

# **The geography of .pt top level domain. The Internet diffusion in Portugal and its implications for the decrease of spatial disparities.**

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## **1. Introduction**

The radical role of information and communication technologies (ICT) is one of the most visible topic in the media today and seems to grow from day to day, as well as telecommunications are gradually becoming the central infrastructure tying together our society.

The advent of these technologies during the past decades, and their widespread use, is radically transforming the dynamics of communication and our understanding of spatial relationships (by the reduce of distances and the increase of accessibility to information and new services).

If there are many studies, attempting to show how city management and regional development policies can creatively address the complex linkages between ICT and urban and regional prosperity (influencing the objective of increasing urban living conditions, combating inwardness, promoting employment and economic competitiveness and supporting social integration policies), there are also many authors arguing that electronic communications reinforce existing patterns of physical communication rather than create new patterns.

These suppositions are usually theoretical discussions, that needs to be rigorously tested with empirical analysis and comparative perspectives. The main objective of this paper is precisely to present a detailed study about Portugal, with the purpose of questioning the decrease of spatial disparities due to the potential influence of ICT's.

This research is mostly based on new spatial statistics, collected, mapped and analysed in order to understand the diffusion process of the most sophisticated, diverse and capable telecommunication infrastructures, and consequently verify the plasticity of space throughout Portugal, and the ways it has been stretched or compressed.

We will be focusing the globally-interconnected set of computer networks, known as 'The Internet'<sup>1</sup>, which is widely used by millions of individuals, firms and institutions every day, as a way to get into an invisible domain, popularly known as cyberspace, in order to seek information, marketing new services and products, and as means of communication within and between organizations. We believe that this invisible territories of the cyberspace do have a geography and, in an attempt to reveal its topography, we should analyse the spatial patterns of the ownership of Internet space.

Despite the rapid growth of Internet in recent years, and the gradually recognition of its implications, there is a lack of knowledge about its geographic diffusion and its attendant implication for regional and urban development. Nowadays we do not know if we are facing a technology that will generate substantial readjustments on traditional portuguese regional dichotomies, or instead if we are facing a technology that will act as an unexpected contribute to reinforce territorial disintegration tendencies. Like Moss and Townsend (2000, p. 39) said "the urban planning profession has remained blissfully

ignorant of both the negative implications and potential benefits of new telecommunications technologies”.

In this paper and for the empirical research we will try to find links between cyberspace and the portuguese physical geography, expecting that these links will enable us to understand better how new telecommunications media have affected the existing spatial structure. In our opinion a good way to achieve this goal is discovering which and where are located the portuguese entities that recognize the importance to distribute globally information, about their activities and services, through the use of the Internet. For that we will explore the compulsory registration of all .pt domain names<sup>ii</sup> on one single institution –*Foundation for National Scientific Computing*- (FNSC), which performs all the registration services for the geographical .pt domain.

## **2. The Internet and its implication for urban and regional development**

The few academic empirical research that has been examining the geography of Internet are mainly focused on four types of measurement. The most widely used geographic measurement of Internet activity is the number of hosts, or computers connected to the Internet, but this type of measurement is criticized because it simply focuses on a technological availability. Moss and Townsend (2000) consider that the number of domain names registered by geographic area is a technique vastly superior as it represents a social construct, since it corresponds to the entities with websites. The density of IP addresses is another indicator commonly used, despite its limitation since the geographical location of the entity owner of the IP address may not necessarily be the same where the internet-linked computers are located. The geographic structure of backbone networks offers a fourth aspect that can be measured as an indicator of new flows of communications relationships emerging between places, and its configuration can be seen as a market response to localized demand for long-distance data transport services.

In this paper we will try to understand the geography of the Internet in Portugal studying exclusively the addresses of all registration .pt domain names, and more specifically variations in diffusion rates among portuguese municipalities. Between this four types of measurements we will explore the domain names because they represent the origins of the Portuguese information flows that characterize the internet, therefore studying its spatial distribution will allow us to discover where in Portugal are located the municipalities with individuals and institutions with competences to explore more efficiently the use of this telecommunication systems.

For comparison purposes we will now summarily present the results of similar studies conducted in three different realities: United States, United Kingdom and Korea.

For the United States, Townsend (2000) proposes a theoretical framework based on empirical findings that describe the geographic diffusion of Internet activity and infrastructure between 1969 and 1999, which allow him to say that a new network of urban spaces is emerging, structured by many cities that have been able to successfully market their own services on a global scale. He concludes that although New York and Los Angeles represent the US two largest clusters of Internet activity by the measure of domain names<sup>iii</sup>, in terms of density of adoption there are several metropolitan areas that outpace the traditional global cities.

“New York and Los Angeles clearly contain the largest clusters of Internet activity. (...) Chicago, which is typically considered a global city in the academic literature, ranks closer to Boston than to either New York and Los Angeles. Furthermore, there are a

number of medium-sized metropolitan areas that top the list – including Boston, Seattle, Miami and Atlanta.” (Townsend, 2001, p. 50-51)

For the United Kingdom, Dodge and Shiode (2000) conducted another academic empirical research that examined the geography of Internet in a detailed geographic scale. Using the density of IP addresses<sup>iv</sup>, they conclude that the majority of the UK’s Internet space is owned by commercial organizations, which are located in a few urban centers: Central London and its surrounding satellite towns (as expected); Nottingham (caused by a large block of address space allocated to an ISP – Internet Service Provided- placed in Nottingham<sup>v</sup>) and Cambridge (with a high concentration of computing, research-oriented companies and the university). The results of this study also underline that the internet, rather than disintegrate cities and major metropolitan regions, will reinforce the comparative advantages that such regions have as centres for information production and transmission, which reflects the significance of face-to-face contact in business and social life in order to generate innovative individuals and firms. For the Korea, Huh and Kim (2003) present a study considering the internet domains, the backbone networks and the flows on them “in order to have an overall picture of how the internet organizes the spatial structure of a nation” (Huh and Kim, 2003, p. 63). The coropleth maps of the geographic distribution of domains in Korea illustrates clearly the dominance of the metropolitan centers, Seoul in particular and to some extent the satellite cities nearby, revealing an evident geographic concentration of information production.

But, concerning to Portugal, which have been the implications of the internet widespread use in our understanding of spatial relationships? This is the main question that we will now try to answer.

### **3. The domain names as a way to discover the geography of internet and its methodological limitations**

The globally-interconnected set of computer networks, communicating via an agreed set of protocols, known as ‘The Internet’, is widely used by millions of individuals, firms and institutions every day, as a way to get into an invisible domain, popularly known as cyberspace, in order to seek information, marketing new services and products, and as means of communication within and between organizations. However, like Dodge and Shiode (2000) said, these invisible territories of the cyberspace do have a geography and, in an attempt to reveal its topography, we should analyse the spatial patterns of the ownership of Internet space.

In order to examine the geography of Internet in Portugal we need to find links between cyberspace and the portuguese physical geography. Since a domain name represents a single organisational entity present on the Internet, and because the content contained within any type of domain name is globally accessible, we will explore the geographic distribution of the domain names registered in Portugal as a way to discover where are located the portuguese entities that recognize the importance to distribute globally information, about their activities and services, through the use of the Internet.

Just before presenting the main results of our analysis, we should now clarify two important limitations of this methodological approach. Firstly, this spatial pattern may not necessarily reflects the location of the portuguese internet content producing activities, since those services can be provided faraway from the domain ownership. Secondly, Steineke (2000, p.13) underline the need to be vigilant in order to explain some high domain densities with the practice of domain grabbing “when private

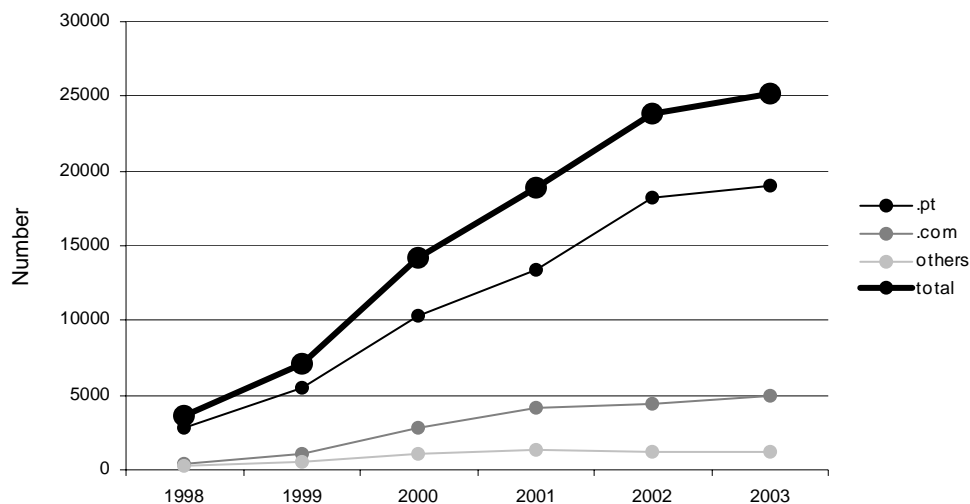
speculators register intuitive or trademarked names with the hope of selling the rights to these names to others at a latter date”.

The organisational domains may be grouped under CONE domains (.com for commercial businesses, .org for non-profit organisations, .net for networking companies and .edu for educational institutions) or CC domains (country codes such as .fr for france, .uk for the United Kingdom or .pt for Portugal). CONE domain names can be registered by anyone regardless of their location but are centrally administrated by a monopoly delegated by the US National Science Foundation (Steineke, 2000). CC domain names are generally administrated by national institutions, which make it more available for this kind of geographical analysis.

In Portugal the *Foundation for National Scientific Computing*- (FNSC) is a private non-profit-making institution whose responsibilities include managing the registration service for .pt domains under the authority delegated by the IANA - Internet Assigned Numbers Authority, an organization replaced by the ICANN- Internet Corporation for Assigned Names and Numbers (FNSC, 2004).

In this paper we will not study all portuguese domain names for the reason that we did not have access to CONE domains registrations done by the portuguese institutions, so these results represent only a part of the portuguese Internet content providers. However, according to the Anacom, which is the regulator, supervisor and representative of the communications sector in Portugal, at the end of 2003 there were about 25 thousand domain names registered, and the .pt domain with more than 75% of all domains registered in Portugal is definitely the more expressive of all typologies (Chart 1). Therefore studying the .pt domain name will give us a good representative picture of the geography of Internet in Portugal.

**Chart 1. Evolution of portuguese internet domain names (1998-2003)**



Data collected in: Anacom (2004)

Besides the registration under the .pt domain, FNSC manages eight other official hierarchies for .pt. The distribution of registered entities by these sub-domains (Table 1.) expose a clear predilection to choose the .pt or .com.pt domains independently of the nature of the applicant bodies. Since this option is a decision exclusively dependent of the individual/body applying to register a brand name, thus means that the

examination of these figures is not valid to conclude which entities are more conscientious of the potential of being present in the internet. Therefore in this paper we will look at all these registers independently of the chosen hierarchy.

**Table 1. Distribution of FNCS registers by the eight hierarchies for .pt domain (June 2003)**

83,6%	.PT - Legal Persons, sole partnerships, self-employed persons, administratively independent public bodies, and any individual/body holding or applying to register a brand name
0,1%	.NET.PT - restricted to telecommunication service providers
0,0%	.GOV.PT - restricted to bodies that belong to Portuguese Government structures
0,2%	.ORG.PT - restricted to non-profit-making organizations
0,1%	.EDU.PT - restricted to public educational establishments and owners of private or co-operative establishments
0,0%	.INT.PT - restricted to international organizations and diplomatic representations duly registered with the National Registry for Legal Persons
0,0%	.PUBL.PT - there are no restrictions as to the applicants, as long as they are owners of a periodical or magazine
15,9%	.COM.PT - there are no restriction as to the applicants
0,1%	.NOME.PT - restricted to individuals who are holders of an ID card issued by the Portuguese Identification Archive, as long as they are resident in Portugal, and hold a valid residence permit

Data collected in: Foundation for National Scientific Computing (2003)

#### 4. Foreign institutions with .pt domain names

FNCS administration gave us the addresses information of almost all entities with an internet presence under de .pt top level domain<sup>vi</sup>, which allow us to patiently pinpointed a geographical location, by municipality, for the ownership of 24.724 .pt domain names (using the zip codes of the mailing address details), which have become much useful in discovering geographic variations in portuguese Internet activity.

Curiously there is not a correspondence between the number of .pt domains presented by Anacom and the number revealed by FNCS. Probably the explanation for this difference may be due to the fact that Anacom do not consider the total registrations but only the active domains. We should not forget that some registered institutions give up from paying the amounts of the charge for the biennial maintenance of their domains.

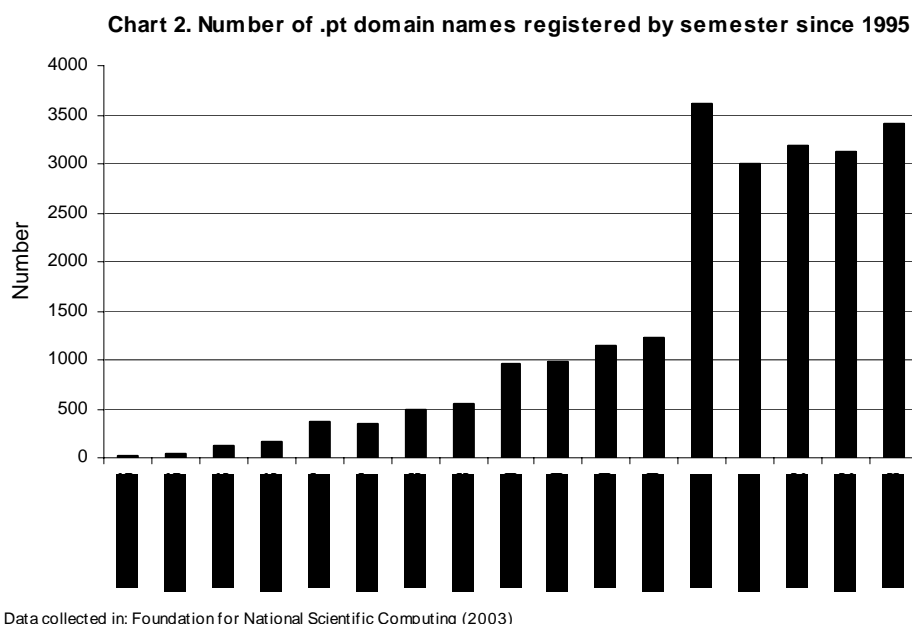
Analysing the spatial distribution of these domains we conclude that approximately 2 thousand of .pt domains are in the possession of foreign institutions, that for some reasons recognised advantages to promote their objectives and services through the use of a website with a .pt domain.

The six countries more represented, in a decreasing order of magnitude, are: USA, Switzerland, Spain, Germany, France and United Kingdom. These are countries with strong relations with Portugal, not only as a direct result of continued business connections (except Switzerland all others belong to the list of the top 7 portuguese import and export countries), but also as countries with the more expressive portuguese emigrants communities. On one hand USA, France and Germany as a long date receivers for portuguese emigration, on the other hand Switzerland, Spain and United Kingdom belonging to a new set of recent destinations.

#### 5. The process of spatial diffusion of .pt domain names

FNCS started registrations in 1991, however only at the beginning of 2001 it begun an ownership trivialization of .pt domains around portuguese institutions, with more than 3

thousand new domains each semester (Chart 2). In spite of this recent acceleration, preceded by a decade of slow adoption, we are still facing an emerging phenomena throughout Portugal concerning the diffusion of .pt domains.



Considering only the .pt domains that belong to entities placed in Portugal and in order to understand the logics behind the spatial diffusion process throughout Portugal, we decided to analyse each one of the .pt domains by the semester they have been registered. But more important than discover when had occurred the first registration for each municipality, we decided to signalise the semester when the continuous registration started non stop up to the present date (Figure 1).

(Figure 1, Page 12)

The pioneer municipality with systematic registration of .pt domains was the portuguese capital Lisbon (1991), followed by Oeiras (1993) and Cascais (1995). All of them located in Lisbon Metropolitan Area, which is the portuguese leading financial and administrative centre and concentrates a large and mixed supply of advanced services, with the head offices of the largest domestic and multination companies being found there.

The second diffusiveness centre was established at the end of 1995 in the north of Portugal, structured by a node around Oporto (Oporto, Vila Nova de Gaia and Matosinhos) and another one in Braga. The Oporto Metropolitan Area and its surrounding municipalities form an almost continuous urban sprawl, generally known as city agglomeration, which comprises an extensive area, stretching north as far as Braga, south to Oliveira de Azeméis, and east to Amarante.

After this initialisation it begun a new diffusion stage (between 1996 and the beginning of 1998) characterized by the appearance of a set of other leading municipalities that correspond more or less with the medium-sized cities that structure the urban coastal system that have grown up between these two metropolitan systems (it is the case of Aveiro, Coimbra, Figueira da Foz and Leiria/Marinha Grande), as well as the relevance of the linear urbanization of the Algarve coast.

Away from the urban coastal, Évora and Viseu lead the inward systematic emergence of .pt domains, followed by the Beira Interior medium-sized cities (Guarda, Covilhã,

Fundão and Castelo Branco), and the two others important cities in Alentejo (Portalegre and Beja).

This diffusion process allow us to conclude that the cyberspace conquest begun in Portugal throughout the most urbanised municipalities, also with an economic relevance and better served in terms of road accessibility. And as we will now demonstrate there is a clear correspondence between these precursor municipalities and the portuguese localities with the largest clusters of Internet activity at the present time.

## **6. A density measure to understand better the spatial distribution of the .pt domain**

To point out the Portuguese localities that nowadays participate more actively in the global flows of information, we decided to use the density of domain name registrations with respect to the local population as a measure of intensity, rather than analyse the magnitude by municipalities since it would comprehensively reveal the more populated ones.

Through the spatial distribution of the domain density (number of .pt domain levels per 10.000 inhabitants, by municipality) we can catch the most wired Portuguese localities in 2003 (Figure 2). If we consider only the municipalities with a density higher than the national average (21,99 .pt domains per 10.000 inhabitants) we may highlight their agglomeration into five main areas, all of them located in the portuguese urban coastal system.

(Figure 2, Page 13)

The north extension of the Oporto agglomeration (Porto, Matosinhos, Maia, Santo Tirso and Braga), which have a significant demographic potential, a productive structure not so rich or diverse in terms of services, and a industrial profile more traditionally based but strongly export orientated.

A group of municipalities polarized by Aveiro (Aveiro, Águeda and Albergaria-a-Velha) and Coimbra. Aveiro with the University and Research Centres present new areas of expansion and internationalisation (telecommunications, electronics and informatics), and together with its neighbouring municipalities presents a dynamic manufacturing based on ceramics and metallurgy. Coimbra polarizes an extended area of influence and its University as well as a science complex linked to the area of health cares distinguishes the city and gives it an international profile.

Leiria, Batalha, Ourém and Marinha Grande is also a significant urban system and an internationalised industrial cluster linked to the plastics injection moulding industry.

The north section of the Lisbon Metropolitan Area (Lisbon, Loures, Amadora, Oeiras, Cascais, Sintra and Mafra), intensively urbanized and with a marked specialization in services for industry, financial services, cultural and recreational activities.

Finally the urbanization of the south coast (specially the municipalities of Faro and Loulé) is strongly connected with the Algarve potentialities in what respects to international tourism. Nowadays a great part of hotels reservations are done by internet, and the numerous hotels placed in Algarve must have a website connected to several on-line booking agencies.

To summarize we can state that there is a strong relationship between the geographic patterns exhibited by the portuguese ownership of Internet activity and the municipalities with the biggest cities and also with an economic profile more competitive and internationalised. So far these signals allow us to say that the use of

new telecommunications systems instead of contribute to overcome traditional geographic barriers it has reinforce territorial disintegration tendencies.

## 7. The distribution of .pt domain names by portuguese economic activities

The FNCS provided us the code of the Portuguese Statistical Classification of Economic Activities (CAE) for each one of 17306 entities with a .pt domain name. This information give us the opportunity to find out which are the economic activities best represented in cyberspace.

Curiously if in a geographic analysis we discovered a clear correspondence between the most dynamic municipalities and those localities that nowadays participate more actively in the global flows of information, on the contrary in an economic analysis we can conclude that there is some relevant discrepancies between the most vibrant Portuguese economic branches (in terms of number of firms) and those that recognize the potential of being owners of Internet space (Table 2).

Table 2. Comparison between economic activities more represented in terms of firms and .pt domains	.pt domain names (2003)			Firms <sup>vii</sup> (2000)		
	Number	%	Order	Number	%	Order
Agriculture, hunting and forestry	19	0,1		10430	3,4	
Fishing	2	0,0		303	0,1	
Mining and quarrying	107	0,6		1154	0,4	
Manufacturing	2922	16,9	3°	48404	15,5	2°
Electricity, gas and water supply	62	0,4		619	0,2	
Construction	722	4,2		39800	12,8	3°
Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods			2°			1°
Hotels and restaurants	4609	26,6		102490	32,9	
Transport, storage and communication	265	1,5		33282	10,7	4°
Financial intermediation	771	4,5	5°	11993	3,9	
Real estate, renting and business activities	298	1,7		7761	2,5	
Public administration and defence; compulsory social security	4810	27,8	1°	27766	8,9	5°
Education	481	2,8		261	0,1	
Health and social work	387	2,2		3494	1,1	
Other community, social and personal service activities	245	1,4		11264	3,6	
Extra-territorial organizations and bodies	1592	9,2	4°	12292	3,9	
Extra-territorial organizations and bodies	14	0,1		4	0,0	
TOTAL	17306	100,0		311317	100,0	

Data collected in:

Foundation for National Scientific Computing, 2003

Labour, Employment and Professional Training Statistics Department, 2003

For instance the economic branch concerning real estate, renting and business activities join up only 8,9% of all Portuguese firms, however, is the economic branch more represented in the cyberspace, since these activities represent almost 28% of all Portuguese economic activities with .pt domains.

Other example is the construction sector, the third economic sector in Portugal, with 12,8% of all firms, but it only have 4,2% of all .pt domain names, confirming that among some kind of private institutions there is more evident a lack of recognition about the importance to distribute globally information, about their activities and services, through the use of the Internet.

Other important conclusion, that results from this economic analysis, point out that the influence of internet for regional development is in some cases a clear contribute to reinforce territorial disintegration tendencies, promoting geographic disparities throughout Portugal even more pronounced than in real space.



For the three economic branches with more .pt domains (Table 3,4 and 5) we can conclude that the institutions with internet websites are much more spatial concentrated comparing with their physical locations, which means that electronic communications reinforce existing patterns of physical communication rather than create readjustments on traditional portuguese regional dichotomies.

For instance, Lisbon concentrates 19,9% of all firms in the real estate, renting and business activities, but if we analyse the spatial distribution of all these activities with .pt domains we will observe a much higher agglomeration in Lisbon, with almost 34% of all these websites. In this economic sector with the exception of Braga, the others 9 municipalities with more .pt domains are located in the two Portuguese metropolitan areas. A carefully analysis allowed us to conclude that in a total of 308 portuguese municipalities only three of them (Lisbon, Oporto and Oeiras) polarize 50% of all these Portuguese firms with .pt domains.

<b>Table 3. Top 10 municipalities with more .pt domains in the economic branch concerning real estate, renting and business activities</b>	<b>.pt domain names (2003)</b>			<b>Firms (2000)</b>		
			%			%
	Order	Number		Order	Number	
Lisbon	1º	1617	33,6	1º	5515	19,9
Oporto	2º	405	8,4	2º	1713	6,2
Oeiras	3º	372	7,7	3º	843	3,0
Cascais	4º	195	4,1	5º	634	2,3
Sintra	5º	180	3,7	4º	838	3,0
Matosinhos	6º	120	2,5	9º	481	1,7
Amadora	7º	111	2,3	10º	453	1,6
Braga	8º	104	2,2	8º	500	1,8
Loures	9º	101	2,1	16º	345	1,2
Maia	10º	96	2,0	17º	331	1,2
Total Portugal		4810	100		27766	100

Data collected in:

Foundation for National Scientific Computing, 2003

Labour, Employment and Professional Training Statistics Department, 2003

Concerning activities related with wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods, we can highlight the position of Oeiras, which is the eighth municipality (concentrating 1,7% of all activities of this economic sector) but is the third in term of this kind of activities with a presence in Internet (with 5,8% of all activities of this economic sector).

<b>Table 4. Top 10 municipalities with more .pt domains in the economic branch concerning wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods</b>	<b>.pt domain names (2003)</b>			<b>Firms (2000)</b>		
			%			%
	Order	Number		Order	Number	
Lisbon	1º	826	17,9	1º	10938	10,7
Oporto	2º	336	7,3	2º	5131	5,0
Oeiras	3º	266	5,8	8º	1777	1,7
Sintra	4º	262	5,7	3º	2928	2,9
Loures	5º	179	3,9	6º	1919	1,9
Cascais	6º	154	3,3	10º	1754	1,7
Maia	7º	146	3,2	21º	1125	1,1
Vila Nova de Gaia	8º	140	3,0	4º	2172	2,1
Amadora	9º	126	2,7	9º	1762	1,7
Matosinhos	10º	122	2,6	12º	1551	1,5
Total Portugal		4609	100		102490	100

Data collected in:

Foundation for National Scientific Computing, 2003

Labour, Employment and Professional Training Statistics Department, 2003

Even more remarkable is the position of Oeiras in the economic branch concerning manufacturing activities (Table 5.). In spite of being in 38<sup>th</sup> position in terms of the number of manufacturing firms, Oeiras is the fourth Portuguese municipality in terms of the number of manufacturing activities with .pt domains. On the contrary, Guimarães is the locality where are located a higher number of manufacturing firms, however those activities are not so well represented in the global flows of information.

All these figures let us to say that the economic geography clearly reveals different patterns in physical space or in cyberspace. If it is true that the internet may have a significant contribute to reinforce territorial dichotomies it is also true that in some cases there are localities that have an economic performance not so stimulating in some economic branches but those activities are exploring much more efficiently the potentialities offered by information and communication technologies.

Table 5. Top 10 municipalities with more .pt domains in the economic branch concerning manufacturing activities	.pt domain names (2003)			Firms (2000)		
	Order	Number	%	Order	Number	%
Lisbon	1º	329	11,3	3º	1787	3,7
Sintra	2º	135	4,6	6º	1373	2,8
Oporto	3º	118	4,0	10º	1081	2,2
Oeiras	4º	108	3,7	38º	336	0,7
Vila Nova de Gaia	5º	102	3,5	5º	1383	2,9
Maia	6º	83	2,8	19º	635	1,3
Guimarães	7º	80	2,7	1º	2021	4,2
Loures	8º	79	2,7	17º	643	1,3
Águeda	9º	78	2,7	23º	541	1,1
Santa Maria da Feira	10º	73	2,5	4º	1551	3,2
Total Portugal		2922	100		48404	100

Data collected in:

Foundation for National Scientific Computing, 2003

Labour, Employment and Professional Training Statistics Department, 2003

## 8. Conclusion

In this paper our main goal was to contribute for the discussion about which portuguese municipalities are best positioned on the space of flows<sup>viii</sup> that characterizes the information societies. This abstract space needs nodal points to organize the networks of exchange of capital flows, information flows and decisions, and if we assume that the Internet will have a major impact for citizens and firms to exert their influence in global markets, we should ask where in Portugal are located the individuals/bodies/activities with capacity to explore more efficiently the use of this telecommunication system in order to capture the growth benefits associated with these changes. The research that we have conducted in order to understand the geographic diffusion of this advanced telecommunication service and its attendant implication for regional and urban development allow us to contest the theoretical framework that emphasize the role of modern means of communication as a way to increase the accessibility to peripheral places and consequently as a way to split up the effects of centrality.

The findings of this study suggest that the expansion of the global economy and the information era enhancing, rather than reducing, the status of Portuguese larger cities. The role of ICT's to overcome spatial inequalities in Portugal is less important than expected, since in reality these technologies are deeply affected by the existing spatial structure.

As we revealed there is an obvious correspondence between the most dynamic municipalities and better served in terms of road accessibility and those localities that

take part more actively in the global flows of information. This conclusion was confirmed when we analysed the distribution of .pt domain names by Portuguese economic activities, by this approach we concluded that the internet have a clear contribution to reinforce territorial desintegration tendencies, and some relevant efforts are needed to prevent a further aggravation of the digital-divide between the two metropolitan areas and the rest of the country.

FIGURE 1. Spatial diffusion of pt top level domains

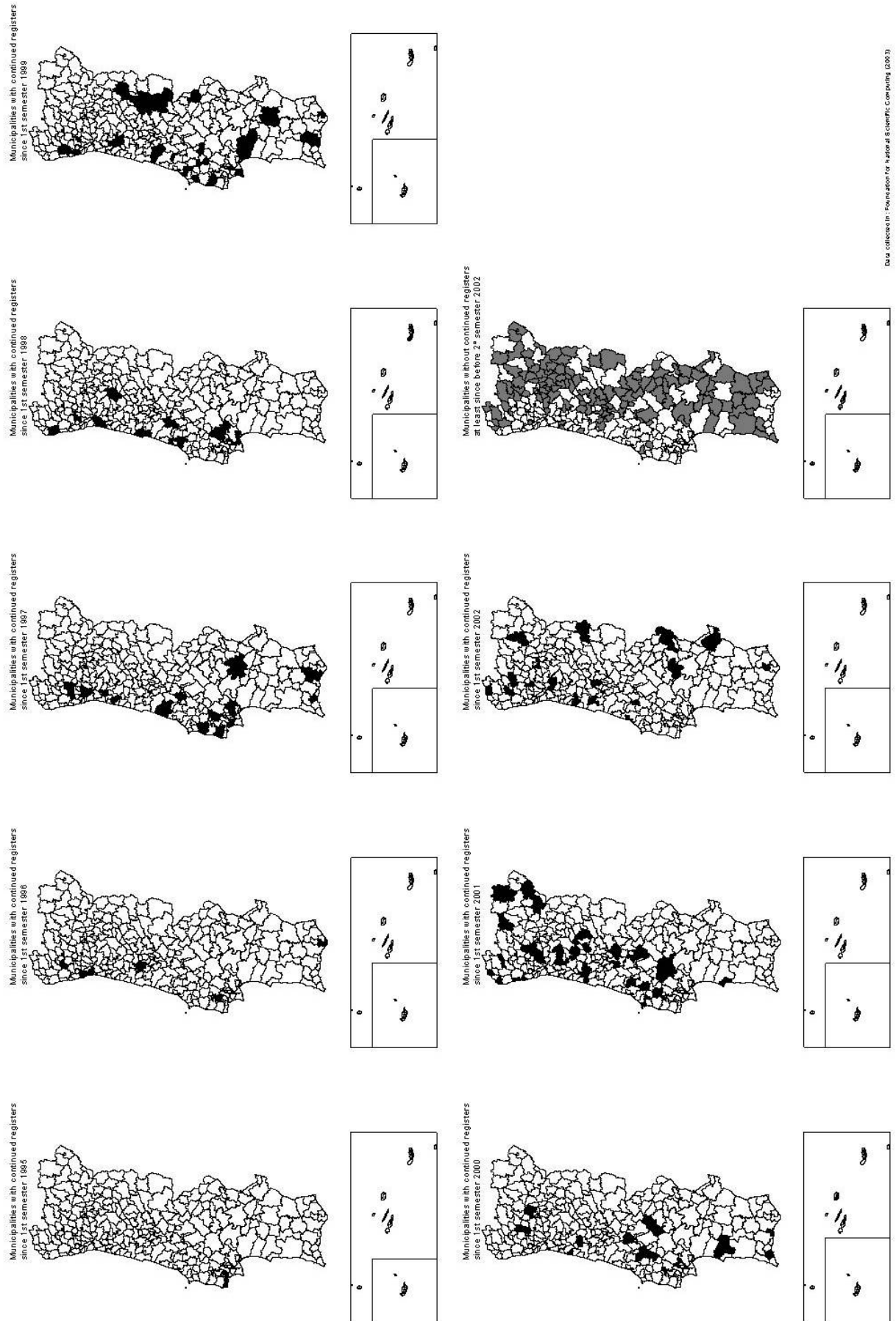
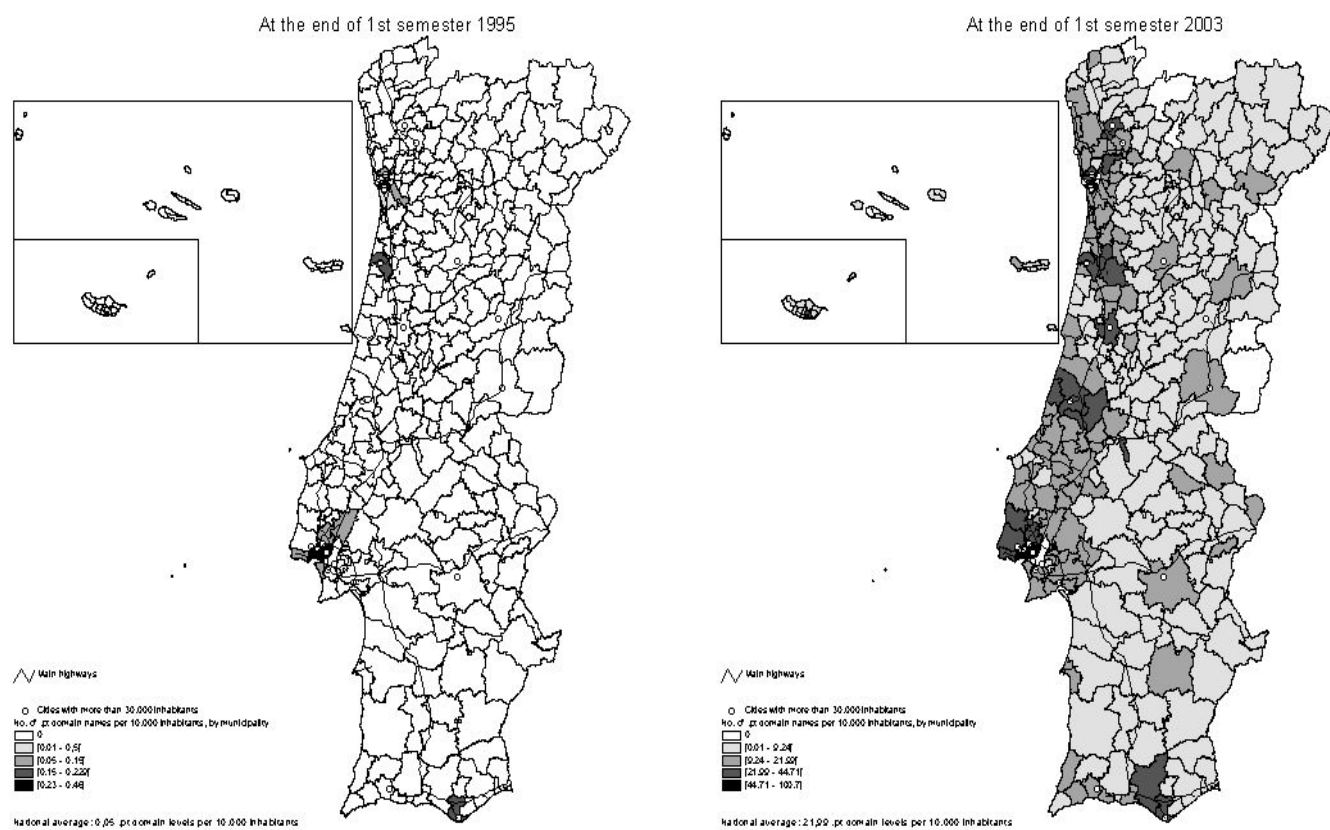


FIGURE 2. Spatial distribution of .pt domain levels by municipality



Data collected in:  
 Foundation for National Scientific Computing (2003)  
 Portuguese National Statistical Institute (2001 data for cities population)

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## Notes

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<sup>i</sup> Although there are technical differences between the Internet as a system of networks and the various networks using protocols themselves, this paper will employ the term Internet for simplistic reasons.

<sup>ii</sup> The domain name for the websites created with a portuguese reference.

<sup>iii</sup> This technique uses the addresses associated with the domain names registration (such as www.mit.edu) in order to geographically localize the sites of Internet activity in the US.

<sup>iv</sup> The Internet Protocol Address is a numeric code used to identify and locate computers on the network. The registry of IP address space lists all the companies and organizations to which allocations have been made. RIPE (Réseaux IP Européens) is the registry entity responsible for covering Europe and surrounding countries.

<sup>v</sup> This results from one limitation of the IP address methodology. "The geographical location at which the IP address space is owned may not necessarily be the same as where the space is actually used, that is, where the Internet-linked computers are located" (Dodge and Shiode, p. 47).

<sup>vi</sup> FNSC do not have the postal addresses information to all registered entities. The registers of .pt domain names with location information represent 78% of total registers (24724 under a total of 31705 .pt domain names in June 2003). In opposition to the earliest registrations (until 1995-96) nowadays the entity addresses is a compulsory demand during the registration process.

<sup>vii</sup> In Portugal the best source source of information for keeping track of the changing structures of markets, in terms of the firms location, size and workers characteristics, is the Labour, Employment and Professional Training Statistics Department (Ministry for Social Security and Work). This database is annual updating (with answers to compulsory questionnaires) and follows the universe of all Portuguese firms, with location references by municipality.

<sup>viii</sup> Castells (1992, p.6) defines space of flows as "the abstract space constituted in the networks of exchange of capital flows, information flows, and decisions that link directional centres among themselves throughout the planet".