Regional Innovation and Competitiveness Policy Workshop
UK-Innovation Research Centre - University of Cambridge
15 Nov 2012

Are EU regional digital strategies evidence-based? An analysis of the allocation of 2007-13 Structural Funds

- **Luigi Reggi[a,b*] and Sergio Scicchitano[a,b]** -

[a]Ministry of Economic Development, Department for Development and Economic Cohesion, Rome, Italy.

[b]EIBURS-TAIPS team, DESP, University of Urbino, Italy

Abstract

The ambitious goals of the European "Digital Agenda" need active involvement by regional innovation systems. Effective regional "digital strategies" should be both consistent with the European framework and based on available evidence on the needs and opportunities of local contexts. Such evidence should be used to balance the different components of the Information Society development (e.g. eServices vs. infrastructures; ICT supply and demand), so as to ensure that they can all unleash their full potential. Therefore, EU regions should spend more money to overcome regional weaknesses than to improve existing assets. In this paper we explore the different strategies of the EU's lagging regions through the analysis of the allocation of 2007-13 Structural Funds. Then, we verify whether such strategies respond to territorial conditions by comparing strategic choices made with the actual characteristics of local contexts. Results show that EU regions tend to invest more resources in those aspects in which they already demonstrate good relative performances. Possible causes of this unbalanced strategic approach are discussed, including the lack of sound analysis of the regional context and the path dependence of policy choices.

JEL Classification: H830, 0330, O380, L96
Keywords: Information society, Digital Agenda, Regional policy, Cohesion Policy, Structural Funds, e-Services, e-Government, Cluster analysis.

* Corresponding author. E-mail: luigi.reggi@tesoro.it luigi.reggi@gmail.com Tel: +39 06 96517921

1. Introduction

A growing body of literature highlights the role of Information and Communication Technology (ICT) in fostering productivity and growth (Van Ark et al., 2008; Meijers, 2010, European Commission, 2010a, OECD, 2004). The "Digital Agenda" of the European Union (European Commission, 2010b), as a key component of the whole Europe 2020 growth strategy, aims at maximizing the social and economic impact of ICT.

According to this strategy, a "sustained level of commitment" at regional level is required for the proposed initiatives to be successful. Indeed, the role of European regions is becoming increasingly important. Their institutional power, albeit very heterogeneous across Europe (Alabau, 1997, Nauwelaers and Wintjes, 2011), has increased in several countries in the last two decades, especially in the field of innovation policy (OECD, 2011). Regional innovation and technology policies have gained momentum and legitimacy, while theoretical concepts such as regional innovation systems (RIS) have helped to describe the variety of multiple development patterns and growth models (Cooke and Morgan, 1998; European Commission, 1998).

Within Information Society (IS) and public eServices development, regions are considered as the "ideal scale" for intervention, since they play an intermediating role between European and national top-down initiatives and the bottom-up efforts of local administrations (Cattaneo, 2004). Therefore, it is crucial that regional planning for IS development is supported by effective "digital strategies", that are both consistent with the European framework and place-based, i.e. reflecting the characteristics of local contexts (Barca, 2009). Furthermore, such strategies should feature a integrated and well-balanced approach, since the harmonious development of each component of IS (e.g. telecommunications infrastructures, public eServices development, demand-stimulating measures) is crucial for the effectiveness of the policy (Tsipouri, 2002).

European Cohesion (or Regional) Policy offers an ideal opportunity to explore the key elements of regional digital strategies. In fact, in the programming period 2007-13, EU Structural Funds finance almost all investments in innovation in the lagging regions of the Convergence objective (CONV), which receive most of the funding. In addition, regional strategies underlying funding allocation imply multi-annual decisions, given that financial resources programmed in 2006 can be spent until December 2015. Regional Policy also forces the regions to follow shared rules and regulations when programming actions, which implies that funding is allocated and classified through common categories and definitions, and that data on the financial distribution of resources is fully comparable.

The purpose of the paper is twofold. First, to investigate the existence of different regional digital strategies among the lagging regions of the EU. Second, to verify whether such strategies respond to local territorial conditions by comparing the strategic choices made with the actual characteristics of local contexts.

A two step procedure is adopted. Firstly, we classify EU regions into homogeneous groups through a Principal Component Analysis (PCA)

followed by a hierarchical Cluster Analysis (CA), on the basis of the allocation of Structural Funds to strategic IS objectives in the 2007-13 period. Secondly, we examine, through an econometric logit model, the link between the strategic choices identified in the first step and the characteristics of regional contexts in terms of socio-economic and IS development. The analysis is based on a unique official dataset provided by the European Commission - Directorate General (DG) Regional Policy. To the best of our knowledge, this is the first attempt to use a quantitative approach in order to analyse the different regional strategies for IS development in Europe.

The article is organized as follows: section two introduces the regional digital strategies in the context of the European Cohesion Policy, including the main policy recommendations drawn from the literature and official guidelines. In section three we describe the data on EU Structural Funds allocation. Econometric methodology and empirical results are shown in section four. Section five concludes with a discussion of the suggested explanations consistent with our findings.

2. Regional digital strategies and European Cohesion policy

Policy documents specifically dedicated by the EU regional authorities to IS development made their first appearance during the mid-1990s, as the IS reached the top of the policy agenda at EU level (Dabinett, 2001). The Bangemann Report (European Commission, 1994) inspired both strategic policy frameworks (e.g. the "IS Programme 1998-2002") and experimental actions mainly focused on the development of eGovernment services and telecommunication infrastructures (Cattaneo, 2004).

The need to adopt comprehensive IS regional strategies became critical when EU Cohesion Policy began to consider the IS as one of the main drivers of regional development, in terms, for example, of competitiveness (European Commission, 1997) and new job creation (European Commission, 2000).

Following a series of pilot projects and policy experiments such as the Regional Information Society Initiative (RISI) carried out in the 1994-1999 (Dabinett, 2001), the European Commission strongly advised regional authorities to conduct specific strategic exercises to effectively allocate the 5.5 billion Euros of Structural Funds dedicated to IS in the 2000-2006 period (Vincente and Lopez, 2011).

Some reports commissioned by DG Regional Policy of the European Commission in the early 2000s explore Structural Fund interventions in the field of IS and include policy recommendations aimed at promoting evidence-based regional strategies. First, regional strategies should adopt a holistic and integrated perspective, since IS development is relevant for all economic and social sectors, both public and private (Tsipouri, 2002). Second, IS strategies should be based on a sound analysis of the implementation context and the territory-specific conditions, needs and opportunities (Tsipouri, 2002; Tecnopolis, 2006). Third, a well-balanced approach is needed, since "IS development involves parallel, mutually

reinforcing developments in a range of fields" (Taylor and Downes, 2001). For example, supply-side interventions such as telecommunication infrastructure development should be balanced by demand-stimulating measures such as the development of ICT skills, digital inclusion and the promotion of ICT uptake among small firms.

The Commission, then, integrated these recommendations into the *Community strategic guidelines on cohesion policy* for the 2007-13 period (European Council, 2006). In particular, according to the guidelines, IS interventions should focus on:

- the uptake of ICT by firms and households and promoting development through balanced support for the supply and demand of ICT products and both public and private services;
- the availability of ICT infrastructure and related services where the market fails to provide it at an affordable cost and to an adequate level to support the required services, especially in remote and rural areas and in new Member States.

In 2006 EU regions were asked to draft specific policy documents guiding the implementation of the 2007-13 actions and to allocate the available financial resources accordingly. The need of carefully choosing the destination of the funding was strong since, in the 2007-13 period, the total amount of funding dedicated to IS had tripled compared to the previous period (Reggi and Scicchitano, 2012).

Regional digital strategies have remained at the centre of the EU stage until now, with the Cohesion Policy as the main source of funding of "Innovation Union" and "Digital Agenda" initiatives (European Commission, 2010a). In particular, EU requirements for regional strategic planning may become even stricter in the future, since regional "digital agendas", as drafted in the Commission's proposal for the 2014-2020 Structural Funds regulation, are included in the list of "ex-ante conditionalities" for accessing funds. This means that European regions will not receive the funding from the EU until a balanced strategy supporting both ICT demand and supply has been approved (European Commission, 2011).

3. Data on EU Structural Funds allocation

The data on the allocation of EU Structural Funds is based on financial resources programmed by each 2007-13 Operational Programme (OP) of the EU Cohesion Policy. The unique dataset is provided by the European Commission – DG Regional Policy and includes data on the amount of financial resources by category of expenditure[1].

[table 1]

[1]The dataset includes all OPs formally approved in July 2009

As shown in table 1, OPs are classified into various categories depending on the objective, type of fund and territorial scope. In our analysis we consider all the OPs except those of Territorial Cooperation (Cross-border cooperation, Interregional cooperation, Transnational cooperation), which involve by definition more than one Member State and account for only about 2% of total funding.

Since the OPs have different territorial scope, namely regional, national and multiregional, a match with the Eurostat database of EU Regions (NUTS2 level) has been performed in order to estimate the programmed amount of resources at regional level. In particular, the total amount of national and multiregional OP has been equally assigned to all regions directly involved in each OP[2].

According to the current regulation (European Commission, 2006), the contribution of Structural Funds to each policy field has to be classified into "categories of expenditure". In particular, the following aggregated categories are dedicated to the IS.

- Telephone infrastructures (including broadband networks) [category no.10]
- Access, security, interoperability, risk-prevention, research, innovation, e-content, etc. [categories no. 11 and 12]
- Services and applications for the citizen (e-health, e-government, e-learning, e-inclusion, etc.) [category no.13]
- Services and applications for SMEs: e-commerce, education and training, networking, etc. [category no.14]
- Other measures for improving access to and efficient use of ICT by SMEs [category no.15]

4. Econometric procedure

In this section we present the results of a two-step approach aimed at exploring EU regional digital strategies and their main determinants.

Our analysis is limited to the CONV objective, which covers the regions whose GDP per capita is below 75% of the EU average, almost exclusively located in Southern and Eastern Europe (European Commission, 2008). This choice is due to the fact that, in the lagging regions of the EU, Structural Funds can be considered as a proxy of the total amount of financial resources that a region can invest in IS development. In fact, although there is no hard evidence about the total amount of funds that each EU region can leverage (which include EU, national and regional sources), we can assume that most regional investments in IS development are financed through EU Cohesion Policy, because: (a) CONV regions benefit from an unprecedented amount of 2007-13 EU Cohesion resources dedicated to innovation (Bonaccorsi, 2010), with a three-fold increase compared with the 2000-06 programming period; and (b) lagging regions

[2]Consequently, the amount of Structural Funds assigned to each region is calculated as the sum of: (a) the amount of resources allocated by the regional OPs (typically, the ERDF regional OP plus the ESF regional OP) and (b) the share of national or multiregional OPs that involve that specific region.

tend to spend the few locally available resources to maintain the current levels of basic public services such as transportation and water management rather than to invest in high-tech services.

As a first step, we apply a Principal Component Analysis (PCA), followed by a hierarchical Cluster Analysis (CA). This is a convenient method for identifying *clubs* of regions that are very similar with regard to the allocation of Structural Funds to different IS categories of expenditure. As a second step, in order to verify whether existing strategies are consistent with local conditions, we employ a *logit* model to estimate the effect of selected regional socio-economic and IS variables (e.g. broadband penetration, public eServices diffusion, etc.) on the probability of belonging to each of the clubs previously identified.

4.1 Identifying regional digital strategies for Information Society development

In order to verify the presence of different digital strategies, we take into account the amount of resources allocated to the five categories of expenditure shown in table 2, as a percentage of the total funding dedicated to IS development.

[table2]

The PCA found 4 dimensions in the data, each of which accounted for between 36.9% and 13.3% of total data variation. We will consider the first two dimensions, which individually accounted for the largest amount of variation in the data (64.1%).

[figure1]

Figure 1 shows the plot of the variables included in the PCA according to their scores in dimensions 1 and 2. Where variables are closely grouped together, they show high levels of association. The figure also shows the location of the three clusters identified through the CA (yellow circles).

The first cluster is at the left of Figure 1 (*Cluster 1*), and groups together the EU regions that have allocated the majority of their financial resources (59% on average, as shown in table 3) to infrastructure services connected to public eServices development such as interoperability, security, and access. Another cluster appears at the top-right of Figure 1 (*Cluster 2*). The group is defined by the strategic choice to invest mainly in public eServices (55%), while the other categories present very similar levels of allocation (about 10%). A third cluster is found at the bottom-right corner of the plot (*Cluster 3*). This group is defined by a relatively high proportion of total expenditure devoted to both ICT development among SMEs (40%) and broadband networks (25%). These variables, showing a similar location in the space defined by the first two dimensions, show in fact the highest degree of correlation with each other.

The size of the yellow circles in Figure 1 is proportional to the number of regions belonging to each cluster. The third cluster is in fact the largest group both in terms of the number of regions belonging to it (49%) and the amount of total resources devoted to IS (38%). Cluster 1 and cluster 2 show the same number of regions (29%), but different amounts of total resources (33% and 28% respectively).

[table3]

Finally, Table 3 shows which EU regions are classified into the three clusters by reporting the name of the Member State and, in brackets, the name of the region whenever two or more regions of the same State belong to different clusters.

4.2 The determinants of regional digital strategies

We now estimate three logit models separately for each cluster.
The observed dependent variable is binary, taking the value of one if a region belongs to one of the three clusters and zero otherwise.

We include as model regressors selected Eurostat variables on IS local development[3], namely i) Households with broadband access *(Broad_house)* ii) Households with access to the Internet *(Internet_house)* iii) Individuals who ordered goods or services over the Internet for private use *(Order_indiv)* iv) Individuals using the Internet for interaction with public authorities *(Interact_indiv)* v) Enterprises who have ERP software package to share information on sales/purchases with other internal functional areas *(integr_process)*. We also include the following control variables: vi) Gross Domestic Product (GDP) per capita *(GDP_percapita)* vii) number of local units *(Local_units*) viii) number of employees (*Employees)* in local units ix) total intramural R&D expenditure in the higher education sector *(R&D)*x) rate of unemployment *(Unemp)*.

Summary statistics are shown in table 4, while the results of the analysis are reported in Table 5, which shows the value of the coefficients, the standard errors, the levels of significance measured by z statistics, the number of observations, the value of the likelihood function and that of the R-squared.

Our estimates show some interesting and quite surprising results. In particular, logistic regressions for both cluster 1 (devoted to ICT infrastructures underlying public eServices provision) and cluster 2 (public eServices implementation) show a positive value for the coefficient of the variable "Individuals using the Internet for interaction with public authorities" (*Interact_indiv*). This means that the effect of a unit change in *Interact_indiv* on the probability of the event occurring - i.e. on the log of

[3] All variables employed are at the NUTS2 (regional) level, with the exception of "Individuals using Internet for interaction with public authorities", which is available only at the national level. The variable "Enterprises who have ERP software package" is available at the national level as well, except for Italian and Spanish regions, where data is at the NUTS2 level. Depending on data availability, most of regressors are from 2006, the year when regional strategies were approved; from 2007 otherwise.

the relative probability of belonging to that cluster - is positive and of a magnitude equal to 0.59 for cluster 1 and 0.34 for cluster 2. This means that the uptake of public eServices, which implies past public investment in delivering such services, significantly increases the relative probability of EU regions choosing one of the two strategies on public eServices provision (cluster 1 being focused on "back-end" issues and cluster 2 on "front-end" issues).

As explained before, EU regions belonging to cluster 3 tend to allocate their funding to a mix of policy measures aimed at improving both ICT use in enterprises and broadband penetration. Our analysis shows that a high proportion of households with broadband connection significantly raises the probability of belonging to the third cluster, with a coefficient of 0.43. We find the same effect when considering the percentage of enterprises that share information on sales and purchases with other internal areas through ERP software. Once again, EU Regions seem to choose this strategy if their broadband penetration and ICT use among enterprises are already high. On the contrary, an increase in the uptake of public eServices decreases the probability of choosing the strategy associated with cluster 3.

5 Discussion and conclusions

Regional investment in IS development is crucial to realize the vision of the EU "Digital Agenda" strategy, since most of the key actions required can be effectively implemented at the regional level. According to the mainstream view, regional digital strategies should include a balanced set of actions supporting both demand and supply of ICT.

In this paper we explored the characteristics of regional IS strategies through a quantitative approach, i.e. by making use of the data on programmed resources of the EU Cohesion policy for the 2007-13 period. Indeed, 2007-13 EU Structural Funds represent the main source of funding for innovation in general and for IS in particular in the lagging regions of Europe classified in the "Convergence" objective. They are also perfectly comparable, given that all regions, in the programming phase, share the same rules, classifications and definitions.

Therefore, the amount of European Structural Funds allocated to the different components of EU regions' policy for IS development was used to verify the presence of different regional digital strategies and explore the links with local conditions, our research question thus being "are strategies really evidence-based?". The underlying hypothesis is that policy decisions should be linked to specific territorial contexts, in the spirit of the place-based approach of Barca (2009) and following the suggestions of European Commission's guidelines and reports.

Three different strategies were identified: the first is based on the development of ICT infrastructural services such as interoperability and e-ID, the second is focused on e-Services provision and the third on a policy mix that includes the improvement of broadband networks together with the adoption and use of ICT in enterprises. In order to analyze the links with regional conditions, three *logit* models (one for each cluster previously

identified) were employed, using as regressors the main available indicators from Eurostat on IS development at the regional level.

The results are quite surprising. The analysis of the coefficients of IS variables included in the model shows that the EU's less-developed regions tend to invest their financial resources in those strategic aspects where they already show good relative performance. In other words, they seek to further improve their strengths rather than focus on the weaknesses that emerge from the regional IS context.

This seems to explicitly contradict the indications of official guidelines and a number of policy recommendations included in scientific reports and articles that have investigated the issue. In particular, regional strategic choices – far from featuring a "well-balanced approach" – tend to repeat the same investments as in the past and so increase the imbalance between the different components of the regional strategy. In particular, EU regions following strategies no. 1 and 2 (first two clusters on back-end and front-end aspects of public eServices provision) may not be able to reach a critical mass of users because of scarce current broadband penetration and levels of ICT adoption. Conversely, regions adopting strategy no. 3 (third cluster, focused on broadband and ICT in enterprises) risk the lack of effective eServices and ICT infrastructures other than physical ones jeopardizing current policy efforts towards qualified ICT demand and efficient telecommunication networks.

It is interesting to explore some of the possible causes of this unbalanced strategic view. We suggest two possible and arguably not alternative explanations consistent with these findings. A first possible cause is quite obvious: an inadequate analysis of local conditions, needs and opportunities. Even though regional strategic documents dedicated to IS development as well as 2007-13 Operational Programmes must contain an evaluation of the strategic context in order to identify investment priorities, the lack of relevant data at regional or sub-regional level (especially in 2006, when the strategies had to be finalized) could prevent quantitative analysis being done properly. The scarcity of sub-national data remains an issue; today, for example, NUTS2 data on IS are a fraction of all the indicators included in the "Digital Agenda Scoreboard" of the European Commission. Besides, most regional analyses lack inter-regional (and international) comparison. The analysis of local context is often carried out through qualitative tools and does not take into account the relative position of the region among the others belonging to the same CONV objective in terms of relevant indicators and benchmarks.

A second possible reason is that regions are experiencing a form of path dependence. The study of path dependence - the idea that institutional life is often characterized by positive feedback processes that make change costly - has become important in understanding how institutions can be so "sticky" and resistant to modification (Pierson 2000). Empirical literature (David 1985) has argued that a choice, decision or event, through inertia, can lock-in an industry or technology on a particular path of subsequent development - whether or not that choice and that path are in any sense the most desirable from an aggregate standpoint. In the field of IS, a path

dependence could take place, for example, in the case of multi-annual investment decisions to implement large telecommunication infrastructures. This issue is relevant, in particular, in the context of CONV regions, where the level of institutional capacity is lower compared to the more advanced regions (Quality of Government Institute, 2010).

A third reason could lie in the rules of Structural Funds. In particular, according to current regulations, financial resources allocated for a given year that are not spent in the following two years are "automatically decommitted", i.e. definitely lost for the Operational Programme. This mechanism, introduced to speed up the implementation of Cohesion Policy, implies that EU regions (and the CONV regions in particular, with the largest budgets to be spent), in order to avoid losing their funding, tend to concentrate financial resources on the projects that ensure immediate spending. Such projects could include on-going programs (e.g. an infrastructure started in the previous programming period) or easy-to-implement actions such as providing grants to SMEs to adopt ICTs.

In conclusion, the evidence we provided highlights the need to rebalance most of current "digital strategies" of EU regions. This is particularly important considering that, according to the current proposal of the European Commission, a balanced strategy for the IS is now a prerequisite for accessing 2014-2020 Structural Funds. This means that regions have to have a strategy in place that is based on "the analysis of balancing support for demand and supply of ICT", before they can receive EU financial support. Therefore, a radical change in current practice is needed to make IS strategies and policies more effective.

ACKNOWLEDGMENTS

This paper is part of the research project "Technology adoption and innovation in public services" (TAIPS). The project is carried out by the Department of Economics, Society and Politics (DESP), University of Urbino, Italy, and funded by Eiburs –EIB University Research Sponsorship Programme.

Part of this research was carried out while Sergio Scicchitano was teaching fellow at the Queen Mary University of London and he would like to thank the School of Economics and Finance for its hospitality and support.

The authors would like to thank Pasquale D'Alessandro and the European Commission – DG Regional Policy for providing the dataset on the financial resources programmed by the EU Cohesion Policy. The authors are also grateful to Davide Arduini, Annaflavia Bianchi, Marco Biagetti, Andrea Bonaccorsi, Marco Marini, Maurizio Franzini, Harald Gruber, Stefano Kluzer, Dimitri Tartari, Antonello Zanfei who provided valuable suggestions and comments to a previous version of this paper.

The views expressed in this article are those of the authors and, in particular, do not necessarily reflect those of the Italian Ministry of Economic Development. The usual disclaimer applies.

REFERENCES

Alabau, A. (1997). Telecommunications and the Information Society in European regions. Telecommunications Policy, Vol.21, No.8,pp.761-771

Barca, F. (2009), An Agenda for a Reformed Cohesion Policy A place-based approach to meeting European Union challenges and expectations, Independent Report, European Commission.

Bonaccorsi A. (2010). Towards better use of conditionality in policies for research and innovation under Structural Funds: The intelligent policy challenge, working paper underlying Barca Report "An agenda for the reformed Cohesion Policy"

Cattaneo, G. (2004). Building eGovernment: European Regions and Alternative Strategies. Communications & Strategies, no. 54, p. 191

Cooke P.N., Morgan K. (1998) The associational economy. Firms, regions and innovation.Oxford, Oxford University Press.

Dabinett, G (2001): EU Mainstreaming of the Information Society in Regional Development Policy, Regional Studies, 35:2, 168-17

European Commission (1994) Report on Europe and the global information society, Bulletin of the EU, Supplement 2/94. Office for Official Publications of the European Communities, Luxembourg.

European Commission (1997).The Deployment of the Information Society for Regional Development - Examples of Applications from EC Actions.Office for Official Publications of the European Communities, Luxembourg.

European Commission (1998), Regional Innovation Systems: Designing for the Future, final report of the REGIS project, TSER Programme (Targeted Socio-Economic Research), European Union, Brussels, DG XII.

European Commission (2000).Strategies for Jobs in the Information Society.Officefor Official Publications of the European Communities, Luxembourg.

European Commission (2006).Commission Regulation (EC) No 1828/2006 of 8 December 2006 setting out rules for the implementation of Council Regulation (EC) No 1083/2006 laying down general provisions on the European Regional Development Fund, the European Social Fund and the Cohesion Fund and of Regulation (EC) No 1080/2006 of the European Parliament and of the Council on the European Regional Development Fund.

European Commission (2010a). Europe's Digital Competitiveness Report 2010, Brussels. Retrieved at http://ec.europa.eu/information_society/digital-agenda/documents/edcr.pdf

European Commission (2010b). A Digital Agenda for Europe, COM(2010) 245, Brussels.

European Commission (2011). Proposal for a regulation of the European Parliament and of the Council laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development

and the European Maritime and Fisheries Fund. COM(2011) 615 final/2, Brussels

Meijers H. (2010). Trade, Internet and economic growth: a cross country panel analysis. Paper prepared for the first ICTNET workshop Parma, Italy on the 16-17 of December 2010. Retrieved at http://meijers.unu-merit.nl/.

Nauwelaers and Wintjes (2011), Comparative Review of Innovation Policies, report for the Lincoln University research programme "Studies in Technology User's Innovation", October, Canterbury.

OECD (2004). The economic impact of ICT: Measurement, evidence and implications. Paris: Organization for Economic Cooperation and Development.

OECD (2011).Regions and Innovation Policy, OECD Reviews of Regional Innovation, OECD Publishing.

Quality of Government Institute (2010). Measuring the Quality of Government and Subnational Variation, Report for the European Commission Directorate-General Regional Policy Directorate Policy Development.

Reggi and Scicchitano (2012). Financing e-services in Europe: a regional perspectivein M. De Marco, D. Te'eni, V. Albano, S. Za (Editors) Information Systems: Crossroads for Organization, Management, Accounting and Engineering, Springer.

Taylor S. and Downes R. (2011). The Structural Funds Facilitating the Information Society.European Policies Research Centre, University of Strathclyde.

Technopolis (2006). Strategic Evaluation on Innovation and the knowledge based economy in relation to the Structural and Cohesion Funds, for the programming period 2007-2013. A report to the European Commission, Directorate-General Regional Policy

Tsipouri, L. (2002). Final Report for the Thematic Evaluation of the Information Society.Technopolis Ltd and IRISI (Europe) Ltd. Retrieved at http://www.diba.cat/ri/ce/descarrega/documents/information_society.

Van Ark, B. O'Mahony, M and Timmer, M.P. (2008). The Productivity Gap between Europe and the United States: Trends and Causes. Journal of Economic Perspectives—Volume 22, Number 1 - Pages 25–44.

Vincente M.R. and Lopez A.R. (2011). Assessing the regional digital divide across the European Union-27. Telecommunications Policy Volume 35, Issue 3, April 2011, Pages 220–237

Tables and figures

Table 1
Operational Programmes co-financed by Structural Funds, by country, objective, Fund and territorial scope

	Territorial objective*			**Fund**		**Nat / reg**		
	Convergence	Comp.	Cooperation	ERDF	ESF	National or multireg.	Regional	**AllOperational Programmes**
BG	7	-	-	5	2	7	-	**7**
BE	2	8	-	4	6	1	9	**10**
CZ	15	2	-	14	3	8	9	**17**
DK	-	2	-	1	1	2	-	**2**
DE	14	22	-	18	18	1	35	**36**
EE	3	-	-	2	1	3	-	**3**
GR	14	-	-	10	4	5	9	**14**
ES	23	22	-	23	22	7	38	**45**
FR	9	27	-	31	5	5	30	**36**
IE	-	3	-	2	1	1	2	**3**
IT	19	33	-	28	24	9	43	**52**
CY	1	1	-	1	1	2	-	**2**
LV	3	-	-	2	1	3	-	**3**
LT	4	-	-	2	2	4	-	**4**
LU	-	2	-	1	1	2	-	**2**
HU	14	1	-	13	2	8	7	**15**
MT	2	-	-	1	1	2	-	**2**
NL	-	5	-	4	1	5	-	**5**
AT	2	9	-	9	2	1	10	**11**
PL	21	-	-	20	1	5	16	**21**
PT	11	3	-	10	4	7	7	**14**
RO	7	-	-	5	2	7	-	**7**
SI	3	-	-	2	1	3	-	**3**
SK	10	1	-	9	2	9	2	**11**
FI	-	7	-	5	2	-	7	**7**
SE	-	9	-	8	1	1	8	**9**
UK	6	16	-	16	6	-	22	**22**
Cross-bordercooperation	-	-	54	54	-	-	-	**54**
Interreg coop	-	-	3	3	-	-	-	**3**
Trans-nationalcooperation	-	-	14	14	-	-	-	**14**
Total	**190**	**173**	**71**	**317**	**117**	**108**	**254**	**434**

** Programmes belonging to both Convergence and Competitiveness objectives are classified into Convergence objective*

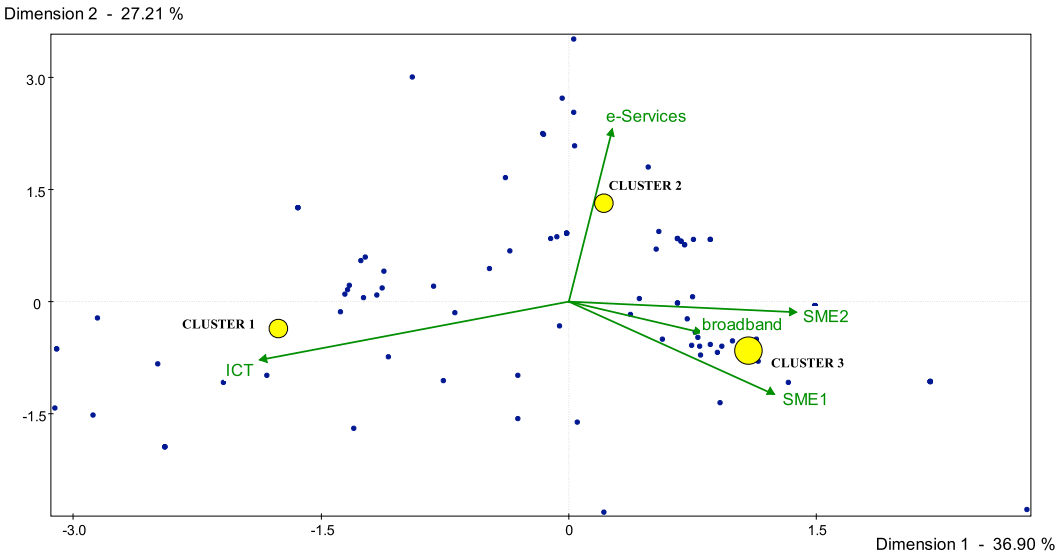
Source: Own elaboration from European Commission - DG Regional Policy data

Table 3
Categories of expenditure considered and financial resources allocated in CONV regions, as a % of the total resources dedicated to IS and e-Services development

Variable	Name	Avg	Min	Max
broadband	Broadband networks	15.0	0	100
ICT	Information and communication technologies (including TEN)	25.4	0	100
e-Services	Services and applications for citizens	33.0	0	100
SME1	Services and applications for SMEs	16.5	0	100
SME2	Other measures for improving use of ICT by SMEs	9.9	0	100

Source: Own elaboration from European Commission - DG Regional Policy data

Fig. 1
Identifying three strategies in allocating financial resources for IS development in CONV Regions



Source: Own elaboration from European Commission - DG Regional Policy data

Table 3
CONV Regions of EU Countries and the three cluster revealed

Cluster 1 - ICT infrastructures (interoperability, security..)	Cluster 2 - e-Services (e-health, e-Gov, etc.)	Cluster 3 - ICT among SMEs and broadband
DE (all except Lüneburg and Thüringen), FR (Guyane and Guadelupe), HU, IT, LV, PT, SK	CZ, DE (Lüneburg), EE, ES (all except Castilla-la Mancha), GR, LT, MT	AT, BE, BG, DE (Thüringen), ES (Castilla-la Mancha), FR (Reunion and Martinique), PL, RO, SI, UK

Source: Own elaboration from European Commission - DG Regional Policy data

Table4
Summary statistics

Variable	Obs	Mean	Std. Dev	Min	Max
Broad_house	85	35.91765	12.77387	9	77
Internet_house	85	46.76471	13.23923	17	84
Order_indiv	85	18.96471	15.02177	1	80
Interact_indiv	99	15.29542	9.606259	0.9434	33
Integr_process	91	17.41758	7.99509	5	31
GDP_percapita	99	11928.28	6224.754	2300	25300
Local_units	98	1274.02	1713.281	0	9858
Employees	98	4178.153	5940.11	0	31315
R&D	82	45.4939	45.94835	0.4	258.1
Unemp	97	11.24845	5.169766	3.9	28.5

Table 5
Determinants of regional strategies on IS and e-services: Logit results

Var	Cluster 1			Cluster 2			Cluster 3		
	Coef.	Std. Err.	z	Coef.	Std. Err.	z	Coef.	Std. Err.	z
Broad_house	-1.143005	0.4492695	-2.54**	0.0564842	0.1604883	0.35	0.4275693	0.1313482	3.26***
Internet_house	1.142004	0.448562	2.55**	-0.1895048	0.1902209	-1	-0.3502617	0.1241232	-2.82***
Order_indiv	-0.3475656	0.124287	-2.8***	0.1648801	0.107555	1.53	0.1935861	0.0728091	2.66***
Interact_indiv	0.5869741	0.2845014	2.06**	0.3405171	0.2055405	1.66*	-0.4194555	0.1579136	-2.66***
Integr_process	-1.371032	0.5737002	-2.39**	0.406413	0.1739903	2.34**	0.2302201	0.098529	2.34**
GDP_percapita	0.0000899	0.0002822	0.32	-0.000795	0.0003868	-2.06**	0.000012	0.0001531	0.08
Local_units	0.0030452	0.0013319	2.29**	0.0029206	0.0023873	1.22	-0.0035533	0.0011161	-3.18***
Employees	-0.0008222	0.0003594	-2.29**	-0.0008053	0.0007944	-1.01	0.0009812	0.0003352	2.93***
R&D	0.0448095	0.0290908	1.54	0.0209459	0.026945	0.78	-0.0387537	0.0197503	-1.96**
Unemp	0.4254679	0.2084043	2.04**	-0.2785523	0.1644312	-1.69**	0.0813006	0.0633516	1.28
Cons	-6.153135	4.415426	-1.39	-1.577808	3.686809	-0.43	2.023108	2.100155	0.96
Number of obs.	70			70			70		
LR chi2(10)	57.68			30.16			37.17		
Log likelihood	-14.734982			-11.777133			-29.475342		
Prob> chi2	0.0000			0.0008			0.0001		
Pseudo R-sq	0.6618			0.5615			0.3867		

Note: Significance levels are as follows: * p<0.10,
** p<0.05, *** p<0.01.