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***INTERNET GEOGRAPHY: SPACES OF INOVATION***

**ABSTRACT**

Information Society plays an important role in all kinds of human activity, inducing new forms of economic and social organization and creating knowledge.

Over the last twenty years of the 20<sup>th</sup> century, large investments in telecommunication networks were made to approach economies and put an end to the asymmetries. The most isolated regions were the beneficiaries of this new technological investment's wave disseminating through the territories. The new economic scenarios created by globalisation make high capacity backbones and coherent information society polity, two instruments that could change regions fate and launch them in to an economic development context. Technology could bring international projection to services, products and could be the differentiating element between a national and an international economic strategy. So, the networks and its fluxes are becoming two of the most important variables to the economies.

Measuring and representing this new informational accessibility, mapping new communities, finding new patterns and localisation models, could be today's challenge.

In the physical/real space, location is defined by two or three geographical co-ordinates. In the network/virtual space or in cyberspace, geography seems incapable to define location, because it doesn't have a good model. Trying to solve the problem and based on geographical theories and concepts, new fields of study came to light. *Internet Geography* is one example.

In this paper and using *Internet Geography* and informational cartography, it was possible to observe and analyse the spacialisation of the *Internet* phenomenon through the distribution of the IP addresses in the Portuguese territory. This work shows the great potential and applicability of this indicator to regional development studies, and at the same time.

The IP address distribution of *Country Code Top Level Domains* (.pt for Portugal) could show the same economic patterns, reflecting territorial inflexibility or, by opposition, new regional hierarchies. The spatial concentration or dispersion of top level domains seems to be a good instrument to analyse the info-structural dynamic and economic development of a territory, especially at regional level. At the same time it shows that information technologies are essential to innovation and competitive advantage.

**KEYWORDS:**

Information Society, Innovation, *Internet Geography*, Top Level Domains, Economic Development.

## **Introduction**

Information Society (IS) represents a group of interactions whose inputs are images, sounds, attitudes and information that flows in physical space. Society is formed by flows. They represent, not only an element of social organization, but they determine the economical, political and symbolic processes of life itself.

Information Society generates a new developing model. 'Information Highways' (IH), constant innovation in the productive processes and the use of 'Information and Communication Technologies' (ICT) are some of the crucial elements to achieve competitiveness in the globalized economy.

But ICT and IH are still a luxury of the rich and developed countries and its global diffusion is far from being equally distributed. As for Innovation, it usually comes with the first two.

It seems that ICT is strongly related with mature economic development; new technologies like *Internet* are 'on-line' with development and seem incapable of starting a developing environment that could attract investment and trigger a growing cycle. But the studies are beginning to appear. The use of new indicators based, not on virtual, but on real variables, could be used to show phenomenon that until recent years were completely unknown and should be taken in consideration.

### **1. Information Society and Innovation**

The concept of Information Society has its roots in the 'post-industrialism' literature, a very common notion in the 60's and in the 70's. The idea proclaims the end of 'industrial capitalism' and the emergence of a 'services society' or a 'recreational society'. But only in the 80's the concept began its wide spreading.

There are many contributions to the concept; among them, there are the optimistic and the pessimistic approach. J. MARTIN (1978), the author of *Wired Society* it's a positivist and he saw in information technologies, 'non pollution and non destructive

characteristics'. T. STONIER (1983) saw the end of wars and P. DRUCKER (1993) considered the actual information revolutions as the ideal scenery for the Information Society. W. HALAL (1993) e W.J. MARTIN (1995), with a more pessimistic approach, consider IS as a phenomenon without maturity and difficult to quantify and qualify.

R. LINDLEY (2000) goes a little bit further and differentiates 'information society' from 'learning society'. The first one, says the author, refers to information diffusion stimulated by microelectronics and by its social and economic impact. And the second one, includes the potential of people's participation in long life learning. He also talks about 'knowledge society' that takes into consideration the long term structural change in economy, and the production and use of knowledge in the process of wealth creation.

The creation of new knowledge is innovation. This concept has a double significance because it refers to the 'process' and at the same time to the 'result'.

According to the European Commission (1996), 'innovation' means transformation of scientific and technological knowledge in products and services; and in this sense, it describes a process. But when innovation is applied to a new product, it describes a result. This duality between the factors that promote innovation and its result in the form of new products generates some confusion in the innovation theories. "...Innovative knowledge could lead to the introduction of innovative processes..." (FELDMAN M. P. 1994:2 and 2000:373-375). And "...it could be seen as a good that serves as an input, creating an output that might be considered (again) as knowledge..." (OCDE, 2000:13).

## **2. Networks of Knowledge and the Geography of Innovation**

Over the last thirty years we've seen an unprecedented evolution in computers. In the eighties, besides processing, memory and disk capacity, the resources began to be shared in networks. But also the telecommunications sector with the development of products and applications in transmission and *routing*, became a reality. Fibre optics increased transfer speeds and laser technologies with more stable protocols were the

answer to different programming languages. The convergence of all this high-tech products led to an evolution of the network concept.

Networks should be seen as communities of relations, not only has a group of nodes. They could be economic, financial, social, cultural, of innovation or simply recreative. The benefit of being connected would be increasingly proportional to the size of the network. In the end, we could say that information society depends on well distributed networks and its nodes, but territorial dissemination is far from being homogeneous. Wireless technologies could be the answer to the problem, but for now, the future remains uncertain.

With the globalization of local economies and new business organizational structures, the circulation of goods, capital and work have been suffering considerable mutations. As for the territories, the constant transformations caused a rearrange of social and economical spaces. The involvement of local agents in a global market as changed the physical organization of territorial units. Administrative boundaries loose their importance and at the same time regions and cities increase its influence.

This kind of organization is based on a strong geographical dispersion, in which mobility is a crucial element. And nowadays, maps that represent social and economical variables almost ignore administrative boundaries. The networks, mainly cities and regions responsible for their hierarchy in the global context, are the major elements.

What characterizes technological revolution is not the use of information and knowledge for itself, but the application of that knowledge to generate even more and better knowledge in a continuous cycle of innovation (DIZARD W.P. 1982; FORESTER T. 1985; HALL, P. and PRESTON, P. 1988; e SAXBY S. 1990)<sup>1</sup>. Or the idea, that the best *output* is the one who serves as an *input* on other process.

Spread over physical space and mainly in territories with high degree of technological and inovacional potential, networks represent constraining elements to cultural, social and economic development. Every country has different development strategies, but two

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<sup>1</sup> In CASTELLS, M. (2000:31).

of them are usually coincident: the reach of its network must be the largest possible and broadband should be broad enough to permit a well dimensioned use, adapted to daily needs.

These technological networks are based in hierarchical models, according to its speed and capacity. All of them have the so called *backbone* that supports all the branches. It's over these networks that the milieux d'Innovation, information seedbeds, intelligent cities and other figures responsible for creating innovation potential, are located.

The considerable amount of information that flow trough a network obliges to constant upgrades. New services and new technologies require more sophisticated resources and the networks grow far beyond the most optimistic survey. That's the story of the *Internet*.

Considered as the most advanced technological platform amongst all networks, *Internet* has a structuring role in the innovation process and it's very important in defining territorial hierarchies. It's easy to prove that the activities that contribute the most to the development potential and R&D of a nation are always concentrated in very important network nodes. This is true to all economic sectors. If we analyse more carefully, we could see that those nodes are always very high in *Internet* hierarchy.

The progress of mankind depends upon the creation of knowledge and it's related (also) with the creation and use of innovation, in its several forms. Digital contents and its *Internet* diffusion might be considered as two of these (new) forms of innovation. For example, the "Human Development Report" from the *United Nations Development Program* uses the number of *Internet* domains, to quantify the diffusion of recent innovations.

### **3. The Distribution of Top Level Domains in Portugal – A reliable Innovation Indicator?**

All systems connected to *Internet* have a unique number, the IP address, for example 193.136.113.4. But due to the difficulty of memorising that number to open a certain

web page, it was created the *Domain Name System* (DNS), which makes possible the association between the numerical address and a certain number. For example *fcsh.unl.pt* is the correspondent DNS of the IP 193.136.113.4.

Due to the global reach of an *Internet* address, as well as its economical and social impact, the combined use of geographical top level domains (Country Code or CC) and organisational top level domains (CONE) could be one of the best indicators to quantify the *Internet* potential of a country or region. This could correspond to an informational productive potential. That's, in general, the reflex of a dynamic productive base.

In Portugal the *Fundação para a Computação Científica Nacional* (FCCN) allocates *Internet* space of geographical top level domain (CC) .pt. The organizational top level domains (CONE) could be registered in one of the 32 *Internet* Service Providers operating in Portugal but due to confidentiality and market reasons, it wasn't possible to obtain data related to the territorial distribution of CONE domains.

The growth of top level domains since 1997 has been remarkable. This is related to the number of *Internet* subscribers (fig. 1). The number's also influenced by the growth of DSL and cable access.

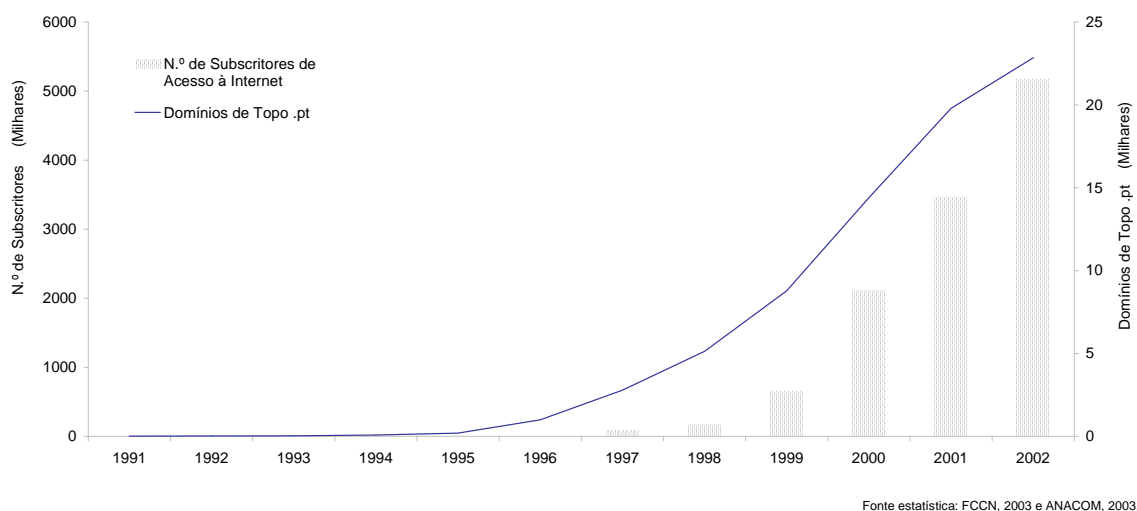


Fig. 1 - *Internet* subscribers and Top Level Domains .pt, February 2003.

In February of 2003 there were approximately 25.500 top level domains (geographical and organisational) in Portugal. (Fig. 2) If we analyse the type of top level domains, only 22% are CONE domains (.com, .net and .org), the other 78% are geographical (CC) domains. This means that per each CONE domain there are 4 CC domains. One of the reasons to this difference was the late liberalisation of the telecommunication sector. Only then, *Internet* service providers (ISP) began to operate and the registration of CONE domains could be done. But this also reflects that *Internet* in Portugal is (still) turned to internal market. This value also reflects the true importance of Portugal in foreign markets, even in a European context. In other international studies (Zook, 2001) the number of CONE domains was much more near to the CC number.

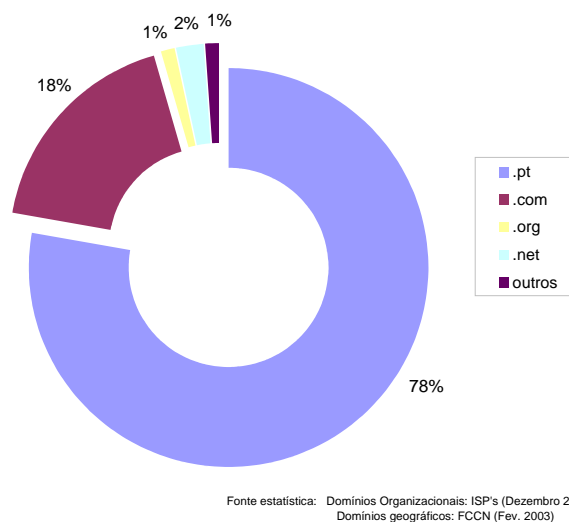


Fig. 2 - Percentage of Top Level Domains (according to its type), 2002 and 2003.

In the beginning of 2003 the distribution of the 19.794 geographical top level domains .pt in the twenty eight regions of Portugal (NUT III) showed a divided country. (Figure 3 and 4). The dissemination of domains reveals that urban and coastal regions continue to be determinant to ITC variables. Lisbon and OPorto regions (the two bigger metropolitan areas of Portugal) could be, in a so called first group, with 8.393 and 3.351 CC domains, followed by Setúbal Peninsula and the Cávado region with 900 and 700 domains. In a third group, below the 700 domains: Ave, Pinhal Litoral and Baixo Vouga. The regions of Serra da Estrela and Dão-Lafões have less than 50 domains. The urban regions with more population have a higher number of domains.



Fig. 3 – Distribution of TLDs, 2003.

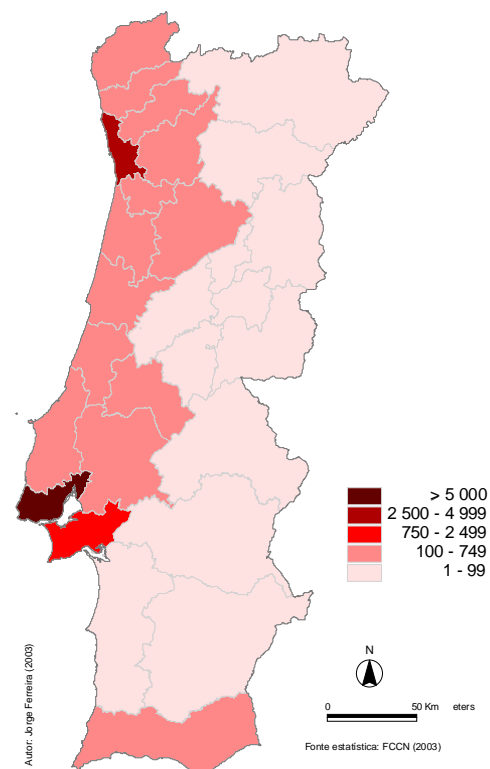


Fig. 4 - Distribution of TLDs (NUTs), 2003.

Using the last demographic census of 2001, the regions were compared according to the number of domains and population and the results were very interesting. Then it was calculated the correlation value between the two variables and the result was 0,937 to an interval of confidence of 99%.

The number of domains per 1000 habitants is a very common variable used on *Internet* geography and innovation studies. For all the regions of Portugal, the value is below 6 domains per 1000 habitants (reference value) which mean a very low density of CC domains (fig. 5). From the twenty eight analysed regions, sixteen had a value of domains per 1000 habitants below 1. Even if we add the CONE domains number (only available for all the country) the total number of CONE plus the CC domains, the value would be 2.5760 domains per 1000 habitants, which remains a very low number.

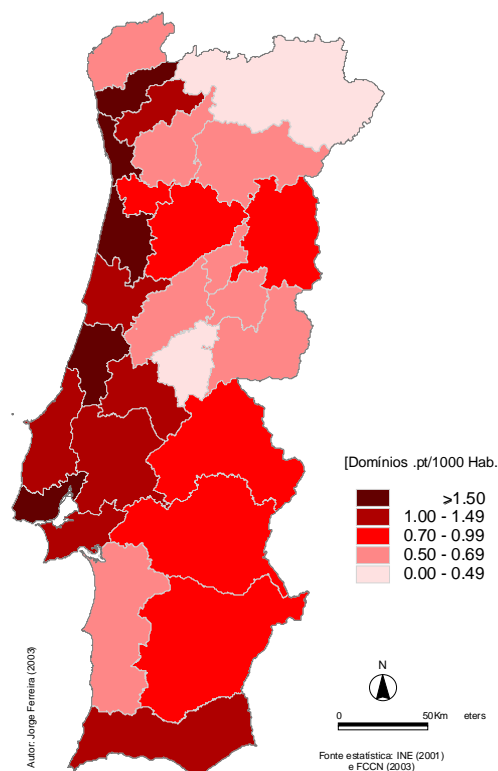


Fig. 5 – Number of domains per 1000 habitants.

Analysing TLDs for the 278 ‘concelhos’ of Portugal, it’s possible to see that its distribution across the territory favours the ones with higher population values, in particular, the two major metropolitan areas, Lisbon and oPorto. The correlation between the distributions is (in general) very high. And the exceptions go to the concelhos with more investment in R&D or high tech industries (to be analysed in future works); or with Universities or another higher education facilities.

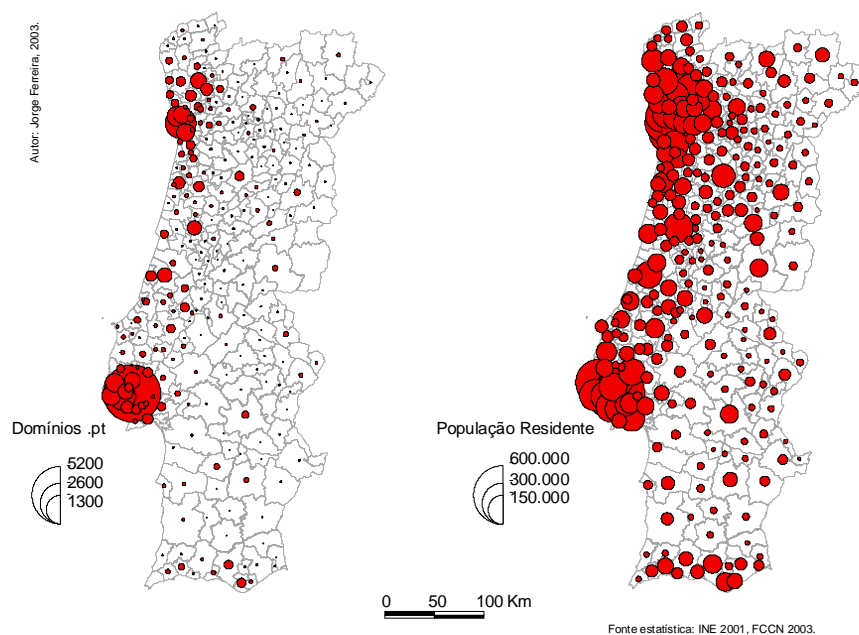


Fig. 6 – Domains and population distribution in the ‘concelhos’ of Portugal, 2003, 2001.

The next step was a brief analysis of the 48 Portuguese cities with more than 25.000 habitants according to the last census of 2001. The only 3 cities with values above 6 domains were Lisbon, Maia and Leiria. Values above 6 are considered a good reference value, indicating high TLD densities. Between 6 and 4 domains there were 5 Portuguese cities: Porto, Matosinhos, Vila Nova de Famalicão and Aveiro. But considering the medium value of the 28 Portuguese regions (1,17 domains/1000Hab.), this cities have a good overall performance in content production. Between 4 and 3 domains, another 4 cities: Guimarães, Figueira da Foz, Braga and Faro. So, at the end, 37 from the 48 studied cities had values below 3 domains per 1000 habitants, which is in fact, a very low value.

From the 20 cities with more than 2 domains per 1000 habitants, 15 are located in the littoral. The interior concelhos with higher values are the ones with Universities. The fact that the Portuguese territory doesn't have medium size cities reflects itself on the small number of TLDs in the most interior regions of Portugal.

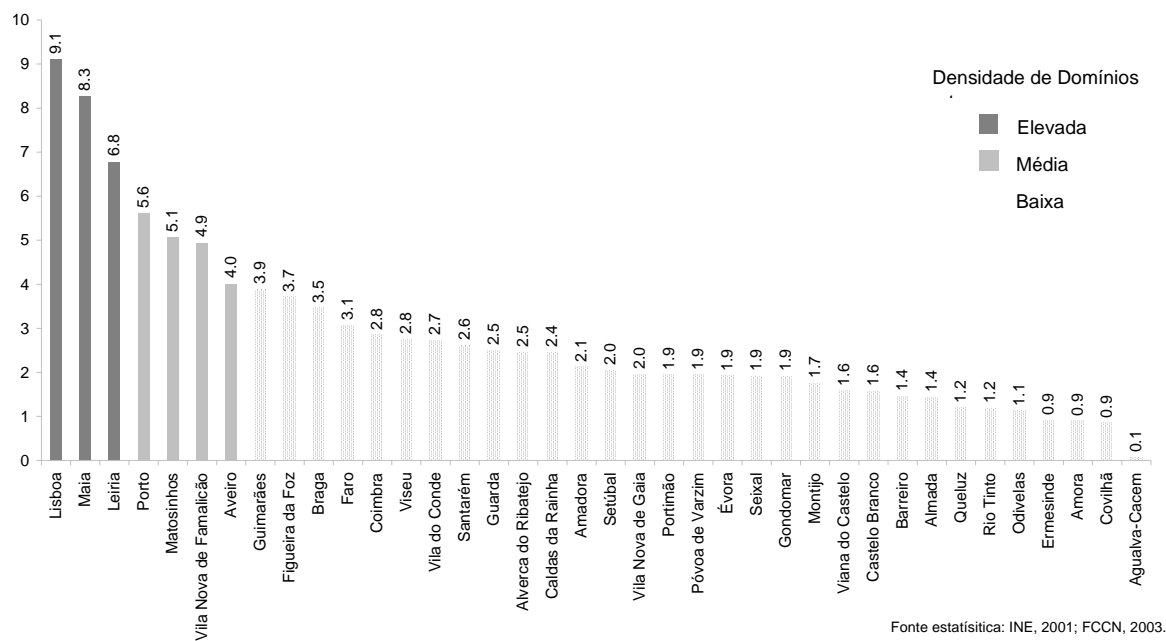


Fig. 7 – TLDs in the cities (with more than 25.000 habitants)

*Internet* is obviously related with a country or region production capacity. So, the next step was comparing the number of domains with GDP. The last numbers of GDP dated from 2001. The results were once more very interesting. Amongst the ten regions with more registered domains, eight were also amongst the ten with higher values of GDP. From the five regions with lower values in domains and in GDP, three were coincident. Once more Lisbon, OPorto and Setúbal Península presented the higher values and Serra da Estrela e Cova da Beira regions were at the bottom (Fig. 8). Once again we calculate the correlation between domains and GDP for all the regions and for an interval of confidence of 99%, the value was 0,991.

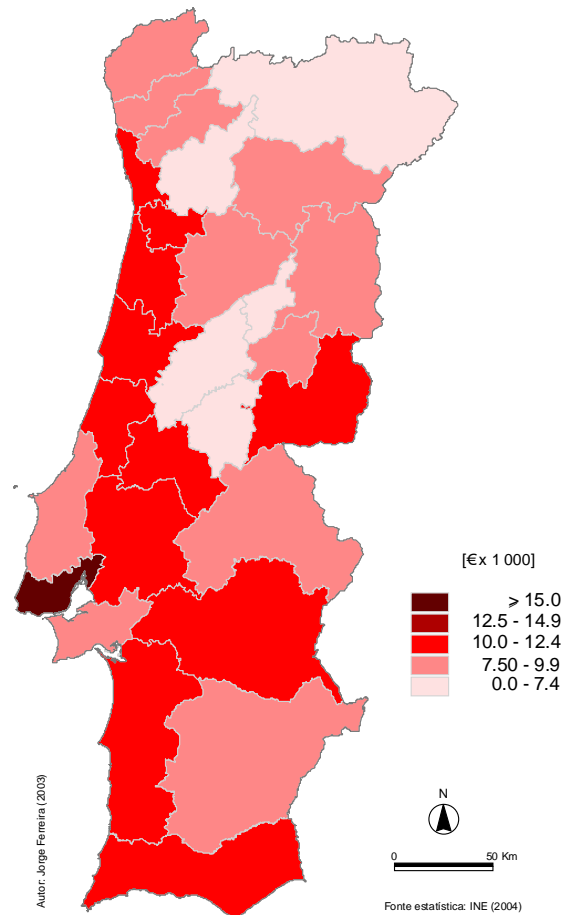


Fig. 8 – Distribution of GDP, 2001.

Indicador per Capita (IpC) is an indicator that is used by the Statistics Portuguese Institute, to evaluate people's buying power. Once again, the list of the ten regions with more domains was compared with the list of the ten regions with an higher IpC value. The result was clear; seven regions were coincident in the two lists. In the table with the five lower values, two were coincident (Fig 9). The correlation analysis value was 0,799. The IpC indicator doesn't reflect regional development or economic productivity, but at the end shows the welfare of populations and represents in a certain way the quality of life.

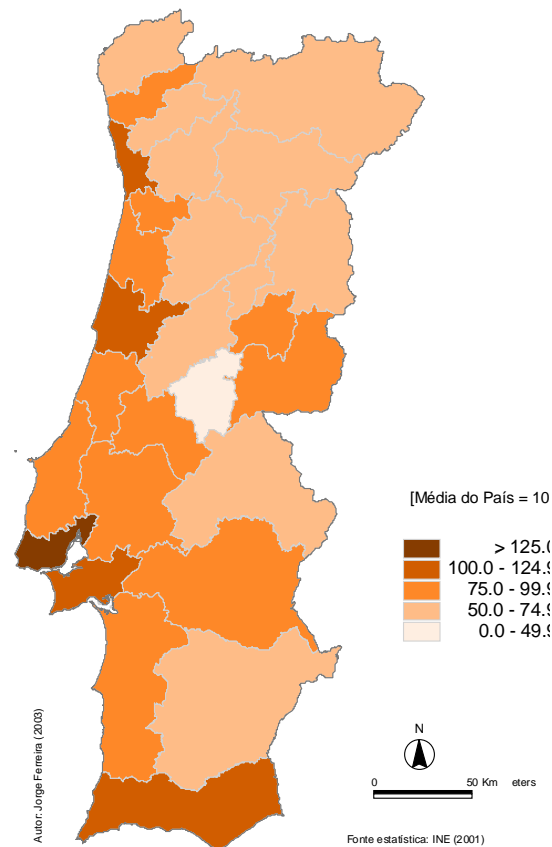


Fig. 9 – Distribution of IpC, 2001.

## Conclusions

Innovation is an essential element to economic growth and social wellbeing. Access to innovation is as important as access to education. Innovation and knowledge dissemination are considered to be elements of competitive advantage in regional development. Information technologies could be a crucial element to launch regions in the global market.

After analysing the three variables - population, GDP and IpC - confronting them with the geographical Top Level Domains dissemination in Portuguese territory, it's easy to answer the questions that we've made in the beginning. One of the most significant elements in the territorial dissemination of domains seems to be population. In fact,

*Internet* is where its users are. In Portugal, the most populated regions have more registered domains and *Internet* it's clearly an urban phenomenon. The Lisbon and Oporto Metropolitan Areas are clearly ahead and the difference between regions with higher and lower values is huge.

It seems that *Internet* reflects an economical and social regional dynamic. But, *Internet* is also an element that reinforces economic and social dynamics, especially when related to the new information and telecommunication sector. In different regions of the globe there are some case studies where *Internet* seems to induce a new information potential, giving to people the necessary tools to leap across the digital divide: Africa and India are only two successful examples.

Technological variables and its territorial behaviour should be analysed to understand the differences between regions. The top level domains number (organisational or geographical) is one of these variables. It's important however to use another indicators and variables besides traditional ones to quantify and qualify the physical space and its asymmetries. Only then we can extract information that continues to be ignored in today's research.

This methodology could be used in other regions and it would be very interesting to compare the dissemination of this phenomenon in other countries.

The wireless revolution, as I said earlier, could be the missing element or the answer to a real *Internet* dissemination but the future remains uncertain.

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