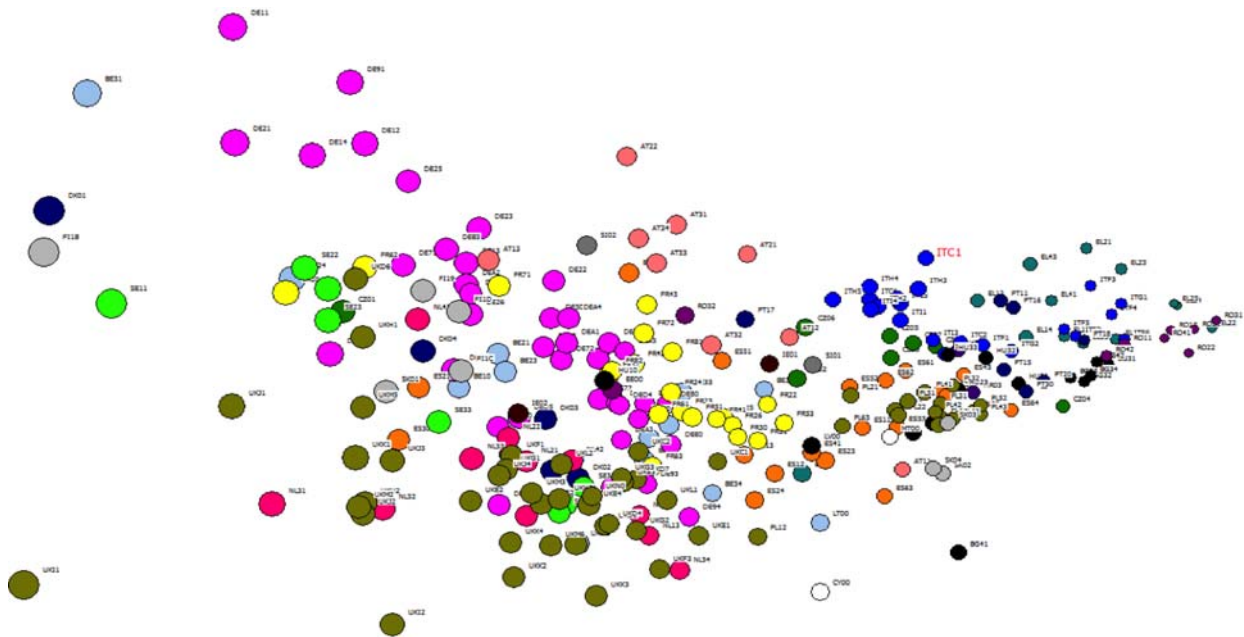


Fig.1 MDS visualization of the distribution of the European regions according to the D distance matrix (\*)

(\*) The size of dots is proportional to the value of the Synthetic Index. Blue dots: Italy; pink dots: Germany; yellow dots: France, Green dots: UK; orange dots: Spain.

The map of Fig.1 makes it straightforward to appreciate the regional proximity space, thus providing a richer interpretative lens of the regional smartness profiles. As for Piedmont, for example, it shows that: a) the region is situated in right part of the map, where the less performing regions are grouped; b) the region is far away from the best performing regions many of which stand alone in the left part of the map; c) its surrounding regions are mostly Italian.

When considering the impact of the updated regional distances ED (see eq.2), a quite different layout appears, Fig.2. Not unexpectedly, regions appear more evenly scattered and the regions surrounding Piedmont are also different.

<sup>4</sup> A map for each main descriptive profile of regional smartness (absorptive capacity, innovation system and digital agenda) has also been produced and is available from the authors upon request.

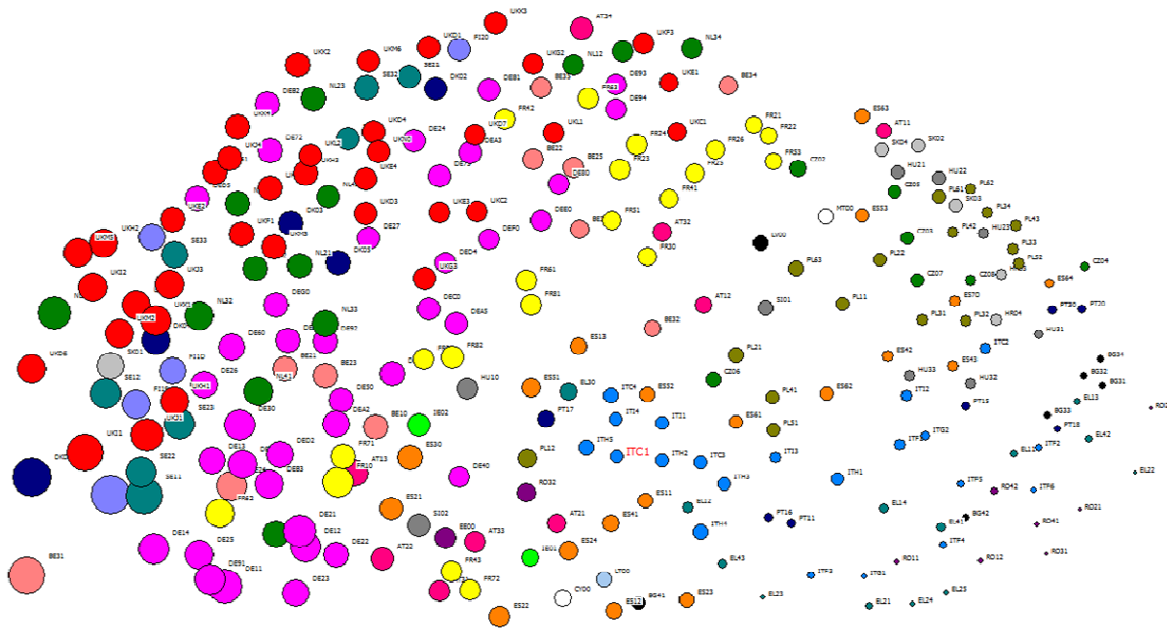


Fig.2 MDS visualization of the distribution of the European regions according to the ED distance matrix (\*)

(\*) The size of dots is proportional to the value of the Synthetic Index. Blue dots: Italy; pink dots: Germany; yellow dots: France, Green dots: UK ; orange dots: Spain.

Changes in the pattern of Fig.2 can be more easily appreciated by comparing the distributions of the D and ED distance values for Piedmont and for the all regions, whereby the values are ranked from the highest to the lowest value of the regional Synthetic Index, Fig.3. Their examination shows that the ED distance matrix does make the regions get closer to each other and that the effect seems relatively more accentuated positive for the Piedmont region, Fig.3a.

If, therefore, we maintain the original argument that regional collaborations would have a positive role in regional convergence processes, it is not unlikely that the FP7-ICT partnerships might have given Piedmont an opportunity to get contacts with the European regions endowed with a comparatively more robust smartness profile, thus giving the region a chance to enhance its own profile.

We expect in fact that as a result of the ED matrix application a shuffling in the regions surrounding Piedmont will occur and tend to bring closer those regions with a more robust smartness profile.

To explore the hypothesis we computed the means of the normalized elementary indicators for the group of regions (those included in the first distribution quartile) closest to Piedmont according to the D and ED distance matrices and compared them with the Piedmont profile.

The results of the investigation are displayed in Fig.4. They show that the Piedmont Innovation System profile is relatively robust and performs better also after the shuffling. The latter seems to be more successful in bringing Piedmont closer to regions with relatively stronger Absorptive Capacity and Digital Agenda profiles.

### 3. CONCLUDING REMARKS

This study is a contribution to refine current approaches to the assessment of regional smartness. It contends that sound methodological approaches have an encompassing role in making more sense-able territorial evidence. Methodological refinements in fact can have a positive impact on the recognition of regional smartness profiles and on how to inform smartness policy oriented initiatives in practice.

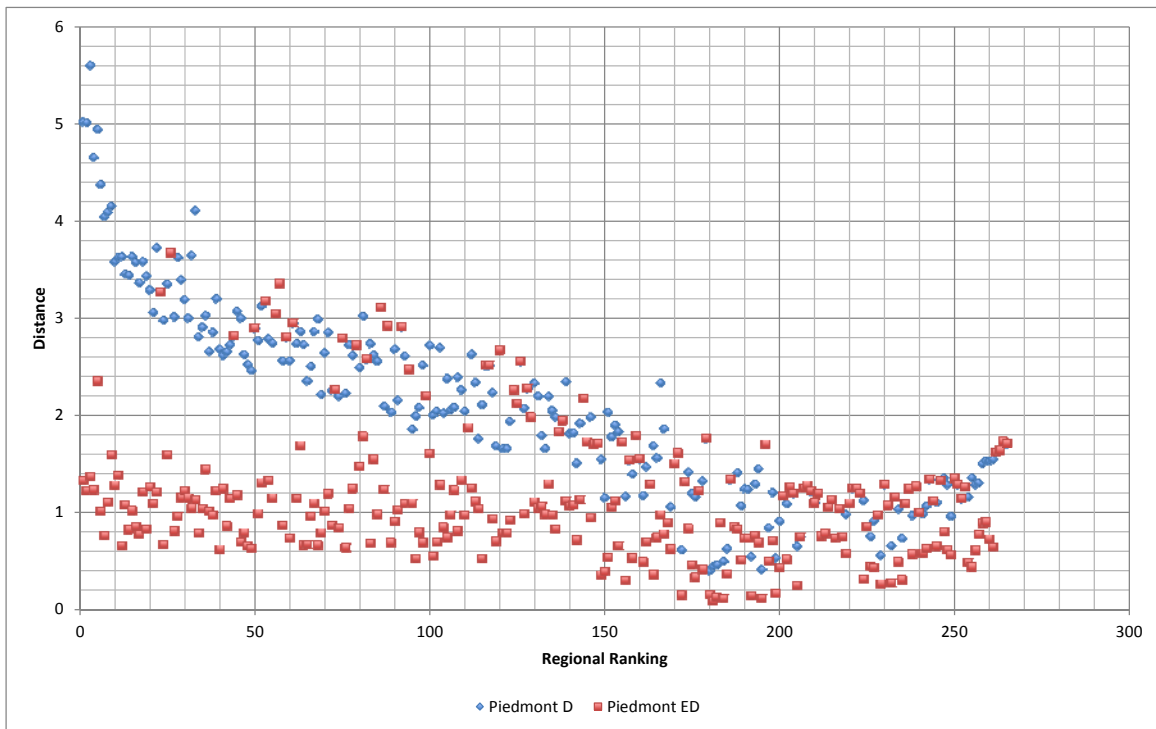


Fig.3a Region to Piedmont distances

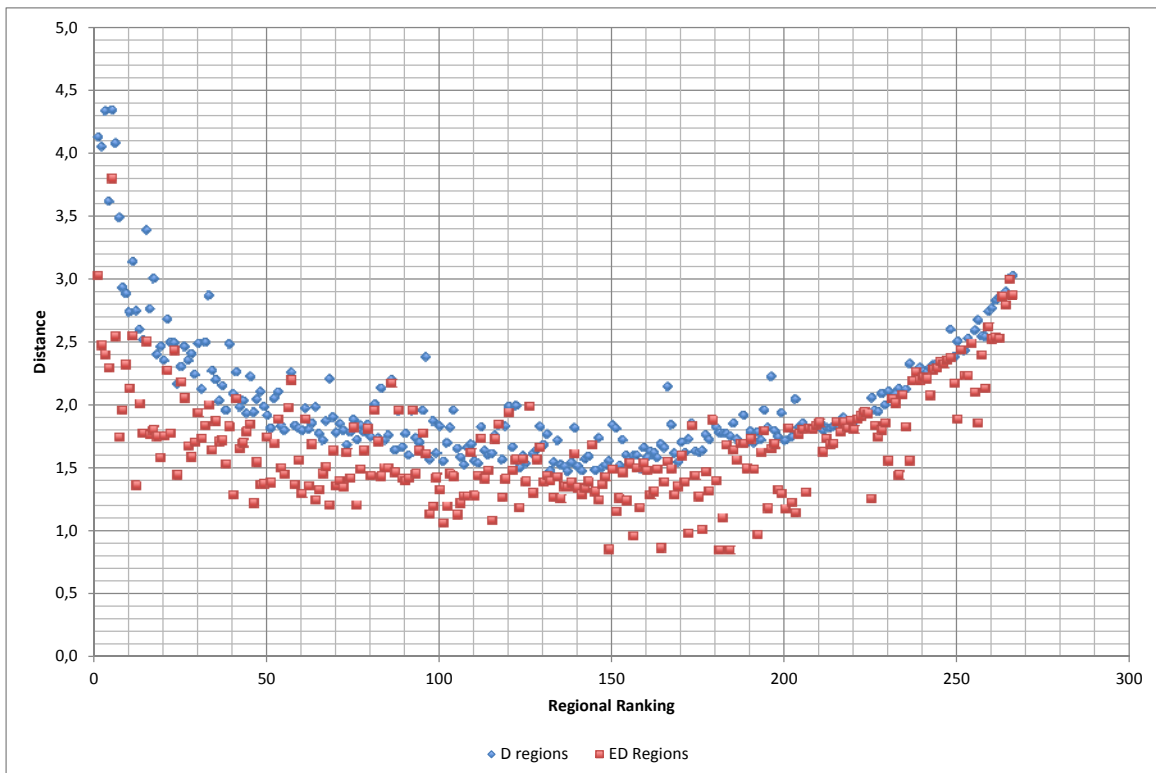


Fig.3b Mean regional distances

Fig.3 Region to Piedmont (D and ED) distances (3a) and of the mean regional (D and ED) distances (3b), by regions ranked by the Synthetic Index value

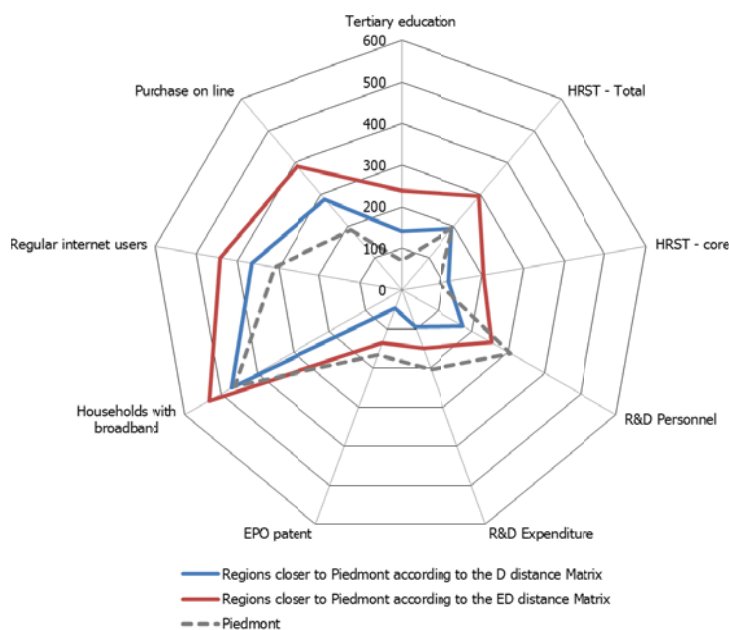


Fig.4 Indicators' profiles for Piedmont and the group of regions closer to Piedmont according to the D and ED distances

This contention ultimately underlies the Europe 2020 strategy and inform several of the key recommendation made by Espon for more effective place-based 2020 policy actions (Espon, 2014).

In this respect further work is needed to sharpen the approach, improving the methodological side, i.e. by developing a network centric multi-layered analysis, and gathering a wider set of pertinent relational data.

On a broader ground, this paper is, to some extent, a challenge to the current fix about smartness. It suggests a more modest view, one which builds on the contention that, after all, smartness is in the eye of the beholder. Training the ability to see smartness and create the conditions for stakeholders to progressively build it, is therefore, is a major endeavor to be undertaken.

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#### OVERVIEW OF RESEARCH PROJECTS IN THE ICT DOMAIN 2012

ICT statistical report for annual monitoring (StReAM).

#### IMAGES SOURCES

Insert here images sources

Fig.1 : Eurostat

Figg. 2, 3, 4: Eurostat , Digital Agenda Scoreboard.

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