



ESPON project 1.2.3

Identification of Spatially Relevant Aspects of the Information Society

***Final Report
March 2007***

This report represents the final results of a research project conducted within the framework of the ESPON 2000-2006 programme, partly financed through the INTERREG programme.

The partnership behind the ESPON programme consists of the EU Commission and the Member States of the EU25, plus Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

This report does not necessarily reflect the opinion of the members of the Monitoring Committee.

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Foreword

This is the Final Report of ESPON Project 1.2.3 "Identification of Spatially Relevant Aspects of the Information Society". The project started officially on June 27, 2005. The Subsidy contract between ESPON Monitoring Authority and Warsaw University EUROREG (Lead Partner) was signed on 6th October 2005. The partnership agreements between all Project Partners and the Lead Partner were signed before the end of October 2005.

The Information Society is a new phenomenon influencing regional development within Europe. The understanding of IS impacts on spatial processes is crucial when formulating adequate policy recommendations. Thus the project aims at integrated analysis of three IS components: technological, economical and social in order to understand the territorial aspects of the Information Society and assess whether the ICTs and initiatives on the Information Society are making space more coherent and promoting a balanced and sustainable development of the territory of the EU or are exacerbating disparities between regions, both inside and across countries.

The project was expected to define concepts and to find appropriate territorial indicators, typologies and instruments as well as methodologies to identify trends, with special reference to regions, concerning the development of the Information Society and taking into account typologies developed by other ESPON projects (on polycentrism, urban-rural relationship, transport trends and R&D impact).

As ESPON project 1.2.3 belongs to the first strand of the ESPON projects, covering thematic issues of major spatial developments, it holds an important position for the elaboration of the whole programme by contributing to the preparation of common ground for the investigation of IS related themes in relation to the spatial structure in Europe. Among other newly launched projects, ESPON project 1.2.3 can be expected to serve as a strong scientific basis for the Commission's proposed reforms of the Structural Funds post-2007 and for the role of the IS envisaged by the Lisbon Strategy.

To achieve such ambitious objectives, the findings of the project are based on literature analyses, statistical comparisons and empirical studies. They have a more general meaning for a broader context of the European spatial and cohesion policies, as well as for the national and regional development policies in the member states of the EU. The methodology applied in the project fulfils all the requirements referring to

the indicators collected, data analysis, and references to earlier ESPON projects.

The presented Final Report is the result of joint effort of the all project partners under the leadership of Warsaw University, EUROREG.

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The ESPON Programme was launched after the preparation of the European Spatial Development Perspective (ESDP), adopted by the Ministers responsible for Spatial Planning of the EU in May 1999 in Potsdam (Germany) calling for a better-balanced and polycentric development of the European territory. The programme is implemented in the framework of the Community Initiative INTERREG III. Under the overall control of Luxembourg, the EU Member States have elaborated a joint application with the title "The ESPON 2006 Programme – Research on the Spatial Development of an Enlarging European Union". The European Commission adopted the programme on 3 June 2002.

See www.espon.eu for more details.

The views expressed in this report do not necessarily reflect the opinion of the ESPON Monitoring Committee.

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PART ONE: SUMMARY

1. Executive Summary

The operational objective of the ESPON TPG 1.2.3 was to develop a project aiming at:

1. Analysis of the Information Society (IS) from a territorial perspective – identification of Information Society's state and trends, typology of spatial units from the perspective of the level of development of Information Society, relations between traditional regional competitiveness indicators and indicators specific for Information Society;
2. Analysis of the Information Society's territorial aspects at macro-, meso- and micro-levels – effects of the Information Society on spatial development in different types of regions, relocation of economic activities in relation to changing transport patterns.
3. Formulation of policy recommendations for macro-, meso- and micro-levels – identification of possible policy initiatives supporting cohesion in terms of ICT availability and use and in accordance with the most recent understanding of Cohesion Policy (Communication from the Commission, 05.07.2005).

For achieving this goal, both qualitative and quantitative approaches measuring the state of IS in the whole ESPON space were required.

According to the combined concept of the IS adopted in the project, the knowledge-based economy (KBE) is an element of a wider definition of the IS, the latter incorporating different aspects of knowledge and information in economic and social life within three different dimensions. While the KBE itself is based on permanent innovation processes and competitiveness of the knowledge intensive firms and sectors, it is also influenced by and interdependent with the frame of the IS. For instance, human capital influences the performance of the KBE, as human resources are a fundamental production factor in such an economy. Similar relations can be drawn for the other elements 'surrounding' the KBE. In addition, also these dimensions of the surrounding space are interlinked with each other. The example of interrelations between the institutional context and the entrepreneurship illustrates these linkages.

Within the common concept of the IS a threefold differentiation of the IS has been developed, which distinguishes between a technological, an

economic and a social dimension of the IS. The first dimension comprises above all the availability and use of ICT for enterprises and households. The second is related to the development of relevant sectors (ICT-related industries, R&D or knowledge intensive services), the value added created in these sectors and research intensities and their output (e.g. patents). The social dimension, finally, describes the role of education and ICT in the citizens' life and includes aspects such as e-government.

The threefold differentiation of dimensions of the IS as developed in the last chapter allows to specifically structure the indicators which could possibly be used for an analysis of the IS. Nevertheless, the review of data availability has clearly indicated the data constraints, which in turn, affected the methodological opportunities.

These data constraints go far beyond the constraints exerted by the availability of data in the ESPON database or any other EU or other international resources. Most data available for many countries of the ESPON space are, however, not available at NUTS 2 or even NUTS 3 level, but on country level only. In addition, data could often only be found for one indicator and one year, sometimes even at different years across the countries. Based on these findings, national statistical sources were deliberately searched for relevant data. Yet, again it turned out that for hardly any indicator preliminary listed the majority of the six reviewed countries could provide regional data. Furthermore, data measures are often differing slightly which does not allow an easy comparison across countries.

Given these limitations, the role of national (and regional) reviews within the overall methodology becomes quite apparent. This the more, since tentative findings indicate that one year can make quite a big difference with regard to the development of the IS and since country-related effects seem to be prevailing. The latter is particularly due to policies specific to the country and institutional settings e.g. with regard to the provision of ICT infrastructure availability.

Consequently, it had been concluded that the regional analysis of selected countries, which is supplemented with regional in-depth case studies, can achieve much more specific results than the overall ESPON review. Therefore, the TPG followed a stepwise process analysing different kinds of data at different spatial levels. Furthermore, this methodology also distinguished between different logical steps, which were inherent to the project's objective. This twofold-differentiated methodology is depicted in Table 1.

Table 1 Spatial and analytical steps of proposed methodology

| | | Analytical steps | | |
|-----------------------|-----------------------------------------------------|----------------------|-----------------|--------------------|
| | | Descriptive analysis | Impact analysis | Spatial Assessment |
| Spatial levels | Whole ESPON national & regional analysis | | | |
| | National analysis of selected countries | | | |
| | Regional case studies | | | |

The darker the shade of the field in the table, the more promising is the respective combination of spatial and analytical steps. These different perspectives largely occur as of above stressed limits on data availability and comparability for the ESPON territory.

The project’s results will be summarised using the spatial levels and analytical steps of the adopted methodology.

1.1. Descriptive analysis – main findings

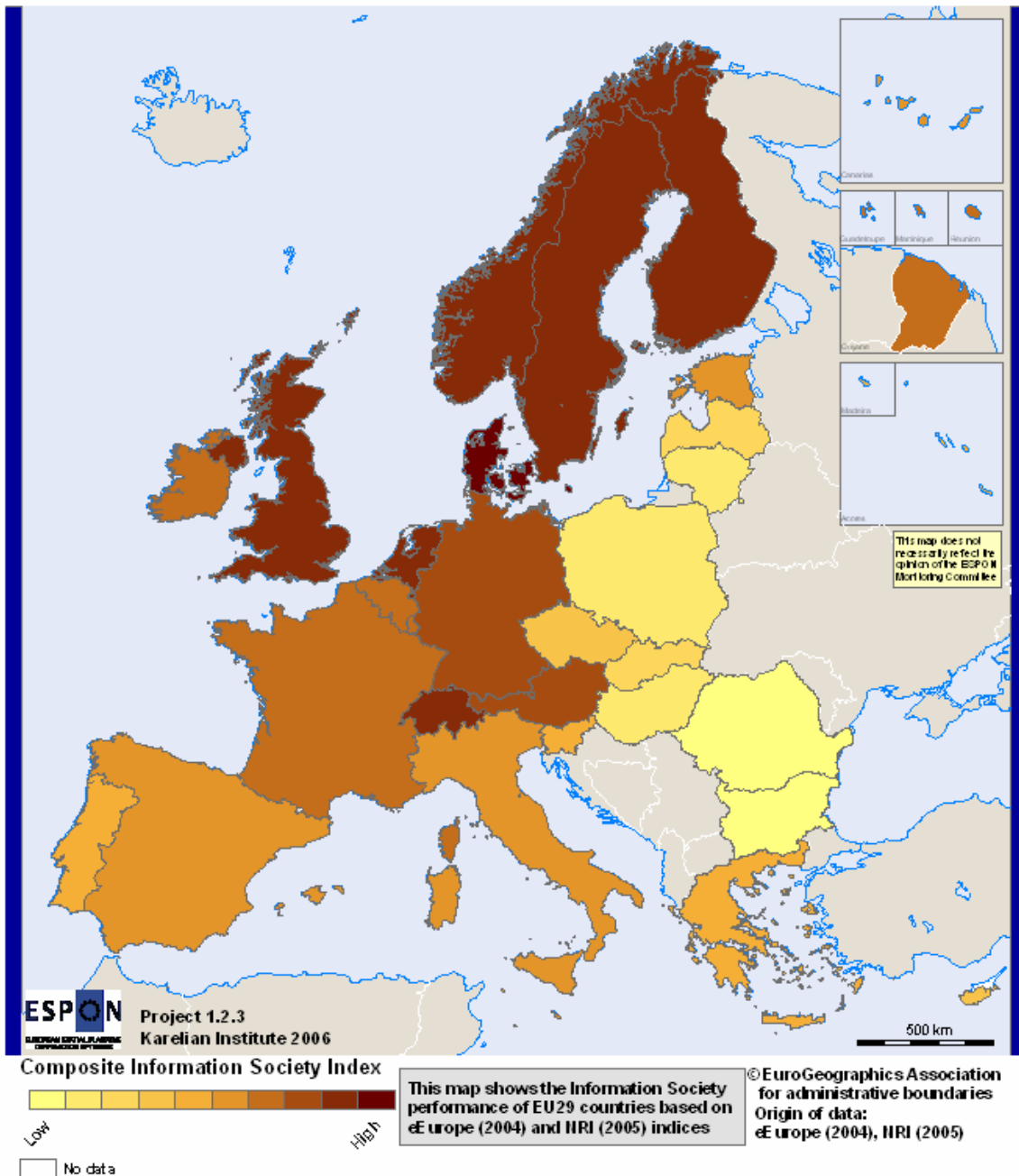
1.1.1. Macro-level analysis

The macro-level analysis of IS in the ESPON space was conducted by using a synthetic IS index. The index was based on the eEurope and NRI indices and it was related to the IS lifecycle concept of OECD (1999)¹. The IS lifecycle assumes three stages of IS development: readiness, intensity and impact. The results of the analysis in section 6.5. clearly show that the ESPON countries are located in different stages of the IS lifecycle, implying significant differences in terms of IS performance in Europe. Not surprisingly, north-south and east-west divides seem to be the most apparent divisions in this respect. Northern European countries, and particularly Nordic countries, seem generally to have a more developed IS compared to southern and eastern Europe. Furthermore,

¹ The eEurope (INSEAD 2004) and NRI (WEforum 2005) are synthetic IS indices of individual indicators and they are commonly used to rank countries by their IS performance.

the new member states as well as Romania and Bulgaria seem to lag behind the general European pattern. However, there are exceptions such as Estonia, which seems to be a more advanced IS in comparison to the Mediterranean member countries and other new member states (Map 1).

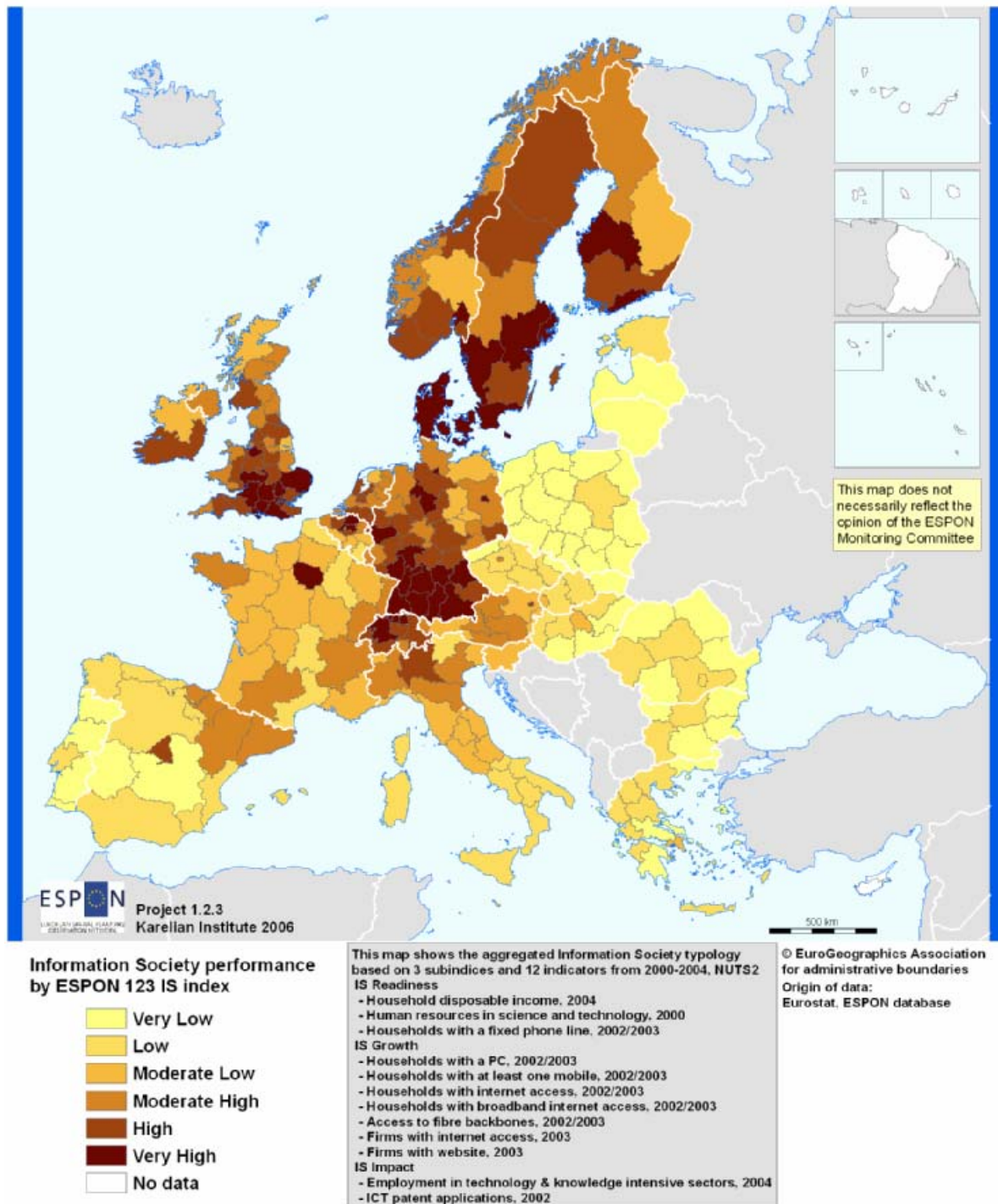
Map 1 The composite index of the IS in Europe based on eEurope (2004) and NRI (2005).



The ESPON countries represent a relatively broad range of the IS lifecycle, and in fact, the countries are located in all the three stages of the lifecycle concept (readiness, intensity and impact). Generally, the

Nordic and northern ESPON countries could be seen to be at the impact stage, whereas, for example, Romania and Bulgaria represent the less developed information societies at the readiness stage.

Map 2 The ESPON 123 IS index. NUTS2, EU25+2+2.



The fact that ESPON countries are located in multiple stages of the IS lifecycle is challenging from the viewpoint of the eEurope monitoring process. The lifecycle framework implies the collection of different types of indicators at different stages of IS. If the countries are at different stages, this would mean that the set of indicators should be tailored to meet the different information requirements at each stage of the IS cycle. This, of course, also has implications for the overall meaning of benchmarking and comparing such different countries with each other.

A synthetic territorial (NUTS2 level) IS index was constructed to reveal a detailed picture of the diversity of ESPON space in terms of the level of development of the Information Society. The index was calculated as a weighed average of 12 background variables (see section 6.5. for details). The components of the constructed synthetic IS index were assigned to three main categories (or subindices) according to the readiness, growth and impact stages of the IS lifecycle framework (Map 2).

The results show that while national differences are significant, there are also considerable intra-country inequalities in IS development in ESPON space. This is reflected by the fact that some territories located in countries with a lower aggregate IS score perform better than some of their counterparts located in countries with higher country scores. For example, Madrid has a higher score than Northern Ireland, and the peripheral regions in Nordic countries are in a worse situation than their country ranking suggests. Overall, but not very surprisingly, the core areas, capital regions and MEGAs, such as NUTS2 regions of Paris, Madrid and London, seem to be in a better position. The remote and peripheral NUTS2 regions, such as northern parts of the UK, southern Italy, and eastern Finland, seem generally to lag behind the national averages. In most countries these characteristics lead to a scattered or a mosaic-like spatial pattern, resulting in high territorial discontinuities (e.g. France, Spain), while in some countries the spatial distribution tend to be more continuous, changing smoothly from the region to its neighbours (e.g. Italy, UK).

The territorial IS index shows that the national averages partly hide behind national variations: in some cases, top regions of low performing countries do better than low regions in high performing IS countries.

Despite the documented problems with the data availability, the index seems to measure what it is supposed to do. The index was compared to the eEurope and NRI indices and the observed highly significant and

positive correlations support the validity of the index as a reliable and valid measure of the IS. However, the data used for the calculation of the index set limits on its use. It is partly based on estimated data and it combines data from several years. Thus, rather than being an accurate measure of the IS in a particular point of time, the index illustrates the relative magnitude of the regional differences among EU countries in the period of 2000 – 2004.

1.1.2. Meso-level analysis

The IS technical dimension

The results of the country case studies show that there are marked disparities between the better developed countries: Finland, Germany and Italy, and the remaining countries. At the same time, among the more developed countries a clear hierarchy can be observed, with Finland unquestionably in the lead, followed by Germany and Italy, which could be a consequence of the differences in the adaptability of these countries or the way the data transmission market is organised (significance of the state monopoly). At the same time, the level of IS development in Greece was practically the same as that in the three new Member States (Czech Republic, Poland and Hungary). The national surveys also corroborate the thesis that, as a rule, the differences in the accessibility of modern technological developments are reduced with time.

The analyses carried out by the research teams point to a number of factors that foster disparities within the surveyed countries. The first such reason was the degree of polycentricity of a given national settlement system. As a rule, the more monocentric the settlement structure, especially the dominance of the capital city over the national system (Greece - Athens, Hungary – Budapest), the greater differences could be observed. Another factor, which was definitely not conducive to the development of technical infrastructure, was the scattered settlement network and low population density, particularly in mountainous areas (Italy, Greece). The third important factor was the diffusion period for new technological developments: the longer a given technology was available on the market the lesser the disparities between the regions. This was also related to the prices of new technological solutions, which, as a rule, fell with time (which was mainly visible in the countries with a low purchasing power in the household sector). Fourthly, the need to meet the challenges posed by the market was a reason for smaller disparities in the enterprise sector than in the household sector. The last, but not the least, important factor included cultural differences and the

related adaptation barriers, as a result of which the development of new technologies was slower in traditionally rural areas (which was especially visible in Poland).

The IS economic dimension

In all the surveyed countries (except Poland), increased outlays on ICT can be observed, as a result of different forms of combining public and private expenditures. Unlike Poland, where both R&D outlays and employment rates are falling (with the outlays expressed as a percentage of GDP being nearly four times lower than the EU average), these are on the increase in the remaining countries.

It is generally confirmed that IS development is correlated with the overall development level, although in some cases the penetration level of infrastructure (which determines ICT accessibility) remains relatively independent (which can be a result of extensive public investment in less developed areas). However, the question of the direction of this correlation remains open: the case of Finland shows that IS development can be the driving force in fostering development, and not only a correlate of an overall development level.

In territorial terms, most of the indicators in each of the surveyed countries show manifest disparities in the level of IS development, although in the better developed countries these differences have a different qualitative aspect (for example in Germany they mainly include the penetration rate of broadband connections, and consequently the possibilities for new applications or a new scale of applications in business). In all the countries, the territorial differences fall into a similar pattern (though not necessarily of a similar intensity) and are based on the axis dividing agglomerations and rural and peripheral areas. For instance, the degree of concentration of R&D outlays is particularly high in the countries with one or few agglomerations (Hungary, Finland, Czech Republic), and much lower (yet visible) in such countries as Germany, Poland or Italy.

The social dimension

The surveyed countries show considerable disparities in terms of IS development and use of ICT applications by the society at large. The highest such levels are found in Finland and Germany, where the accessibility and availability of on-line services in such spheres as administration, training, education, banking services or purchases are relatively the highest. But even in those countries the e-signature,

apparently expected to revolutionise relations between citizens and public institutions, is not very popular. In the remaining countries, the scale of ICT applications is growing steadily, although at different speeds in different locations, with particularly low growth dynamics observed in Poland and Greece.

The collected data indicate that a qualitative change was more and more distinctly visible in the last few years. While, until quite recently, infrastructure and supply of services were the factors determining both the availability and use of web-based services, currently in the countries which are the most advanced in terms of IS development (including high infrastructure capacity), cultural and psychological factors are increasingly gaining in importance and can restrict the actual use of the available services. This phenomenon is particularly well illustrated by the analyses from Finland, where a considerable share of the society – having the choice – instead of handling their official matters on-line, prefer to do it in the office, on a face-to-face basis, or by telephone. An important conclusion can be drawn from this for the less technologically advanced countries: the expansion of infrastructure is a necessary but insufficient condition for building an open Information Society. Promoting IS, acquainting school students with new technologies and possibilities of their applications in the economy and in everyday life should be a no less important component of IS development programmes than technical matters.

1.1.3. Micro-level analysis

Households

The regions covered by the research can be divided into those where the level of provision of households with computers (including those with Internet access) is higher than the country's average (Italy, Germany, Finland, Hungary), and those where it is similar to the national average (Poland, Greece, Czech Republic). At the same time, distinct intra-regional disparities could be observed between towns and rural areas, mainly those peripherally located. This was primarily the case in the metropolitan Hungarian region, while in the Finnish case study region the differences in both equipment and access were not as distinct and were mainly related to the use of the latest technical developments. This clearly shows the direction that the diffusion of innovation is most likely to take. The in-depth surveys conducted in the Finnish region have demonstrated that the factors that determine these disparities largely result from the socio-economic structure of the population. New technologies are most frequently used by young professionals with

tertiary education and higher than average incomes. On the other hand, it can be observed that the lower degree of ICT use among the rural population can to some extent stem from a lower number of potential applications.

Enterprises

The main similarities between the individual countries include:

- the scope of content of the Internet websites of enterprises did not show any systematic differences between the individual countries (for instance, in none of the regions did the share of websites, where orders could be paid for, exceeded 10%);
- the intensity of electronic contacts with public administration was similar in most cases (as a rule more than 60% of the enterprises made use of this form of communication);
- the Internet did not have much influence on the spatial linkages of enterprises as it mainly affected the form and nature, and not the scope of their business contacts;
- in all regions covered by the research, regardless of the country they were located in, the key element of the competitiveness strategy of the businesses was the high quality of the offered products and services.

The basic differences could be described as follows:

- running a dedicated website was less frequent in the less developed regions, such as the Polish or Greek regions (only about 50% of enterprises in each), while in the remaining ones the corporate website was commonplace, just as the corporate e-mail address;
- a majority of the enterprises made use of Internet banking (about 80% of companies), with the exception of the Greek region with the lowest share of as little as 40%;
- the percentage of enterprises involved in R&D work ranged from 5% in the Polish region and 10% in the Greek region to over 80% in the Finnish region and about 80% in the Italian region, which was visible in substantial differences where new or modernised products were launched;
- the spatial linkages of enterprises were considerably varied (for instance, the highest level of labour market internationalisation could be observed in the Italian and Finnish regions, the Polish and

Czech regions attracted the most inward capital, and the weakest innovative potential of the Greek region was the reason why the local enterprises usually sought information about innovations abroad, while in the German region the intra-regional linkages were definitely the strongest in this respect);

- in better developed regions (Finland, Germany, Italy) innovation and technological advancement of products were the more important elements of the competitiveness strategy than price of the offered products (we may therefore talk about Porter's "competitive advantage"), while in the less developed regions, mainly in Poland and the Czech Republic, the price still remained a substantial factor of competitiveness (called by Porter "comparative advantage").

The analysis of the spatial distribution of the enterprises using ICT shows mainly the differences between the major city of the region and the remaining areas (such differences are usually more pronounced in the less developed case study regions: Czech, Greek and Polish, and the metropolitan Hungarian region).

Public administration- analysis of administration offices' websites in the region

Among the surveyed regions two groups can be distinguished:

- regions situated in better developed countries, where running a website by the local government units is a standard practice (Tampere - 100% units, Tuttlingen - 91%);
- regions located in countries with lower development indicators, where only some governments maintain their websites (South Moravia - 50%, Podlaskie - 73%). In addition to that, internal disparities can be observed in most of the analysed cases. For example, in the Podlaskie voivodship the share of the gminas (municipalities) with their own website is higher in cities and urban poviats and definitely lower in typically rural gminas. In Central Hungary digital gaps exist in the neighbourhood of the metropolis, while in South Moravia small regional units with low populations operate www pages definitely less frequently than large regions.

The functionality of the website of a given local government depends, on the one hand, on supply factors such as the scope of information, the validity of its content and interactivity of the website, and on the other hand on demand factors related to the technical capability of households

and their views on using modern ICT in different areas of life. There are differences in the scope of information published on the websites of the local governments both within and between the analysed regions. In terms of factors determining website functionality, the surveyed regions can be divided into two categories.

In the first group of regions, website functionality is limited both by demand and supply factors, while the latter, related to technical capability, seem to play a greater role. For instance, in the Podlaskie voivodship the scope of information placed on the local governments' websites is usually limited to 4-7 categories, such as news or tourist and cultural information (found in 65-85% of the analysed cases). The least present is information about the European Union and its assistance funds, GIS information, as well as labour market and citizen's information. The weaknesses of such websites include their low level of interactivity and the limited scope of on-line services for citizens. Despite the sufficient technical capability and willingness to use e-administration tools of some of the Podlaskie residents, this can be done on a limited scale only.

In the second group, while no objections can be voiced as to the spectrum of information and website interactivity, the first and foremost problem is the limited demand for the services offered on-line. For example, in the Tampere region, where all the local administration offices have websites offering tools for an interactive communication between the citizens and office, and the Internet services offered by the local governments are the most frequently visited public websites in Finland, only as few as 20% of the region's inhabitants declare that they often use such services.

ICT application in the public administration

The empirical research indicates that the use of ICT in local and regional government units is perceived as a necessary aspect of administrative performance. The impact of ICT application on improving the quality of work and streamlining communication within the offices is emphasized (e.g. Tuttlingen, Podlaskie). Some negative aspects are recognized by the administrative officers in the Tuttlingen region, most of all the danger of getting overflowed by e-mails and information. Therefore, a strong focus on priorities and quick decision making is necessary.

A serious problem in ICT application in local and regional administration offices in the case study regions in Poland, the Czech Republic and Greece has been the lack of qualified personnel and, more importantly,

an unwillingness of the staff to improve qualifications. New ICT applications that bring into effect the transparency of actions and decision making processes are resented by some public officers. On the one hand, they want to avoid the need to acquire new skills and to break existing routine, and on the other hand they fear changes that would strengthen a system monitoring their performance.

The ICT development in local and regional government units is also impeded by legislative factors such as inadequacy of legal provisions (South Moravia) or tardiness in adopting relevant secondary legislation (Podlaskie Voivodship). Another issue pointed out by the respondents in the Polish region was the need to incur costs related to the introduction of the e-signature, stipulated by law.

Educational system

The conducted research indicates that only two of the surveyed regions are characterised by a very high level of school provision with ICT (Tampere, Tuttlingen). In the majority of the remaining regions, the use of ICT in the education sector is not as widespread, being, as a rule, accompanied by strong intra-regional disparities. For instance, there are more than tenfold differences between the gminas of the Podlaskie voivodship regarding the provision of schools with computers. In very general terms, it can be said that areas with a low population density and a scattered settlement network (mainly rural areas) are less computerised than larger cities and more densely populated rural areas with a well-developed settlement network. Similar differences between urban and rural areas could be observed in the Greek region (Dytiki Makedonia). In the Central Hungary region, the disparities between Budapest and the surrounding region are the more pronounced the more advanced equipment is taken into account (for instance, only schools in Budapest are equipped with notebooks, laser printers or Pentium-4 powered PCs). At the same time, a lower standard of provision can be observed in the municipalities located in the vicinity of large cities (such as Białystok – the seat of the Podlaskie voivodship), which is probably due to large-scale commuting to schools in larger urban areas.

Problems related to the furnishing of schools with new technologies vary depending on the rate of ICT penetration. In areas with a lower level of provision, the usual difficulties include an insufficient number of computers to actual educational need, lack of Internet access and too little training for teachers (e.g. Podlaskie voivodship, some parts of Tuttlingen).

On the other hand, in the regions with longer traditions of ICT application in schools and better ICT-related indicators, the basic problems include the replacement of used, obsolete, equipment that no longer serves its function (Dytiki Makedonia, Tampere). Another problem raised by the respondents is the need to prevent uncontrolled use of the plethora of information available on the Internet, which is often outdated or inappropriate, by pupils (Tuttligen).

Depending on the region, the role of the ministry of education and significance of the national education policy are emphasized among factors stimulating the use of ICT in the didactic process (Podlaskie, Dytiki Makedonia) or, alternatively, the role of the regional policy is stressed (Tuttligen). In addition, the level of provision in a given school mainly depends on the personality traits and involvement of the principal, who must act as a manager and seek funds for ICT development purposes (e.g. use of the school's own funds and EU funds in some schools of the Podlaskie voivodship). Computer-assisted teaching depends, on the one hand, on the level of education and ingeniousness of the teacher (South Moravia region, Podlaskie), and on the other, on technical capability (using the computer room for the teaching of other subjects than IT) and costs of legal software for teaching individual subjects, which in many cases represent a considerable burden for schools (Podlaskie, Dytiki Makedonia).

The main factor hindering the use of ICT in the teaching process is an uneven level of provision with computers and Internet access in households, particularly in rural areas (South Moravia, Podlaskie). The reasons underpinning such disparities are not only economic, relating to the low income levels of the population. Social reasons, connected with the mentality of certain local communities that prioritise other needs than new technologies (e.g. the former state farms areas in the Podlaskie region), can also play an important if not decisive role.

1.2. Impact analysis – main findings

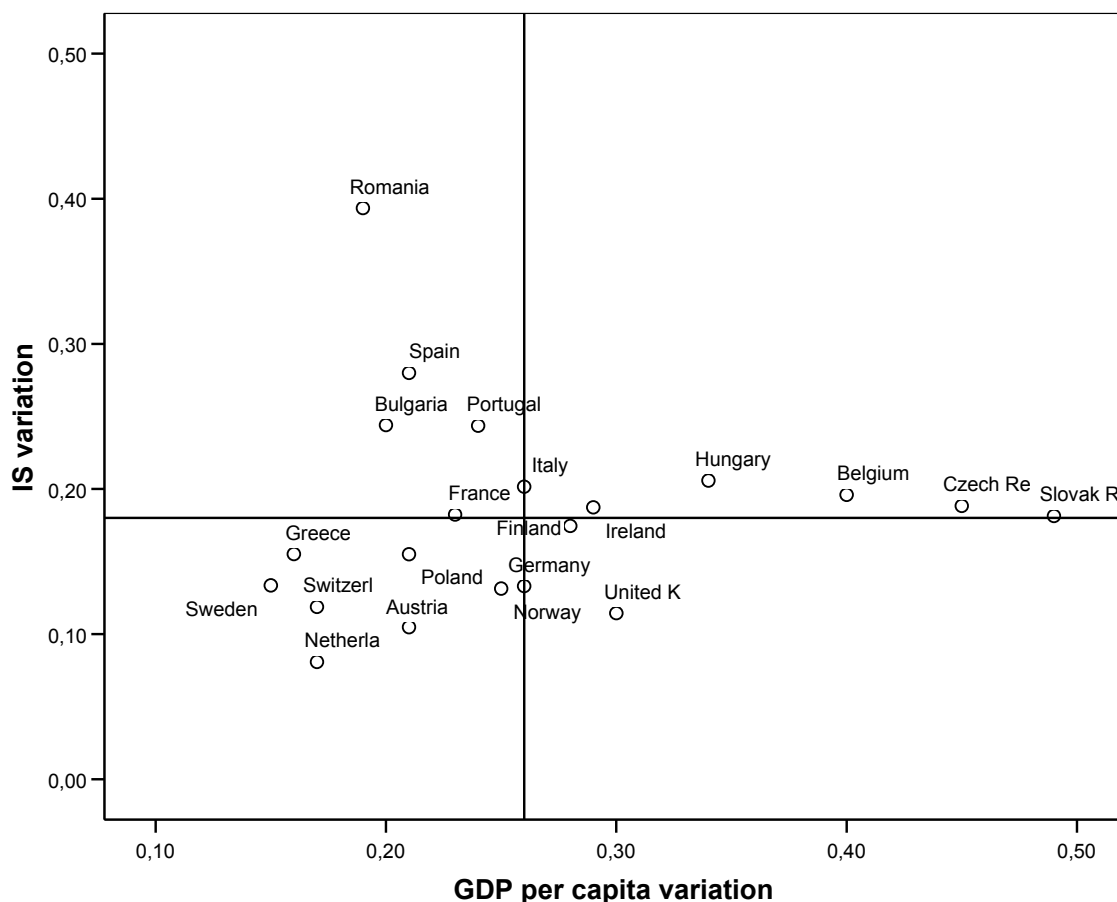
1.2.1. Macro-level analysis

The results for the 21 European countries² show that in general, at least at NUTS2 level, the territorial differences in terms of IS performance do exist, and, although less strongly pronounced than territorial differences regarding the economic performance (GDP per capita), partly follow a

² Because of only one data point (NUTS2 region), the variation measure was not calculated for CY, DE, EE, LT, LU, LV, MT and SI.

similar pattern. The variation of IS within the nations was found to be only weakly, if at all, interrelated with their regional variation in GDP per capita: the less GDP variation in a country, the less the variation of IS. This pattern does not support the view that the EU (economic) cohesion policies may also lead to territorially balanced information societies (Figure 1).

Figure 1 The relationship between regional (NUTS2) variations in GDP per capita (x-axis) and variation in IS performance (y-axis).



There are, however, a few minor exceptions and one major exception to the overall pattern. Firstly, the United Kingdom seems to have a relatively small IS variation despite a large GDP per capita variation. Secondly, Bulgaria, Portugal, Spain and especially Romania, seem to be countries where differences in IS between NUTS2 regions are large despite their relatively small regional differences in GDP per capita. The reasons behind these exceptional cases are, of course, beyond the scope of this research.

1.2.2.Meso-level analysis

At the country level, correlations of IS indicators with economic performance in regions are more or less evident, but can vary for particular countries and indicators. Taking into consideration Internet use at home (households with Internet access) and level of GDP per capita, positive correlation is relatively strong in Germany, Poland and Hungary but not in the case of Greece and the Czech Republic. In general metropolitan areas present better performance both of economic and IS indicators. For instance, in Hungary correlation between GDP per capita and proportion of households with more than one computer while including Budapest region is quite strong ($r^2 = 0,5019$), but without Budapest there is no significant relation ($r^2 = 0,1582$) – in this case correlations between regional indicators strongly depend on the delimitation of the region.

1.2.3.Micro-level analysis

Factors enhancing IS

There are a number of factors affecting the development of the Information Society. The major ones include those related to the expansion of a relevant information infrastructure, cost-effectiveness of ICT application, the attitudes of citizens, entrepreneurs, officials and policy makers, the existence of programmes or measures relating to this sphere and their planned implementation.

As a rule, the surveyed regions have developed an infrastructure which allows using ICT regardless of the actual place of residence. Some differences can be observed in the access to higher capacity connections because their construction is not economically effective in sparsely populated areas - a factor which can potentially foster concentration of business activity in cities (this is especially visible in the Polish, Czech and Hungarian regions).

The development of ICT application in enterprises largely depends on the nature of the business sector in a given area. The region's specialisation in branches that are characterised by a higher level of technological advancement (Finland, Germany) fosters the dissemination of ICT. Furthermore, a greater intensity of business interactions, typical of metropolitan areas (Italy, Hungary) encourages companies to develop such technologies to enhance exchange of information and improve local contacts, which could be later translated into changes in the spatial organisation of their operations. On the other hand, an excessive sectoral

diversification (Poland, Greece) and uneven distribution of enterprises in space can lead to a less intensive use of these technologies and in many cases negatively affect the scope of initiated innovative activity.

The regional communities in the surveyed regions are strongly differentiated in terms of their ability to absorb new technologies. Major mental barriers exist, particularly in the less developed, agricultural regions, which hinder the application of ICT. Another factor impeding their development in such areas is the smaller scope of potential applications. Generally speaking, the factors conducive to the absorption of state-of-the-art technological developments include being young, good education and high incomes. These factors pose a special challenge for educational systems, which should aim to equalise the opportunities of children and young people in this sphere.

The level of school provision with ICTs is a fundamental prerequisite for the development of an Information Society. In the contemporary world, lack of computer literacy is a form of illiteracy. An equal distribution of ICT provision at schools is a necessary condition for equalising the 'start' conditions for people who come from smaller and peripheral locations. Importantly, the awareness of the need to make use of ICT should be developed at the level of elementary education, and schools should be able to keep up with the developments in information and communication technology. The conducted surveys confirm that there is no retreat from using ICT as it is both a great aid in the teaching process and a tool enhancing the administration and running of schools (e.g. using ICT in the recruitment process to secondary schools in Poland).

So far, the activities of public authorities aimed at popularising the e-signature have not been particularly effective; only a small percentage of companies use this form of communication, even in the most technologically advanced regions such as Tampere in Finland. The factor responsible for limited popularity of this invention is the unfavourable ratio between the expenditure (understood not only as the charges involved, but also as the need to introduce time-consuming organisational changes and implement the required safeguards) and the outcome (the still limited range of applications).

Generally speaking, IS development in the private sector is based on economic effectiveness and therefore no initiatives launched by public authorities can be indicated which might significantly speed up the dissemination of ICT.

1.3. Spatial assessment – main findings

1.3.1. Macro-level analysis

The results of the quantitative analyses support the view that the EU (economic) cohesion policies may lead to territorially balanced information societies. In particular, it should be emphasised that the better coverage of the European space with ICT infrastructure, as well as provision of Internet connections priced according to the purchasing power of the population should lead to increase of Internet use, also among poorer strata of the population, the business sector, as well as public administration and educational establishments in relatively less favoured countries and regions.

1.3.2. Meso-level analysis

Comparison of the national case studies' results shows that, despite the IS-related initiatives at the Community level and the availability of funds to the less developed countries and regions for at least some IS development projects, countries tend to adopt individual approaches in dealing with this issue.

In common with each other, all the national case studies prioritise IS development in their strategic documents. However, examined more critically it is clear that such documents contain more broad declaration than concrete provision for implementation. This is partly due to the lack of awareness of the significance and the opportunities opened up by modern ICT and R&D, and partly due to a relatively low level of development and perception of the problem in individual countries. It has to be admitted though that these two factors are interrelated.

This can clearly be seen in the relationship between IS and regional and spatial development. While there are regional differences in IS development between the cases studied, these regional differences do not reflect policy initiatives undertaken so far. The roles of regions in IS development can also differ. In most of the cases studied, the regions do not play any important or active role, probably for more reasons than just financial considerations, and depend to a great extent on central-level programmes and funds. In this respect, of the cases studied, the situation in Germany is more favourable because of its federated state structure, but even there the gap between the East and the West can be observed (though at a higher level in terms of quality).

The findings from the analysis indicate that the main obstacles to IS development so far have been supply-sided (infrastructure, prices), but

the demand-side factors, such as motivation and skills, are gaining in importance. They also include the willingness and ability to participate in complex cooperation networks, which are necessary conditions for any actions in the sphere aimed to ensure the intended success in an increasingly globalised world.

In broader terms, it should be observed that the situation concerning IS development is yet further tangible evidence of difficulties which are encountered in the process of understanding, disseminating and translating into development policy terms the new paradigm associated with knowledge-based economy.

1.3.3. Micro-level analysis

IS influence on spatial behavior

The development and application of ICT affects many spheres of life and exerts an influence on enterprises, households and public authorities alike, which can in effect lead to changes in regional social and economic structures.

However, on the basis of the collected data, no strong correlations between the application of ICT, innovation, spatial linkages and competitiveness can be unambiguously identified. The use of information and communication technologies does not directly affect the spatial range of linkages of enterprises. When compared to traditional forms of business contacts, web-based contacts are complementing rather than changing the range of impact. Their role is mainly related to seeking information about innovations, although this is rarely followed by the launch of new products or services. Nevertheless, in some cases ICT application has observably led to an increased regional cohesion as the new technologies facilitated the development of companies with peripheral locations (the number of such companies was usually low, but this was offset by the range of applications). In addition, teleworking exerted some influence on the spatial behaviour of households. As this mainly applies to selected specialised services, such a phenomenon was more easily observed in the regions with a higher penetration of these types of services, e.g. Tampere (Finland), Rome (Italy), Tuttlingen (Germany). Similar to the use of Internet contacts vs. traditional forms of communication, teleworking is only complementary in character and does not help to reduce the need for commuting, although it could have some influence on the actual commuting patterns.

At the same time, in all the surveyed regions the availability of public services offered on-line has visibly increased. Web-based tools were also used to streamline communication and enhance organisation between different levels of public administration.

On the basis of the research so far, it is difficult to conclude beyond doubt whether the development of ICT will help significantly increase the level of polycentricity in the regions and enhance their internal cohesion. Owing to the unevenly distributed access to the network, it can be anticipated that developmental opportunities between locations that are hubs of the network (that is, larger cities) will be more equalised. On the other hand, it can be expected that the disparities between cities and rural areas, characterised by a lower level of infrastructure provision, will increase even further. The growing intra-regional disparities will also probably arise from the greater barriers concerning the adaptation of the rural population to new technology, which can impair the competitiveness of measures undertaken in these areas.

Problems described here are especially valid for the second stage in the IS lifecycle. With a more equalized standard of ICT infrastructure, as in the more developed countries, the development of IS can also support cohesion (diminishing distance through intensified communication), as well as support a well balanced polycentric development (see also regional study Tuttlingen, p.26-27).

Role of regional/national policies

The assessment of the regional IS development policy is not an easy task. The first barrier is the short implementation period of this policy to date in some of the regions, and the lack of regional data which would allow evaluating the achievement of specific goals in this area (Podlaskie, Dytiki Makedonia).

In some regions, IS regional policy clearly plays a secondary role in the development of the Information Society. For instance, the motor for change in the Tuttlingen region is the external pressure to introduce ICT-related changes, whereas in the Podlaskie voivodship the activities of public authorities currently focus on aligning them to the legal framework regulating IS development. On the other hand, the findings from the Czech region indicate that regional policy is weak and does not have any influence on the development of an Information Society in the region.

The examples from the countries with the highest level of IS development show that regional level activities play a major role not only at the stage of building a technical capacity for ICT application in the

administration, but are also of great importance in popularising knowledge about possible ICT applications and in motivating local communities to make use of ICT.

The Information Society provides many opportunities for improvement, as far as cohesion and polycentricity are concerned. But in order for these opportunities to be efficiently utilised, in precedence to everything else, three major requirements must be met: people must be adequately informed about the possibilities of ICT, specific skills should be acquired and equality and accessibility should be secured. Local and regional policy makers should concentrate their efforts on introducing policies that are aimed at fulfilling these requirements.

Policies and measures to improve cohesion and polycentricity at regional level should include publicity and sensitisation activities (both general and specific in content), educational, vocational and training activities, as well as activities to remove obstacles that disallow access to small or larger groups within the region (e.g. people in remote areas, infrastructure problems, disadvantaged groups etc.).

Role of governance

Governance is commonly regarded as a factor that can stimulate IS development. For the purpose of the analysis, it was assumed that – in line with the definition adopted in ESPON 2.3.2 "Governance" – governance reaches beyond the traditional, general meaning of the word, and denotes a process within defined territorial limits whose aim is "to regulate, to 'govern', to manage territorial dynamics through the pilotage of a multiplicity of actors sharing a common agreed objective" (FIR, p.15). A dynamic IS development is heavily dependent on this meaning of this term.

Information compiled in the countries covered by the research indicates beyond doubt that there exists a demand for much more pro-active governance. It is also pointed out (particularly in Dytiki Makedonia) that this correlation works both ways, as a well developed IS can also considerably affect the quality of governance.

Expectations concerning an increased role of governance are mainly due to the very nature of IS and the resultant need to enhance understanding, communication and coordination of activities between the public sector, the private sector and the local community. In addition to infrastructural investment, this calls for 'soft' measures, addressed to individuals, government institutions and non-governmental organisations (public awareness raising, incentives to cooperation and coordination of activities). It is pointed out that success largely depends on respecting

the autonomy of the decision making of individual actors involved – as shown by the example of the German region.

Regions where a modern institutional system is considered to be the source of success in IS development (Tampere) also see the need for improved governance. As we can see, there exist deficits at the regional level even in successful regions, where there is a need for a greater pressure to develop public-private partnership between the high-tech industries and public research institutions.

Improved governance was also proposed as a solution to the problem encountered in South Moravia, where "lack of mutual communication among relevant partners" was identified, with excessive bureaucracy perceived as the main reason for such a state of affairs.

The example of the Polish region offers many strong arguments in favour of increasing the role of governance to overcome social barriers to IS development, which originate from an insufficient pool of qualifications in the region and an overly conservative attitude to modernisation, including modern technologies. This example shows particularly well the complexity of the measures required (education, promotion, coordination of agricultural extension centres and business advisory centres, R&D establishments, enterprises, etc.).

The findings from the research leave no doubt that a dynamic IS development depends to a great extent on the quality of governance. However, any solutions in this sphere must fully consider the specific character of every region and its surroundings. The experiences of the poorly developed, peripheral EU regions highlight the role of broadly understood education and popularisation of knowledge about ICT and other aspects of an IS. This problem can also be observed in more developed regions, though not at such a basic level.

In view of the above considerations, in order to overcome problems related to the IS development, which were discussed earlier, it is necessary to ensure pro-active governance that is both flexible and responsive to local conditions.

1.4. Policy recommendations

The policy recommendations were formulated with regard to the three levels approach developed with ESPON program.

1.4.1. Policy recommendations – macro level (ESPON space)

The indicators

The first policy recommendation relates to the efforts in enhancing the statistical coverage of information related to different manifestations of the Information Society, in particular through providing comparable indicators not only on technical infrastructure, but also on use of “softer” spheres such as social and economic dimensions related to the use of ICT.

Decomposing the national indicators to the regional level seems to be the most important recommendation in relation to the spatial/regional analysis conducted within the European Union, which could influence the regional policies of the European Commission.

Improving the statistical database related to the IS will also create richer opportunities for constant monitoring of developments within this sphere, which is now difficult, if possible at all (socially on the sub-national levels) due to scarcity of data and their limited comparability.

Cohesion Policy and the Lisbon Strategy

Community Strategic Guidelines of July 5, 2005 have strongly related the future cohesion policy of the EU with the Lisbon Strategy, indicating, that competitiveness and efficiency are to assume greater roles in the policy of the European Commission for 2007-2013.

This aim is directly related to the development of the Information Society within the member states and their regions. The goals of the Lisbon Strategy will be better achieved if:

- ICT infrastructure – mainly the development of broadband access – assumes an important role in financial appropriations for infrastructure development, in particular in less developed member states and less favoured regions.
- greater efforts in ICT infrastructure development is particularly important for the rural, peripheral areas, which become marginalised within the “digital divide”, since the processes of metropolisation of growth lead to faster development of the IS in the core metropolitan centres than in the more remote countryside.
- IS development is regarded as one of the main dimensions of general social education and skill development. Traditional approaches to education and training seem to put more stress on skills and qualifications specific for particular professions and

activities – while computer illiteracy is often one of the strongest barriers for those who need retraining due to industrial restructuring;

- e-administration has achieved a very differentiated level of development among the EU member states. Enhancement of this process by improving common standards seems to be one of the main means of achieving transparency of the decision-making process and procedures and in the relationship of public administration with citizens and businesses.

Spatial perspective

The issues of Information Society building and development should become one of the most important streams during the preparation of the next spatial perspective for the enlarged European Union. In the current ESDP these matters are considered in a limited way, since – as indicated on page 38 of this document – at the moment of publishing this policy statement, we have been at the “advent of the information society” (in fact, the IS was mentioned only twice in the entire document). The seven years that have elapsed since publishing the ESDP is an entire epoch in IS progress, as well as in the very composition of the European Union, and the spatial processes are shaped by the development of ICT much more and on a much wider territorial scale than it had been the case in May 1999, when the ESPD was revealed.

Communication policy

A wider spread of best practices within the IS sphere - both at national and regional levels - should become one of the core activities of the communication policy of the Commission, and especially of the DG Regio (however, the mistakes should also be revealed).

1.4.2. Policy recommendations – meso level (national)

Since the situation with regard to the IS development and its role in overall social and economic processes vary, the policy recommendations formulated for particular countries are strongly nationally-oriented and were presented in the projects’ results. Here the policy recommendations are limited to general issues.

Statistical coverage

As already indicated, all countries of the EU should intensify efforts in order to provide a wider and deeper statistical coverage of the

manifestations (in different aspects: technical, economic and social) of the IS, on both national and regional (NUTS2) levels.

IS development within regional policy

Instead of redistribution strategies, knowledge based ones have emerged in the new regional policy. The most popular measures associated with this policy shift are science parks (co-location), groupings of firms (clustering), and linking knowledge producers with users. These policy measures fit well with the regional development of IS, but are suited best to more advanced regions. Lagging regions should not copy the more advanced ones: a more individually tailored approach is needed. Public interventions tend to include private partnerships, splitting the costs and the risks and creating an environment where local stakeholders may contribute. Similar to the access issues (e.g. universal service obligation) the definition of digital literacy and ICT skills should be an evolving concept, adaptable to different people at different location. Using the place specific externalities and unused potentials of a region, IS development should be embedded in a multisector development concept. Lacking experience of the effectiveness of IS policy measures it is recommended that more room is allowed for experiments and learning through best practices.

MEGA issues

Proximity to major urban centres still matters. The incumbent advantages of major cities on the eve of IS are still decisive: the adoption of ICT begins sooner, the network roll-outs are faster and the interdependent growth stimulus related to ICT is more intense. However, the impact of ICT on basic working and residential functions is relatively little, the existing traditional systems and locations may prevail. The entry and growth prospects of ICT related activities and services follow the spatial structure of regions. MEGAs' IS development tends to be interlinked. The remote areas in the agglomerations still do not have much benefit from the unbound nature of ICT. There is a need to strengthen the existing, but sporadic efforts in the agglomeration of IS development strategies to compete with the urban centres (business, education, innovation). Relatively backward agglomeration areas must not wait for the spillover effects, they have to rely more heavily on national development programmes. MEGAs should not be satisfied with their incumbent position and relative advantage, they should compete on international level. The relatively advanced ICT-related industries and knowledge based sectors in MEGAs may cause bias towards informatics and hide the inherent subregional inequalities and weaknesses

concerning IS. This needs a more coordinated effort in formulating IS specific MEGA strategies.

Usage policy issues

Having access to ICT, usage patterns differ mainly along the lines of age, income and education, which are positively correlated with access. Better educated and ICT savvy younger generations may replace middle-aged groups very early causing, in the medium to longer term, social tensions in ESPON countries. The presence of children in a household is a major factor in access to ICT and home broadband connections. This implies that it is most important to take into account how people use ICT in their everyday life. Relevant content for different social and professional groups of citizens should be identified and created. In this process the connectivity of those people who are supplying their own content may be a catalyst (Local Nets, eInclusion).

1.4.3. Policy recommendations – micro level (regional/local)

The conclusions made in relation to the regional case studies can be generalised for a certain type of regions to a limited extent.

MEGAs in all countries under study – and also in the general statistical framework – are the leaders in developing the Information Society. They are the places where innovations occur and from where they disseminate. Therefore, it can be said that the national policies to a great extent are also the MEGA policies, since if some national-wide processes emerge or regulations are being introduced, the MEGAs will be first to implement them.

However, the regional case studies do allow for the following recommendations:

1) on the supply side:

- provide cheap and general access to broadband, since the ICT infrastructure – mainly the development of broadband access – assumes an important role in financial appropriations for infrastructure development, in particular in less developed member states and less favoured regions;
- accelerate development of ICT infrastructure in less favoured regions, because greater efforts in ICT infrastructure development are particularly important for the rural, peripheral areas, which become marginalised within the “digital divide”.

2) on the demand side:

- introduce ICT techniques into the educational process, make them „part of life“, since the IS development is regarded as one of the main dimensions of general social education and skill development;
- promote e-government and e-administration as a way of everyday life, since the e-administration has achieved a very differentiated level of development among the EU member states.

1.5. Further research issues and data gaps

The most important limitation of the project was lack of comparable data not only at the regional level, but also at the national level, especially in the dynamic perspective. At the same time there is a need to adopt widely broader view of the Information Society. The collected data cannot be any longer limited to the technological definition of the IS but it should integrate all aspects of the IS as in the Webster's original conceptualisation of that phenomenon. It is essential for the assessment and understanding of the IS influence on the societies' development to consider the economic and social aspects of the Information Society development.

More accurate and deeper picture of the IS development among the EU regions could be obtainable only after a considerable effort by the respective services of the national statistical systems of the member states and the EUROSTAT. In particular, a deeper insight into the use of ICT in the following spheres: economy, government and administration, households, education. It is a typical bias of almost all statistical systems which put much greater stress on provision of infrastructure and facilities, and less on their direct use by respective recipients.

It could be also advised to undertake a coordinated research effort in order to collect new data not on the basis of a routine statistical coverage but with the use of surveys based on representative samples on the regional level. This method is very often much cheaper and provided accurate results. These surveys could relate to innovation strategies assumed by companies, and especially the SMEs, social behaviors related to use of ICT, performance of R&D establishments etc. Additional effort could be undertaken in assessing the policies undertaken by national and regional governments in the field, of ICT and innovation development. A comprehensive survey could be performed within the EU on this topic which could result in a deeper knowledge of the role of public administration on national and regional levels in implementing the Lisbon Strategy measures.

The 1.2.3 ESPON Project "*Identification of Spatially Relevant Aspects of the Information Society*" has been the first attempt to include the issues of the Information Society into research conducted in the wide field of spatial development within the enlarged European Union. This Final ESPON Report is to be considered as a starting point for future research. The data limitations were the main obstacle to including more indices within constructed ESPON 1.2.3 IS index, especially in the IS Impact component. Such exercise will help to achieve a more accurate picture of the IS performance in ESPON space and to improve the proposed typology in the future. The Information Society phenomenon is very dynamic, but nowadays the processes related to the IS are the most visible while considering technological aspects. As time goes by though it can be expected that European economies will become similarly saturated with ICT. Thus more and more countries will achieve more matured stages of the IS life cycle: those of intensity and impact. Then more categories (types) of regions distinguished in these two stages will allow to depict more realistic map of the IS regional differences in the ESPON space.

The regional case studies have been carried out in all the seven countries participating in the project, with one case study per country. Several types of regions of special interest to the ESPON 1.2.3 project have been included in the research – MEGAs, FUAs, rural regions and geographically handicapped regions, but the number of regions studied does not allow to formulate detailed conclusions and recommendations for each type of the region mentioned. Thus, in the future research the qualitative analysis should be extended and comprise a more representative number of regions within the given type. At the same time the resources available to the project did not allow to undertake extended qualitative research required to further explore the IS effects in different types of regions according to the proposed typology related to the life cycle of the IS concept adopted for the ESPON 1.2.3 IS index. Such a study will give deeper insight into the spatial processes, which vary with regard to the level of IS activity in the given area. Thus it will be a useful exercise from the political perspective.

2. Scientific Summary

In order to overcome data constraints in the measurement of the state of IS and trends in the ESPON space, as well as IS spatial consequences, different methodological approaches were undertaken on different spatial levels of the analysis.

2.1. Scientific Summary -macro level

Due to the regional data restrictions across the ESPON space, the macro-level analysis was used mainly for the **descriptive and impact analyses** but could only very roughly consider the **spatial assessment**.

The general background of the macro approach was introduced by presenting the aspects of IS indicators relating to the IS lifecycle framework. The lifecycle of IS is seen to range from the stage of readiness and intensity to that of impact. In the first stage only enabling factors are of importance, whereas in the later stages, the availability, use and impact of IS (e.g. technologies) gain prominence.

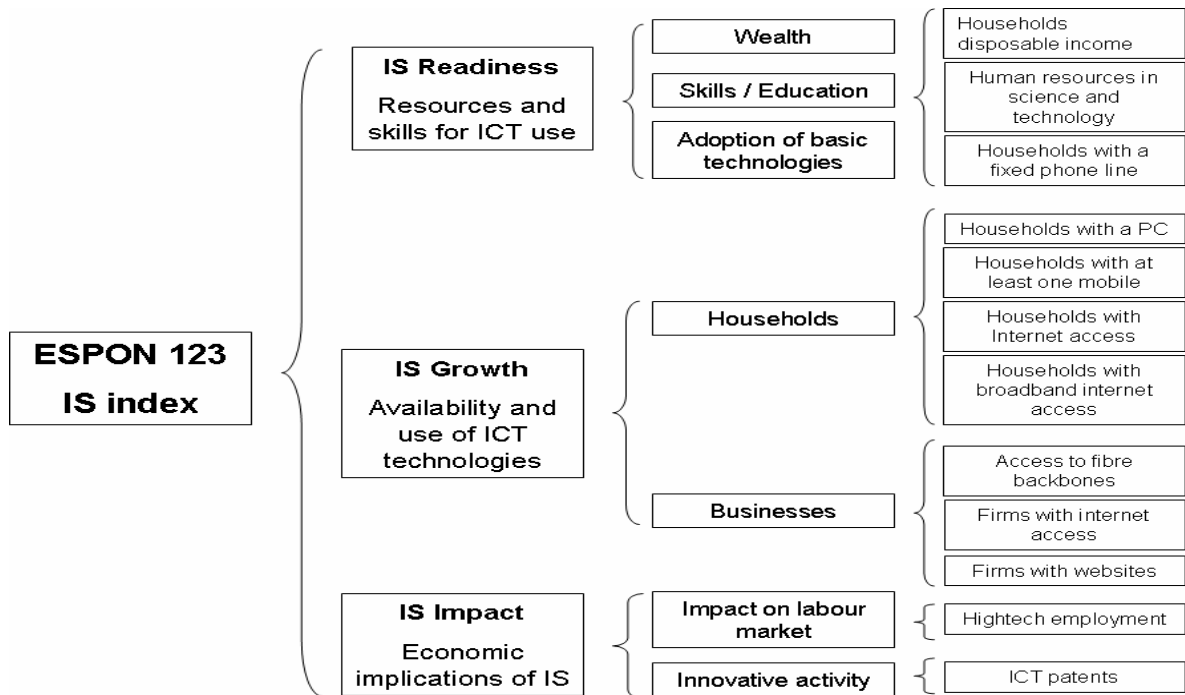
To illustrate the territoriality of IS in Europe **the composite IS index** was used. The index has been compiled using the scores of the ESPON countries for the eEurope index and Networked Readiness. In addition to the original index values, the indices were also presented in a standardized form ranging from 0 to 1, with 0 representing the lowest and 1 the highest level of IS performance³. The differences between the two indices and their averages were presented in a table, on a chart and a map and by using the IS life cycle framework in order to depict some tentative findings on the spatial differentiation in the EU25+2+2 area.

The territorial pattern of IS has been presented in more detail using the **territorial IS index**. Figure 2 presents the components of the constructed synthetic IS index. The index divides into three main categories (or subindices) according to the readiness, growth and impact stages of the IS lifecycle framework. IS readiness is defined as the "resources and skills for ICT use", and thus consists of the following three factors: wealth, skills and education, and adoption of basic technologies. The definition of IS growth is "availability and use of ICT" and it is composed of two factor groups: household and business use of ICT. The impact of IS is defined as "economic implications of IS", and it

³ The rescaling of the indices to the scale from 0 to 1 was done as follows: NRI (original range -3 to 3): $NRI_{rescaled} = (NRI_{original} + 3)/6$; eEurope (original range 1 to 7): $eEurope_{rescaled} = (eEurope_{original} - 1)/6$.

is measured by two factors: impact on labour market and innovative activity.

Figure 2 ESPON 1.2.3 IS index framework.



The defined factors are measured by various indicators, which are available for the NUTS2 regions of the selected 29 European countries. The indicator set reflects the scarce availability of territorial data on IS. Several indicators provided by the ESPON Telecom-project were used in the calculation of the territorial IS index. As this project provided categorized ICT indicators on the scale from 1 to 6, the indicators provided by Eurostat were also standardized to fit the same scale. The average of the indicators in each main category is used as a subindex value, and the average of these subindices is the value of the synthetic index. As the synthetic index is a weighted average of the used indicators⁴, its scale is also from 1 to 6, with 1 representing a low and 6 a high performing IS territory.

On the bases of the NUTS regions results and using the IS lifecycle concept, the six-category typology of IS across the ESPON space was presented:

- Very Low = Low IS readiness territories

⁴ With weights inversely proportional to the number of indicators in the categories.

- Low = High IS readiness territories
- Moderate Low = Low IS growth territories
- Moderate High = High IS growth territories
- High = Low IS impact territories
- Very High = High IS impact territories

The **regional variations** of the constructed composite IS index were analyzed in order to get an insight into the dynamics and trends of the territorialities in IS development. This issue is examined by comparing the coefficients of variation for GDP per capita (in year 2000) with IS performance to test whether the regional differences in IS development decrease with economic convergence. Figure 3 gives a more detailed interpretation of the possible four types of variations.

Figure 3 Types of intra-country variations: variation of IS vs. variation of GDP per capita.

| | | | |
|-------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| Regional variation in Information Society performance | | 3 | 1 |
| | | Low economic – High IS: High intra-country differences in IS performance but low differences in economic performance | High regional differences: Countries with high intra-country differences in economic and IS performance |
| HIGH | | | |
| Regional variation in Information Society performance | | 2 | 4 |
| | | Low regional differences: Countries with low intra-country differences in economic and IS performance | High Economic – Low IS: Low intra-country differences in IS performance but high differences in economic performance |
| LOW | | | |
| | | LOW | HIGH |
| | | Regional variation in GPD/capita | |

2.2. Scientific Summary -meso level

The methodological approach to the meso-level analysis concentrated on national reviews of the IS taking into consideration regional breakdowns of different aspects of the IS.

Due to the time and resources of the project the number of national case studies has been limited to the seven Partners' countries of origin (the Czech Republic, Finland, Germany, Greece, Hungary, Italy, Poland). This

sample of countries is not fully representative for the whole ESPON space, but it covers old member states and new member states of the EU and countries characterised by different level of IS development. Moreover, the Partners' countries of origin have been chosen intentionally in order to obtain high quality information and achieve reliable results of the analysis in the given project framework.

In order to achieve the most comparable results of the case studies the common template was developed by the TPG. According to the template, the first part of the national case studies was devoted to the **description** of the IS state and trends for the regions of the respective countries. This part of the analysis was based on the set of common indicators within the three thematic dimensions of the IS (technical, economic and social). As the results of the survey on data availability showed that it is hardly feasible to base the descriptive part of the country case studies on the set of common and comparable indicators, other relevant and, for the particular country, available indicators were considered as well.

For the **impact analysis** a twofold approach has been chosen. The first approach was a purely quantitative method, which considered the coincidence of various regional technological, economic and social IS aspects with regional levels of the GDP per capita. The second approach used a qualitative methodology aimed at uncovering deeper meaning from the findings, especially as they referred to IS-specific national policy influences within the framework of a country study.

For the **spatial assessment** at the meso-level, the second part of the country case study was of high importance, as it aimed at analysing the policy documents relating to IS development (e.g. strategies for ICT and R&D development, as well as other relevant document). The analysis led to the depiction of the role and the importance of the IS development policy in the given region. Moreover, on the basis of the main IS policy documents, the definitions of the IS phenomenon and the priorities of IS policy as well as the responsibilities relating to the IS policy implementation have been described and compared. The IS policy documents have been checked also in order to identify their regional context (i.e. are there any special aims, instruments, etc. provided for different types of regions: metropolitan areas, big cities, rural and geographically handicapped). Finally, wherever feasible, some examples of the regional IS strategies have been given and described.

2.3. Scientific Summary -micro level

The regional case studies have been carried out in all seven countries participating in the project, with only one case study per country. Due to the project's limitations the initial ambitions of the TPG had to be reduced. The selection of regions and spatial coverage of the case studies had to comply with the project's needs, especially in the situation of quantitative data limitations. Thus different kinds of regions, which apparently participate to different extents and in different ways in IS developments, have been investigated. Several types of regions of special interest to the ESPON 1.2.3 project have been included in the research – MEGAs (Rome, Budapest), FUAs (South Moravia), rural regions (Podlaskie, Tampere, Tuttlingen) and geographically handicapped regions (Dytiki Makedonia). The sample of regions is certainly not representative for the whole ESPON space and the results of the case studies are not fully comparable. Thus, the conclusions on the micro level should be formulated and interpreted cautiously.

The research was based on the regional case studies template and additionally on the business questionnaire and interviews framework in order to achieve comparable results.

From the point of view **descriptive analysis**, the most important outcome of the regional case studies is the description of IS state and trends within the given region in the relation to IS development. In all regions under study but the Italian one (in which only enterprises were investigated) the following four spheres have been examined:

1. **Households.** The spread and use of ICT among households was assessed by collecting existing data - if available - information was sought on private computer ownership and connectivity to Internet.
2. **Public administration.** An assessment of the role of the Internet and Intranet within the offices of public authorities in the studied regions was sought by the following activities: a) interviews with officials of the local governments; b) analyses of the web pages of these governments.
3. **Businesses.** An assessment of the use of the Internet for commercial purposes had been done by two complementary methods, namely: a) interviews with the representatives of selected business organisations, such as the chamber of commerce, business associations etc. b) a survey based on a common questionnaire (Appendix III – **Business questionnaire**) made on a sample of firms. This analysis had been preceded by an analysis of the web pages of the selected firms.

Table 2 Methods adopted in the regional case studies

| Name and type of region | source of information | method | sample | questionnaires returned |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------|
| South Moravia – FUA | random selection from the phone register | the e-mail questionnaires and additional telephone contacts plus several interviews with the representatives of selected companies | 685 | 52 - 7% (the return rate) |
| Tuttlingen – rural (not FUA) | database of businesses obtaining an e-mail address, provided by the Chamber of Commerce | e-mail survey of businesses | 1350 | 82 - 6.07% (the return rate) |
| Dytiki Makedonia – geographically handicapped | random selection with the use of business catalogues | e-mail survey of businesses plus interviews in firms (appointments with the help of local authorities and agencies) | 40 via e-mail, 56 interviews | 4 - via e-mail-1% (the return rate); 50 interviews – 89.3% (the return rate) |
| Tampere –rural | random selection from the phone register | e-mail survey of businesses | 433 | 48 - 11% (the return rate) |
| Central Hungary – MEGA | No field research. The conclusions included in the regional case study were based on the recent existing surveys of firms. | | | |
| Lazio - MEGA | random selection with the use of business catalogues | e-mail survey of businesses | 672 | 22 – 3.2% (the return rate) |
| Podlaskie –rural | random selection from the phone register | e-mail survey of businesses plus interviews in firms | 200 via e-mail, 125 interviews | 2 - via e-mail-1% (the return rate) 74 interviews – 59.2% (the return rate) |

Source: own compilation based on the regional case studies.

Originally the questionnaire had to be sent by e-mail to the firms selected on the basis of their presence in the telephone register in order to get ca. 100 responses. But this common method had to be revised when the field research was started by every Partner Project. It turned out that methods of selecting the research samples and the way research was conducted varied between regions studied. The main reason for that

was the unique character of specific case and different socio-economic circumstances which affected the low probability of getting the desirable number of responses via e-mail (and sometimes made the research impossible to conduct at all). The methods eventually used in specific regions are presented in Table 2.

4. **Educational system.** The spread of ICT in schools and the role of ICT applications in the educational process have been investigated through: a) interviews with the appropriate educational institutions at the regional level and b) through direct visits to the potentially "best" and "worst" schools in the region.

The most important results of the regional case studies for the **impact analysis** were expected to be the relations of IS indicators (with regard to the three IS dimensions) within the given region against the background of a general description of the region and its position in the regional setting of the studied country (e.g.: level of development, economic structure, human capital development).

Regional case studies have been of crucial importance for the purposes of **spatial assessment** at the micro-level. The aim of the regional case studies was to answer the following questions:

- Has the IS development influenced the spatial behaviour of the most important actors in the three sectors: households, public administration and enterprises?
- Have the changes in spatial behaviour influenced the levels of cohesion and polycentricity?
- What kinds of activities were undertaken by regional and local policymakers to improve cohesion and polycentricity with regard to IS in the region (bottom-up approach)?

These questions had to be answered by, for example, consideration of changes in households and in enterprises location in the given region due to the IS development. Since such changes can lead to more even spread of the industry or services and could in this way influence the economic performance of the region and improve its position in comparison to others. These findings could be followed then by consideration of the regional IS policy directions in order to find out, for example, whether the policy interventions are promoting new areas for business or whether they develop some incentives for teleworking.

2.4. Performance indicators

Table 3 shows the information on the number of performance indicators achieved in the 1.2.3 ESPON project.

Table 3 **Number of performance indicators achieved**

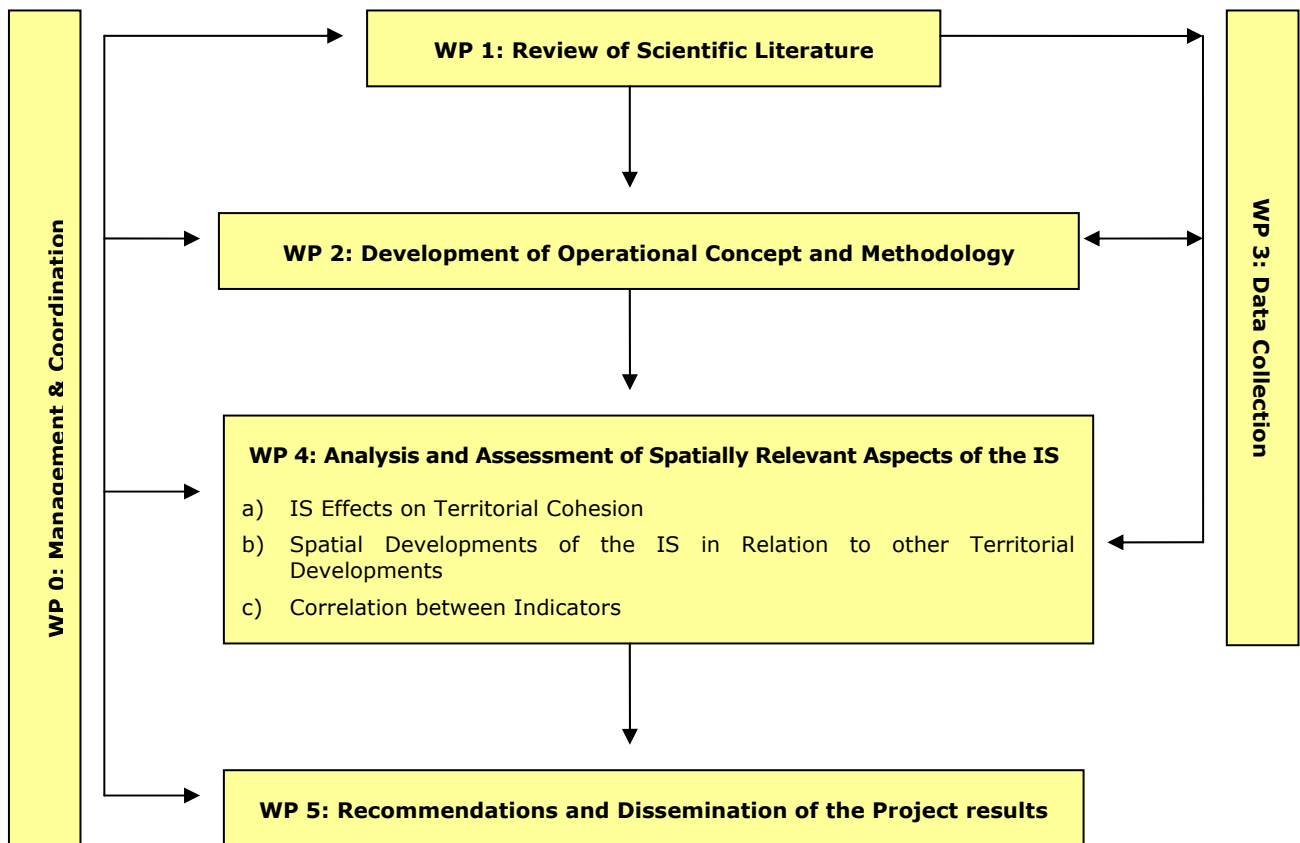
| | |
|------------------------------------------------------------------------------------------------------------------|-------------|
| No of spatial indicators developed: - in total covering - the EU territory - more than the EU territory | 2 2 2 |
| No of spatial indicators applied: - in total covering - the EU territory - more than the EU territory | 2 2 2 |
| No of spatial concepts defined | 1 |
| No of spatial typologies tested | 1 |
| No of EU maps produced | 5 |
| No of ESDP policy options addressed in that field | 5 |

3. Networking and self-evaluation

3.1. Project management and coordination

The Subsidy contract between ESPON Monitoring Authority and Warsaw University EUROREG (Lead Partner) was signed on 6th October 2005. The partnership agreements between all Project Partners and the Lead Partner were signed by the end of October 2005. Due to the relative short time period of ESPON project 1.2.3 (June 2005- May 2006) the TPG faced a tight time schedule, which required strong project management and coordination.

Figure 4 Graphical presentation of the project's components



In order to obtain a clear and streamlined structure of the project, the tasks presented in the Terms of Reference and the award criteria in the restricted call for tender have been grouped into work packages (Figure 4). The clear division of responsibilities between partners as well as contracting and financial issues explained from the very beginning of the projects resulted in the smooth and successful running of the project

with most of the partners (however with the exception of the Italian one).

As research and analysis in the context of work packages were running parallel to each other, a close communication and clear division of responsibilities/tasks was needed. For several working steps this was organised by elaboration of templates and guidelines by the work package responsible (EUROREG/IRS/UJOE). These have served as common bases of analysis conducted by all partners (e.g. template for data collection, template for country case studies, template and guidelines for the regional case studies).

In order to have good cooperation within the TPG and to secure free exchange of opinions, suggestions and concepts, three project meetings were organized. Besides issues related to the project's organization and tasks division financial reporting has also been clarified in order to ensure full understanding of the ESPON CU's requirements.

The representatives of 7 Partners were present only during the first TPG meeting; the Italian Partner was absent during the two last meetings, which resulted in only partial fulfillment of common agreements by this partner.

The kick-off project meeting of ESPON project 1.2.3 was held in September 2005 in Warsaw (Poland). The project's philosophy, content and methodology as well as division of tasks between partners have been discussed, as well as issues relating to the project's organisation, contracting and financial reporting.

The second project meeting of ESPON project 1.2.3 was held in December 2005 in Erkner (Germany). The discussions on the qualitative methodology as well as on case study methodology (at both country and regional levels) were the main points on the agenda. Partners agreed as well on the final selection of the regional case studies. Moreover the outcomes of the data availability and preliminary results of the analysis on macro level (whole ESPON space) were presented and discussed.

The last TPG meeting was organized in Budapest (Hungary) at the beginning of March 2006. The meeting was devoted to presentation and discussion of the results of the national case studies, as well as the preliminary results of desk research on the regional case studies. Most of the TPG discussion was spent on the content and methodology of the regional case studies, as well as on the possible directions for the development of policy recommendations.

The ESPON seminars and Lead Partners meetings also made the opportunity for the TPG members to meet and discuss project related issues among themselves and with other ESPON TPGs. Several partners, including EUROREG, IRS and UJOE attended:

1. the ESPON Lead Partner meeting in Brussels, Belgium (12 October 2005),
2. ESPON Scientific Conference (13-14 October 2005),
3. the ESPON Seminar in Manchester, United Kingdom (7-8 November 2005),
4. the ESPON Seminar in Salzburg, Austria (13-14 March 2006),
5. the Lead Partner meeting in Brussels, Belgium (3 April 2006),
6. the ESPON Seminar in Helsinki, Finland (14-15 November 2006).

3.2. Self evaluation

According to the addendum TPG was obliged to deliver three reports in the time framework of the project. Both interim reports were submitted on time: First Interim Report on 31 October 2005, Second Interim Report on 31 January 2006.

Since the Second Interim Report, the TPG have made significant progress with regard to all project's parts envisaged. The quantitative analyses were done and the second parts of the national case studies and regional case studies were developed by all partners. The case studies' results were compared and the conclusions were elaborated at all three spatial levels and three methodological steps described in the methodological part. Finally, the policy recommendation using the three levels approach was also developed by the TPG.

In order to improve the Final Report and ensure high quality of the results, the feedback given by the ESPON Coordination Unit in response to the FIR and SIR was presented and discussed during last TPG meeting in Budapest. The CU comments were respected and implemented as far as it was possible due to time and financial constraints. Moreover, the Guidance Papers from Matera, Lillehammer and Nijmegen have been used during the work on the Final Report.

The main requirements for the delivery of the Final Report were mentioned in the Terms of Reference as follows:

- An executive summary of the main results of the research undertaken and recommendations for policy development.
- Comprehensive presentation of the state, trends and impacts of the Information Society in relation to a polycentric and balanced development of an enlarged European Union;
- Presentation of access points and concrete ideas for policy responses to the territorial trends at different scales and in different parts of the Union that could improve territorial cohesion;
- Presentation of the developed definitions, territorial indicators, concepts and typologies linked to the Information Society, including maps and data to the ESPON database;
- Presentation of the database and the mapping developed covering as far as possible the EU 25 plus Bulgaria, Rumania, Norway Switzerland and the neighbouring countries;
- Proposal for selection of good practice and positive outcome of integrating ICTs in strategies for territorial development;
- Production of a glossary of technical terms relating to the Information Society and used/produced along with the development of the project;
- Listing of further data requirements and ideas of territorial indicators, concepts and typologies and further developments linked to the database and mapping facilities.

The presented Final Report contains the results of all work packages envisaged in the Project and the above points were respected and implemented.

This final report should be considered as a draft version since a request for clarifications, asking for amendments and improvements might be made by CU, Monitoring Committee and by the ESPON Contact Points.

PART TWO: RESULTS OF THE PROJECT

4. Definition and common concept of the IS

4.1. Review of scientific literature

4.1.1. Definitions of Information Society

While the Internet was first conceptualized in 1974 as a “network of networks”, the building blocks for its exponential growth were not fully in place before 1995 (Leiner et al 1980, p. 65-75). Since then, the world-wide-web has entered into almost all wakes of social, economic and political life of all countries of the globe, and has reached most of the world population.

The technological progress is tremendous since – according to the observations of Manuel Castells (1996) - “*innovation creates innovation*” and information collection, processing and transmitting is in the core of these processes. We have observed a constant process of increase of technological capacities, and it seems that the next step in technological change – integration of several means of coping with information (Internet, telephone, television) has already started.

We are currently living in a transition period that can, notwithstanding all terminological and contextual debates, be called the development of “the Information Society” (Webster, 1995; Castells, 1996; Lacroix, Tremblay, 1997, p. 1-154). Transition – and not full implementation or spread – is due to the fact that great parts of humanity are excluded from the influences of information exchange, and also because the depth of influence of coping with information on societies, economies and politics are unevenly distributed among those, who are not “excluded”, but are – or can be – “connected”.

Issues regarding the development of an Information Society have increasingly begun to attract interest from the civil society point of view, in addition to market needs. Control over one’s own life within the Information Society calls for emphasising an ability to communicate and interact with others using new tools and modes of operation differently from that required in an industrial society (European Commission, 1996).

According to some authors, the ‘Information Society’ can be regarded as a key word of the future at the present and it has become an object of

both theoretical discussion and pragmatic programmes (Viherä, Nurmela, 2001, p. 245-265). The Information Society is seen to manifest itself in a variety of ways: in networks, in the economy, in technology, in expertise, content and action, in internationalisation and in the very idea of postmodernism.

The substructure of the Information Society is the generalised use of low cost and accessible data and information, its gathering, storage, manipulation and retrieval and its later purposeful use in the form of knowledge to improve the quality of life of citizens through the provision of products and services (HMSO, Modernising Government, 1999, Cmnd. 4310). As many theorists have expressed in different terms and varying concepts (Bell, 1973; Gershuny, 1978; Masuda, 1983; Druckner, 1993; Stonier, 1983), societal development in advanced industrial countries has led toward an Information Society, where the major driving forces are the development of information and communication technology, the rapidly increasing use of new devices, and the growth of the specific service sector (Ahlqvist, 2005, p. 501-519). According to Castells (1996), the crucial technological turning point was the invention of microchips in the early 1970s. Since then, the core of the Information Society has been seen as consisting of technologies of information processing and communication. The logic of information technology has been regarded as the basis of the Information Society. Information and knowledge are simultaneously pivotal as production factors and as products. Hence, not just the role of information per se, but also its self-cumulativeness, productiveness, and creativity have been central technological dimensions of Information Society (Ahlqvist, 2005).

Contrary to a rather restrictive concept based on the characteristics of information and communication technologies, Castells (1996) emphasizes the accumulation of information and the societal effects of information technology. In this view, the Information Society is more than an expression of technological determinism (Grantham, Tsekouras, 2005). It encapsulates shifting power relations and organisational and cultural change. For this reason Castells uses the term *network society* (Castells, 2002, p. 507; Stehr, 2000, p. 83-94).

Building on Lundvall and Johnson's (Lundvall, Johnson, 1994, p. 23-42) concept of the learning economy, Conceic et al. (Conceic, Heitor, Lundvall, 2003) discuss the learning society in terms of innovation and competence building with social cohesion. They view innovation as the key process that characterizes a knowledge economy understood from a dynamic perspective, while competence is the foundation from which

innovation emerges and which allows many innovations to be enjoyed (for more IS definitions and related terms see Appendix V).

4.1.2. Factors leading to the emergence and development of the Information Society

Conceptually, the factors leading to emergence and development of the IS include: rapid technological advances in the information technology sector; the widespread recognition that computers can be used to communicate information, not merely process it; the spread of simple, inexpensive and powerful computer networks; and an economic climate with risk tolerant capital willing to finance venture capital investments into technology based upstart companies.

Other authors mention the following components: (1) the diffusion of personal computers to businesses, universities, and homeowners; (2) local area networks made cheaply available by the commodification of Ethernet technology; (3) the maturation of the standards used to connect disparate communications networks, permitting address assignment, email messaging and file transfers; and (4) the availability of browser technologies that enable a common, easy to use interface via hypertext markup language.

4.1.3. The societal impact of the information technologies

Within the evolution to the Information Society – and with it the rise of electronic networking, office automation or computerization of service delivery – the emergence of a breeding-ground for the development of completely new business concepts can be observed. According to the Bangemann report, “Europe and the Global Information Society” (Bangemann et al., 1994), the notion of the Information Society could mean - at least in Europe - a modern society with its economic and cultural life crucially dependent on information and communication technology, that is, on computer techniques, on communication hardware and software and the already global network. Thus, the Information Society would be a global society characterized by increasing intellectual activity and a growing dependence on the use of ICT in all its activity fields.

Another distinction of this kind of society is its quality of ‘co-operative competition’. In this respect, another aspect of an Information Society would be an unfolding mass education and cultivated individual self-

development to meet the needs of intensified innovation. According to the Bangemann report, the primary goal of the European Union is to become the leading Information Society in the world, creating the framework to which others will have to join and adapt themselves. Therefore, not only a quick and efficient access to information should be provided - albeit such access still leaves a lot to be desired - but new innovations should be used to gain technological and consequently economic advantage.

4.1.4. The complex nature of an Information Society

The discussion of IS-related issues has shifted its focus from the mere development of ICT toward the social notion, that is, toward the primacy of content and communicative applications (Negroponte, N., 2003). In the pioneer countries of the Information Society, for example the United States and Nordic countries, the content applications have been growing in importance as the primary motor of technological development. This reflects the changing demands of ICT users. Furthermore, the notions of maximum (im)mobility and universal connectivity will also have crucial impacts on the future of information and communication technology (Ahlqvist, 2005).

However, the Information Society complicates the picture by adding many emergent features such as the increase in the forms and infinite amount of information and the rise in the level of sociotechnical interlinkages (Schienstock, Hämäläinen, 2001). Following this argument, it can be stated that the Information Society is a very complex phenomenon.

4.1.5. The changing nature of the process of competition

A firm or a region competes on the basis of what they have which is unique in relation to their competitors. Thus, the competitiveness of a region rests on its capability to continuously innovate and diversify its product range rather than on production of the same products at a lower cost than competitors.

Drawing on the work of Joseph Schumpeter, learning economy theorists argue that the most significant form of competition is based on 'quality' rather than 'price', especially within an economic environment where the rate of innovation is high (Morgan, 1997, p. 491-504; Todtling, 1994).

Innovation is increasingly seen as a way for firms, regions and nations to gain competitiveness in the face of globalization because it enhances the learning abilities of firms and workers (Lundvall and Borras, 1997).

For Morgan, all this interest in innovation has stimulated a debate around the character of contemporary capitalism "where knowledge is the most strategic resource and learning the most important process" (Lundvall, 1994).

Maskell (Maskell, 1999, p. 113) argues, "a knowledge-based economy is materializing, where the competitive edge of many firms has shifted from static price competition towards dynamic improvement, favouring those who can create knowledge faster than their competitors".

In a knowledge economy the competitiveness of the firms is determined by the quality of the products and processes, the decrease of decision, production and delivery times of new products, the adoption of technological and organizational innovation in production processes. Thus, it is crucial to develop the competencies and professional skills of the labour force, the intermediate and top managers. In particular, the factors that determine the survival and success of firms are increasingly less the fixed investment and the financial resources and more the know-how, the intangible resources and the distinctive competencies.

It should also be indicated that the ability to create innovation is a condition for achieving a stable competitive advantage. Innovation creates demand for itself. Therefore the innovative actors (e.g. firms, countries, territorial units hosting innovative companies) can belong to the high segment of the global economy, where not the cost of production but its novelty is a main factor determining the competitiveness of a given product.

4.1.6. Concepts of knowledge and its creation

Learning is seen as a key element for long-term advantage (Teece et al., 1997, p. 509-533; Kylaheiko, 1998, p. 319-332). In the same way knowledge is nationally embedded through sectoral specialisations and political and cultural organisations and institutions. Knowledge is also regionally embedded as a result of an historically produced territorial division of labour.

In a methodological perspective, there are different frameworks, within which knowledge may be created and analyzed. These are:

- the individual firm, where different employees, managers and entrepreneurs interact,
- the sector or the market where different firms interact through relations of monetary exchange, increasingly within an international perspective,
- the institutions, where various private and public collective actors (stakeholders) interact in the framework of political relations and aim to modify public norms and regulations, mainly within a national perspective,
- the regions or the territory, where in a formal and informal way actors belonging to different sectors and institutional cultures also interact, within the framework of complex regional innovation systems, and adapt their behaviour and strategies.

Whereas information can be considered a part of knowledge that can easily be partitioned and transmitted either through computer networks or in written form, knowledge itself is a much wider concept. Knowledge is often defined as organized information, and information as organized data. Knowledge is a human practice rather than a thing that resides in artefacts. Knowledge may be shared between people, but this involves a process of learning and experience about each other's knowledge.

Because knowledge is not simply data or information, but is rooted in human experience and social context, its management demands that close attention is paid to people and culture as well as to organizational structure, and information technology (Havens and Knapp, 1999, 4-9).

Traditionally, knowledge is seen as something belonging to the individual. Individual knowledge is the knowledge each individual has or masters, acquired through education and experience. But this is not all the knowledge an enterprise runs by. Knowledge is also collective (March and Simon, 1958; Nelson and Winter, 1982). Ducatel points out that organisational learning is a social process and skill development 'does not take place at the individual level but amongst groups [which is] a fact that many training programme[s] still seem to ignore '(Ducatel, 1998, p. 19).

The importance of collaborative linkages has been commented on by several scholars in recent years (see OECD, 1992, chapter 3, for a review). Pavitt (Pavitt, 1991) showed that one of the reasons large firms engage in basic research was as a way of making links with experts in other institutions to improve their innovative potential. Thus, innovation

is the 'craft of combination', revolving around the combination of various types of knowledge (Lundvall, Johnson, 1994, p. 23-42).

4.1.7.A wider sectoral scope than the so called high-tech sectors

The concept of the knowledge economy has been linked by some to a new IT driven techno-economic paradigm (see, for example, Freeman and Perez, 1988). However, the learning economy is not necessarily a high-tech economy.

According to Lundvall and Borrás 'the learning potential ... may differ between sectors and technologies but in all sectors there will be niches where the potential for learning is high' (Lundvall and Borrás, 1998, p. 35). Maskell (Maskell, 1996) showed that, in Denmark, learning also took place in traditional low technology sectors, and this still led to growth.

The concept of the "learning economy" means an extension of the range of branches, firm-sizes and regions that can be viewed as innovative, and also includes traditional, non R&D intensive branches (e.g. the importance of design in making furniture manufacturers competitive and moving them up the value-added chain).

Thus, the development in European countries toward the model of the knowledge economy cannot be reduced to the development of new high-tech sectors or R&D intensive sectors. Moreover, R&D investments should be integrated by policies that deal with other crucial dimensions of the innovation process. In fact, the new knowledge economy is different from the development of high-tech industries.

4.1.8.A new model in the process of knowledge creation

Knowledge creation and innovation are the result of an interactive learning process, which requires the creative and intelligent combination of various information and knowledge pieces, the socialization of a wide range of different experiences and competencies and the flexible management of complex roles and workflows of different actors as also the integration of scalable components and the support of complementary services in the solution of specific production problems.

As knowledge will play a dominant role in organisations, not only at the top but at all levels, the day to day work environment should favour learning processes that support, what Kessels (Kessels, 1996, p. 168-174) tends to describe as, the process of 'knowledge productivity'.

Knowledge productivity involves signalling, absorbing and processing relevant information, generating and disseminating new knowledge and applying this knowledge to the improvement and innovation of processes, products and services.

Recent studies have developed analytical models to explicate the changes under way in academic knowledge production. One such model is "new knowledge production" of Gibbons et al. (1994) and Nowotny et al. (2001); another is "entrepreneurial science," posited by Etzkowitz (1996, 1998), Etzkowitz et al. (2000) and Etzkowitz and Leydesdorff (2000).

Lundvall argues that we ought to expand the range of objects of study beyond the knowledge institutions, such as universities and laboratories, to the more general arena of routinised learning (for example, learning-by-doing or learning-by-using) 'which emphasise knowledge creation as a by-product of routine activities' (Lundvall, 1998, p. 35).

In a learning economy innovation is understood as an interactive learning process, which is socially and territorially embedded and culturally and institutionally contextualized (Lundvall, 1992). It emphasizes a dynamic approach to innovation rather than the more static approach adopted in the knowledge-based economy that emphasizes access to a stock of specialised knowledge (Lundvall, Archibugi (Eds), 2001).

4.1.9. The role of institutions in the knowledge economy

In contrast to traditional linear models, modern theorists argue that the process of innovation is highly interactive and is dependent on social and cultural institutions and conventions (Morgan, 1997, p. 493). Keeping in mind the high importance of know-how, networks or organised market governance structures (see Powell W.W., 1990, p. 295-336) play a crucial role in supporting a trust that facilitates interactive innovation (Lundvall, Johnson, 1994; Morgan, 1995, 1997; Cooke and Morgan, 1993, p. 543-564).

Knowledge is channelled within networks by formal and informal institutions. In principle, explicit and coded knowledge may be traded on markets. On the contrary, tacit knowledge competencies and skills cannot be transferred effectively through conventional markets and requires non-market allocation: for instance, within the firm, in the context of inter-firm networks or forms of co-operation between private agents and public institutions.

Thus, institutions have a key role in the process of innovation and in the generation and working of “knowledge and learning networks”.

Connectivity between the various institutions should be a central concern of policy. According to the “Territorial Knowledge Management” approach (Cappellin, 2004, p. 303-325), governance of knowledge and innovation networks implies a continuous public investment in the development of technical standards, social norms, and organizational, financial and institutional solutions, which may facilitate the adoption of innovation.

Governance is the challenge of steering and positioning complex organizations. These can be committees, research groups, firms, networks, communities, regions and international agencies. An IS-related development requires from policy groups to become highly adaptive organizations that incorporate learning in their strategy (de la Monte (Ed.), 2001).

Institutions play a crucial role in innovation networks, since they:

- reduce transaction and production costs,
- increase trust among economic and social actors,
- improve entrepreneurial capacity,
- increase learning and relational mechanisms,
- reinforce networks and cooperation among the actors.

Mokyr (2002) has argued that industrial revolutions need to be explained by the development, but mostly by the diffusion and use of new knowledge. Thus, it can be considered a coincidence that England around 1780 was the first country where sustained economic growth based on the use of newly developed knowledge could be observed. England was by no means the most technologically advanced country, and indeed it used knowledge developed in countries such as France extensively. Mokyr points to the institutions of English society that lowered the costs of communication about new knowledge. The result was that knowledge was much more readily exchanged among savants, among fabricants, and between these two groups. Thus, new knowledge was more easily created, but most importantly existing knowledge was put to good use faster, even if the knowledge were of a tacit nature (cf. Cowan et al., 2000, p. 211–253).

Communication then, in Mokyr’s argument, will both broaden and tighten the knowledge base of propositional knowledge, and stimulate the development of techniques (“prescriptive knowledge) “that find an immediate application in society and stimulate economic activity. Central

to Mokyr's analysis is his concept of the "access costs" people face when in need of "useful knowledge".

The process of knowledge creation has a local dimension. Learning can be considered as a social process of ongoing development embedded in a specific regional socio-cultural context. As the creation of new knowledge implies an intense process of interaction, the concept of sectoral/geographical clusters deserves special attention. Within clusters, "social capital" and trust relations between local actors can be seen as a conceptualization of the glue that facilitates transactions, cooperation and learning in an uncertain world. Clusters and networks can then be regarded as economic clubs acting to internalize the problems of effective knowledge transmission.

To this degree, clusters and networks are a substitute both for formal markets and for hierarchical integration. Clusters represent subtle and differentiated "institutions" for co-operation and interactive learning.

The spatial patterns of innovation and the related geographical dimension of economic and social development have witnessed a renewed and increasing interest in the literature (Cooke, Morgan, 1998; Storper, 1998), but attention is to be focused on ability to build social capital, including interactive learning, local externalities, and networks among institutions (Swann, Prevezer, Stout, 1998). This focus on relational assets is part of the "institutional turn" in regional development studies as a result of the relative failure of classical approaches, which sought to privilege either "state-led" or "market-driven" processes regardless of time, space, and milieu.

Uncertainty is high in its production (i.e., research) but declines rapidly as it is diffused. There is considerable social leakage in the transmission of knowledge. There are also considerable spill-over effects which result in secondary benefits of proximity to the source of knowledge production, such as the development of high technology clusters, the attraction and retention of skilled workers, the attraction of investment, and the spinning off of new firms, jobs, and industries.

4.2. Review of ESPON documents

The review of ESPON results is based on the latest reports available for each project. Thus, e.g. for the finalised projects only final reports have been considered. This decision is based on the assumption that all major information and results are included in the final reports and may only have been mentioned in one or other interim report.

4.2.1. Definition of terms relevant for the Information Society and related indicators used in ESPON

Different aspects of the development of an Information Society as well as of the knowledge-based economy (KBE) or knowledge economy are the subject of a number of the reviewed ESPON documents. Both terms are often used along the lines of economic or technological aspects such as the spread of e-commerce firms or the quality and usage of ICT infrastructure. This understanding of IS and KBE is complemented by a range of indicators used in different contexts of the different projects (see Table 4).

But also a broader understanding of the concept of the IS is being discussed, which goes beyond technical aspects and includes the social dimensions of these developments (2.2.1, p.19). Also a few indicators take account of these aspects, such as access of all segments of the population to education and virtual learning (2.2.1, p.111) or access to communication infrastructure among excluded groups (see Table 4).

Much more widespread than the appearance of the term 'knowledge-based economy' is the usage of 'knowledge economy' in the reviewed documents. However, in all cases, these terms are related to the respective project's specific topic. Consequently, IS or KE and other related terms' references are regarded as influence etc. in these contexts rather than being discussed for their own sake.

The aspect of research and development is very often mentioned in combination with its relevance for spatial developments. For instance, it is described as a 'potential in addressing the spatial positioning and strengthening regional specialization' or referred to as 'a policy sector with relevance for polycentricity' (2.2.1, p.147). Next to its importance in economic development, it is also considered as a possible means to address some negative environmental aspects in fields such as transport (2.1.1, p.262).

For the measurement of R&D, indicators such as R&D expenditure, R&D employment or data accessibility are used (2.2.2, pp.17,22). Particular emphasis on R&D issues is given in respective ESPON project dealing with R&D impact assessment. Here, many more related numerous indicators have been developed and used.

Innovation is generally considered one of the most important forces in regional development in the EU, promoting the components of a new governance culture, such as interconnectivity, information, communication and horizontal networking (2.3.2, p.81). Innovation is described as consisting of (and thus can be measured by) new or

improved products, processes, policies, systems or services (2.1.2, p.35). More detailed indicators used within the ESPON projects are listed in Table 4.

Table 4 Selected indicators relevant for the IS and their use in the reviewed ESPON reports

| Term | Indicator | Source |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Knowledge | Number of students attending higher education institutions | 1.1.1, p.9 |
| Knowledge | Adult literacy rate | 3.2, p.522 |
| Knowledge functions | Location of university, number of students | 1.1.1, p.85, 89ff |
| Access to knowledge | Relative share of pop. finding university education within the region | 1.1.2, p.175 |
| Access to knowledge | Identified by access to cities... Access by car to the three closest cities of more than 100000 inhabitants to respect the freedom of choice of the citizens Accessibility by car to cities of more than 200000 inh. | 1.2.1, p.17 |
| Access to knowledge | Development of local learning centres | 2.2.1, p.108 |
| Knowledge economy | Internet connectivity | 2.2.3, p.8 |
| Innovation | Population density (higher pop. dens. facilitates contacts, thus accelerates information flows) | 1.1.2, p.58, 190 |
| Innovation | Employment in high & medium high-tech manufacturing Employment in high-tech services Working age population with tertiary education Patents | 2.1.2, pp.31,35,37,123 |
| Innovation | High-tech patents in mill. population Human resources in science technology R&D capacity | 3.1, p.167 |
| Innovation | R&D personal, R&D infrastructure | 3.2, p.174 |
| IS (participation in IS) | Usage of internet (number of users) Mobile telephony | 1.2.2, pp.106,187 |
| Knowledge & IS | N° of e-learning institutions N° of municipalities with e-government N° of firms with internet access, own website N° of e-commerce firms | 3.3, p.39ff |
| IS | Access to communication infrastructure among excluded groups | 2.2.1, p.108 |
| R&D | Expenditure Employment | 2.2.2, pp.17,22 |

While the usage of most of the above discussed terms of the IS has been quite frequent and randomly spread in the reviewed documents, other aspects of the IS such as information and communication technology

(ICT) or high-tech industries appeared much less often. They were mostly limited to specific projects and reports. ICTs are mentioned a few times as an important 'European level driver' (2.2.3, p.58) and are described as factors improving the contact between the business sector and the public administration (2.2.3, p.69).

4.2.2. Spatial impacts of the Information Society

While the above table shows that a range of indicators has been already used when studying aspects of the IS in different contexts, a certain lack of definitions and indicators still prevails. This becomes especially visible when trying to assess the spatial impacts of IS-related issues. Many ESPON projects complain about the lack of data regarding knowledge flows. Project 1.1.3 for instance offers information on various potential barriers and opportunities to cross-border knowledge flows, but the flows themselves are not examined. Another example is the Pre-accession aid project (2.2.2), where a lack of appropriate indicators raised problems with evaluating the respective impacts (2.2.2, pp.41, 167).

Table 5 Selected case studies with relevance for the IS in reviewed ESPON reports

| Project | Relevant Case Studies |
|-------------------------|-----------------------------------------------------------------------------|
| 1.1.1 Polycentrism | Country reports for EU 25+2+2 |
| 1.1.2 Rural Relations | Case studies, some referring to knowledge creation (useful) |
| 1.2.2 Telecommunication | 2 case studies in telecommunication networks (Nordic experiences + Estonia) |
| 2.1.2 Impact of R&D | Case studies on R&D, with high utility regarding methodology |
| 2.2.1 Structural Funds | Country reports on territorial effects of SF and inclusion of Lisbon themes |
| 2.2.2 Pre-accession aid | Case studies, some referring to establishing IS |
| 2.2.3 Urban in SF | Case studies on growth of knowledge economy in sample regions |
| 3.3 Lisbon | Case studies, few results so far, but might be helpful in the future |

Therefore, the assessment of spatial aspects of the IS is very limited and statements towards these questions rarely appear in the reviewed documents. Also, IS policy concepts or recommendations are mentioned sparsely, and if so, hardly any further detailed information on the

concepts or strategies is provided (e.g. 'regional innovation strategy' in Sheffield, see 2.2.3, p.69).

Some ESPON project documents contain case studies, which include aspects of establishment of the IS functions or growth of the knowledge economy, for instance by looking at the promotion of start-ups, university research or the establishment of research centres (e.g. 2.2.3; see Table 5). For the respective regions, which have been examined, they can provide useful additional information. However, this information is not useful for cross European analysis.

Somewhat more useful information might be obtained from examining the spatial scenarios in project 3.2. Special IS-related scenarios investigate the interconnectedness and also contradiction of the development of the IS on the one hand and the realization of cohesion policy goals on the other. As one scenario claims, current cohesion policies of the EU seem to stand in the way of reaching the aims of the Lisbon strategy. Future dimensions of EU expenditure and the overall aims of these policies are widely discussed, and some future spatial trends related to the IS can be derived from the examples given with the scenarios (see 3.2).

4.2.3. Typologies

In some of the ESPON projects typologies have been developed in order to classify certain regions according to different IS-related aspects. Some of them give important hints for the further development of indicators in IS research, others should be reviewed for specific research questions. The typologies especially developed in the projects about Polycentrism (1.1.1), Enlargement (1.1.3) and Telecommunication (1.2.2) offer some typologies that might prove useful for further development of indicators and methodology in IS-related research (see Table 6).

Table 6 Appearance of relevant typologies in ESPON reports

| Project | Relevant Typology |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------|
| 1.1.1 Polycentrism | Classification of European FUAs concerning knowledge functions (high utility) |
| 1.1.3 Enlargement | Typology of border regions concerning their potential of integration (level of exchange of knowledge, best practices etc.) |
| 1.2.2 Telecommunication | Numerous maps and typologies in fields of ICT infrastructure and usage |
| 2.1.2 Impact of R&D | Several typologies describing R&D and innovation capacity |

4.2.4. Concluding remarks

Since the development of an Information Society is considered a prerequisite of the competitiveness of the EU, and increasingly seen as a horizontal and cross-sectoral policy concern (2.2.1, p.19), IS research should be further developed in an interdisciplinary manner. While some useful information can be obtained from a number of ESPON project documents, a lack of methodology and indicators was apparent, especially in the field of research on the spatial impacts related to the IS. Therefore, ESPON project 1.2.3 aims at using the available information and results from other ongoing and already finalised projects, while simultaneously searching for more specific IS related aspects. For instance, the above-mentioned typologies could be used for further typology development, focussing on influences and effects of IS related developments.

4.3. Review of EU sources

4.3.1. Definitions of IS related terms

The Information Society is an integral element of the revised Lisbon Strategy - building Europe as the most competitive and innovative economy in the world. Therefore it has been treated as a horizontal issue that should be taken into account and developed throughout all EU policies and activities (although main areas are: telecommunications policy, support to technological development in information and communication technologies - ICT, competitiveness of the Community's industry, trans-European networks - TEN in transport, energy and telecommunications sectors, research policy).

As a result, there are multiple research initiatives undertaken by different DGs, under different financial programmes.

The backbone of the IS activities, support and promotion actions is eEurope 2005 (a follow up of eEurope 2002) – an Action Plan for IS development, presented at the Sevilla European Council (Com2002/263)⁵. On the practical basis it is supported by i2010 - an initiative to provide an integrated approach to Information Society and audio-visual policies in the EU, covering regulation, research, and deployment and promoting cultural diversity.

⁵ eEurope 2005: http://europa.eu.int/information_society/eeurope/2005/index_en.htm

There is no clear unified definition of IS. However, as can be found in EU legal basic sources (SCADPLUS), the Information Society is synonymous with what is meant by "new information and communication technologies" (ICT) and their usage. It includes number of aspects and fields of activities. At the moment the umbrella term for EU actions related to the Information Society is eEurope⁶.

eEurope has been the object of monitoring and benchmarking. Therefore the system of 23 indicators has been developed – which in practice can be regarded as a kind of an operational definition. They include such items as (for full list see: Council Conclusions, 13493/00, LIMITE, ECO 338):

- percentage of population who regularly use the internet,
- percentage of households with internet access at home,
- internet access costs,
- speed of interconnections & services, etc.

However they do not have any specific regional aspect.

4.3.2. The IS spatial perspective in EU research and policies

The main sources of IS consideration in spatial perspective are the activities financed by DG-Regio, in the framework of Structural Funds⁷.

There is only one relevant study that considers IS in a regional perspective, covering the whole European Union - the Thematic Evaluation of the Information Society. The aim of this study was to investigate to what extent the IS issues are supported in regions using Structural Funds. Definition of the IS used was: "economic, social and institutional processes in which ICT related changes are embedded". The main reference framework was eEurope Communication (Technopolis, 2002).

The study reviewed all strategic documents – that is OPs, and census of regional programmes (over 150) and checks to what extent IS-related actions exist in particular programmes. Therefore, focusing on strategic and planning sides of the process, this study has limited relevance to the actual project.

⁶ European Commission (2002) eEurope 2005: An information society for all, Com(2002)/263 final

⁷ IS in DG-Regio:

http://www.europa.eu.int/comm/regional_policy/themes/infotech_en.htm

Apart from the Thematic Evaluation of the Information Society study, there are a number of initiatives that focus on some of the EU regions. The example of this is IRISI (Inter-Regional Information Society Initiative) and its later coordination platform – ERIS (European Regional Information Society Association) that covers 45 European regions. Its activities focus on practical approaches for developing regional strategies for the Information Society and pilot projects concerning regional cooperation for IS. Similar to this is IANIS aimed at development of so-called e-Regions hub, which is establishing networking and knowledge transfer between regions of old and new EU member states in the field of Information Society. These initiatives are practice oriented, they do not dwell on definitions (they usually take the main EU one) or situation analysis but rather combine different approaches into one action plan. They also have limited spatial perspective (selected regions of EU)⁸.

Table 7 BISER IS benchmarking indicators

| Population-side indicators | Establishment-side indicators |
|--------------------------------------------------------|-------------------------------------------------------------------|
| Broadband access to the Internet (population) | Broadband Internet access (establishments) |
| Internet users (population) | Establishments with an internal computer network |
| Private e-government users | Business e-government users |
| Share of employment in ICT-Occupations | Establishments with a website |
| ICT-based multi-locational work | Establishments with at least 10per cent of sales conducted online |
| E-learning for work-related training | Participation in electronically integrated supply chains |
| Users of transport related information on the Internet | IP-supported process and product innovation |
| Online communication with doctor/clinic | Establishments providing ICT training for their staff |
| Use of the Internet for regional purposes | More than 25per cent of staff need Internet skills |
| Ratio of Internet use – lower and higher incomes | |
| Internet affordability insufficiency | |

BISER: <http://www.biser-eu.com/>

Outside the DG-Regio there is only one fully developed operational study that deals with IS spatial aspects. This is BISER - Benchmarking the Information Society: e-Europe indicators for European Regions, Information Society Technology Programme⁹. The aim of the BISER

⁸ IANIS: <http://www.ianis.net/>

⁹ BISER: <http://www.biser-eu.com/>

project is to develop, define and pilot statistical indicators for measuring and benchmarking the impact of the knowledge economy in Europe's regions, based on a model of factors influencing regional development. Each regional economy and society is examined in the context of the underlying structural foundations of the Information Society. The latest benchmarking exercise covers 28 EU regions. For its purposes 20 indicators were used (group in two groups) – their level inform on IS development (see Table 7). This study is highly relevant for the purposes of this project.

4.4. Review of OECD sources

4.4.1. Definitions of IS related terms

Although the term "Information Society" is seldom used in the Organization for Economic Co-operation and Development (OECD) sources, the research conducted by this organization to a great extent deals with that issue. As an organisation providing economic policy advice to its member governments, OECD recognises that future economy will be an "information economy" and society will be increasingly an "Information Society". The contribution of "information economy" to overall economic growth and performance in OECD publications is related to the amount of resources devoted to new information technologies (IT), whether in terms of consumption, investment or innovative efforts (OECD, 2002, p. 10).

The term "knowledge-based economy (KBE)" is more commonly used in OECD documents. It is defined as economy "where knowledge (codified and tacit) is created, acquired, transmitted and used more effectively by enterprises, organisations, individuals and communities for greater economic and social development. It calls for:

- An economic and institutional regime that provides incentives for the efficient use of existing knowledge, for the creation of new knowledge, for the dismantling of obsolete activities and for the start-up of more efficient new ones.
- An educated and entrepreneurial population that can both create and use new knowledge.
- A dynamic information infrastructure that can facilitate effective communication, dissemination and processing of information.

- An efficient innovation system comprising firms, science and research centres, universities, think tanks, consultants and other organisations that can interact and tap into the growing stock of global knowledge; assimilate and adapt it to local needs; and use it to create new knowledge and technology” (OECD, 2001, p. 13-14).

In other words: “The knowledge-based economy is an expression coined to describe trends in advanced economies towards greater dependence on knowledge, information and high skill levels, and the increasing need for ready access to all of these by the business and public sectors” (OECD, 2005, p. 71). Knowledge and technology have become increasingly complex, raising the importance of links between firms and other organisations as a way to acquire specialised knowledge. A parallel economic development has been the growth of innovation in services in advanced economies.¹⁰

The OECD documents broadly discuss questions on the role of information and communication technologies (ICT) in economic growth and social change. The ICT sector seems to be the basic term used in relation to IS and it is defined as “a combination of manufacturing and services industries that capture, transmit and display data and information electronically” (OECD, 2002, p. 81).

The most important outcome of the research on information economy is that the production, diffusion and use of ICT vary considerably between and within countries, although they continue to spread and their economic importance has grown over the 1990s.

To overcome the problem with ICT measurement the OECD and Eurostat, together with statistical offices in OECD member countries, have worked together to develop common definitions, common methods and common surveys of ICT. OECD publications on ICT measurement build mainly on the work of the OECD Working Party on Indicators for the Information Society (WPIIS), which is composed of representatives from national statistical offices (NSO) of OECD member countries (OECD, 2002).

The Working Party has agreed on several standards for measuring ICT. Besides the definition of industries producing ICT goods and services (the “ICT sector”), they cover the definitions of e-commerce and Internet transactions, and model questionnaires and methodologies for measuring ICT use and e-commerce by businesses and households/individuals¹¹.

¹⁰ <http://www.stats.oecd.org/glossary/search.asp>

¹¹ www.oecd.org/sti/measuring-infoeconomy

OECD Information Technology Outlooks presents the results of the WPIIS research. The Outlooks discuss the information technology (IT) as a major driver of economic change, restructuring businesses, affecting skills and employment, and contributing to growth. The latest (2004) edition of the Outlook describes recent market dynamics and gives a detailed overview of the globalisation of the information and communication technology (ICT) sector and the rise of ICT-enabled international sourcing. It analyses the development and impacts of electronic business processes and describes trends in industries supplying IT goods and services. The publication also provides an overview of IT policy priorities in OECD countries and how these are evolving.

It must be said that the OECD has been taking a leading role in the international debate on measuring ICT. The OECD is involved in The World Summit on the Information Society (WSIS). It is an initiative of the UN specialised agency, International Telecommunications Union (ITU) whose objective is to "build the framework of an all-inclusive and equitable Information Society" and find ways to use Information and Communication Technologies to advance development goals, such as those contained in the Millennium Declaration¹².

Additionally OECD publishes the biennial reports *Communications Outlooks* (1998-2005). The reports analyse communication policy in 30 OECD member countries. The latest one (2005), addresses the issues of policy, regulation, and the size and structure of the telecommunication and broadcast markets, including mobile communications, leased lines and research and development (OECD, Communications Outlook 2005).

Another periodical publication related to IS definition is *The OECD Science, Technology and Industry Scoreboard*. The latest, seventh edition (2005) brings together the latest internationally comparable data to explore the growing interaction between knowledge and globalisation. It draws mainly on OECD databases, indicators and methodology developed by the Directorate for Science, Technology and Industry and focuses on:

- R&D and innovation: investment in knowledge, the financing and performance of research activities, linkages in innovation systems, science and engineering publications;

¹² For more information on WSIS and in its second phase, the "Tunis Summit", to be held in Tunis from 16-18 November 2005, go to www.wsis.org.

- human resources in science and technology: university graduates, R&D personnel, the international mobility of scientists;
- patents: "triadic" patent families, patents in new technological fields, cross-border ownership of inventions;
- ICT: resources and infrastructure for the information economy, the diffusion and use of Internet technologies and electronic business, the contribution of the ICT sector to economic activity and international trade;
- knowledge flows and the global enterprise: key channels of economic integration and technology diffusion, including foreign investment, the role of foreign-owned affiliates, as well as the contribution of multinationals to productivity;
- the impact of knowledge on productive activities: comparison of OECD economies in terms of income, productivity and industrial performance, the growing importance of technology and knowledge-intensive industries, the interaction between services and manufacturing, and the changing nature of manufacturing.

4.4.2. Spatial dimension of OECD research

Although research undertaken by the OECD is of high relevance for ESPON 1.2.3 project, the OECD international statistical comparisons are devoid of regional breakdown and the lack of regional references is evident in the OECD analyses.

There are only few relevant studies that deal with the IS issue in a regional perspective. Although they do not present the overall picture of spatial differentiation of the IS, the selected OECD studies have a regional dimension and investigate IS using the case study approach. Thus they seem to be important from the ESPON 1.2.3 project's point of view.

The most valuable of these is the report that addresses specific strategies relevant to the dissemination of ICT in rural areas (OECD, Information and Telecommunication Technologies, 2001). It consists of two parts: theoretical and empirical based on the several case studies.

According to this report the implications of ICT for the development of rural areas can be seen in terms of – at the same time - risks and opportunities. The risks are those of seeing ICT infrastructure and services continue to be deployed preferentially where the most important and receptive customer bases are located. This would leave many rural

citizens and businesses out of the Information Society and the Knowledge Economy for a long time, and probably aggravate existing economic difficulties. The opportunities, on the other hand, offer added value, since ICT tends to diminish the constraints linked to time and distance. A certain number of activities can now be located outside of traditional production centres, whereas a wide range of public services can be efficiently delivered through ICT to sparsely populated or remote areas. Risks and opportunities appear in three major areas that are analysed in the report: fundamental issues common to all policies and projects, societal issues, and overall economic issues.

The case study approach was undertaken in order to show that a growing number of activities are performed in multiple locations that are not necessarily urban. The case studies conducted within the framework of the report have been chosen on the basis of several criteria: 1) a clear ICT strategy with ambitious but not unrealistic goals; 2) the involvement of the population in projects; 3) the usefulness of analyzing different strategies, policies and projects at various geographical scales: regional, sub-regional and community.

Another study which deals with regional approach towards IS and KBE developments is "Cities and Regions in the New Learning Economy". This publication analyses the relationships between various forms of learning and economic performance at the regional level and provides rather strong evidence of the importance of individual and firm-level organisational learning for regions' economic performance. Case studies of five regions and cities indicate that social capital – in terms of social networks and social conventions and norms – affects both individual and organisational learning. In particular, they give many examples of the ways in which a low stock of social capital can impede learning (OECD, Cities and Regions, 2001).

4.5. Common concept of the Information Society – towards an operational definition

Both 'Information Society' and 'Knowledge Economy' are the terms most often used in everyday language, as well as in official documents. These terms are often not defined in a precise, theory-based way, and even more, particular organisations and institutions propose their own understandings of them. In several cases operational definitions are used by proposing a set of indicators that are supposed to measure processes and phenomena related to both terms.

Since uniform and commonly accepted definitions neither exist for the 'Information Society' nor 'Knowledge Economy', the current project applies an operational approach for these terms, especially that of IS. This approach will be elaborated in this section.

Because of the numerous definitions available for the term 'Information Society' (see previous sections), it is necessary to find an operational definition for the Information Society (IS), which allows conceptualisation of the analysis in accordance with the project's objectives. In this framework it is particularly important to identify appropriate indicators, which can contribute to the analysis of territorial aspects of the IS. Not all indicators describing one or another feature of the Information Society have a territorial feature. Thus, they need to be selected carefully. In addition, the following operationalisation of the definition aims at structuring the variety of possible indicators. Such a structure will be useful in order to develop the foreseen methodology.

Besides the above review of definitions of Information Society related terms, it is also necessary to consider alternatives approaches based on operational IS definitions. Thus, a few such approaches are briefly reviewed in this sub-section. Only approaches related to spatial issues of the IS are mentioned, since this is also the focus of ESPON project 1.2.3.

One such approach of grasping elements of the IS in spatial terms are the *Regional Systems of Innovation*. This approach addresses localised structural and institutional factors which shape the innovation capacity in specific regional contexts. For the operationalisation the concept utilises qualitative and quantitative indicators aiming at the measurement of innovation generation and diffusion (Immarino, 2005).

Another concept reflects on *Learning Regions*. This approach considers successful and permanent learning of individuals and of organisations in the frame of networks as being crucial for the success in a knowledge-based economy. This concept regionalises the ongoing transition towards a *learning economy*. The concept of learning regions is closely linked with a new generation of regional policy, which focuses on social issues rather than infrastructure, on opening minds rather than physical opening and which promotes policies with SMEs instead of policies for SMEs (Hassink, 2005).

Finally, concepts based on empirical research will also be discussed here. The concept of *Measuring a Knowledge-based Economy and Society* by the Australian Bureau of Statistics¹³ is based on five dimensions, namely

¹³ This example has been chosen for its exceptional combination of methodology and its operationalisation.

innovation and entrepreneurship, human capital, ICT, economic and social impacts and a context dimension. The latter is a very broad dimension incorporating numerous background information and preconditions, including institutional environment. All dimensions are described by characteristics, which are in turn operationalised by indicators (Trewin, 2002). This approach offers the advantage of a detailed operationalisation and categorisation of IS characteristics and elements on a quantitative level. On this basis, for the purpose of ESPON project 1.2.3, it could be asked, how these dimensions evolve and how they impact on IS spatial development. The shortcoming of this approach is the limited availability of respective regional data – as they are indicated in this concept – for the whole ESPON space. Nevertheless, the categorisation can support the development of an operational and common concept for ESPON project 1.2.3.

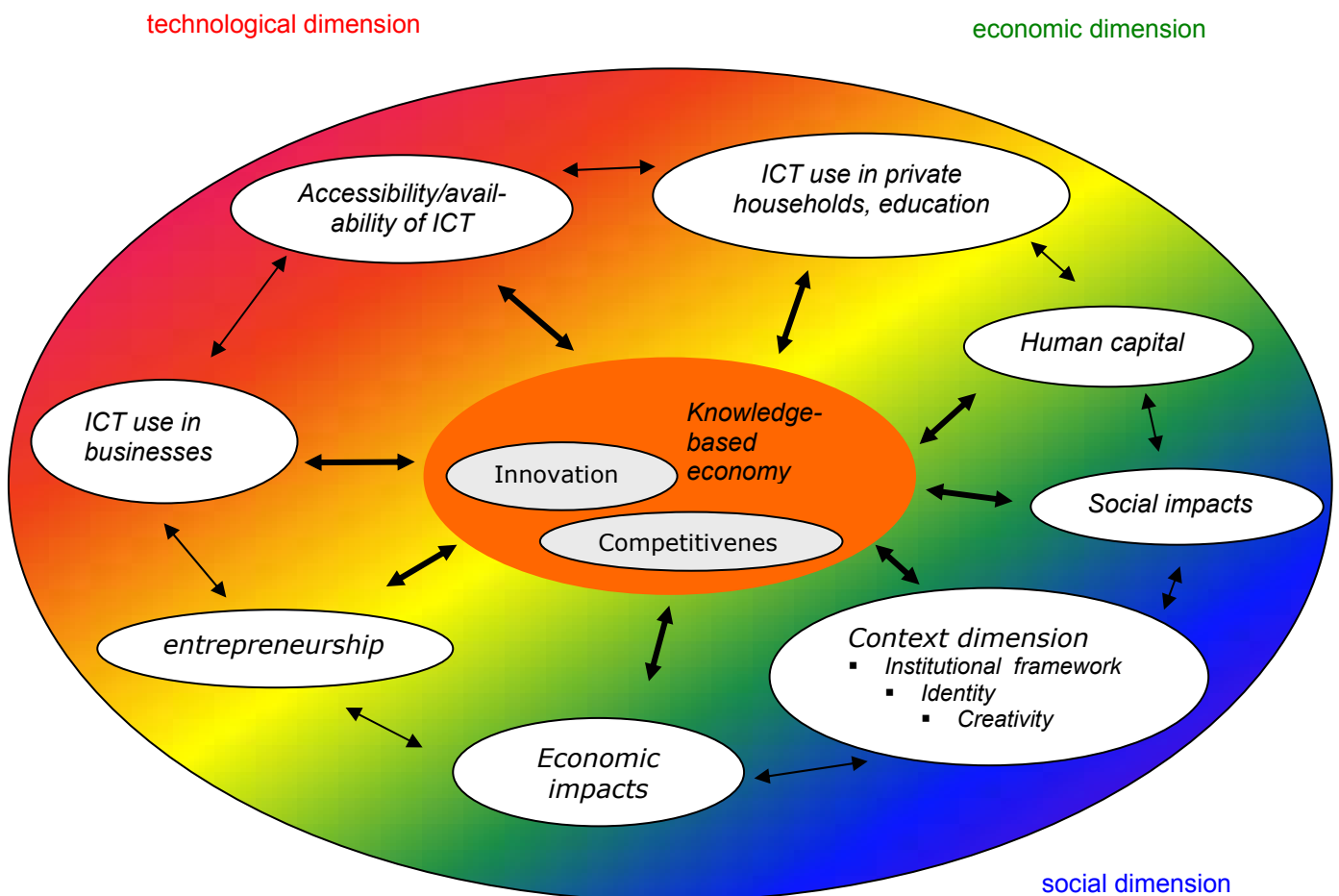
Before finally proposing a common concept, a few issues particularly relevant for the objectives of ESPON project 1.2.3 shall be reviewed shortly. In order to identify spatially relevant aspects of the IS, it is necessary to first recognize the characteristics of the IS, among which spatial relevance can be identified. In addition to the selection of indicators, spatial issues are taken into account, if it is asked, what the IS means for different types of regions. This relates to the question of how the IS can be measured in different types of regions. It can be assumed that the IS reveals different characteristics in different types of regions. In order to take account of these regional differences it will be necessary to find appropriate relative formulations for the indicators finally used for the analysis.

In Figure 5 it is proposed to consider the knowledge-based economy as the inner core of the IS. This concept represents a proposal for a combined approach of above concept *Measuring a Knowledge-based Economy and Society* and an approach of Cappellin (2003), which deals with territorial knowledge management. Thus, the proposed common concept inhibits elements of a thematic approach to the IS as well as policy oriented aspects.

According to this combined concept, the KBE is an element of a wider definition of the IS, the latter incorporating different aspects of knowledge and information in economic and social life within three different dimensions. While the KBE itself is based on permanent innovation processes and competitiveness of the knowledge intensive firms and sectors, it is also influenced by and interdependent with the frame of the IS. For instance, human capital influences the performance of the KBE, as human resources are a fundamental production factor in

such an economy. Similar relations can be drawn for the other elements 'surrounding' the KBE. In addition also, these dimensions of the surrounding space are interlinked with each other. The example of interrelations between the institutional context and the entrepreneurship illustrates these linkages.

Figure 5 Approach to an operational common concept for the Information Society



Source: own concept.

Within the common concept of the IS a threefold differentiation of the IS has been developed, which distinguishes between a technological, an economic and a social dimension of the IS (see Figure 5).

The first dimension comprises above all the availability and use of ICT for enterprises and households. The second is related to the development of relevant sectors (ICT, R&D or knowledge intensive services), the value added created in these sectors and research intensities and their output (e.g. patents). The social dimension, finally, describes the role of

education and ICT in the citizens' life and includes aspects such as e-government.

This differentiation of IS dimensions represents a categorisation of IS aspects which is complementary to that of the IS life cycle. Also in the IS life cycle approach technological, economic and social aspects are considered, though from a different perspective. Here the social dimension is included in terms of the human resources, the economic dimension is considered in terms of employment and patent figures and various technological aspects are included as well. In this approach, a dynamic perspective prevails whereas in above figure a sectoral perspective reigns. However, due to the limited availability of indicators for the economic and social dimensions, both, the life cycle approach and the resulting index, are technology biased. In other words, from a theoretical perspective, above figure considers all three dimensions of the IS to be of comparable weight whereas the empirical analysis, so far, is more strongly based on only one of these dimensions, i.e. the technological dimension.

Summarising, the relevance of different issues for the IS in general can be noted. In order to analyse spatially relevant aspects of the IS, thus, these different dimensions need to be taken into account. Within these dimensions, however, characteristics and indicators need to be differentiated as to whether they inhibit spatial relevance or not. For further operationalisation, a number of potential indicators is proposed in the next section and assigned to the different dimensions of the IS.

4.6. Proposed set of indicators

The following set of proposed indicators has been developed according to the operational definition of the IS used in this project. The proposed list aims at theoretically desirable indicators rather than proposing an indicator list that can be utilised on NUTS 2 or 3 level for the whole ESPON space.

Independent of the data availability at different spatial levels, this theoretically or concept driven indicator list matters, since ESPON project 1.2.3 is based on a step-wise methodology, in which, in addition to a cross European regional analysis, cross European national and regional analyses for selected countries of the ESPON space have been conducted¹⁴.

¹⁴ For the corresponding methodology see next chapter.

In addition, the analysis of spatial aspects of the IS is embedded in general regional socio-economic conditions, which – according to above understanding – are not part of the dimensions of IS as described before. Nevertheless, they need to be considered. Since these conditions and developments are part of different ESPON projects and the respective indicators are part of the ESPON data base, these further socio-economic conditions (such as GDP per capita), not specifically related to the IS, are not considered in the indicator list below, although they have not been neglected in the different analytical steps.

The list below is not approved in terms of actual use and availability of respective data and does not claim to be complete. The aim of the list below is to point out the possible indicators which could be utilised for the description of one or another aspect or dimension of the IS. Thus, it is a sampling list of indicators. Further indicator list elaborations have been closely linked to data availability, as (already early) data reviews have indicated in the very limited availability of comparable regional data across the ESPON space (see the following chapter).

Indicators for the technological dimension:

- Availability of Digital Subscriber Lines (DSLs)
- Proportion of businesses with own homepage
- Proportion of businesses using
 - Internet
 - DSL
- Proportion of households using
 - Internet
 - DSL

Indicators for the economic dimension:

- R&D Expenditure as share of regional GDP
- Relative number of patents by region
- ICT sector value added as share of total value added
- ICT sector employment
- Employment in R&D as share of regional labour force
- Proportion of population with completed secondary/tertiary education

Indicators for the social dimension:

- Regional participation in e-government

- Participation of population having used the internet for educational or training purposes
- Participation of population in e-commerce activities

While above indicators have been defined only in static terms, for many indicators, theoretically, it would also be possible to define them in their dynamics, i.e. indicating their change over time. In addition, for all these dimensions further static and/or dynamic indicators could be listed. However, the availability of the majority of these further indicators could be doubted for the regional level in particular.

5. Methodology and hypothesis

The threefold differentiation of dimensions of the IS as developed in the last chapter allows the indicators which could possibly be used for an analysis of the IS to be specifically structured. Nevertheless, the review of data availability has clearly indicated the data constraints, which in turn affected the methodological opportunities for in-depth research.

Table 8 Comparison of IS related data availability for a sample of six countries, from national sources at different spatial levels for one specific year (2004*)

| Indicators | Territorial levels | | | | |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------|----------------|-------------|--------|-------|
| | NUTS1 | NUTS 2 | NUTS 3 | NUTS 4 | NUTS5 |
| Technological dimension (ICT infrastructure and use) | | | | | |
| Number of mobile (cellular) phones subscriptions per 100 inh. | CZ FI | CZ FI | CZ FI | | |
| Number of cable modem subscriptions per 100 inh. | CZ | CZ | | | |
| Number of xDSL subscriptions per 100 inh. | CZ | CZ FI | CZ FI | | |
| Proportion of households with a computer | CZ FI | HU | HU | | |
| Proportion of households with internet access at home | CZ DE FI GR | CZ DE FI HU | CZ FI HU | | |
| Proportion of households with broadband internet access at home | CZ FI | CZ FI | CZ FI | | |
| Share of enterprises with internet access | GR | PL | HU | | |
| Share of enterprises with own homepage | | PL | | | |
| Share of enterprises receiving orders over Internet | | PL | | | |
| Economic dimension (ICT sector & R&D & Education) | | | | | |
| ICT sector employment, per cent of total (as defined by OECD) | DE | DE | DE | | |
| ICT sector value added, per cent of total (as defined by OECD) | | | | | |
| R&D expenditure | CZ FI | FI | CZ FI | | |
| Private R&D expenditure | CZ FI | FI | CZ FI | | |
| R&D personnel and researchers, per cent of work force | CZ DE | DE | CZ | | |
| Number of patents | CZ FI | FI | CZ FI | FI | |
| Proportion of population with completed secondary education | CZ FI | FI | CZ FI | CZ FI | CZ FI |
| Proportion of population with completed tertiary education | CZ FI | FI | CZ FI | CZ FI | CZ FI |
| Social dimension (use of e-Government etc.) | | | | | |
| Percentage of population using the Internet for interacting with public authorities | CZ | CZ | | | |
| Percentage of population having used the Internet in relation to training and educational purposes | CZ | | | | |
| Percentage of population using Internet to seek health information whether for themselves or others | CZ | | | | |
| Percentage of population having ordered/bought goods or services for private use over the Internet in the last three months | CZ | CZ | | | |

* In several cases, data for other indicators are available for other (previous) years in the different countries.

These data constraints go far beyond those exerted by the availability of data in the ESPON database or any other EU or other international resources. Most data available for many countries of the ESPON space are, however, not available at NUTS 2 or even NUTS 3 level, but on country level only. In addition, data could often only be found for one indicator and one year, sometimes even at different years across the countries. Based on these findings, national statistical sources were deliberately searched for relevant data. Yet, again it turned out that the majority of the six reviewed countries could provide regional data for hardly any indicator in the preliminary list, as is indicated in Table 8. Furthermore, data measures are often differing slightly which does not allow an easy comparison across countries. Even the consideration of older data from years before 2004 does not change the impression given in Table 8.

Given these limitations, the role of national (and regional) reviews within the overall methodology becomes quite apparent. This the more so, since tentative findings indicate that one year can make quite a big difference with regard to the development of the IS and since country-related effects seem to be prevailing. The latter is particularly due to policies specific to the country and institutional settings e.g. with regard to the provision of ICT infrastructure availability.

Table 9 Spatial and analytical steps of proposed methodology

| | | Analytical steps | | |
|----------------|------------------------------------------|----------------------|-----------------|--------------------|
| | | Descriptive analysis | Impact analysis | Spatial Assessment |
| Spatial levels | Whole ESPON national & regional analysis | | | |
| | National analysis of selected countries | | | |
| | Regional case studies | | | |

Consequently, it had been concluded that the regional analysis of selected countries, which is supplemented with regional in-depth case studies, can achieve much more specific results than the overall ESPON

review. Therefore, the TPG followed a stepwise process analysing different kinds of data at different spatial levels. Furthermore, this methodology also distinguished between different logical steps that were inherent to the project's objective. This twofold-differentiated methodology is depicted in Table 9.

The darker the shade of the field in the table, the more promising is the respective combination of spatial and analytical steps. These different perspectives largely occur as of above stressed limits on data availability and comparability for the ESPON territory.

These different spatial and analytical steps have been kept in mind for the development of the methodology further on in the project. Furthermore, for these different spatial levels and analytical steps, the above threefold thematic differentiation has been applied as far as possible.

5.1. Descriptive analysis

The descriptive analysis has been conducted on all three different spatial levels mentioned above. In addition, this approach also ensures the consideration of the three spatial levels (macro, meso and micro) as utilised in ESPON. As of limited regional ESPON-wide comparable data, however, the ESPON-wide and macro-level description for many indicators stayed rather limited to the national level.

In view of the common concept developed in the FIR and the above threefold differentiation between the technological, economic and social dimension of the IS, the descriptive analysis has been differentiated accordingly. Thus, different indicators, as they are listed and differentiated in Table 8, were considered. However, depending on their availability across countries, the descriptive analysis for the different spatial levels and between selected countries and regions can vary considerably. This approach ensured to develop insights into the IS, which could not be realised by means of an overall comparable approach for the whole ESPON territory only.

Depending on the availability of comparable data over time, the descriptive analysis also aimed at indicating dynamics of the IS rather than only static data at one point of time. In addition, the combination of different indicators has been very useful for testing some of the research hypotheses. This also aimed at typology development.

5.1.1. Macro-level analysis

The descriptive analysis at the macro-level for the whole of the ESPON territory largely aimed at the development of IS related typologies. As mentioned above, many such variables and indexes are only available on national level rather than for regional breakdowns. In order to obtain typologies on the regional level, however, such data needed to be crossed with other regionally available data, which can be expected to be related to the IS development. As tentative empirical analyses indicate, regional GDP per capita appears to be an indicator appropriate for such typology development.

Therefore, at macro-level, typologies for the different thematic dimensions could distinguish between regions with a high or low IS attainment which is combined with high or low GDP per capita performance. Below, Table 10 illustrates the structure of such a typology using the example of the technological dimension of the IS.

Table 10 Methodological approach to macro-level typology development for the IS using the example of the technological dimension

| | | GDP per capita | |
|-----------------------------------|------|-----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | | High | Low |
| Technological dimension of the IS | High | <p>High-high <u>Top IS regions</u> High national level of technological IS dimension coincides with high regional GDP per capita levels</p> | <p>High-low <u>Peculiar IS regions</u> Despite a high national level of technological IS attainment regional GDP per capital level is relatively low</p> |
| | Low | <p>Low-high <u>Potentially developing regions</u> High regional per capita GDP performance despite limited technological IS level</p> | <p>Low-low <u>Restricted IS regions</u> Regionally lagging GDP per capita coincides with low national level of technological IS aspects</p> |

With regard to the technological dimension, national multidimensional indexes such as the Network Readiness Index (NRI) or the Digital Access Index (DAI) could, for instance, be applied. In this way it has been ensured that single aspects within the dimension do not dominate the developed typology. Nevertheless, such data are not able to depict regional deviations in the respective IS dimension. Thus, such typologies need careful interpretation and further analysis on meso- and micro-level. These further considerations are likely to explain the occurrence of 'high-low' respectively 'low-high' regions. One possible explanation could be related to inner-country differences in the availability of modern ICT means, which are not visible at the NUTS 0 level, but become evident when comparing different indicators or indexes across several countries.

5.1.2. *Meso-level analysis*

Due to the limited regional data availability for most of the ESPON space only a few aspects of the above dimensions could be considered for more than the selected countries. Therefore, the methodological approach to the meso-level analysis concentrated on national reviews of the IS taking into consideration regional breakdowns of different aspects of the three above thematic dimensions of the IS.

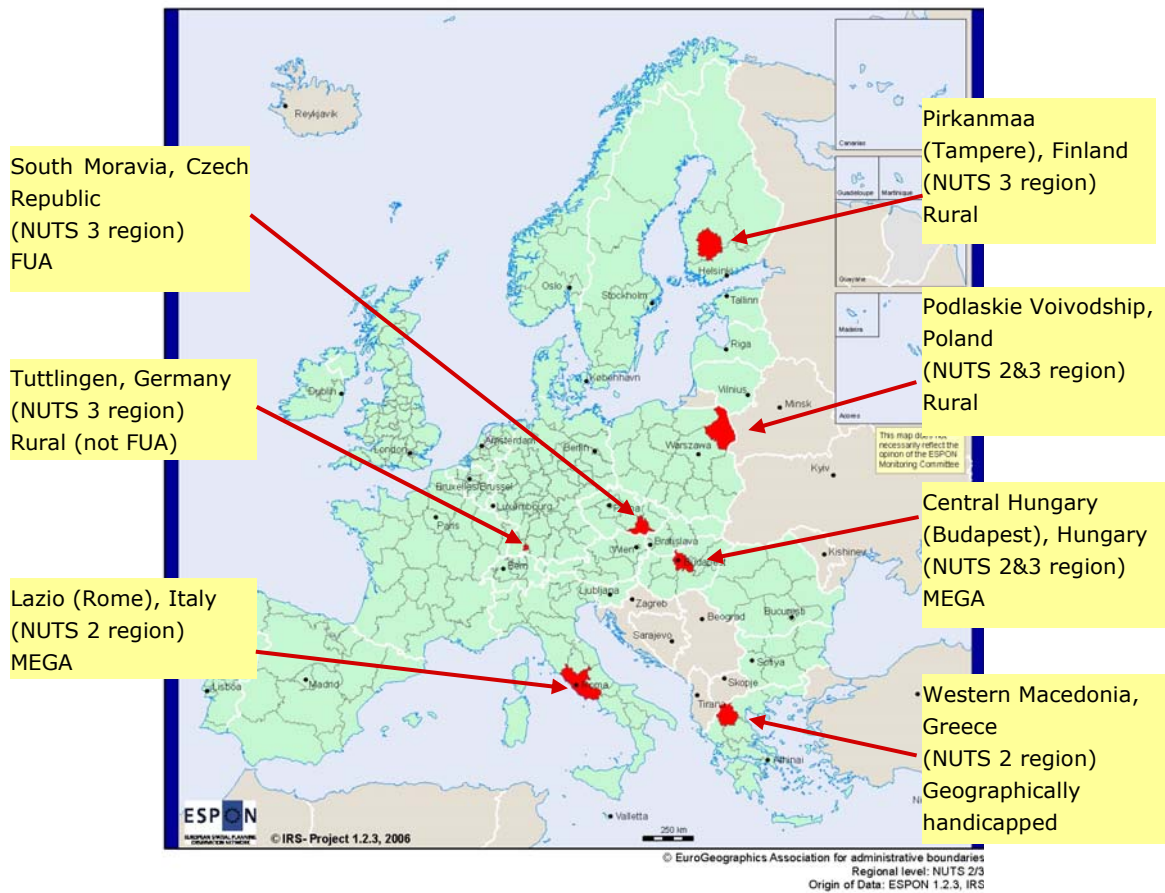
The number of national case studies has been limited to the seven Partners' countries of origin in order to obtain high quality information and achieve reliable results of the analysis. According to the template developed by the TPG (Appendix I), the first part of the country case studies was devoted to the description of the IS state and trends for the regions of the respective countries. This part of the analysis was based on the set of common indicators within the three thematic categories of the IS described above. As many indicators as possible of the above shown Table 8 have been included in the country studies. The results of the survey on data availability showed that it is hardly feasible to base the descriptive part of the country case studies on the set of common and comparable indicators. Therefore, other relevant and, for the particular country, available indicators were considered as well. The basic level for the analysis was the NUTS 2 level, but wherever possible, lower regional levels were analysed as well. The description has not been limited to the static analysis. The trend description for the period 2000-2004 was included as well, as far as time series data were available.

5.1.3. *Micro-level analysis*

The regional case studies have been carried out in all seven countries participating in the project, with one case study per country. The selection of regions and spatial coverage of the case studies had to comply with the project's needs, especially in the situation of quantitative data limitations. Thus different kinds of regions, which apparently participate to different extents and in different ways in IS developments, have been investigated. Several types of regions of special interest of the ESPON 1.2.3 project are indicated in the Terms of Reference and as such they have been included in the research –MEGAs, FUAs, rural regions and geographically handicapped regions.

The case studies have been conducted in selected NUTS 2 or NUTS 3 regions, according to the following distribution of cases by countries (Figure 6).

Figure 6 The regional case studies



The selection of the regional case studies has been associated with the geographic location of the Project Partners in order to assure the highest quality of the analysis and to overcome the resources' shortages. Furthermore, the number of case studies had to be relatively limited in order to be able to cover a rather broad thematic scope adequate for the objective of the project. Nevertheless, the case study selection also takes account of North-South and East-West divisions of the ESPON territory and as such considers a number of different conditions in which the IS evolves.

From the descriptive analysis point of view, the most important outcome of the regional case studies is the description of IS state and trends within a given region in relation to the IS development across different sectors of this region: households, public authorities, enterprises. The sources of information vary among case study regions, as the identification of IS manifestations depends on the research undertaken so far in the given region. However, the empirical research results have

been conducted on a comparative basis in all cases (for Regional case study template see Appendix II). In all regions under study but the Italian one (in which only enterprises were investigated), the following four spheres have been examined:

1. **Households.** By collecting existing data - if available - information had to be provided on private computer ownership and connectivity to the Internet.
2. **Public administration.** An assessment of the role of the Internet and Intranet within the offices of public authorities in the studied regions had to be provided. This was mainly achieved by the following activities: a) interviews with officials of the local governments; b) analyses of the web pages of these governments (for interviews framework see Appendix IV).
3. **Businesses.** Another objective was the assessment of the use of the Internet for commercial purposes. Two complementary methods of data collection have been applied, such as: a) interviews with the representatives of selected business organisations, such as the chamber of commerce, business associations etc. These interviews provided an overview of the importance of the Internet in current business operations within the survey region; b) a survey based on a common questionnaire (Appendix III – **Business questionnaire**) made on a sample of firms. This analysis has been preceded by an analysis of the web pages of the selected firms.

Originally the questionnaire had to be sent by e-mail to the firms selected on the basis of their presence in the telephone register in order to get ca. 100 responses. But this common method had to be revised when the field research was started by every Partner Project. It turned out that methods of selecting the research samples and the way research was conducted varied between regions studied. The main reason for that was the unique character of specific case and different socio-economic circumstances which affected the low probability of getting the desirable number of responses via e-mail (and sometimes made the research impossible to conduct at all). The methods eventually used in specific regions are presented in Table 11.

Table 11 Methods adopted in the regional case studies

| Name and type of region | source of information | method | sample | questionnaires returned |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------|
| South Moravia – FUA | random selection from the phone register | the e-mail questionnaires and additional telephone contacts plus several interviews with the representatives of selected companies | 685 | 52 - 7% (the return rate) |
| Tuttlingen – rural (not FUA) | database of businesses obtaining an e-mail address, provided by the Chamber of Commerce | e-mail survey of businesses | 1350 | 82 - 6.07% (the return rate) |
| Dytiki Makedonia – geographically handicapped | random selection with the use of business catalogues | e-mail survey of businesses plus interviews in firms (appointments with the help of local authorities and agencies) | 40 via e-mail, 56 interviews | 4 - via e-mail-1% (the return rate); 50 interviews – 89.3% (the return rate) |
| Tampere –rural | random selection from the phone register | e-mail survey of businesses | 433 | 48 - 11% (the return rate) |
| Central Hungary – MEGA | No field research. The conclusions included in the regional case study were based on the recent existing surveys of firms. | | | |
| Lazio - MEGA | random selection with the use of business catalogues | e-mail survey of businesses | 672 | 22 – 3.2% (the return rate) |
| Podlaskie –rural | random selection from the phone register | e-mail survey of businesses plus interviews in firms | 200 via e-mail, 125 interviews | 2 - via e-mail-1% (the return rate) 74 interviews – 59.2% (the return rate) |

Source: own compilation based on the regional case studies.

4. **Educational system.** Education is one of the most crucial spheres of building and developing the Information Society, since it creates behavioural patterns and provides competences to the youngest generation. Two most essential fields have been investigated: a)

how do schools provide knowledge about ICT applications, and what equipment is used for ICT classes; b) what is the role of ICT applications in the educational process; to what extent are pupils encouraged to use information collected through the Internet in their daily educational efforts. These two issues have been investigated through interviews with the appropriate educational institutions at the regional level and through direct visits to the potentially "good" and "poor" schools in the region. On this occasion information about the spread of computers, access to the Internet and ways it is used in pupils' households could partly be collected as well (for interviews framework see Appendix IV).

5.1.4. *Research hypotheses*

The following research hypotheses are related to the descriptive analysis:
The features and roles of the IS manifestations vary between different types of regions.

From this hypothesis it follows that it might be necessary to consider different regional characteristics of IS for the different types of regions. For instance the relation between business and private use of modern ICT might significantly vary, depending on the regions' intensity of economic activities.

Even within one or another type of region, the features can at least partly vary due to different niches of specialisation.

The second hypothesis especially follows theoretical considerations of different kinds of metropolitan regions, which, regarding their knowledge-intensive service production are differentiated e.g. between *global cities* and *service-industrial cities* (for further differentiation related to metropolitan areas see e.g. Kujath, 2005).

5.2. **Impact analysis**

Due to the limited availability of comparable data for the whole ESPON space, quantitative impact analysis had to remain rather simple. Therefore, a qualitative approach of the country and regional case studies has been highly important for conducting the impact analysis of the IS at lower spatial tiers.

Generally, the impact analysis in ESPON project 1.2.3 aimed to explain in which way the IS affects global socio-economic indicators such as GDP per capita or unemployment rates, as well as the dynamics of these phenomena. Since the IS cannot be described as such by one comprehensive indicator (as it could be thought of for the measurement

of the impact of one specific policy), it was necessary to relate various aspects of the IS to the above-mentioned global indicators. Here it was again reasonable to follow the logical structure of the previously described three thematic dimensions of the IS.

5.2.1. Macro-level analysis

In quantitative terms, the consideration of stock data at different points in time, mentioned above, were a possible starting point for the impact analysis, which is also useful for spatial assessment introduced below. However, altering indicator definitions over time and respectively varying time references across countries could easily affect results. Thus, such measures needed careful consideration.

In addition, simple correlation analyses have been conducted for comparable data. This could indicate varying strengths of the relationship between technological, economic and social aspects respectively and, for instance, GDP per capita. However, such analysis cannot clearly identify the direction of influence. It had to be supplemented on the basis of corresponding theoretical considerations with regard to the role of the IS for socio-economic development. Yet, with the help of mutual consideration of the corresponding findings for the meso- and micro-level analysis outlined below, this analysis has been particularly helpful for the development of policy recommendations.

5.2.2. Meso-level analysis

In accordance with the already mentioned data restrictions, meso-level analysis largely concentrated on selected countries. Therefore a twofold approach has been chosen. The first approach was a purely quantitative method, which considered the coincidence of various regional technological, economic and social IS aspects with regional levels of the GDP per capita. This approach represented the linkage between the macro-level analysis and the following more qualitative analyses' elements. It could show, to what extent more general findings of the macro-level analysis were supported or contradicted by regional data relations.

The second approach had the intention of deepening these findings, as it considered the qualitative aspects of the IS development and especially referred to IS-specific national policy influences within the framework of a country study. The second part of the country studies' template is focused on the description of the country-specific IS development policy,

which gives an opportunity for international comparison among the seven countries. The analysis leads to the depiction of the role and the importance of the IS development policy in the given country in comparison to other state policies. Moreover, on the basis of main IS policy documents, the definitions of the IS phenomenon and the priorities of IS policy as well as the responsibilities related to the IS policy implementation have been described and compared. This kind of investigation allowed a deeper understanding of the perception of the IS in different countries, of changes in definitions of the IS, the role of the IS over time and its main areas of influence.

Both parts of this analysis aimed at determining the most important relations between different aspect of the IS in a country, which justified a focused regional case study design. Furthermore, this country-specific consideration could also emphasis how various aspects of the IS related differently with, e.g., GDP per capita in different countries.

5.2.3. Micro-level analysis

The most important results of the regional case studies for the impact analysis were expected to be the relationship of IS indicators (with regard to the three IS dimensions) within the given region, against the background of a general description of the region and its position in the regional setting of the studied country (e.g.: level of development, economic structure, human capital development).

The outcomes of the comparison of case studies was assumed to allow for statements regarding the general project's hypothesis on the relation between the level of regional socio-economic development and the spread of ICT applications, technological advancement and the level of development of the Information Society.

5.2.4. Research hypotheses

The following research hypotheses are related to the impact analysis:

The development of an IS depends to a great extent on the role of the state, and on its tendency to support the creation of adequate prerequisites for the IS either in a more centralised rather than in a decentralized manner, fostering an innovative environment also in disadvantaged regions.

Such a hypothesis is closely linked to the context dimension and assumes that the context dimension in different regions and countries can be more or less supportive of the development of an IS.

The role of human capital and adequate and flexible education systems become increasingly important for development of the IS.

This hypothesis is based on the observation that in highly advanced economies it becomes increasingly difficult for citizens with low educational attainment to participate in economic development. Mainly due to low educational attainment and sometimes poor accessibility to jobs, they suffer from foreign competitors and job losses. Thus, in order to achieve an IS in which the majority of the population can participate and use modern information sources, adequate education systems are needed in different types of regions.

5.3. Spatial assessment

Besides the descriptive analysis and the analysis of spatial impacts of IS developments, these developments were also to be assessed concerning spatial objectives. For operational reasons, this spatial assessment has been envisaged for selected EU objectives only, thereby concentrating on spatial convergence, competitiveness, cooperation, regional diversity and polycentricity. Consequently, this assessment aimed at mirroring the observed IS developments, policy measures and observed relations to global socio-economic indicators against ESDP objectives. In this way it was possible to analyse to what extent the regions of the ESPON space progress in terms of one or other of IS-related objectives, simultaneously assessing cohesion-related achievements of the IS.

5.3.1. Macro-level analysis

Due to the regional data restrictions across the ESPON space, the macro-level analysis could only very roughly consider a few of the spatial objectives, especially taking into account the extremely low availability of time series data. Therefore, the most appropriate approach appeared to be the consideration of the relationship between the observed patterns of the IS in terms of the different thematic dimensions and specific ESPON typologies, such as the urban-rural, polycentricity or potential accessibility typologies.

5.3.2.Meso-level analysis

For the spatial assessment at the meso-level, the second part of the country case study is of high importance, as it aimed at analysing the policy documents related to IS development (e.g. strategies for ICT and R&D development, as well as other relevant documents). It was assumed that this comparison would find out how far these documents are related to spatial development. Among other things, the case study template included an analysis of references regarding the diagnosis of IS state and trends at the regional level. Moreover, the IS policy documents have been checked in order to identify their regional context (i.e. are there any special aims, instruments, etc. provided for different types of regions: metropolitan areas, big cities, rural and geographically handicapped). Additionally, on the basis of the available evaluation reports, a description of the IS policy influence on spatial development (with special references to cohesion, polycentricity and location changes) has been provided.

Finally, wherever feasible, some examples of the regional IS strategies have been given and described.

On that basis some conclusions on the different IS spatial impacts could be formulated.

5.3.3.Micro-level analysis

Regional case studies have been of crucial importance for the purposes of spatial assessment at the micro-level. The aim of the regional case studies was to answer the following questions:

- Has the IS development influenced the spatial behaviour of the most important actors in the three sectors: households, public administration and enterprises?
- Have the changes in spatial behaviour influenced the levels of cohesion and polycentricity?
- What kinds of activities were undertaken by regional and local policymakers to improve cohesion and polycentricity with regard to IS in the region (bottom-up approach)?

These questions had to be answered for example by consideration of changes in enterprise location in the given region resulting from the IS development. Since such changes can lead to more even spread of the industry or services and could in this way influence the economic performance of the region and improve its position in comparison to the

others. These findings could then be followed by consideration of the regional IS policy directions in order to find out, for example, whether the policy interventions are promoting new areas for business or whether they develop some incentives for teleworking.

5.3.4. Research hypotheses

The following research hypotheses are related to the spatial assessment:

Backward, peripheral and other disadvantaged regions have a smaller chance to catch up and build up growth because of the lack of important prerequisites such as e.g. ICT networks.

This hypothesis is quite technical oriented and thus considers only the technical dimension of the IS. Nevertheless, it might be useful for a possible access to understanding the lack of IS developments in such regions. Thus, it is a hypothesis which is impact-related and from which – depending on the respective empirical findings – possible policy recommendations might be developed.

Depending on the level of economic development, the regions in different geographical parts of Europe are not equally affected by the spatial impacts of the IS. Centralisation – decentralisation tendencies vary.

This hypothesis can be used to found the selection of case studies and the importance of the inclusion of Western, Eastern, Northern as well as Southern European regions. As especially in the new member states numerous economic indicators point towards centralisation developments around a small number of MEGAs. This raises the question of how far this aspect is also translated into the features of the IS, taking into account the society's developments beyond economic activities.

While metropolitan regions basically are best prepared for developing a strong knowledge-based economy and restructuring towards an Information Society, their success varies depending on the persistence of structures created in the industrial society and their ability to stimulate the restructuring processes. This also affects the strengths of ties between metropolitan regions and their hinterland.

This hypothesis depicts one possible relationship between the core of the IS and economic impacts. In this context policies could also matter, if they influence the persistence of existing structures. It is also a hypothesis, which relates the metropolitan development of the IS to the micro-level, as compared to other hypotheses which focus more predominately on the macro-level.

5.4. Development of policy recommendations

Due to the quite different methodological approaches that have been followed for the different spatial levels, and the scarcity of available statistical information, policy recommendation formulation had to be based on comprehensive analytical reviews that would consider simultaneously the macro-, meso- and micro-level analyses as well as the results of the different analytical steps. Thus, policy recommendations do not strictly differentiate between the three spatial levels. However, they do focus on different options in terms of alternative or complementing policy objectives and – wherever possible – differentiate between the three dimensions of the IS, which had been considered in the analytical process.

6. Quantitative Diagnosis of the Territorial State of IS in the ESPON Space

6.1. Introduction

One of the core ESPON objectives is to acquire new regional data for the “ESPON space”, i.e. the 27 countries of Europe. This task aims at extending and enhancing the scope of knowledge on regional differentiation of issues under study, and in this way creating a cognitive basis for exploring interrelations and formulating theoretical generalization – which, finally, should lead to policy recommendations.

In the case of investigation into regional differentiation of the Information Society in the ESPON Space this has appeared to be a difficult endeavour. Scarcity of data is the factor strongly limiting the opportunities for providing new knowledge on the regional distribution of indicators related to the IS. However, in face of lack of original, full datasets, some approximations have been made, which should be considered as sufficiently accurate for this stage of analysing the IS in the regions of Europe.

6.2. Towards quantitative analysis of IS: Previous research and data availability

In general, IS indicators describe the level of Information Society development achieved in a particular society in quantitative terms. They can serve a range of purposes: for example, following the evolution of IS or benchmarking IS with other territories. By considering changes over time, IS indicators also comprise a critical tool in the monitoring, evaluation and improvement of IS policy. Probably, the primary benefit of indicators lies in this capacity to guide policy-makers into proactive thinking, i.e., to focus their attention on future priorities.

Constructing a comprehensive set of IS indicators is a major task, requiring both a solid scientific background and a remarkable empirical effort for establishing meaningful benchmarks and measuring change. In other words, the set of IS indicators should be based on a sound and operational definition of the Information Society. While the IS is actually a very recent phenomenon, numerous empirical projects have aimed at empirically measuring and quantitatively monitoring different aspects of it. This substantial body of work has been carried out by various actors: supranational organisations (OECD, 2004; ITU, 2003; Eurostat, 2004) national statistical offices, research projects, consultant agencies etc. In

order to get an insight into how the “territorial dimension” has been acknowledged, a review concerning the recent work in this field was undertaken. Table 12 presents a sample of projects which have collected IS indicators in the ESPON space since year 2000, complemented by a regional analysis of the Nordic countries and a Finnish IS project.

Table 12 Examples of Information Society indicator projects in the EU since year 2000.

| Regional focus | Project | Year | Territorial level | Source |
|-------------------------|--------------------------------------------------------|------|-----------------------------------------------|-------------------------------|
| EU country | ESIS ¹⁵ | 2000 | EU15, NUTS0 | Public sources |
| | SIBIS ¹⁶ | 2002 | EU15, partly EU27, NUTS0 | Interviews |
| | Eurobarometer ¹⁷ | 2002 | EU15, NUTS0 | Interviews |
| | Eurostat InfoSoc Pocketbook 2003 edition ¹⁸ | 2002 | EU15, NUTS0 | Interviews |
| | E-Business Market Watch ¹⁹ | 2005 | 7 EU countries, NUTS0 | Interviews |
| EU territories | BISER ²⁰ | 2003 | 28 NUTS2 regions in EU15 | Interviews |
| | INRA ²¹ | 2004 | EU15, partly NUTS2 | Interviews |
| | ESPON Telecom ²² | 2004 | EU25+2+2, partly EU15 NUTS0, partly NUTS2 | Previous projects, simulation |
| Nordic countries | Nordic Information Society Indicators ²³ | 2002 | 4 Nordic countries, capital vs. other regions | Interviews, |
| Finland | Statistics Finland ²⁴ | 2002 | Finland, NUTS3 | Interviews |

Table 12 reveals that several actors have been working with the IS indicators simultaneously in Europe in recent years. While many of these projects may be considered to represent pioneering work in this field, the somewhat overlapping attempts also indicate a poor coordination in this very first phase of collecting IS data on a European level. Another distinctive feature is the common methodological approach of collecting the data via interviews, indicating that up-to-date and publicly-available statistical sources are either of inadequate quality or totally lacking. The two projects that use public sources utilize either the indicators of previous projects (ESPON 1.2.2) or collect their indicators at a country level (ESIS).

For the EU25, member countries’ statistical offices, Eurostat, and more recently, EU DG Infosoc nowadays provide selected IS indicators.

¹⁵ <http://www.eu-esis.org/>

¹⁶ <http://www.sibis-eu.org/>

¹⁷ http://www.qesis.org/en/data_service/eurobarometer/

¹⁸ http://epp.eurostat.cec.eu.int/portal/page?_pageid=1073,46587259&_dad=portal&_schema=PORTAL&p_pr oduct_code=KS-56-03-093

¹⁹ <http://www.ebusiness-watch.org/>

²⁰ <http://www.biser-eu.com>

²¹ http://europa.eu.int/information_society/policy/ecom/info_centre/documentation/studies_ext_consult/inra_year2004/index_en.htm

²² http://www.espon.lu/online/documentation/projects/thematic/1864/fr-1.2.2_revised.pdf

²³ http://www.stat.fi/tk/yr/tietoyhteiskunta/nordic_iss_02.pdf

²⁴ <http://www.stat.fi/tk/yr/tietoyhteiskunta/>

However, territorial data are not commonly available through these public sources, and some projects have collected territorial IS indicators themselves. For example, the ESPON TPG 1.2.2 analyzed the availability of telecommunications and also IT in general. The project used information from Eurostat and INRA, of which the latter provided information at a territorial level for EU15 member countries. For the rest of the ESPON countries the indicators were simulated. As the technological aspect – the availability and use of IT technologies – is in practice the most monitored IS indicator, its poor availability at a territorial level clearly manifests that other types of regionalized IS data are even harder to find.

Table 12 also shows that the projects at the EU level have tended to broaden from the EU15 to include the EU25 and even more countries. Moreover, it seems that the territoriality of IS has become of interest only recently. As collecting a territorially representative sample by conducting interviews requires remarkable resources, the task has been reduced either by limiting the coverage to selected regions from the observed countries (BISER), or by calculating IS indicators on the basis of other available data (ESPON 1.2.2). Moreover, the only country specific project in Table 12, measuring the state of the IS in Finland, collected data at the NUTS3 level. The projects looking at many countries have collected territorial IS data either at the NUTS2 level, or compared the capital region with the rest of the country. In general, international projects seem to pay attention only to country level indicators.

The conclusions from this review are twofold:

1. While the situation is improving through the eEurope monitoring process, there has not been a coordinated collection of IS indicators for the whole EU or ESPON space; and
2. Comprehensive territorial data measuring the IS for the whole ESPON space has not been collected by previous projects.

This is probably due to the lack of coordinated collection of IS indicators, and the lack of resources for collecting a territorially representative sample. Moreover, the vague definition of the term Information Society is reflected by the collected IS indicators. Table 13 presents the number and categories of indicators collected by the six reviewed projects. The number of IS indicators varies from 7 to 145. This wide range reflects the differences in indicator categories, mirroring the projects' views of what the IS means from the operational perspective.

Table 13 Number of indicators and indicator categories in six IS indicator projects.

| Project (Year) | ESIS (2000) | Eurostat (2003) | BISER (2003) | INRA (2004) | ESPON Telecom (2004) | Statistics Finland (2003) |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No of Indicators | 30 | 34 | 145 | 10 | 7 | 28 |
| Indicator categories | <ul style="list-style-type: none"> • Telecom markets • Telephone lines • Telecom equipment • Telecom prices • Personal computers • Internet • Television | <ul style="list-style-type: none"> • ICT sector • ICT market and external trade • ICT penetration • ICT usage in households • ICT usage in enterprises • ICT and education, training and skills • ICT government and health | <ul style="list-style-type: none"> • eGovernment • Transport • Healthcare • Regional identity • Business enterprise • Innovation and R&D • Work • Education, training and skills • Social inclusion • ICT infrastructure | <ul style="list-style-type: none"> • Fixed and mobile telephony • Internet | <ul style="list-style-type: none"> • Mature ICT availability and use • Broadband, e-commerce and Internet backbone | <ul style="list-style-type: none"> • Views of Information Society • Usage of phones, computer and internet • Usage of computers and IT networks in schools • IT at work • eGovernment • Differences of ICT usage on the NUTS3 level |

Following the approach of Webster (1995), the indicator categories in Table 13 represent three general types of IS concept: 1) broad; 2) intermediate; and 3) narrow view of IS.

- The *broad* view follows Webster’s original conceptualization of the Information Society into five definitions: technological, economic, occupational, spatial, and cultural. All these aspects are included in this broad view as well as spatial and cultural features such as regional identity, social cohesion and inclusion. Among the projects, this view is best represented by BISER.
- The *intermediate* view of IS includes technological and economic indicators in the data collection, such as the size of ICT sector, market and external trade. It also includes indicators measuring IT at the workplace, the state of eGovernment and health. This view is typically represented by statistical agencies: Eurostat and national statistical offices.
- The *narrow* view of IS defines the IS technologically as it looks at the availability and usage of different ICT (ESIS, INRA, ESPON Telecom). By doing so, the indicators measure the ‘digital divide’, the difference between the number of users and non-users. This view relates with Webster’s technological definition of IS.

While these types of IS concept imply any concrete criteria for selecting IS indicators in this context, the broad and intermediate views were used

as points of reference when the indicator list for measuring the availability of the data on IS was constructed. The aim was to test whether the regional data from national sources could be compiled for this study. Two surveys on the availability of national statistical resources were conducted. The first survey considered the availability of 21 indicators, ranging from ICT deployment to innovation potential in seven ESPON 1.2.3 countries. The results from this survey are presented in Table 14. They show significant data shortages particularly at NUTS2 and 3 levels.

Table 14 Availability of the set of IS indicators in the seven ESPON 1.2.3 TPG countries for the year 2004.

| # | Indicator | Availability, % of countries | | |
|----|-----------------------------------------------------------------------------------------------------------------------------|------------------------------|-------|-------|
| | | National | NUTS2 | NUTS3 |
| | ICT infrastructure and use | | | |
| 1 | Number of mobile phones subscriptions per 100 inh. | 86% | 29% | 29% |
| 2 | Number of cable modem subscriptions per 100 inh. | 71% | 14% | 0% |
| 3 | Number of xDSL subscriptions per 100 inh. | 71% | 0% | 0% |
| 4 | Proportion of households with a computer | 86% | 43% | 43% |
| 5 | Proportion of households with internet access at home | 86% | 71% | 43% |
| 6 | Proportion of households with broadband internet access at home | 86% | 29% | 29% |
| 7 | Share of enterprises with internet access | 71% | 29% | 14% |
| 8 | Share of enterprises with own homepage | 57% | 14% | 0% |
| 9 | Share of enterprises receiving orders over Internet | 43% | 14% | 0% |
| | ICT sector & R&D & Education | | | |
| 10 | ICT sector employment, % of total (OECD definition) | 43% | 14% | 14% |
| 11 | ICT sector value added, % of total (OECD definition) | 29% | 0% | 0% |
| 12 | R&D expenditure | 71% | 29% | 29% |
| 13 | Private R&D expenditure | 71% | 29% | 29% |
| 14 | R&D personnel and researchers, % of work force | 57% | 29% | 14% |
| 15 | Number of patents | 57% | 14% | 14% |
| 16 | Proportion of population with completed secondary education | 43% | 14% | 29% |
| 17 | Proportion of population with completed tertiary education | 43% | 14% | 29% |
| | Purpose of use: e-Government etc. | | | |
| 18 | Percentage of population using the Internet for interacting with public authorities | 86% | 14% | 0% |
| 19 | Percentage of population having used the Internet in relation to training and educational purposes | 57% | 0% | 0% |
| 20 | Percentage of population using Internet to seek health information whether for themselves or others | 57% | 0% | 0% |
| 21 | Percentage of population having ordered/bought goods or services for private use over the Internet in the last three months | 71% | 14% | 0% |

The second survey focused on a more limited set of eleven indicators, representing the intermediate view on IS (see, Table 15). The results follow the pattern of Table 14: while the data availability at the country level can be considered as moderate, the data at NUTS2 level are scarce or nonexistent (see, Appendix VI for data availability by country).

Table 15 Availability of the subset of IS indicators in twenty nine ESPON countries for the year 2004.

| # | Indicator | Availability % of countries | |
|----|------------------------------------------------------------------|-----------------------------|-------|
| | | National | NUTS2 |
| 1 | Number of mobile phones subscriptions per 100 inh. | 86 % | 32 % |
| 2 | Proportion of households with a computer | 93 % | 50 % |
| 3 | Proportion of households with internet access at home | 93 % | 57 % |
| 4 | Proportion of households with broadband internet access at home | 96 % | 50 % |
| 5 | Share of enterprises with internet access | 93 % | 39 % |
| 6 | Share of enterprises with own homepage | 79 % | 29 % |
| 7 | ICT sector employment, % of total (as defined by OECD) | 36 % | 29 % |
| 8 | R&D expenditure | 71 % | 57 % |
| 9 | Number of patents | 50 % | 36 % |
| 10 | Percentage of population using the Internet for interacting with | 54 % | 14 % |
| 11 | Percentage of population having ordered/bought goods or services | 79 % | 32 % |

6.3. Conclusions on the availability of IS data on national and regional level

The surveys of previous research and existing data on the IS in Europe pointed out that the weak availability of IS indicators sets strict constraints to the quantitative territorial analysis of the IS in Europe, and to the formulation of regional typologies for the EU25+2+2. The implications for this study are as follows:

1. The conceptual definition of IS remains unclear. This is seen in the empirical work: unharmonized data collecting formats, diverse indicators and different methodological approaches to data collection. However, the survey of the recent European IS indicators projects indicates three general operational categories of IS: the narrow technological, the intermediate techno-economic and the broad all-inclusive definition.
2. European-wide territorial data on IS are scarce, or even totally lacking. Moreover, the available IS data below the country level is incomplete for comparative purposes in the ESPON space – in those areas where regional data is available, it covers only a limited subset of the EU29 countries.
3. Given the resources and time allocated to the ESPON 1.2.3 project, a collection of raw data from national sources by the project team was seen as unrealistic. Surveys on the availability of IS data in TPG and ESPON countries provided further evidence on this conclusion. In general, the results clearly show that while a number of territorial indicators are available in each country, the data from existing

national sources are far too heterogeneous for the needs of international comparisons.

As a whole, the evidence from our surveys leads to the conclusion that territorial data on IS is not readily available for more than a couple indicators in a few of the EU25+2+2 countries. Given the magnitude of the missing data and the amount of the resources, the primary data collection by the project team was also seen as an unrealistic option. This implies two possible ways to characterize the key task of the project – description of the IS from a territorial perspective. Firstly, a macro analysis of the spatial aspects of IS is to be based on existing country-level data and indicators on IS in the whole ESPON space. This is a practical solution, given the fact that the IS appears to be predominantly a country-level phenomenon since IS policies are often implemented at the national level. This approach is deepened by a NUTS2 level IS typology. Secondly, the general picture is complemented by case studies to provide a more detailed analysis of the IS's characteristics and trends in selected ESPON subspaces. The present section takes a look at the first perspective, whereas the second approach is articulated in some detail in other parts of this report.

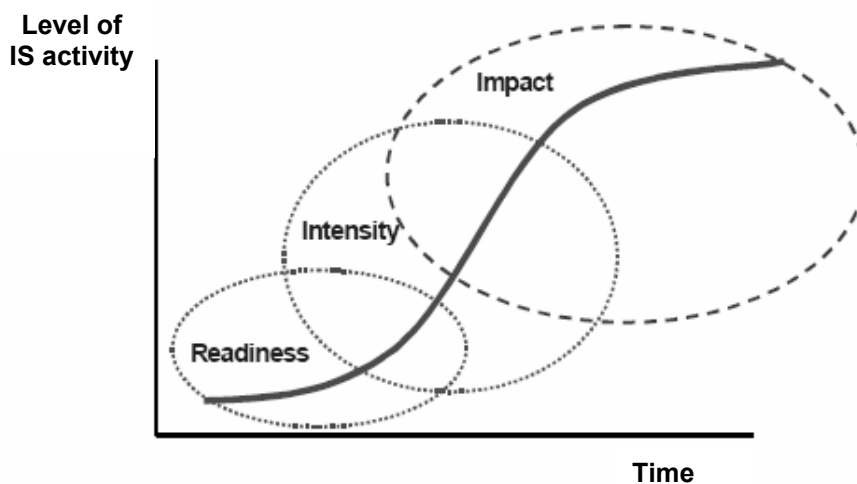
Next, the general background of the macro approach is introduced by presenting the aspects of IS indicators with respect to the IS lifecycle framework. Then composite IS indices are used to illustrate the territoriality of IS in Europe, and to present some tentative findings on the spatial differentiation in the EU25+2+2 area. After that, we turn our focus on the territorial pattern of IS in more detail, and present a NUTS2 level typology of IS across the ESPON space. Finally, the regional variations of the constructed composite IS index are analyzed in order to get an insight into the dynamics and trends of the territorialities in IS development.

6.4. Spatial patterns of the IS in Europe – a macro level analysis

As it is shown in Table 14 and Table 15, our surveys on the availability of IS indicators cover the technological characteristics (ICT infrastructure and use), the economic side (ICT sector, R&D, Education) and the social aspects (purpose of use) of the IS. These three dimensions relate to the three operational categories of IS mentioned above: the technological dimension corresponds with the narrow view, the technological and economic dimensions with the intermediate view, and the whole sets with the broad view of the IS. The division in Table 14 can also be linked

with the life-cycle framework provided by the OECD (1999) (See also, Simpson, 1999), highlighting that various IS indicators can be interpreted in terms of evolutionary stages of IS (see Figure 7). The lifecycle of IS is seen to range from the stage of readiness and intensity to that of impact. In the first stage only enabling factors are of importance, whereas in the later stages, the availability, use and impact of IS (e.g. technologies) gain prominence. Comparing this setting with Table 12, it can be argued that the presented indicators are mostly linked with the intensity stage of IS, but some of them can also be seen to measure impacts: the economic part focusing on operational restructuring, and the purpose of use on the social inclusion and participation.

Figure 7 Life-cycle of Information Society and research needs. (Source: OECD 1999 with some modifications).



The life-cycle approach has also been applied in the collection of IS indicators (Gareis & Osimo 2004; Statistics Finland 2005). In this framework the readiness phase of IS includes, for example, indicators measuring the availability of ICT infrastructure, and opportunities and skills needed for using ICT, such as general computer skills. The intensity or growth phase concentrates on the coverage and means of ICT use; the relevant indicators measure, for instance, computer, Internet and e-mail penetration. In other words, these two phases largely focus on measuring the digital divide and the knowledge gap – the phenomenon that some people have better access to ICT and information than others. The third, impact or outcome phase, measures the operational restructuring caused by the use of ICT, and in the social inclusion and participation in the IS.

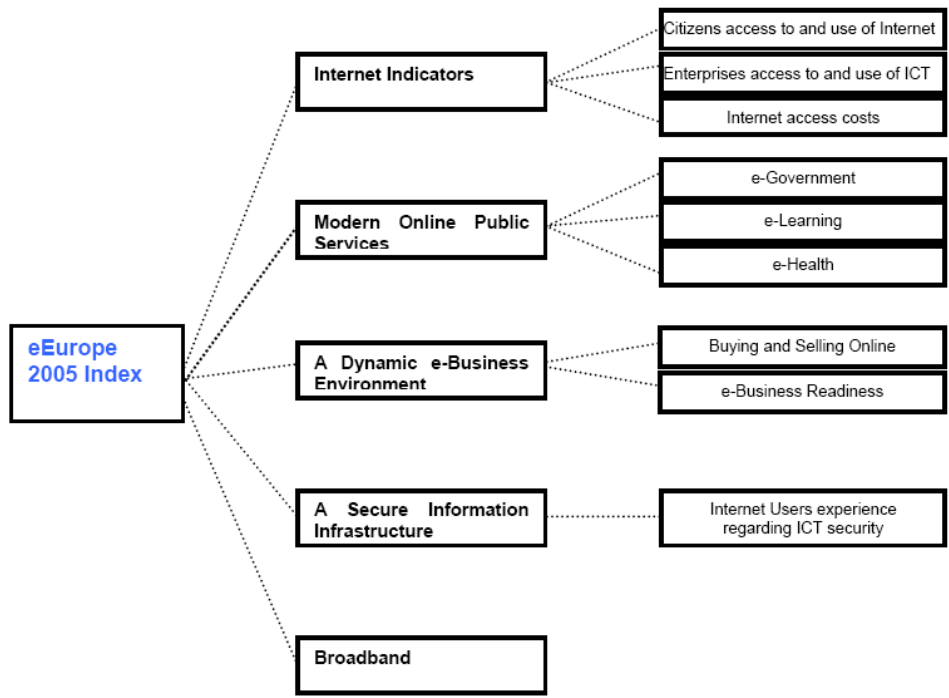
Irrespective of its limitations, the life-cycle approach reveals the methodological and practical difficulties associated with the comparisons between the countries at different stages of IS development. In international comparisons, the indicators should take into consideration the complex dynamics of IS development – the specificity of each IS indicator category in each country in each point of time – and combine all this information into a synthetic measure.

There are only a few such synthetic indices available, describing the characteristics of the IS in European countries. Perhaps the most comprehensive ones are the ITU Digital Access Index (DAI) from 2002, the eEurope Index from 2004 and the Network Readiness Index (NRI) provided by the World Economic Forum in 2005. In the following we take a closer look at the two most recent indices, the eEurope Index and the Network Readiness Index. These indices are so-called composite indices, which summarize the information of several indicators or sub-indices in order to give an overall picture of the state of the Information Society in a country. The overall aim is to compare the macro-regions and countries in terms of IS performance in the ESPON space.

The eEurope Index is calculated for 28 countries, aiming to benchmark the new member states and the candidate countries with the EU15 countries. Thus it includes Turkey but excludes Norway and Switzerland. The index is an average of the following five sub-indices: Internet Indicators, Modern Online Public Services, Dynamic Business environment, Secure Information Infrastructure, and Broadband. Appendix VII provides a more detailed description of the index. (INSEAD 2004)

These sub-indices are developed to suit the needs of the e-Europe 2005 action plan. The action plan provides that by the year 2005 member states should have a widespread broadband availability and a secure information infrastructure for a dynamic e-business environment and modern online public services. The data for the indicators was derived from several international statistical sources, including the World Bank, Pyramid Research, ITU and the World Economic Forum. The eEurope index is measured on a scale from 1 to 7. Figure 8 represents the contents of the eEurope index (INSEAD 2004).

Figure 8 The eEurope Index. (Source: INSEAD 2004).



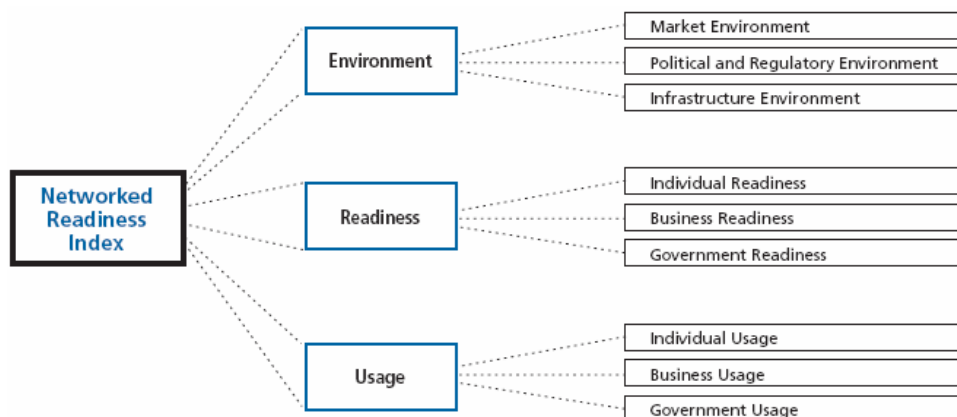
The Networked Readiness Index (Weforum 2004; 2005) looks at 104 economies, including all 29 ESPON countries. The NRI is formed of the three main categories: the environment for ICT development consisting of market environment, political and regulatory environment and infrastructure environment, the ICT readiness of individual, business and government sector, and the ICT usage of these three sectors. The data for the index is collected by questionnaires managed by the Weforum and by statistics from international agencies. The index is measured on a seven point scale, previously from 1 to 7 (Weforum 2004) and recently from -3 to 3 (Weforum 2005). Figure 9 represents the composition of the index, and Appendix VII shows the contents of the index in detail.

The scores of the ESPON countries for the two above-mentioned indices are compiled in Table 16. In addition to the original index values, the indices are also presented in a standardized form ranging from 0 to 1, with 0 representing the lowest and 1 the highest level of IS performance²⁵. The difference and the average of the two indices are

²⁵ The rescaling of the indices to the scale from 0 to 1 was done as follows: NRI (original range -3 to 3): $NRI_{rescaled} = (NRI_{original} + 3)/6$; eEurope (original range 1 to 7): $eEurope_{rescaled} = (eEurope_{original} - 1)/6$.

also presented in Table 16. In the following analysis, the mean of the eEurope and the NRI indices is used as an IS composite index²⁶.

Figure 9 The Networked Readiness Index. (Source: Weforum 2004).



While the NRI and eEurope indices are found to be highly correlated ($r = 0.91$), their contents differ from each other. In comparison to the NRI, the eEurope index considers the availability of public services more broadly and the use of eCommerce in addition to eBusiness readiness. The eEurope index also uses access and use of ICT in two components: first, at a general level, and second, it especially considers the case of broadband. Moreover, the component measuring the security of ICT can also be considered as emphasizing the technological nature of the index. Thus the ICT can be interpreted as having the weight of $3/5$ (or $9/15$) in the calculation of the indicator.

In contrast to the eEurope index, the NRI puts some weight ($1/3$) on environmental factors. The NRI also measures readiness by issues related to educational and affordability factors. The technological side of the NRI concentrates on the usage of ICT, and misses ICT access indicators. The usage of ICT is measured by the weight of $1/3$ (or $5/15$). Thus it seems that the eEurope index is more technology-oriented (Bogdanowicz et al. 2003). This orientation may explain the relatively low eEurope index values for the EU10-countries: for the EU15 both the indices show a similar pattern, but the EU10-countries rank clearly better in terms of NRI than eEurope.

²⁶ The eEurope index is not available for Norway and Switzerland. For these countries, the presented IS composite index is equal to the NRI index.

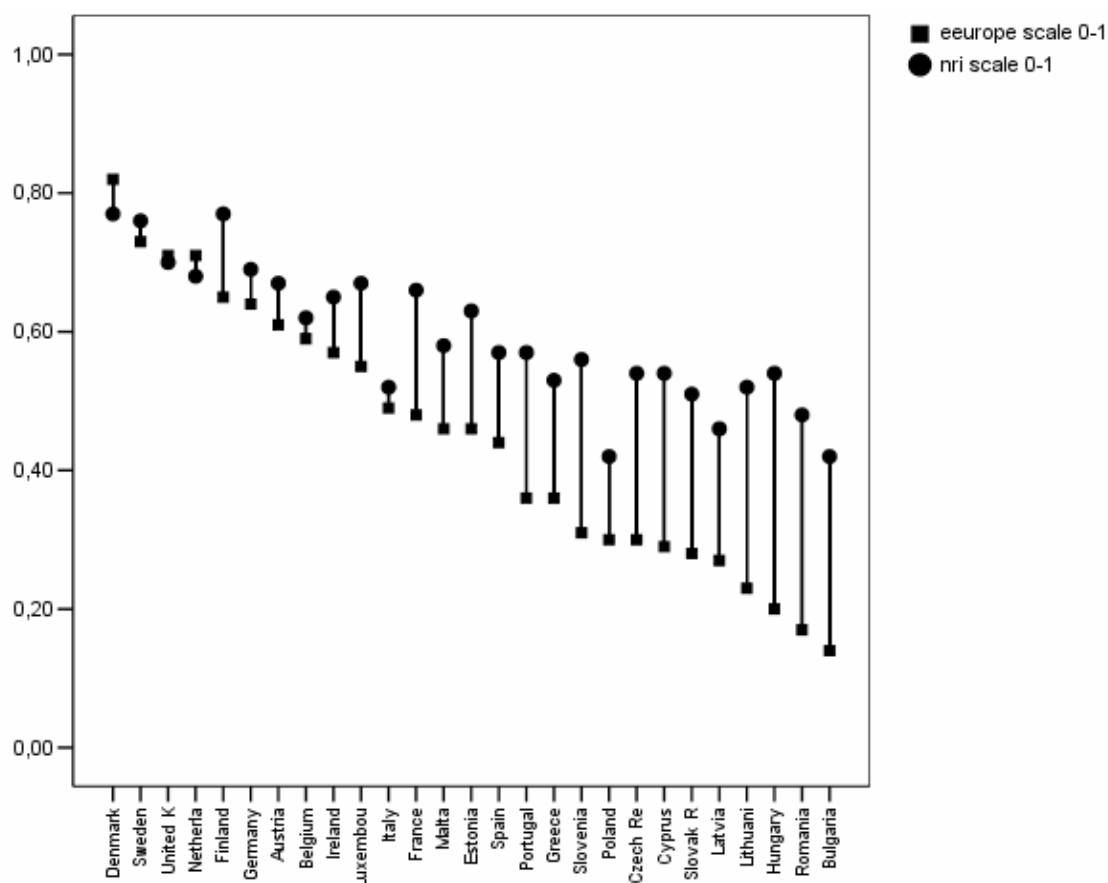
Table 16 ESPON country scores of the eEurope and NRI indices.

| | EEurope (2004) | | NRI (2005) | | Difference | Average |
|-------------|-----------------------|-------------------|--------------------|-------------------|-------------------|----------------|
| | Index value | Scaled 0-1 | Index value | Scaled 0-1 | | |
| AT | 4.64 | 0.61 | 1.01 | 0.67 | -0.06 | 0.64 |
| BE | 4.56 | 0.59 | 0.74 | 0.62 | -0.03 | 0.61 |
| BG | 1.82 | 0.14 | -0.51 | 0.42 | -0.28 | 0.28 |
| CH | - | - | 1.30 | 0.72 | - | 0.72 |
| CY | 2.72 | 0.29 | 0.25 | 0.54 | -0.26 | 0.41 |
| CZ | 2.78 | 0.30 | 0.21 | 0.54 | -0.24 | 0.42 |
| DE | 4.85 | 0.64 | 1.16 | 0.69 | -0.05 | 0.67 |
| DK | 5.90 | 0.82 | 1.60 | 0.77 | 0.05 | 0.79 |
| EE | 3.74 | 0.46 | 0.80 | 0.63 | -0.18 | 0.55 |
| ES | 3.65 | 0.44 | 0.43 | 0.57 | -0.13 | 0.51 |
| FI | 4.92 | 0.65 | 1.62 | 0.77 | -0.12 | 0.71 |
| FR | 3.86 | 0.48 | 0.96 | 0.66 | -0.18 | 0.57 |
| GR | 3.14 | 0.36 | 0.17 | 0.53 | -0.17 | 0.44 |
| HU | 2.22 | 0.20 | 0.24 | 0.54 | -0.34 | 0.37 |
| IE | 4.41 | 0.57 | 0.89 | 0.65 | -0.08 | 0.61 |
| IT | 3.91 | 0.49 | 0.10 | 0.52 | -0.03 | 0.50 |
| LT | 2.62 | 0.27 | -0.23 | 0.46 | -0.19 | 0.37 |
| LU | 4.27 | 0.55 | 1.04 | 0.67 | -0.13 | 0.61 |
| LV | 2.4 | 0.23 | 0.13 | 0.52 | -0.29 | 0.38 |
| MT | 3.77 | 0.46 | 0.5 | 0.58 | -0.12 | 0.52 |
| NL | 5.28 | 0.71 | 1.08 | 0.68 | 0.03 | 0.70 |
| NO | - | - | 1.19 | 0.70 | - | 0.70 |
| PL | 2.78 | 0.30 | -0.50 | 0.42 | -0.12 | 0.36 |
| PT | 3.17 | 0.36 | 0.39 | 0.57 | -0.20 | 0.46 |
| RO | 1.99 | 0.17 | -0.15 | 0.48 | -0.31 | 0.32 |
| SE | 5.36 | 0.73 | 1.53 | 0.76 | -0.03 | 0.74 |
| SI | 2.86 | 0.31 | 0.37 | 0.56 | -0.25 | 0.44 |
| SK | 2.67 | 0.28 | 0.03 | 0.51 | -0.23 | 0.39 |
| UK | 5.24 | 0.71 | 1.21 | 0.70 | 0.01 | 0.70 |
| EU29 | 3.69 | 0.45 | 0.61 | 0.60 | -0.15 | 0.53 |
| EU15 | 4.48 | 0.58 | 0.93 | 0.66 | -0.07 | 0.62 |
| EU10 | 2.86 | 0.31 | 0.18 | 0.53 | -0.22 | 0.42 |

In the context of the IS lifecycle (see, Figure 7), the difference between the eEurope and NRI indices relates to how the different stages of development are emphasized. The NRI clearly stresses the role of IS readiness: both the environment and the readiness components can be interpreted to measure this part of the lifecycle (see, Figure 9). The eEurope index, however, does not include readiness except for technological availability. Moreover, the usage component of the NRI is linked to the Intensity phase of the IS lifecycle, as are the technological components (Internet indicators, broadband, security) of the eEurope index. The eEurope index indicates the Impact phase by its components measuring modern public services and eBusiness environment. In the NRI such a measure for the Impact phase is missing. Thus the eEurope index measures the Information Society from a more advanced point of

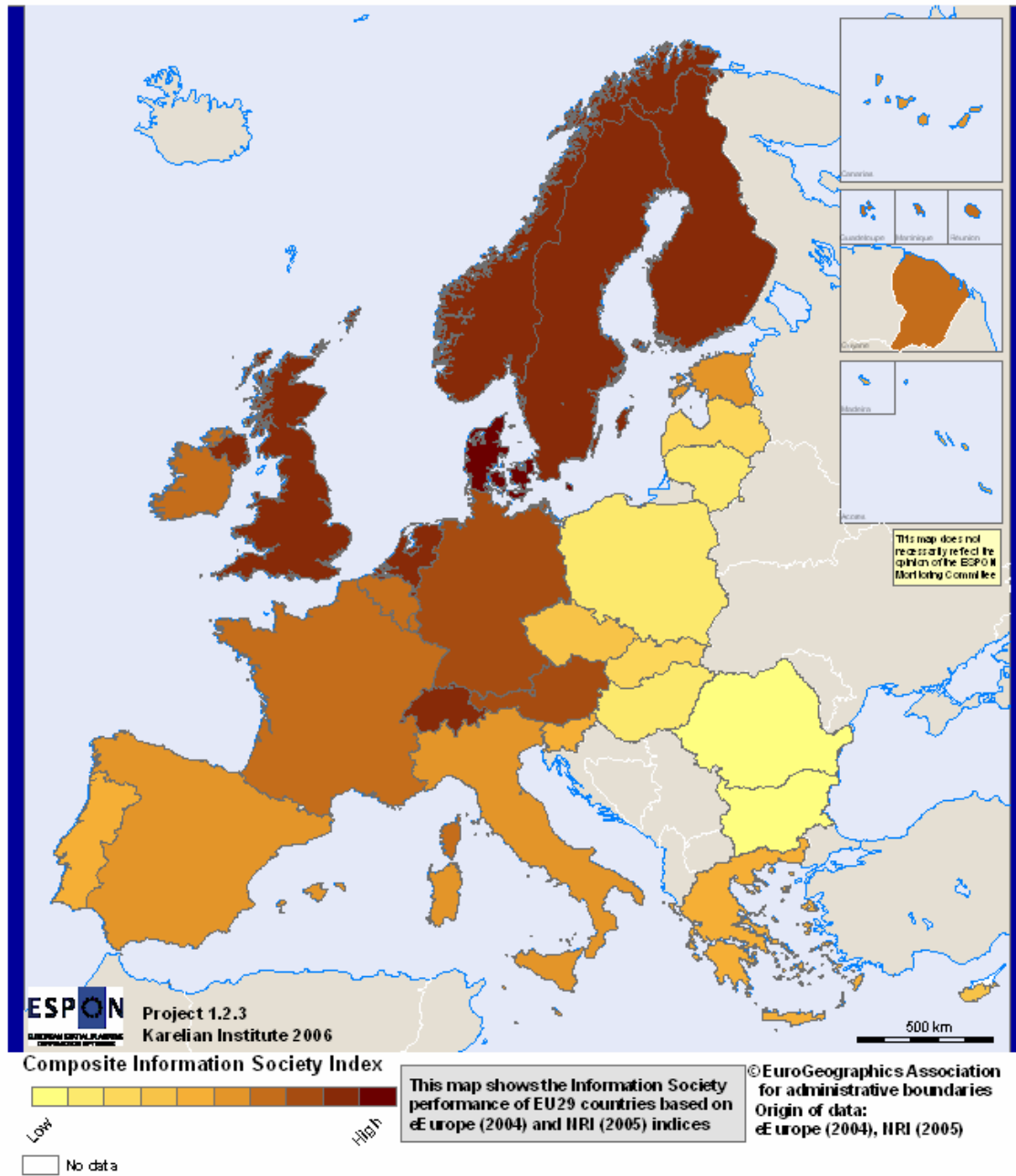
view, whereas the approach of NRI is more conventional. As a result, the less advanced information societies, such as most EU10-countries, seem to present a bigger difference between these two indices. This is also supported by the fact that the difference of these two indices correlates negatively with the indicator values (eEurope: $r = -0.91$ & NRI: $r = -0.67$), implying that less advanced information societies get relatively better values by the NRI index. It is also interesting to note that for three countries (Denmark, United Kingdom and the Netherlands) the eEurope index is higher than the NRI index. This is probably related to the high IS level of the countries and to the above mentioned difference in the weights of the two indices. The relationship of the eEurope and NRI indices is illustrated in Figure 10.

Figure 10 A comparison of the eEurope and NRI indices in the ESPON countries²⁷.



²⁷ Norway and Switzerland do not have values for the eEurope index. The figure aims to illustrate the differences of NRI and eEurope indices so NO and CH were excluded.

Map 3 The composite index of the IS in Europe based on eEurope (2004) and NRI (2005).



Map 3 presents the composite IS index, which is based on the eEurope and NRI indices as described above. The overall spatial pattern of the IS in Europe is clear: there are similar north-south and east-west divisions among the ESPON space as found for the availability of ICT infrastructures by the ESPON TPG 1.2.2. As we would expect, northern (and particularly Nordic) countries seem to have a more advanced IS compared to the southern countries. Furthermore, the new member

countries (and Romania and Bulgaria) seem to lag behind the EU15 countries. However, there are exceptions to this pattern such as Estonia, which seems to be a more advanced IS in comparison to the Mediterranean member countries and new member states.

The IS index presented in Map 3 reveals significant differences in terms of IS performance in Europe. This pattern can be interpreted in light of the lifecycle concept (presented in Figure 7) so that the index values ranging from 0 to 1 represent a degree of IS maturity. It has to be noted, however that the index puts somewhat more weight on measuring the readiness, use and availability of ICT, whereas the impact phase of IS receives lesser weight. This means that the score 1 possibly does not mean a “fully implemented IS”, and the potential upper limit for the IS development is probably higher than 1. Here, however, 1 is seen as a proxy of the upper limit of IS, and the values of the calculated index are used to illustrate the evolutionary stages of the IS in the ESPON space.

A logistic curve, which is commonly used, for example, in the diffusion of innovations research, was chosen to represent the diffusion process of IS. The ESPON countries’ index scores positions on this standard S-curve are calculated using the following formula:

$$(1) \ y(x) = \frac{y^*}{1 + e^{-(a+bx)}} \cdot$$

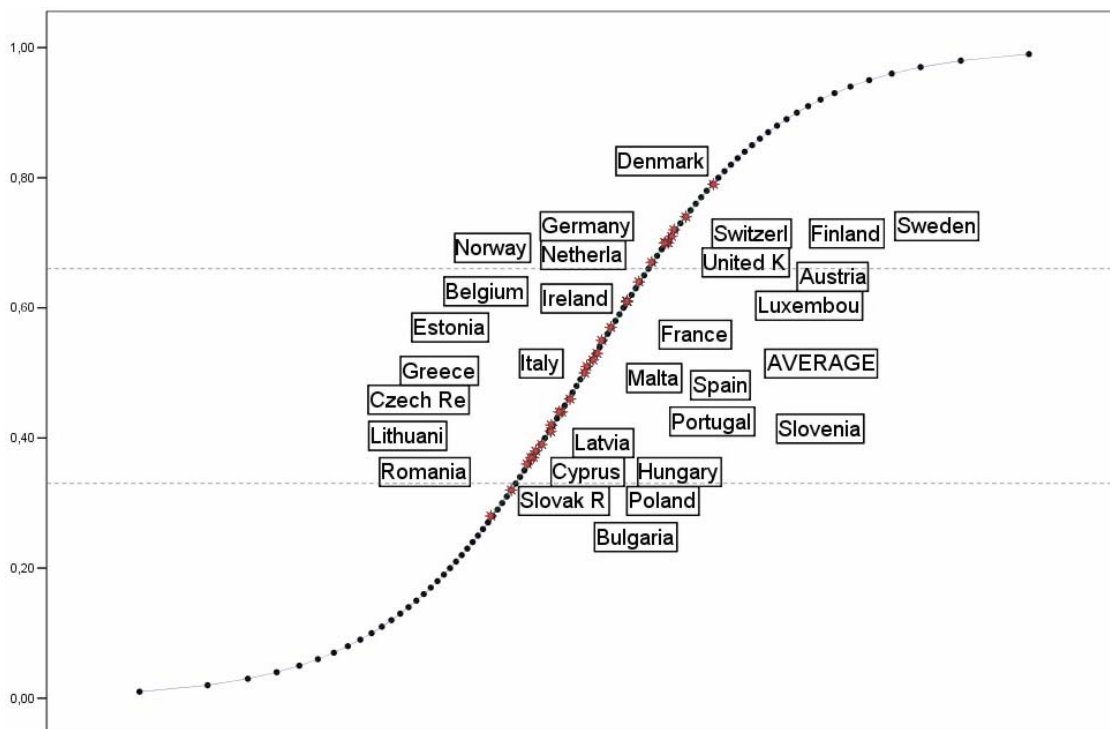
In equation (1), $y(x)$ represents an IS indicator score (the position on y-axis) with respect to a position x on the x-axis. The logistic model presented in equation (1) has three parameters: y^* , b and a . Parameter y^* measures the upper limit of the s-curve presented by the logistic model, parameter b gives the growth rate of the curve, and parameter a the position of the curve on the x-axis. As mentioned above, the value of 1 is seen as a proxy for the upper limit for the IS evolution, and thus y^* is set equal to one. Parameter b has only a visual implication on the “length” of the curve, and thus it is also set as 1. Parameter a has no visual implication in this case, and thus it can be omitted. As the countries’ values on the y-axis are known, their x-axis values can now be calculated by solving the above equation with respect to x (and setting $y^*=1$; $a=0$; $b=1$):

$$x = \ln\left(\frac{1}{(1/y(x))-1}\right).$$

As the x and y values are observed for each country, they can now be plotted against a standard logistic curve representing the IS lifecycle. 0 shows the ESPON countries positions on the IS lifecycle.

0 reveals that the ESPON countries represent a relatively broad range of the IS lifecycle, and in fact, the countries are located in all the three stages of the lifecycle concept (readiness, intensity and impact). Generally, the Nordic and northern ESPON countries could be seen to be at the impact stage, whereas, for example, Romania and Bulgaria represent the less developed Information Societies at the readiness stage.

Figure 11 The stages of IS development in Europe.



The fact that ESPON countries are located in multiple stages of the IS lifecycle is challenging from the viewpoint of the eEurope monitoring process. The lifecycle framework implies the collection of different types of indicators at different stages of IS. If the countries are at different stages, this would mean that the set of indicators should be tailored to meet the different information requirements at each stage of the IS cycle. This, of course, also has implications for the overall meaning of benchmarking and comparing such different countries with each other.

6.5. The territorial differences in IS development in the ESPON space

The IS index above provides a general picture of the state and spatial patterns of the IS in ESPON space. Next we turn our interest to the territorial differences to give an insight on how NUTS 2 regions relate to each other with respect to different aspects of the IS. As already noted, data limitations set strict constraints for the regional analysis. Thus, the content, scope and the quantity of available data formed the operational starting point of the analysis. Based on this practical strategy, the three stages of IS suggested by the lifecycle framework were used as a conceptual guideline for the construction of the territorial IS index.

Figure 12 presents the components of the constructed synthetic IS index. The index divides into three main categories (or subindices) according to the readiness, growth and impact stages of the IS lifecycle framework. The main categories are weighted equally in the calculation of the synthetic index as follows: $ESPON\ 123\ IS\ index = 1/3 * IS\ Readiness + 1/3 * IS\ Growth + 1/3 * IS\ Impact$. The three main categories are further divided into factor groups, as presented in Figure 12.

Figure 12 ESPON 123 IS index framework.

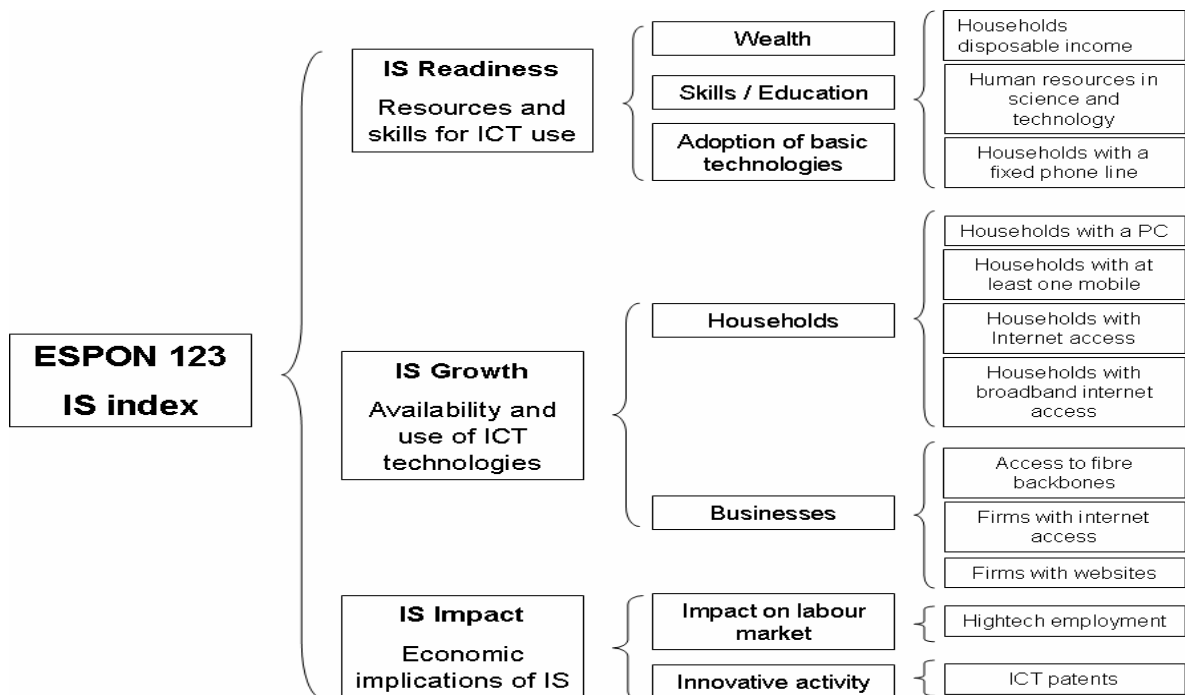


Figure 12 shows that IS readiness is defined as “resources and skills for ICT use”, and thus consists of the following three factors: wealth, skills and education, and adoption of basic technologies. The definition of IS growth is “availability and use of ICT” and it is composed of two factor groups: household and business use of ICT. The impact of IS is defined as “economic implications of IS”, and it is measured by two factors: impact on labour market and innovative activity.

The defined factors are measured by various indicators, which are available for the NUTS2 regions of the selected 29 European countries. The indicator set reflects the scarce availability of territorial data ON IS²⁸. Several indicators provided by the ESPON Telecom –project were used in the calculation of the territorial IS index. Since this project provided categorized ICT indicators on the scale from 1 to 6, the indicators provided by Eurostat were also standardized to fit the same scale. The average of the indicators in each main category is used as a subindex value, and the average of these subindices is the value of the synthetic index. As the synthetic index is a weighted average of the used indicators²⁹, its scale is also from 1 to 6, with 1 representing a low and 6 a high performing IS territory. The indicators and their origins are presented in Table 17.

Table 17 Sources of indicators used for the calculation of the ESPON 123 IS index.

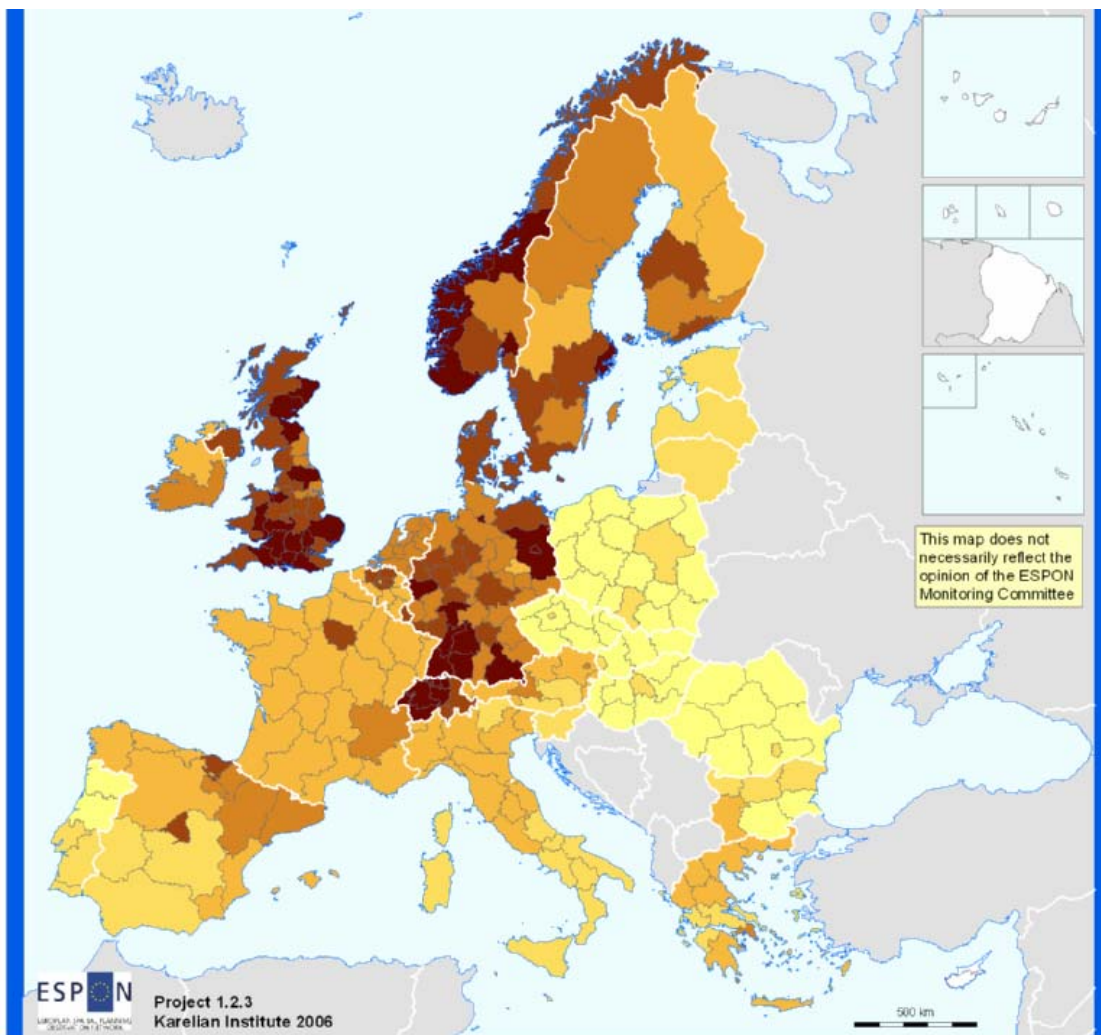
| Indicator | Year | Source | Origin of data |
|----------------------------------------------------------|-----------|--------------------|-------------------|
| Disposable household income | 2000 | Eurostat database | |
| Human resources in science and technology – education | 2004 | Eurostat database | |
| Households with a fixed phone line | 2002/2003 | Espon 122 typology | INRA (2004) & ITU |
| Households with a PC | 2002/2003 | Espon 122 typology | INRA (2004) & ITU |
| Households with at least one mobile | 2002/2003 | Espon 122 typology | INRA (2004) & ITU |
| Households with Internet access | 2003 | Espon 122 typology | estimations |
| Households with broadband Internet access | 2002/2003 | Espon 122 typology | INRA (2004) & ITU |
| Access to fibre backphones | 2001 | Espon 122 typology | estimations |
| Firms with Internet access | 2003 | Espon 122 typology | estimations |
| Firms with websites | 2003 | Espon 122 typology | estimations |
| Employment in technology and knowledge intensive sectors | 2004 | Eurostat database | |
| ICT patent applications | 2002 | Eurostat database | |

²⁸ For example, the ESPON Telecom -project found only one territorial data source covering the EU15 countries. The project thus estimated indicators and used NUTS1 data from the International Telecommunications Union (ITU) for non-EU15 NUTS2 regions.

²⁹ With weights inversely proportional to the number of indicators in the categories.

As Table 17 shows, the indicators represent different points of time. This, of course, sets limits to the interpretation of the results. The aim of measuring the state of IS at the NUTS2 level, to enable the benchmarking of those, can still be achieved. The values of the calculated IS index (on the scale from 1 to 6) for the NUTS2 regions in ESPON space are listed in Appendix VIII. The spatial pattern of the three subindices is depicted in the Map 4 (readiness), Map 5 (growth) and Map 6 (impact). The synthetic IS index is illustrated in Map 7.

Map 4 Readiness-subindex in ESPON123 IS index



Readiness-subindex in ESPON 123 IS index

- Very Low
- Low
- Moderate Low
- Moderate High
- High
- Very High
- No data

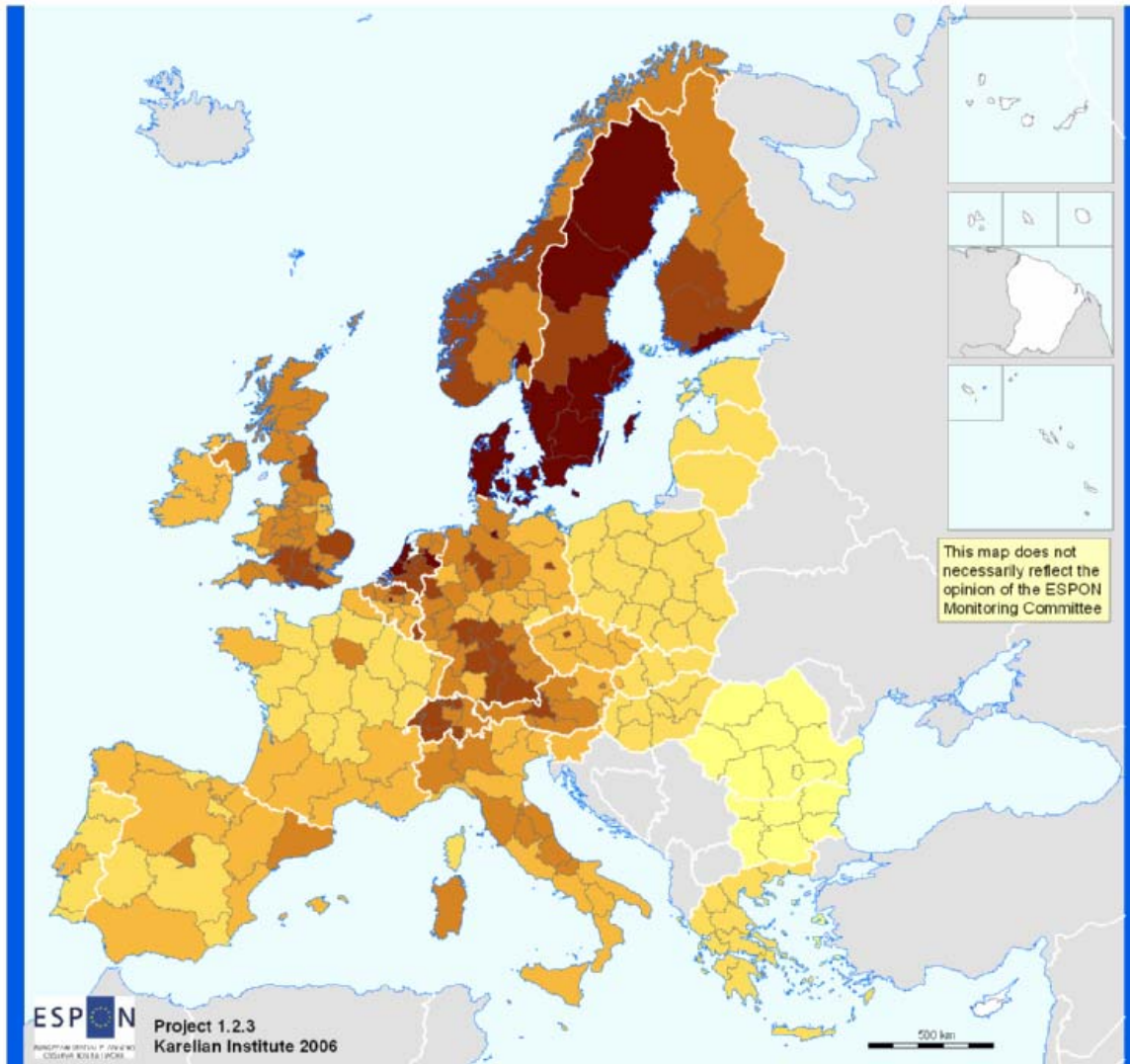
This map shows the aggregated Information Society Readiness typology based on 3 indicators from 2000-2004, NUTS2

- Household disposable income, 2004
- Human resources in science and technology, 2000
- Households with a fixed phone line, 2002/2003

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Origin of data:
Eurostat, ESPON database

Map 5 Growth-subindex in ESPON123 IS index



Growth-subindex in ESPON 123 IS index

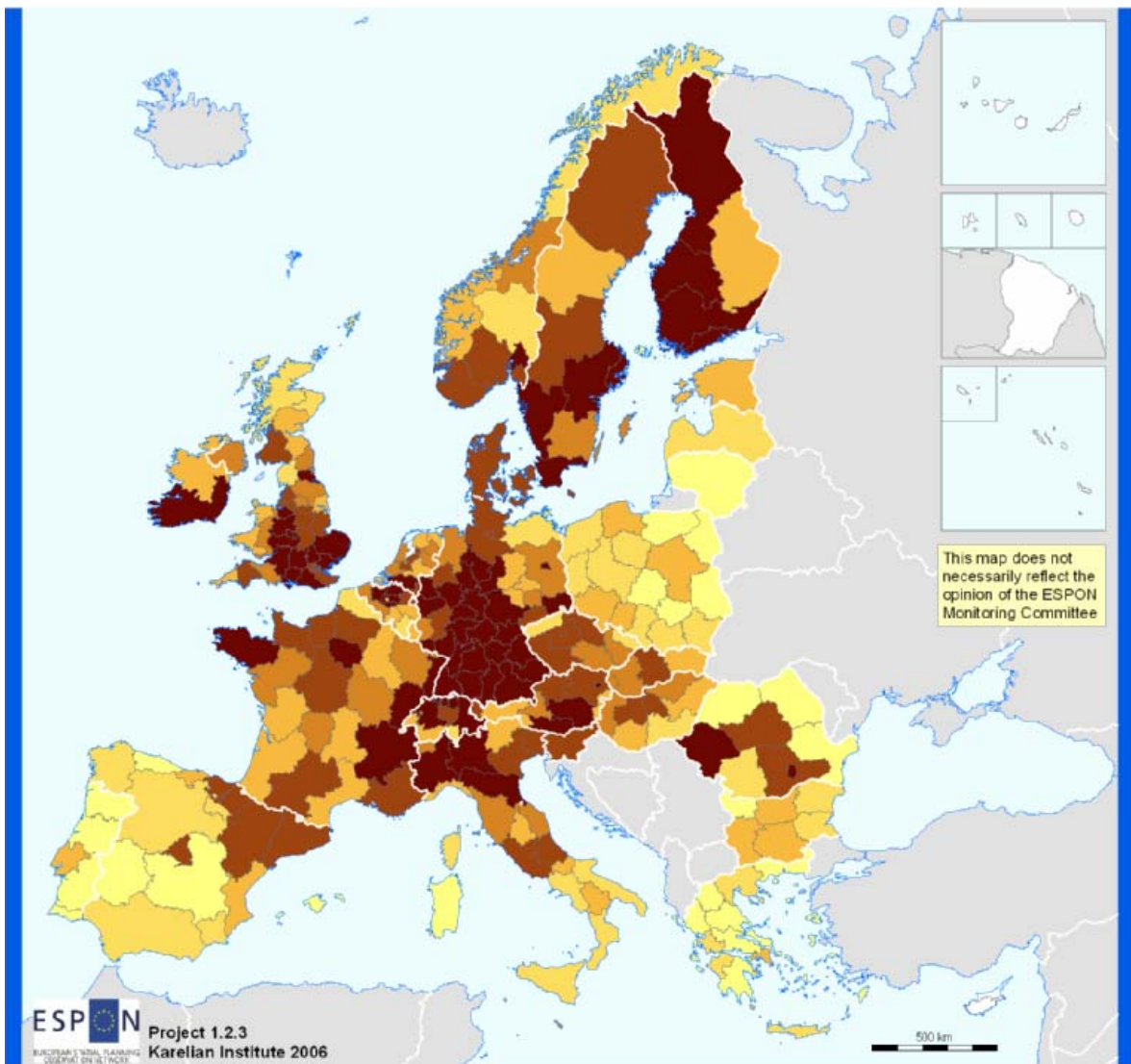
- Very Low
- Low
- Moderate Low
- Moderate High
- High
- Very High
- No data

This map shows the aggregated Information Society Growth typology based on 7 indicators from 2002-2003, NUTS2

- Households with a PC, 2002/2003
- Households with at least one mobile, 2002/2003
- Households with internet access, 2002/2003
- Households with broadband internet access, 2002/2003
- Access to fibre backbones, 2002/2003
- Firms with internet access, 2003
- Firms with website, 2003

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 Origin of data: Eurostat, ESPON database

Map 6 Impact-subindex in ESPON123 IS index



Impact-subindex in ESPON 123 IS index

- Very Low
- Low
- Moderate Low
- Moderate High
- High
- Very High
- No data

This map shows the aggregated Information Society Impact typology based on 2 indicators from 2002-2004, NUTS2

- Employment in technology and knowledge intensive sectors, 2004
- ICT patent applications, 2002

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Origin of data:
Eurostat, ESPON database

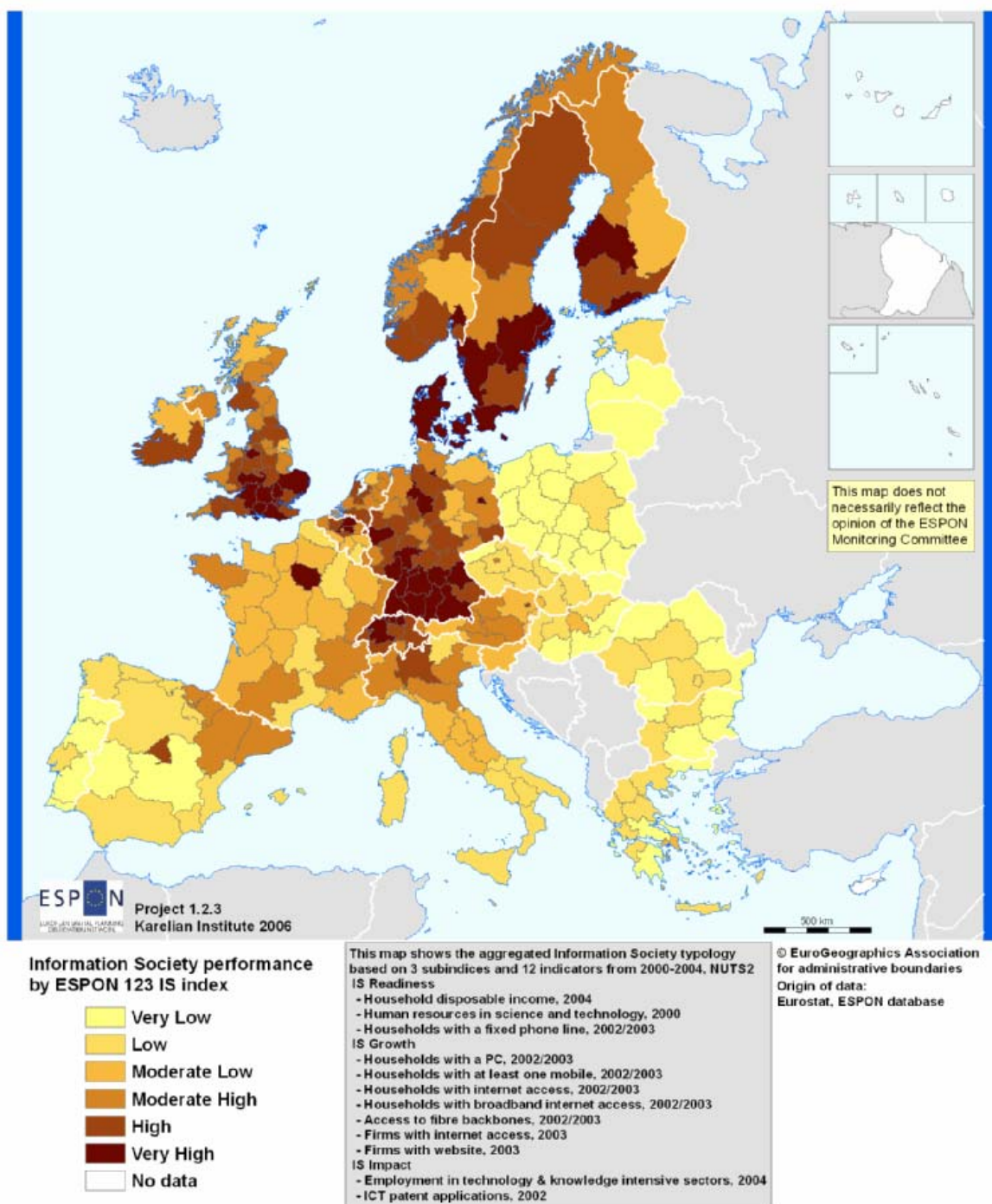
The six-category grouping of the NUTS2 regions in Map 7 translates into a IS lifecycle-typology as follows:

- Very Low = Low IS readiness territories
- Low = High IS readiness territories
- Moderate Low = Low IS growth territories
- Moderate High = High IS growth territories
- High = Low IS impact territories
- Very High = High IS impact territories

There are only limited possibilities to check the validity of the constructed index, i.e. whether the index measures what it is supposed to. In order to test the appropriateness of the developed metrics, the index values of it were compared to those of NRI and eEurope. The hypothesis was that a significant and positive correlation supports the validity of the index as a measure of the IS. To create a comparable test setting, the NUTS2 regions scores were weighted by their population, and aggregated to the national level. The correlations indicate a reasonable validity: the constructed ESPON 123 IS index correlates highly positively with both, the eEurope 2005 ($r = 0.91$) and the NRI ($r = 0.91$) indices.

Map 7 shows that while national differences are significant, there are also considerable intra-country inequalities in IS development in ESPON space. This is reflected by the fact that some territories located in countries with a lower aggregate IS score perform better than some of their counterparts located in countries with higher country scores. For example, Madrid has a higher score than Northern Ireland, and the peripheral regions in Nordic countries are in a worse situation than their country ranking suggests. Overall, but not very surprisingly, the core areas, capital regions and MEGAs, such as NUTS2 regions of Paris, Madrid and London, seem to be in a better position. The remote and peripheral NUTS2 regions, such as northern parts of the UK, southern Italy, and eastern Finland, seem to generally lag behind the national averages. In most countries these characteristics lead to a scattered or a mosaic-like spatial pattern, resulting in high territorial discontinuities (e.g. France, Spain), while in some countries spatial distribution tends to be more continuous, changing smoothly from the region to its neighbours (e.g. Italy, UK).

Map 7 The ESPON 123 IS index. NUTS2, EU25+2+2.

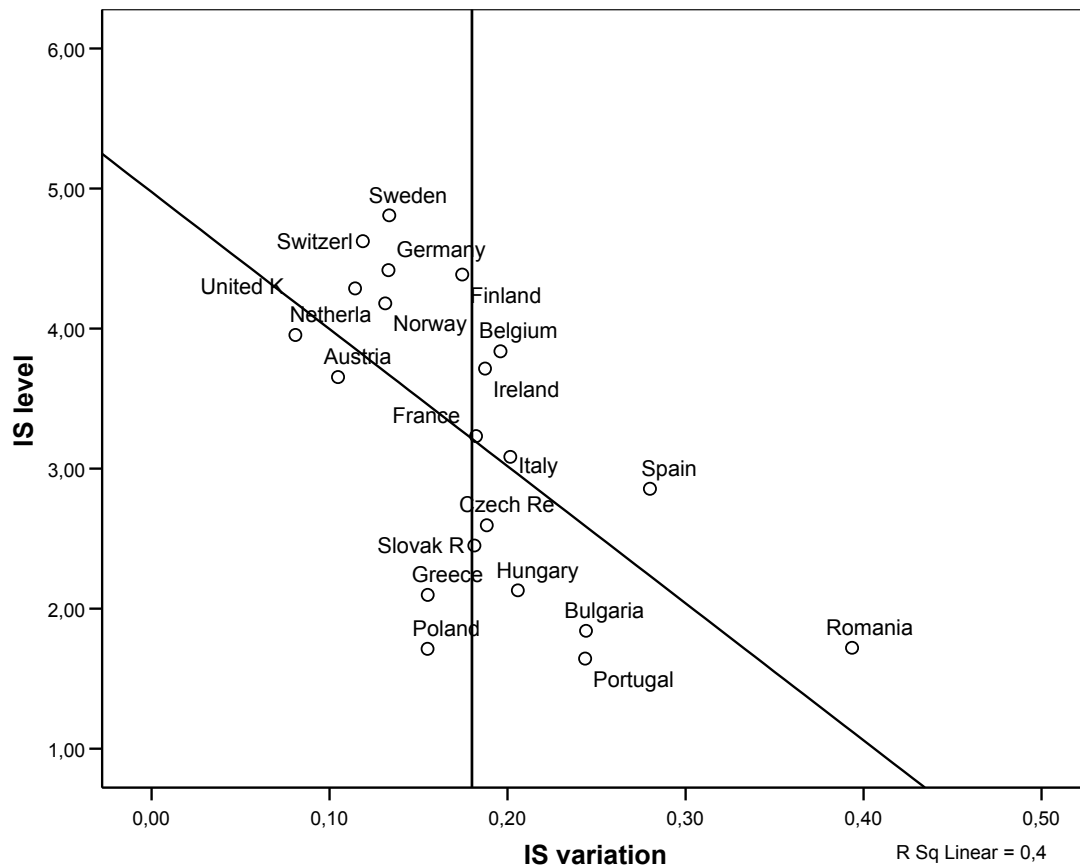


6.6. Territorial trends in IS development – convergence or disconvergence?

According to the lifecycle hypothesis the territorial differences in IS development are likely to be only temporary: as IS evolves, the regional disparities will decrease as regions come close to the slow-growth phase,

i.e. the upper-tail of the logistic curve of the diffusion of IS. In this case, the focus of policy interest is in the time path of adoption: the speed at which adoption of the IS takes off and the later growth occurs. The situation becomes more complicated if the saturation limit of diffusion is not assumed to be a constant, but a region-specific characteristic depending on the type of region. This implies that it is an empirical issue whether the IS development leads to a convergence in terms of IS performance. In the following analysis this issue is considered by comparing the intra-country differences in ESPON countries.

Figure 13 The relationship between intra-country (NUTS2) variation in IS performance (x-axis) and level of IS performance (y-axis).

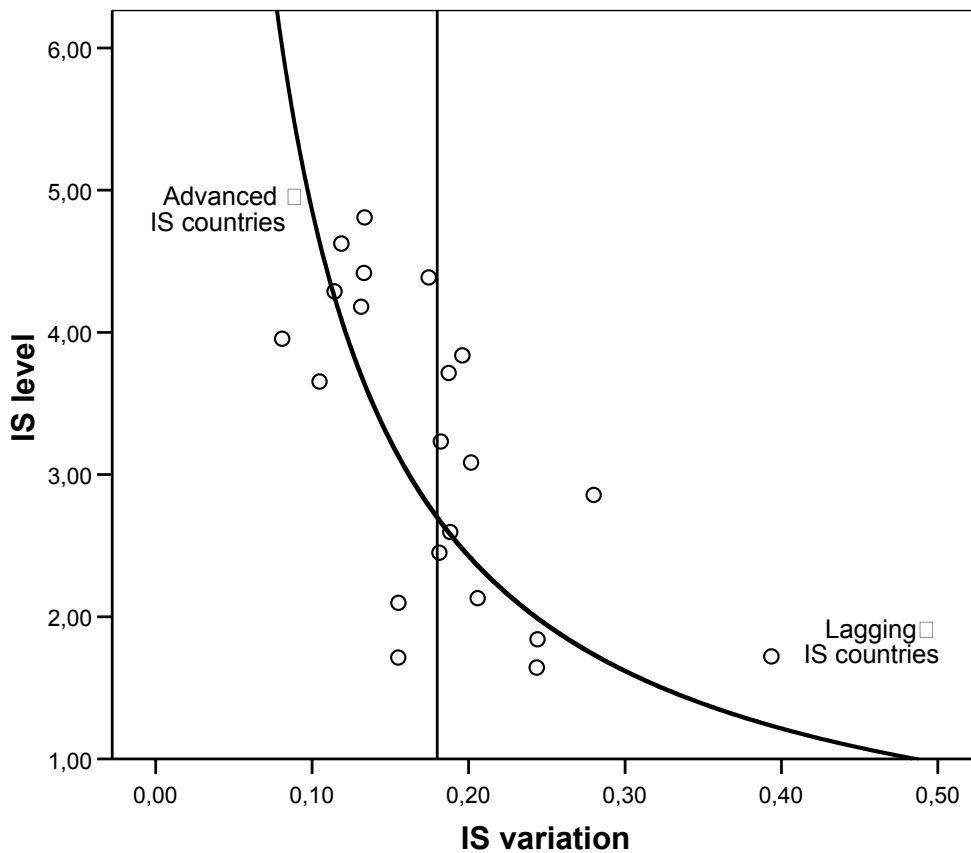


As it is illustrated in Figure 13, within country differences across ESPON countries show a varying pattern. In order to compare the prevailing differences, coefficients of variation (CV) were calculated: the standard deviations of the territories' IS index values were divided by population weighted means of the territories' scores. This analysis of course excludes the countries which have only one NUTS2 region, e.g. the Baltic countries, Denmark, Slovenia, Luxembourg, Cyprus and Malta. Figure 13 shows how

these regional variations in IS performance (x-axis) are related to the countries' IS levels (y-axis). The vertical line in Figure 13 represents the average intra-country variation (CV=0.18). The regression line passing from the upper left to the lower right represents the estimated linear relationship between regional variations and IS performance.

Figure 13 clearly shows that there is a negative relationship (R Sq Linear = 0.4, without Romania 0.6) between the level of IS performance of a country and the variation of IS levels between its territories: the higher the level of IS in a country, the lower the territorial differences between its NUTS2 regions. Figure 14 presents the nonlinear relationship of the form yielding a R square of 0.92 and a parameter value for $b = 0.488$. It implies that the within-country differences in IS levels do not decrease linearly, but diminishingly, by the improvement of the overall state of IS in the country.

Figure 14 Nonlinear relationship between regional (NUTS2) variation in IS performance (x-axis) and level of IS performance (y-axis).



The regression line depicted in Figure 13, or alternatively the curve in Figure 14, can be interpreted to represent the level of what the territorial differences within a country should be at a given level of IS performance. As, for example Finland, positioned above the curve presented in Figure 14, which means that the territorial variation – the differences between NUTS2 regions – is greater in Finland than its performance at a national level would suggest. The reasons for a greater or lesser variation than predicted by the level of IS in a given country could be, for example, the demographic and geographical differences between regions, or the implications of policy measures.

Using the average variation in IS levels ($CV=0.18$) as a dividing line, as presented in Figure 13 and Figure 14, the countries can be grouped into four types with respect to their intra-country differences in IS performance.

- Spain and Romania represent the first type: countries of high internal IS variation, where the variation of IS is also higher than predicted by their IS level.
- Hungary, Portugal and Bulgaria are also average or high internal IS variation countries, but in these countries the variation is less than the regression predicts.
- Austria, Greece, and Poland are countries of less than average internal IS variation, the variation being also less than expected by their IS levels.
- Countries having an average or less than average internal IS variation, but higher than predicted by their IS level, are Sweden, Germany and Switzerland.

In general, the estimated relationships suggest that territorial IS differences between regions diminish as IS evolves. From a policy perspective, this emphasizes the need of long-term national IS targets, rather than region-specific, short-term IS policies to foster convergence in terms of IS as such. This view is further supported by the correlation coefficients in Table 18. It presents the relationships between the IS performance (as measured by the composite index, see Map 7) and some of the so-called key Structural Indicators, which are introduced by the EU Commission to measure the progress made towards the Lisbon objectives. There seems to be a relatively strong positive relationship both between IS level and economic performance and between IS level and social cohesion.

Table 18 Correlations of IS composite index with some overall performance indicators of EU³⁰.

| Economic performance and competitiveness | | | Social cohesion | |
|------------------------------------------|--------------------------|----------------------|--------------------------------------------|--------------------------------------------|
| GDP per capita 2004 | Labour productivity 2004 | Employment rate 2004 | Inequality of the income distribution 2004 | At-risk-of-poverty rate 2003 ³¹ |
| .77 | .73 | .85 | .26 | .80 |

While the correlations do not necessarily indicate causality, the correlation coefficients in Table 18 mean that IS development, economic performance, and social cohesion tend to occur together more often than would be expected by chance. With regard to territorial IS differences, an interesting issue is whether the regional variation of IS within the countries is interrelated with the corresponding regional variations in economic performance and social cohesion. Particularly, if regional differences in IS development decrease with increasing economic performance, the implementation of the territorially balanced IS goes in parallel with policies aiming to stimulate the economic growth and competitiveness.

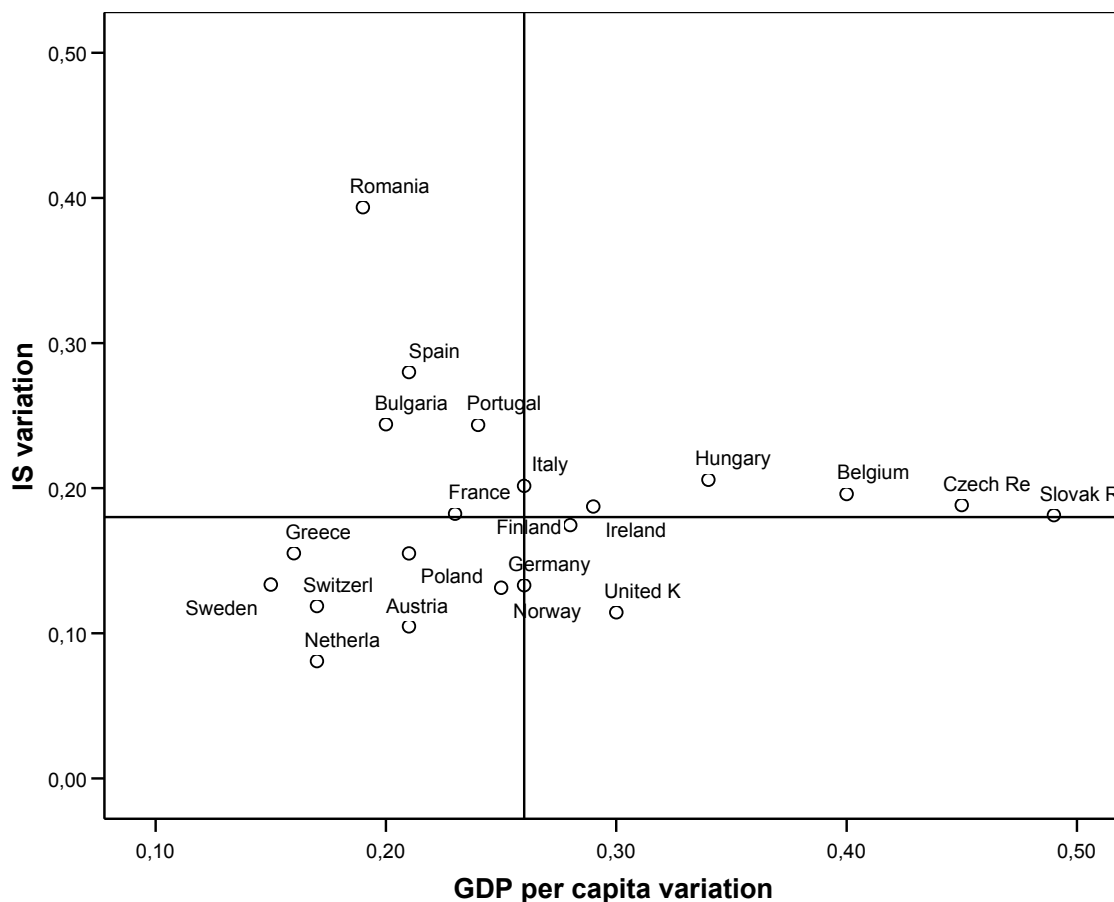
At the country level, correlations of IS indicators with economic performance in regions are more or less evident, but can vary for particular countries and indicators. Taking into consideration Internet use at home (households with Internet access) and level of GDP per capita, positive correlation is relatively strong in Germany, Poland and Hungary but not in the case of Greece and Czech Republic. In general metropolitan areas present better performance both of economic and IS indicators. For instance in Hungary, correlation between GDP per capita and proportion of households with more than one computer, while including Budapest region is quite strong ($r^2 = 0,5019$), without Budapest there is no significant relation ($r^2 = 0,1582$) – in this case correlations between regional indicators strongly depend on the delimitation of the region (for more correlations at the country level refer to the Appendix IX).

Here this issue is examined by comparing the coefficients of variation for GDP per capita (in year 2000) and IS performance to test whether the regional differences in IS development decrease with economic convergence. Of course, the causality can be two-sided: GDP can be seen as a prerequisite for IS, or alternatively, a higher IS level can be seen to lead to increasing competitiveness and thus higher GDP per capita. In both cases, however, the assumption is that the relationship

³⁰ See, Eurostat (2005) for data and definitions of Structural Indicators.

³¹ Higher the rate, lower the at-risk-of-poverty rate.

Figure 16 The relationship between regional (NUTS2) variations in GDP per capita (x-axis) and variation in IS performance (y-axis).



There are, however, a few minor exceptions and one major exception to the overall pattern: Firstly, the United Kingdom seems to have a relatively small IS variation despite a large GDP per capita variation. Secondly, Bulgaria, Portugal, Spain and especially Romania, seem to be countries where differences in IS between NUTS2 regions are large despite their relatively small regional differences in GDP per capita. The reasons behind these exceptional cases are, of course, beyond the scope of this research.

6.7. Concluding remarks

The macro-level analysis of IS in the ESPON space was conducted by using a synthetic IS index. The index was based on the eEurope and NRI indices and it was related to the lifecycle concept of OECD. The results clearly show that ESPON countries are located in all the three stages of this schema – readiness, intensity and impact – which means that significant differences in terms of IS performance in Europe were

observed. Not surprisingly, north-south and east-west divides seem to be the most apparent divisions in this respect. Northern European countries, and particularly Nordic countries, generally seem to have a more developed IS compared to southern and eastern Europe. Furthermore, the new member states as well as Romania and Bulgaria seem to lag behind the general European pattern.

A synthetic territorial (NUTS2 level) IS index was constructed to reveal a detailed picture of the diversity of ESPON space. Despite the documented problems with the data availability, the index seems to measure what it is supposed to do. The index was compared to the eEurope and NRI indices and the observed highly significant and positive correlations support the validity of the index as a reliable and valid measure of the IS. However, the data used for the calculation of the index set limits on its use. It is partly based on estimated data and it combines data from several years. Thus, rather than being an accurate measure of the IS in a particular point of time, the index illustrates the relative magnitude of the regional differences among EU countries in the period of 2000 – 2004.

The territorial IS index shows that national averages partly hide behind national variations: in some cases, top regions of low performing countries do better than low regions in high performing IS countries. The variation of IS within the nations was not found to be interrelated with their regional variation in GDP per capita. This pattern does not support the view that the EU (economic) cohesion policies may also lead to territorially balanced information societies.

7. Qualitative Diagnosis of the Territorial State of IS – comparison of country case studies' results

7.1. Main characteristics of countries under study

The countries under study - except for a large part of Germany - are classified as peripheral areas of the European Union. Despite that they represent different, often dynamic and competitive, economies that represent various development paths and trends. In order to understand better the state of art in terms of the Information Society some basic information on selected features of the countries concerned is presented here. Countries are described in alphabetical order (EUROSTAT information for 2003, as presented in Chalas, 2005.).

Czech Republic is relatively small, with a population of 10 million located in central Europe, bordering Austria, Germany, Hungary, Poland and Slovakia. From the point of view of the concept of European territorial cohesion, it is considered peripheral as most other countries under study. Its GDP per capita in 2003 was equal to 69% of the EU 25 average of 0.32. Employment in services is 55%, in agriculture 5.4% and in industry 40.1% (EU highest). R&D expenditure is quite low (1.3% of GDP), but still twice as much as in Greece or Poland. The unemployment rate is relatively low (7.8%) and stable. The most visible spatial divide is between metropolitan - rural areas. Surprisingly, the best developed region of Prague is surrounded by least developed Stredocesky Kraj.

Germany, with a population of 82 million is located in central/western Europe and has Europe's largest economy, recently stagnating with zero growth rate. GDP per capita represents 106% of the EU 25 average. Germany shares borders with France, Belgium, Luxembourg, the Netherlands, Denmark, Poland, Czech Republic, Austria and Switzerland. Employment in services is 65.1%, while agriculture 2.5% of the total workforce. Germany spends more than average on R&D (2.5% GDP). The unemployment rate is similar to EU average and growing slowly. In spatial terms, the most important division relates to that between the Old and New Laender, which, despite costly programmes represents a real development policy problem.

Finland is a small northern European country with 5 million people. After decades of forced dependency on Soviet Union economy and after difficult but successful restructuring, it joined the club of the most

³² Czechs are proud of overtaking Portugal in 2006 in terms of GDP level, after less than 2 years in the EU.

competitive countries with 111% of EU25 GDP per capita and high growth (4.7%). There are 67.3% of the workforce employed in services and 5.5 in agriculture. R&D expenditure is the second in EU25 (3.49% GDP). The unemployment rate in Finland is close to EU average (9%). Most of the population and economic activity of Finland concentrates in a few southern regions on the Baltic coast.

Greece, the most southern European state on the Balkan Peninsula, has a population of 11 million, partly living on hundreds of islands. Its GDP reaches 79% of EU average with medium growth rate (4.3%). Greece borders Bulgaria, Turkey, FYROM and Albania. Of the cases studied Greece, as Poland, is characterized by a high level (15.8%) of employment in agriculture, while in services there is 65.1%. R&D expenditure in Greece is among Europe's lowest (0.67% GDP). The unemployment rate is similar to EU average (9.3%). Most economic activity in Greece is concentrated in Large Athens' agglomeration. The more peripheral territories, in particular tourism dependent islands, suffer from depopulation and low infrastructure endowment.

Hungary, located on the central European plains has a population of 10 million. Its GDP per capita is slightly lower than the Czech Republic (growth rate ca 3%). Hungary shares borders with Austria, Slovakia, Ukraine and Romania. The employment in services accounts for 59.7%, in agriculture – 6.1%. R&D expenditure in Hungary is low (0.95% of GDP). The unemployment rate in Hungary is low (5.8%). The Hungarian economy is dominated by its capital region of Budapest. The East-West divide is very visible.

Italy lies in southern Europe on the Apennine Peninsula. Its 58 million population makes it the fourth largest EU country. Italy's GDP per capita is equal to 107% of EU average, but its growth rate is low (0.3% in 2003). Services employ 63.5% of the Italian workforce, while 4.9% are to be found in agriculture . R&D expenditure in Italy is relatively low (1.07% of GDP, when compared to 1.93 average in EU25). The unemployment rate is slightly below EU average (8.6%). Italy in its northern regions and biggest agglomerations (Rome in particular) represents a very high development level in contrast with southern parts of the country. The North-South division occasionally results in social tensions.

Poland, almost the same size as Spain, has a population of 38 million. It is located in central Europe and shares borders with Germany, the Czech Republic, Slovakia, Ukraine, Belarus and Russia. Its GDP per capita is circa 46% of EU average with a growth rate close to 4% annually. Of the

cases studied, Poland has one of the highest levels (19.6%) of employment in agriculture. Employment in services accounts for 51.8%.

R&D expenditure is among EU25 lowest (0.65% of GDP). The unemployment rate in Poland in 2003 is high (19.2%) but decreasing steadily. Poland is probably Europe's most polycentric country with clearly visible differentiation along the South-West to North-East axis. Shortage of strategic infrastructure (starting from motorways, dual carriage ways and high speed trains) contributes to peripheralisation of Eastern Poland.

7.2. State and Trends of the Information Society development in the case study countries

7.2.1. The IS technical definition

On the basis of the national case studies, it is possible to compare the level of development of the technical infrastructure required in terms of IS development and assess internal disparities which exist within the individual countries in this sphere. Unfortunately, drawing comparisons between individual countries is not fully possible owing to a shortage of certain (mainly regional) data, and because of marked differences in both the sources and methods of collecting statistical data (such as the last measurement period) by individual research teams.

Information about the IS infrastructure compiled at the national level comprised three basic groups of data: mobile telephony penetration rate; level of computer provision in households, including broadband Internet access; and use of ICT by enterprises, such as broadband Internet access and company website.

Research has shown that mobile telephony was the most popular form of ICT application. This was clearly visible in the country that pioneered this technology, that is Finland, where the number of mobile subscriptions was equal to the size of the population. In the remaining countries, the rapidly growing number of mobile telephones raised the penetration rates to 60-80 per 100 head of population. It can be expected that in the coming years mobile telephony will be fully accessible to all who would like to use it. As a result of the universal application of this technology, regional disparities in this sphere were very small, with the variation coefficient ranging between 4% and 8% (the relevant statistics were available for the Czech Republic, Germany and Italy). The widest disparities could be observed in Italy (with a lower mobile telephony

penetration in the southern regions of the country), while in Germany they were practically nonexistent. Most probably, these disparities would look different if the survey took into account handsets with GPRS functionality. For many users, a mobile phone remains only a supplement to fixed telephony, although in more technologically advanced countries such as Finland or Germany the numbers of households giving up their fixed line subscriptions are constantly growing.

The disparities between individual countries were much wider when the share of households with computers was examined. Two reasons for this could be the higher price of PCs compared with mobile phones and a different marketing strategy used by vendors who did not subsidise their products as they were unable to collect charges for actual use (although such pioneering solutions are currently being implemented in some developing countries, such as India). As a result, the level of computer provision in the countries with lower GDP per capita (Greece, Czech Republic, Hungary, Poland) was nearly two times lower than in the more developed countries (Germany, Finland, Italy). Moreover, there were considerable disparities in the levels of provision between individual regions, the greatest observed in Greece (with a variation coefficient of 49%), but as considerable in Hungary (23%). Even greater disparities could be observed in terms of Internet access. In this respect, there were also marked differences between the better-developed countries, with Finland definitely in the lead (54%), followed by Germany (44%) and Italy (35%). The share of computers with Internet access in households was practically the same in Greece and the Central European countries, where it reached about 15%. In most of the countries, inter-regional disparities measured by the variation coefficient were about two times higher than in the case of the computer penetration rate.

Lesser disparities could be observed in the enterprise sector, probably because it is driven by a greater competitive pressure, i.e. the need to implement new technologies to maintain or improve a company's competitive edge. So far, using modern technologies has had a smaller impact on the incomes of households, and apparently the potential possibility to reduce expenditure as a result of their application has not been as important as in the case of companies.

The share of companies with Internet access was several times higher than that of households (two times higher in the more developed countries to four or five times higher in the Czech Republic and Hungary). At the same time, the share of companies operating corporate websites varied from less than 10% in Greece to 76% in Finland. The range of inter-regional disparities was also considerable (variation

coefficient between 20% and 30% in the countries with the relevant statistics available: Italy, Hungary, Poland) and corresponded, in rough terms, to the range of disparities in Internet access in the household sector.

Based on the research carried out as part of the project, it can be concluded that there exist marked disparities between the better-developed countries: Finland, Germany and Italy, and the remaining countries. At the same time, among the more developed countries a clear hierarchy can be observed, with Finland unquestionably in the lead, followed by Germany and Italy, which could be a consequence of the differences in the adaptability of these countries or the way the data transmission market is organised (significance of the state monopoly). At the same time, the level of IS development in Greece was practically the same as that in the three new Member States (Czech Republic, Poland and Hungary). The national surveys also corroborate the thesis that as a rule the differences in the accessibility of modern technological developments are reduced as time passes.

The analyses carried out by the research teams point to a number of factors that foster disparities within the surveyed countries. The first such reason was the degree of polycentricity of a given national settlement system. As a rule, the more monocentric the settlement structure, especially the dominance of the capital city over the national system (Greece - Athens, Hungary - Budapest), the greater differences could be observed. Another factor, which was definitely not conducive to the development of technical infrastructure, was the scattered settlement network and low population density, particularly in mountainous areas (Italy, Greece). The third important factor was the diffusion period for new technological developments: the longer a given technology was available on the market the lesser the disparities between the regions. This was also related to the prices of new technological solutions, which, as a rule, fell with time (mainly visible in the countries with a low purchasing power in the household sector). Fourthly, the need to meet the challenges posed by the market was a reason for smaller disparities in the enterprise sector than in the household sector. The last, but not the least, important factor included cultural differences and the related adaptation barriers, as a result of which the development of new technologies was slower in traditionally rural areas (which was particularly visible in Poland).

7.2.2. The IS economic dimension

An analysis of the current state of affairs and trends concerning the IS in economic terms encounters two major difficulties. Firstly, many IS-related phenomena are extremely dynamic in nature, and secondly, despite the great significance attached to ICT, the available statistics vary in terms of methodology and content, and it is very difficult, especially at the regional level, to find the required information. As a result, it is not easy to compare data in temporal and spatial aspects. Notwithstanding the above reservations, the information compiled during the research process is sufficient to draw a general picture of the situation and outline the main IS development trends.

In all the surveyed countries (except Poland), increased outlays on ICT can be observed, as a result of different forms of combining public and private expenditures. Unlike Poland, where both R&D outlays and employment rates are falling (with the outlays expressed as a percentage of GDP being nearly four times lower than the EU average), in the remaining countries they are on the increase.

It is generally confirmed that IS development is correlated with the overall development level, although in some cases the penetration level of infrastructure (which determines ICT accessibility) remains relatively independent (which can be a result of extensive public investment in less developed areas). However, the question of the direction of this correlation remains open: the case of Finland shows that IS development can be the driving force in fostering development, and not only a correlate of an overall development level.

In territorial terms, most of the indicators in each of the surveyed countries show manifest disparities in the level of IS development, although in the better developed countries these differences have a different qualitative aspect (for example in Germany they mainly include the penetration rate of broadband connections, and consequently the possibilities for new applications or a new scale of applications in business). In all the countries, the territorial differences fall into a similar pattern (though not necessarily of a similar intensity) and are based on the axis dividing agglomerations and rural and peripheral areas. For instance, the degree of concentration of R&D outlays is particularly high in the countries with one or few agglomerations (Hungary, Finland, Czech Republic), and much lower (yet visible) in such countries as Germany, Poland and Italy.

7.2.3. The IS social dimension

The surveyed countries show considerable disparities in terms of IS development and use of ICT applications by the society at large. The highest such levels are found in Finland and Germany, where the accessibility and availability of on-line services in such spheres as administration, training, education, banking services or purchases is relatively the highest. But even in those countries the e-signature, apparently expected to revolutionise the relations between citizens and public institutions, is not very popular. In the remaining countries, the scale of ICT applications is growing steadily, although at different speeds in different locations, with particularly low growth dynamics observed in Poland and Greece.

The collected data indicate that in recent years a qualitative change was more and more distinctly visible in the last few years. While until quite recently infrastructure and supply of services were the factors determining both the availability and use of web-based services, currently in the countries which are the most advanced in terms of IS development (including high infrastructure capacity), cultural and psychological factors are increasingly gaining in importance and can restrict the actual use of available services. This phenomenon is particularly well illustrated by the analyses from Finland, where a considerable share of the society – having the choice – instead of handling their official matters on-line, prefer to do it in the office, on a face-to-face basis, or by telephone. An important conclusion can be drawn from this for the less technologically advanced countries: the expansion of infrastructure is a necessary but insufficient condition for building an open Information Society. Promoting IS, acquainting school students with new technologies and possibilities of their applications in the economy and in everyday life should be a no less important component of IS development programmes than technical matters.

7.3. The IS development policy

It is difficult to compare information collected during the national case studies mainly because individual countries have different institutional systems and differ from one another in defining the IS goals and development needs and in their approaches to formulating development strategies and programmes. Despite the obvious limitations to such a comparative analysis, it is possible to formulate a number of conclusions concerning similarities and dissimilarities in IS development in the individual countries.

Among the seven surveyed countries there were none that would regard IS development policy as irrelevant. Nonetheless, distinct differences can be observed if we look at the actual role of the IS in development policy. In some countries (such as Germany or Finland), IS development is viewed as the foundation for future development, a precondition and indicator of modernity and competitiveness. For instance, the Finns strongly emphasize the role of IS as both a value and a tool, as do the Hungarians. However, there are countries where despite a huge number of assertions of the high priority given to ICT or R&D, there are not such significant measures or funds allocated to these spheres in strategic documents (Poland).

A comparison of documents dealing with general IS development issues does not allow any definite conclusions to be drawn. All the countries have produced a number of official documents (plans, programmes, strategies) dealing with ICT or R&D policy at the national level. These issues are also addressed in other development documents, such as Development Plans or Operational Programmes within the framework of cohesion and structural and regional policies of the EU. However, of all the surveyed countries only four have prepared and adopted official documents dealing specifically and comprehensively with IS policy (Germany, Hungary, Finland, Poland).

In all the countries, the main IS development actors include ministries and other central bodies with responsibility for economy, education, science, informatisation or communication (depending on a given administrative structure) and regional administration in the countries which have initiated efforts at the regional level (such as the Voivodship Boards in Poland). Countries with the highest level of IS development (Germany, Finland) emphasize the role of other actors, such as NGOs, universities, businesses, etc., as components of the network. Certain German *Länder* are the most advanced and the most independent in this respect (e.g. Bayern); they often have their development strategies in place earlier than the central authorities. In other countries with a non-federal structure, mainly the new Member States and Greece, it can easily be seen that the relatively new regions lack sufficient own resources to undertake large-scale IS development efforts without the support (and in many cases without the inspiration) of the central authorities. For example, 15 of Poland's 16 regions (voivodships) have prepared their Regional Innovation Strategies; this, however, would not have been possible without the support of the State Committee for Scientific Research. Participation in policies supported by the European Union expands opportunities especially for less developed countries and

regions as, with such funds they can launch projects envisaged in the adopted strategies. This topic should be further explored in the future because EU documents have sparked off important debate on IS issues in the Member States.

One of the major goals of the study was to prepare a coherent terminology based on the definition of the Information Society. The collected data indicate that in none of the surveyed countries a precise (and binding) definition of the IS has been worked out. At the same time, there are widespread discussions of IS-related spheres or factors, and the structure of such discussions can vary, depending on the context, even within individual countries. In some countries, references to the terms and phrases from EU documents were highlighted (Greece) and in Italy an attempt was made to define IS as a process.

Generally speaking, however, there is no coherent definition of IS that would assist policy implementation. The aims of IS development policy are formulated differently in different countries, not because there is no commonly acceptable definition but because different countries have different views on development issues. The aims are formulated at the level of strategic goals (for example in Germany: "to secure at an international level Germany's position for the development of the information society") and direct objectives (Germany: "to provide equal access to information and communication technologies for the whole population"). Usually, the latter option prevails. For instance, the following aims have been formulated in the Czech Republic:

- affordable services,
- information literacy,
- modern on-line public services,
- dynamic e-business environment,

In fact, these aims are achieved through many more specific operational objectives or even measures. Poland has formulated three objectives (common availability of electronic content and services; development of valuable content of services; common ability to use computer and communication systems) and translated them into twelve key actions. A slightly different approach was taken by Italy, where ten objectives covering five areas (electronic services to citizens and businesses; efficiency of public administration operations; valorisation of human resources; transparency and quality) were adopted for the years 2000-2006. (Italy's objectives are different in that they define goals in quantitative terms ('where possible')).

Although regional-level and spatial development are perceived to correlate with IS development, the compiled data point to considerable differences between individual countries in this respect. It seems that the wealthier countries, with a higher level of IS development (Finland, Germany) not only attach greater importance to regional issues and spatial development, but they are also more advanced in the formulation of specific programmes and coordination of activities between the central and regional levels (*Länder*). In Germany, the 'growing divide concerning the use of ICT' was diagnosed as the central problem in IS development, to be solved using the five specific programmes:

- Inno Regio (to create innovation networks)
- Innovative regional growth cores
- Centres for innovation competence
- Interregional alliances for tomorrow's market
- InnoProfile (to strengthen East German innovativeness).

In Finland, it was observed that there existed a need to depart from traditional regional programmes as too general and to adopt a more goal-oriented approach, and to build cooperation networks as fundamental prerequisites to successful spatial and regional development.

Apart from the two aforementioned examples, the remaining surveyed countries represent more traditional and less progressive views on linking IS development with spatial and regional development. As a rule, these issues are practically absent from development policy documents (especially in Poland). The shortage of funds at the regional level, which effectively restricts the room for manoeuvre for the regional authorities, is often pointed out as the main reason for this. As mentioned above, 15 regional innovation strategies would not have been formulated if not for the central-level subsidies. Also the Czechs emphasize the problems with funding as obstacles hindering IS development.

Without negating the role of finances, it seems that there are more reasons to explain the weak linkages between IS and regional development, for example: insufficient awareness of the nature of existing problems; traditional approaches to regional disparities; low innovativeness of development programmes. These factors help to understand why, in the group of less developed countries; only six Polish and one Czech regions have their own IS development documents.

The compiled data clearly indicate that there exists a serious deficit in IS activity at the regional level (i.e. not only the quantity but primarily the quality of the programming documents), which is an obstacle to IS development. This problem is not confined to the less developed countries, but is also highlighted in Italian, Finnish and German studies. The latter case is particularly interesting; the difference between East and West Germany at the programming level lies in the fact that the *Neue Länder* – unlike the western regions – do not see the need to develop any special programmes. It can be expected that the less developed regions of Central and Eastern Europe will soon encounter a similar problem. The Finnish and German examples show very plainly the continuing specialisation of development documents which address specific problems of IS development, and the significance of networks.

The recommendations formulated in individual countries concerning further IS development are quite varied, although the dividing lines are not country-based but are very often qualitative.

In most of the surveyed countries, the recommendations primarily relate to further development of infrastructure and improving accessibility, mainly in rural and peripheral areas threatened by digital exclusion. However, while in the less developed countries this means infrastructure in general, in the more developed countries it is an issue of broadband access.

Other popular recommendations include those concerning costs, mainly with regard to broadband access as this means a considerable increase in costs for users. Taking into account the fact that, for example, in Poland Internet and telecommunication costs are much higher than in the highly developed countries, any further increase in this sphere can prove to be a serious obstacle to IS development.

In some of the surveyed countries, it is proposed to expand the scope of on-line services.

One of the recommendations (most strongly expressed in Finland) emphasizes that infrastructure is only a precondition for IS development and that the demand-side is as important, including motivation and skills, as without these the IS will simply not be possible.

Some recommendations are country-specific, referring, for instance, to the need for changes in the legislation (Czech Republic), the need to prepare the necessary statistics or more broadly involve associations in promoting the concept of the IS among businesspeople (Greece).

Conclusions

Despite IS-related initiatives at the Community level and the availability of funds for at least some IS development projects for the less developed countries and regions, countries tend to adopt individual approaches in dealing with this issue.

The feature they have in common is their treatment of IS development as a priority at the strategic document level. However, examined more critically, it is clear that such documents contain more broad declaration than concrete provision for implementation. This is partly due to a lack of awareness of the significance and the opportunities opened up by modern ICT and R&D, and partly due to a relatively low development and perception of the problem in individual countries. It has to be admitted though that these two factors are interrelated.

This can clearly be seen in the relationship between IS and regional and spatial development. While there are regional differences in IS development between the cases studied, these regional differences do not reflect policy initiatives undertaken so far. The roles of regions in IS development can also differ. In most of the cases studied, the regions do not play any important or active role, probably for more than just financial reasons, and depend to a great extent on central-level programmes and funds. In this respect, the situation in Germany is more favourable owing to its being the only federal state among the surveyed ones, but even there the gap between the East and the West can be observed (though at a higher level in terms of quality).

The findings from the analysis indicate that the main obstacles to IS development so far have been supply-side (infrastructure, prices), but the demand-side factors, such as motivation and skills, are gaining in importance. They also include the willingness and ability to participate in complex cooperation networks, which are necessary conditions for any action in the sphere aimed to ensure the intended success in an increasingly globalised world.

In broader terms, it should be observed that the situation concerning IS development is yet further tangible evidence of difficulties encountered in the process of understanding, disseminating and translating into development policy terms the new paradigm associated with a knowledge-based economy.

8. Qualitative Diagnosis of the Territorial State of IS – comparison of regional case studies' results

8.1. Presentation of case study regions

The regional case studies have been carried out in all seven countries participating in the project, with one case study per country. The selection of regions and spatial coverage of the case studies had to comply with the project's needs, especially in the situation of quantitative data limitations. Thus different kinds of regions, which apparently participate to different extents and in different ways in IS developments, have been investigated. A short presentation of the regions under study is provided below in alphabetical order by country.

South Moravia is located in the south-eastern part of the country near to the Austrian and Slovak border. It is the fourth largest region of the Czech Republic. The region's capital - Brno is the second largest city in the country, the population living in the regional capital account for 1/3 of total population. The region has a strong tradition of industrial production in its central and northern parts and a tradition of specialized branches of agriculture and fruit growing in the south. The Brno area with a number of large textile, engineering and other factories belonged to the most industrialized areas of Europe as early as the 19th century. The region has also an advantageous position on railway and road networks of the highest categories and close to another important centre - the city of Vienna.

Tampere region is located in the southern part of Finland. Its regional capital is Tampere, which – in terms of population – is the third-largest city and the second most important FUA in Finland after the Helsinki region. The Tampere region produces approximately 8.2 per cent of the Finnish GDP. There are considerable differences within the region- the subregion of the regional capital (Tampere) is the only one with the GDP per capita above the averages of the whole country. Because of its economic structure and traditions, Tampere is yet often called the industrial heart of Finland. The GDP share of services is 61.2 per cent, while the share of manufacturing has steadily declined in recent decades. As a result of the industrial modernisation process, many of the current largest companies in the region can be considered as high-tech and R&D intensive companies. Currently the Tampere region is among the few NUTS3 regions in Finland with significant R&D funding and institutions.

Tuttlingen is a German NUTS 3 region in the greater region Schwarzwald-Baar-Heuberg, situated in the southwest of the federal state of Baden-Wuerttemberg. This formerly very rural district has had its difficulties competing with economic core areas. But in contrast to other rural districts, industrialisation already set in during the second half of the 19th century, and has now reached a remarkable level. Medical engineering, electronics and mechanical engineering are the most important branches in this region. A number of companies in the region are suppliers for the car industry situated in the Stuttgart area. The district performs very well in socio-economic terms too.

Dytiki Makedonia is one of the thirteen peripheries of Greece, consisting of the western part of Greek Macedonia. It is a low-density populated Region (32 inh. per km², as compared to the country's 79.7 relevant figure), mainly due to its mountainous nature (82% of the total surface are mountainous and semi-mountainous areas). This is also reflected in the population distribution, as the majority of the population (56%) lives in rural areas. The capital of the periphery is Kozani. The Region of Dytiki Makedonia holds the 4th place as far as GDP is concerned, little above the country average, but holds the 1st place in unemployment and one of the last places in the regional R&D expenditure breakdown, accounting for only 0.62 of total R&D expenditure.

Budapest is the capital city of Hungary and the country's principal political, cultural, commercial, industrial and transportation centre. It is located in the central part of the country near Slovakia's border. Budapest belongs to the cities labelled category potential MEGAs in ESPON 1.1. project and it is the seventh largest city in the European Union. The region's GDP per capita is constantly above the national average and its relative position has even strengthened over time compared to other regions. As the ESPON 1.1.1. project stated Budapest is about two and a half times larger for the country as it would be justified by population distribution and more than five times larger by economic potential measured by GDP.

Rome is the capital of Italy and of its Lazio region, which is one of the most populous regions in Italy. The Lazio region is characterised by GDP per capita higher than the national average. Rome is classified in ESPON 1.1.1 project as a strong MEGA. It has a dynamic and diverse economy with thriving innovation, technologies, communications and services sectors. Rome produces 6.7% of the national GDP (more than any other city in Italy) and continues to grow at a higher rate than those in the rest

of the country (4.4% yearly). Tourism is also one of Rome's chief industries.

Podlaskie voivodship is the geographically and economically peripheral region located in the north-eastern part of Poland near the EU's external border. The peripheral location of Podlaskie voivodship is reflected in its small number of inhabitants (1.2 mln) as well as very low population density, approx. 60 people per square kilometre. The urban population is concentrated first of all in the capital city - Białystok (291 000 inhabitants). The region is underdeveloped and the level of GDP per capita is low (75% of Polish average). Furthermore, the role of agricultural sector is greater than in any other region of Poland. The change in socio-economic structure of all Polish regions to large extent follows general trends in the national economy in last 5 years.

8.2. IS regional policies

The local governments in the surveyed regions are highly aware of the need to build an Information Society. Most of them have adopted strategic documents which set out the goals and measures for the implementation of an IS policy in the region.

In some of the regions, IS policy is regulated by one strategic document focusing on the issues of ICT implementation and application in the society at large (Central Hungary region, Dytiki Makedonia region), while in some other regions this policy is governed by a more general strategic document (Tampere, Podlaskie, South Moravia). It should be added that the Polish and Czech regions are at a moment of transition, working on the regional IS development strategy and the regional operational programme as part of their efforts to prepare for the new programming period of the European Union (2007-13). As a result, their current IS policy is now governed by general development strategies. Tuttlingen is an exception, as it does not have any strategy or plan of this kind, although it does undertake IS-related tasks as part of the statutory activities of the relevant institutions at the level of Baden Württemberg.

The significance attached to IS development varies from region to region: from regarding IS as one of many priorities of regional development (Podlaskie voivodship) to subordinating the entire development plan to the IS philosophy in conjunction with the concept of knowledge-based economy (Tampere).

Table 19 Main IS policy documents and IS aims in the six case study regions*.

| | IS policy documents | IS aims |
|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| South Moravia | Regional Development Strategy (RDS) (adopted in 2002) Regional operation programmes for the new programming period between 2007 and 2013 (in preparation) Regional Innovation Strategy (RIS) (adopted in July 2005). | RDE underlines the need to complete accessibility to telecommunication services and information networks throughout the region and to a technical standard fully comparable with that of the EU and to provide e-public services. The Strategy does not contain any measures related to education of human resources in the sphere of Information Society such as improving information and computer literacy, supporting e-learning etc. ROP will concentrate more on the support of building an Information Society through supporting ICT and their utilization, including information literacy. |
| Tampere | The regional plan for the Tampere region from year 2005 onwards (Pirkanmaan liitto 2006) | The plan is built on nine "success factors", in which one factor is targeted to the development of the Information Society's infrastructure and four factors are related to the utilisation of region's technological know-how, high-tech industrial base and R&D. Moreover, the "innovative entrepreneurship and research" and "the specialised knowledge and human capital" are called as the key strategic means (out of four) in the implementation of the vision for the rising competitiveness and increasing cohesion in the region by year 2020. Measures ("narrow view" or Webster's (1995) IS technical definition: development of public e-services, utilisation of ICTs in public participation and governance in general, the ease of access to ICTs, and the need to develop citizens' abilities to use advanced technologies in their everyday life. Measures ("broad view" on Information Society, i.e. taking into account the technological, economic, occupational, spatial and cultural aspects): fostering of the "innovative environment", utilization of the newest production technologies, promotion organisational change (e.g. distant work), and enhancing knowledge diffusion (e.g. university-government-industry collaborations). |
| Tuttling | No specific regional document | The governments of the separate German states undertake efforts to support the achievement of national objectives regarding the IS development by implementing innovation-friendly policies or initiating action programmes in favour of ICT usage within the federal states. |
| Dytiki Makedonia | Operational Plan for the Information Society in the Region of Dytiki Makedonia Regional Operational Program of Dytiki Makedonia | The specific goals for the IS in the Region are: - Full development of telecommunications and mobile telephony. Development of information networks for remote areas. Improvement of the communication between businesses and public agencies. - Improvement of all levels of education and linking to employment. New skills for the human capital. - Strengthening of competitiveness by creating new enterprises, support of economic diversification and access to knowledge, innovation and new technologies. - Development of a strong local entrepreneurial environment, a network of competitive SMEs and support services, as well as support in the creation of hi-tech SMEs. Strengthening of industry-science relationships in the region. - Development of support services in the tourist sector and promotion of contemporary cultural activity. - Improvement of high level services in health care by integrating new technologies and training staff. |

| | | |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p style="text-align: center;">Budapest</p> | <p>Strategy Plan of the Central Hungarian Region (2001-2006), 2001 Strategy Plan of the Central Hungarian Region (2007-2013): The Creative Region, 2006 Innovation Strategy and Action Plan for Central Hungary, 2005 Podmaniczky Plan – Medium-term Development Programme for Budapest (2005-2013), 2005 Budapest Information Management Programme, 2001 Medium-term Informatics Strategy for Budapest (2006-2008), 2005 Regional Information Strategy for Central Hungary, 2005</p> | <p>Priorities:</p> <ul style="list-style-type: none"> • Knowledge management: education, life-long learning, re-qualification of workers, adult education, developing skills and qualifications, promote IT usage, survey and monitoring, knowledge centres • ICT infrastructure: broadband, access, accessibility • Public administration: democracy, eGovernment, eAdministration <p>It was characteristic that the information strategy of Central Hungary did not address the issues of economic development and regional content. The regional strategy stressed the existing discrepancy between ICT supply and digital skills and emphasized the importance of demand evolution. The strategy considers the notion of the IS as a philosophy and it combines with the ICT to form a democratic community with equal opportunities, while preserving the pluralist nature of development and accommodating knowledge based innovation. It builds heavily on programmes raising IT awareness. Among specific goals it mentions the more liveable environment, the closing of spatial differences, the mapping and managing of regional information databases and what is most interesting the reducing of the possible negative aspects of the IS.</p> |
| <p style="text-align: center;">Podlaskie</p> | <p>Development Strategy for the Podlaskie Voivodship Until 2020 (2005) Regional Innovation Strategy (2005) Voivodship IS Development Strategy Until 2013 (in preparation)</p> | <p>I. In the sphere of data infrastructure</p> <ul style="list-style-type: none"> • Ensuring public access to broadband services; development of backbone and access infrastructure for data transmission; • Strengthening the data infrastructure in local administration and ensuring an efficient management of information resources; • Furnishing local governments with computer hardware, local networks and software; IT preparation of staff to ensure a high level of public services provision; • Ensuring universal and cheap access to Internet services and content; preventing digital divide and related negative phenomena; <p>II. In the sphere of Internet public services and content provision:</p> <ul style="list-style-type: none"> • Satisfying public demand for services and content offered through an interactive electronic platform by public institutions, in particular by local government authorities; • Development of electronic services in the business sphere, enhancing the competitiveness of regional enterprises; • Development of telemedical services in the Podlaskie voivodship; • Creating a varied and valuable content offer; facilitating free access to information resources and public electronic services as part of the 'Wrota Podlasia' [Podlasie Gateway] portal; <p>III. In the sphere of IT dissemination in the society:</p> <ul style="list-style-type: none"> • Popularising IT skills and development of IT education, preventing digital divide in the society; • Improving security in the region, electronic back-up to risk management. |

* the information was not provided by the Italian Partner

Source: own compilation on the bases of the regional case studies.

In most of the regions, IS goals cover a broad spectrum of activities, such as the accessibility of ICT infrastructure, offering public services on-line, education and dissemination of knowledge about the significance of ICT and its applications. A marked change in IS policy can be observed: it is demonstrated by a priority shift, giving more significance to behaviour and motivation opting for modern solutions, access to the Internet and skills required to participate in the development of Information Society. This is accompanied by a marginalisation of issues related to technical accessibility.

The above shows that the notion of the Information Society is being expanded and that a narrow, technical definition is being replaced by a broader one, comprising technical, economic, vocational, spatial and cultural aspects of ICT application (F. Webster; 1995). Such a priority shift is taking place in all the surveyed regions, albeit at a different pace, which depends on the level of IS development and, to some extent, on the period of implementation of IS policy in the region to date. In such regions as Podlaskie, South Moravia or Central Hungary, the discussed changes remain in the sphere of declarations, while in Tampere or Tuttlingen they are manifested by specific projects implemented at the regional level.

8.3. Trends in relation to IS development

8.3.1. Households

The regions covered by the research can be divided into those where the level of provision of households with computers (including those with Internet access) is higher than the country's average (Italy, Germany, Finland, Hungary), and those where it is similar to the national average (Poland, Greece, Czech Republic). At the same time, distinct intra-regional disparities could be observed between towns and rural areas, mainly those peripherally located. This was primarily the case in the metropolitan Hungarian region, while in the Finnish region the differences in both the equipment and access were not as distinct and were mainly related to the use of the latest technical developments. This clearly shows the direction that the diffusion of innovation is most likely to take. The in-depth surveys conducted in the Finnish region have demonstrated that the factors that determine the disparities largely result from the socio-economic structure of the population. New technologies are most frequently used by young professionals with tertiary education and higher than average incomes. On the other hand, it can be observed that

the lower degree of ICT use among the rural population can to some extent stem from a lower number of potential applications.

8.3.2. Enterprises

In spite of using quantitative measurement methods, the research material compiled as part of the completed case studies is not fully comparable. This is due to such factors as the unique character of specific cases, differences in the way of selecting the research samples and their different sizes. Nonetheless, if we use the compiled data and opinions of the regional and local actors, the following, overall picture of similarities and differences between the individual countries can be drawn. Also, some hypotheses concerning their reasons can be formulated.

The main similarities include:

- the scope of content of the Internet websites of enterprises did not show any systematic differences between individual countries (for instance, in none of the regions the share of websites where orders could be paid for exceeded 10%);
- intensity of electronic contacts with public administration was similar in most cases (as a rule more than 60% of the enterprises made use of this form of communication);
- the Internet did not have much influence on spatial linkages of enterprises as it mainly affected the form and nature, and not the scope of their business contacts;
- in all the countries covered by the research, the key element of the competitiveness strategy was the high quality of the offered products and services.

The basic differences could be described as follows:

- running a dedicated website was less frequent in the less developed regions, such as the Polish or Greek regions (only about 50% of enterprises in each), while in the remaining regions the corporate website was common, as was the corporate e-mail address.
- a majority of the enterprises made use of Internet banking (about 80% of companies), with the exception of the Greek region with the lowest share of as little as 40%.

- the percentage of enterprises involved in R&D work ranged from 5% in the Polish region and 10% in the Greek region to over 80% in the Finnish region and about 80% in the Italian region, which was visible in substantial differences concerning the launch of new or modernised products.
- spatial linkages of enterprises were considerably varied (for instance, the highest level of labour market internationalisation could be observed in the Italian and Finnish regions, the Polish and Czech regions attracted the most inward capital, and the weakest innovative potential of the Greek region was the reason why the local enterprises usually sought information about innovations abroad, while in the German region the intra-regional linkages were definitely the strongest in this respect).
- in better developed regions (Finland, Germany, Italy) innovation and technological advancement of products were the more important elements of the competitiveness strategy than price (we may therefore talk about Porter's "competitive advantage"), while in the less developed regions, mainly in Poland and the Czech Republic, the price still remained a substantial factor of competitiveness (called by Porter "comparative advantage").

The analysis of the spatial distribution of the enterprises using ICT shows mainly the differences between the major city of the region and the remaining areas (such differences are usually more pronounced in the case of less developed regions: Czech, Greek and Polish, and the metropolitan Hungarian region).

8.3.3. Public administration

Self-government administration represents an important aspect of IS building in the region. In this context, important issues include the use of ICT within the local administration offices and in interactions with the offices from various levels of the administrative structure, as well as ICT application in contacts with other regional and non-regional actors. The scope of information which is made available through the Internet and on-line services provided to citizens by local government units is an important indicator of the IS development level in a given region.

Analysis of administration offices' websites in the region

Presentation of a regional government on the Internet provides an opportunity not only to publicise information on the activities of the regional authorities and promote the region to a wider audience; it can

also be an important tool in the communication of the regional authorities with the regional communities. Among the surveyed regions two groups can be distinguished:

- regions situated in higher developed countries, where running a website by the local government units is a standard practice (Tampere - 100% units, Tuttlingen - 91%);
- regions located in countries with lower development indicators, where only some governments maintain their websites (South Moravia - 50%, Podlaskie - 73%). In addition to that, internal disparities can be observed in most of the analysed cases. For example, in the Podlaskie voivodship the share of the gminas (municipalities) with their own website is higher in cities and urban poviats and definitely lower in typically rural gminas. In Central Hungary digital gaps exist in the neighbourhood of the metropolis, while in South Moravia small regional units with low populations operate www pages definitely less frequently than large regions.

The functionality of the website of a given local government depends, on the one hand, on supply factors such as the scope of information, the validity of its content and interactivity of the website, and on the other on demand factors related to the technical capability of households and their views on using modern technology in different areas of life. On the other hand, there are differences in the scope of information published on the websites of the local governments both within and between the analysed regions. In terms of factors determining the website functionality, the surveyed regions can be divided into two categories:

- in the first group of regions, website functionality is limited both by demand and supply factors, while the latter, related to technical capability, seem to play a greater role. For instance, in the Podlaskie voivodship the scope of information placed on the local governments' websites is usually limited to 4-7 categories, such as news or tourist and cultural information (found in 65-85% of the analysed cases). The least present is information about the European Union and its assistance funds, GIS information, as well as labour market and citizen's information. The weaknesses of such websites include their low level of interactivity and the limited scope of on-line services for citizens. Despite the sufficient technical capability and willingness to use e-administration tools of some of the Podlaskie residents, this can be done on a limited scale only;
- in the second group, while no objections can be voiced as to the spectrum of information and website interactivity, the first and

foremost problem is the limited demand for the services offered on-line. For example, in the Tampere region, where all the local administration offices have websites offering tools for an interactive communication between the citizens and the office, and the Internet services offered by the local governments are the most frequently visited public websites in Finland, only as few as 20% of the region's inhabitants declare that they often use such services.

The analysis also revealed that the less elaborate websites are as a rule operated by the local governments in rural areas (e.g. Podlaskie, Central Hungary region) and that the urban regions attach more importance to the scope and topicality of their websites (e.g. Central Hungary region), and the type of information presented is determined by the region's characteristics (e.g. Dytiki Makedonia), whereas the scope of the presented information increases with the size of a given administration unit (e.g. South Moravia).

ICT application in the office

The empirical research indicates that the use of ICT in local and regional government units is perceived as a necessary aspect of administrative performance. The impact of ICT application on improving the quality of work and streamlining communication within the offices is emphasized (e.g. Tuttlingen, Podlaskie). Some negative aspects are recognized by the administrative officers in the Tuttlingen region, most of all the danger of getting overflowed by e-mails and information. Therefore, a strong focus on priorities and quick decision-making is necessary.

A serious problem in ICT application in local and regional administration offices in Poland, the Czech Republic and Greece has been the lack of qualified personnel and, more importantly, an unwillingness of the staff to improve qualifications. New ICT applications that bring into effect the transparency of actions and decision-making processes are resented by some public officers. On the one hand, they want to avoid the need to acquire new skills and have to break an established routine, and on the other fear changes which would strengthen a system monitoring their performance.

The ICT development in local and regional government units is also impeded by legislative factors such as inadequacy of the legal provisions (South Moravia) or tardiness in adopting the relevant secondary legislation (Podlaskie Voivodship). Another issue, pointed out by the respondents in the Polish region, was the need to incur costs related to the introduction of the e-signature, stipulated by law.

Networks and spatial behaviour

Both in the regions situated in better-developed countries and in those located in countries that are economically weaker, the impact of ICT application in local and regional administration has had only limited spatial consequences. The development of e-government in all the analysed regions (with the exception of Tampere) is restricted to the possibility of downloading official forms (and this only to a limited extent). However, the standard of service in this area is rapidly improving (e.g. Tuttlingen). The development of ICT has only very slightly changed the spatial relations between public officers and their external environment, as a result of reducing the distance between the office and citizens (e.g. Tuttlingen).

It can be assumed that in regions not particularly advanced in terms of IS development, the stage of stronger ICT impact on spatial behaviour is still ahead of us. To date, offices in such regions have mainly focused on the building of infrastructure and linkages within their own structures and with other subordinate or superior institutions, while currently they are opening up to virtual contacts with entrepreneurs, citizens, tourists or foreign investors. Furthermore, local governments in such regions (e.g. Podlaskie) do not seek any opportunities for fostering economic development in the stepping up of efforts on ICT application, although some anticipate that such a correlation will appear in the future.

8.3.4. Educational system

The conducted research indicates that only two of the surveyed regions are characterised by a very high level of school provision with ICT (Tampere, Tuttlingen). In the majority of the remaining regions, the use of ICT in the education sector is not as widespread, being as a rule accompanied by strong intra-regional disparities. For instance, there are more than tenfold differences between the localities of the Podlaskie voivodship regarding the provision of schools with computers. In very general terms, it can be said that areas with low population density and scattered settlement network (mainly rural areas) are less computerised than larger cities and more densely populated rural areas with a well-developed settlement network. Similar differences between town and countryside could be observed in the Greek region (Dytiki Makedonia). In the Central Hungary region, the disparities between Budapest and the surrounding region are the more pronounced when the more advanced equipment is taken into account (for instance only schools in Budapest are equipped with notebooks, laser printers or Pentium-4 powered PCs).

At the same time, a lower standard of provision can be observed in the municipalities located in the vicinity of large cities (such as Białystok – the seat of the Podlaskie voivodship), which is probably due to the large-scale commuting to schools in larger urban areas.

Problems related to the furnishing of schools with new technologies vary depending on the rate of ICT penetration. In areas with a lower level of provision, the usual difficulties include an insufficient number of computers given the actual educational needs, lack of Internet access and too little training for teachers (e.g. Podlaskie voivodship, some parts of Tuttlingen).

In the regions with longer traditions of ICT application in schools and better ICT-related indicators, the basic problems include the replacement of used, technically obsolete equipment which no longer serves its function (Dytiki Makedonia, Tampere). Another problem raised by the respondents is the need to prevent uncontrolled use by the pupils of the plethora of information available on the Internet, which is often outdated or inappropriate (Tuttlingen).

Depending on the region, the role of the ministry of education and significance of the national education policy are emphasized among the factors stimulating the use of ICT in the didactic process (Podlaskie, Dytiki Makedonia) or, alternatively, the role of the regional policy is stressed (Tuttlingen). In addition, the level of provision in a given school mainly depends on the personality traits and involvement of the principal who must act as a manager and seek funds for informatisation purposes (e.g. use of the school's own funds and EU funds in some schools of the Podlaskie voivodship).

Computer-assisted teaching depends, on the one hand, on the level of education and ingeniousness of the teacher (South Moravia region, Podlaskie), and on the other – on the technical capability (using the computer room for the teaching of subjects other than IT) and costs of legal software for teaching individual subjects, which in many cases represent a considerable burden for schools (Podlaskie, Dytiki Makedonia).

The main factor hindering the use of ICT in the teaching process is an uneven level of provision of computers and Internet access in households, particularly in rural areas (South Moravia, Podlaskie). The reasons underpinning such disparities are not only economic, related to relatively low incomes of the population. Social reasons, connected with the mentality of certain local communities, which prioritise other needs

than new technologies (e.g. the former state farms areas in the Podlaskie region), can also play an important if not decisive role.

8.4. Conclusions

8.4.1. Factors enhancing IS on regional/local levels

There are a number of factors affecting the development of the Information Society. The major ones include those related to the expansion of a relevant information infrastructure, cost-effectiveness of ICT application, the attitudes of citizens, entrepreneurs, officials and policy makers, the existence of programmes or measures relating to this sphere and their planned implementation.

As a rule, the surveyed regions have developed an infrastructure that allows using ICT regardless of the actual place of residence. Some differences can be observed in the access to higher capacity connections, because providing such connections in sparsely populated areas is not economically effective. This could lead to further concentration of business activity in cities (this is particularly especially visible in the Polish, Czech and Hungarian regions).

However, this is a bi-directional process, since the development of ICT application in enterprises largely depends on the nature of the business sector in a given area. The region's specialisation in branches that are characterised by a higher level of technological advancement (Finland, Germany) fosters the dissemination of ICT. Furthermore, a greater intensity of business interactions, typical of metropolitan areas (Italy, Hungary) encourages companies to develop such technologies to enhance exchange of information and improve local contacts, which could be later translated into changes in the spatial organisation of their operations. On the other hand, an excessive sectoral diversification (Poland, Greece) and uneven distribution of enterprises in space can lead to a less intensive use of these technologies and in many cases negatively affect the scope of initiated innovative activity.

The regional communities in the surveyed regions are strongly differentiated in terms of their ability to absorb new technologies. Major mental barriers exist, particularly in the less developed, agricultural regions, which hinder the application of ICT. Another factor impeding their development in such areas is a smaller scope of potential applications. Generally speaking, the factors that are conducive to the absorption of state-of-the-art technological developments include

youthfulness, good education and high incomes. This poses a special challenge for educational systems, which should aim to equalise the opportunities of children and young people in this sphere.

The level of school provision with ICTs is a fundamental prerequisite for the development of an Information Society. In the contemporary world, lack of computer literacy is a form of illiteracy. An equal distribution of ICT provision at schools is a necessary condition for equalising the 'start' conditions for people who come from smaller and peripheral locations. Importantly, the awareness of the need to make use of ICT should be developed at the level of elementary education, and schools should be able to keep up with the developments in information and communication technology. The conducted surveys confirm that there is no retreat from using ICT as it is both a great aid in the teaching process and a tool, enhancing the administration and running of schools (e.g. using ICT in the recruitment process to secondary schools in Poland).

So far, the activities of public authorities aiming to popularise the e-signature have not been particularly effective; only a small percentage of companies use this form of communication, even in the most technologically advanced regions such as Tampere in Finland. The factor responsible for limited popularity of this invention is the unfavourable ratio between the expenditure (understood not only as the charges involved, but also as the need to introduce time-consuming organisational changes and implement the required safeguards) and the outcome (the still limited range of applications).

Generally speaking, IS development in the private sector is based on economic effectiveness and therefore no initiatives launched by public authorities can be indicated which might significantly speed up the dissemination of ICT.

8.4.2. IS influence on spatial behaviour

The development and application of ICT affects many spheres of life and exerts an influence on enterprises, households and public authorities alike, which can in effect lead to changes in the regional social and economic structures.

However, on the basis of the collected data, no strong correlations between the application of ICT, innovation, spatial linkages and competitiveness can be unambiguously identified. The use of information and communication technologies does not directly affect the spatial linkages of enterprises. When compared to traditional forms of business

contacts, web-based contacts complement rather than change the range of impact. Their main role is mainly related to seeking information about innovations, although this is rarely followed by the launch of new products or services. Nevertheless, in some cases ICT application has observably led to an increased regional cohesion as the new technologies facilitate the development of companies with peripheral locations (the number of such companies was usually low, but this was offset by the range of applications). In addition, teleworking exerts some influence on the spatial behaviour of households. As this mainly applies to selected specialised services, such a phenomenon is more easily observed in the regions with a higher penetration of these types of services, e.g. Tampere, Rome, Tuttlingen. Similarly to the use of Internet contacts vs. traditional forms of communication, teleworking is only complementary and does not help to reduce the need for commuting, although it could have some influence on the actual commuting patterns.

At the same time, in all the surveyed regions the availability of public services offered on-line has recently visibly increased. Web-based tools are also used to streamline communication and enhance organisation between the different levels of public administration.

On the basis of the research so far, it is difficult to conclude beyond doubt whether the development of ICT will help significantly increase the level of polycentricity in the regions and enhance their internal cohesion. Owing to the unevenly distributed access to the network, it can be anticipated that developmental opportunities between locations that are hubs of the network (that is, larger cities) will be more equalised. On the other hand, it can be expected that the disparities between cities and rural areas, characterised by a lower level of infrastructure provision, will increase even further. The growing intra-regional disparities will also probably arise from the greater barriers concerning the adaptation of the rural population to new technology, which can impair the competitiveness of measures undertaken in these areas.

8.4.3. Role of regional/national policies

The assessment of the regional IS development policy is not an easy task. The first barrier is the short implementation period of this policy to date in some of the regions, and the lack of regional data which would allow evaluating the achievement of specific goals in this area (Podlaskie, Dytiki Makedonia).

In some regions, IS regional policy clearly plays a secondary role in the development of the Information Society. For instance, the motor for

change in the Tuttlingen region is the external pressure to introduce ICT-related changes, whereas in the Podlaskie voivodship the activities of public authorities currently focus on aligning them to the legal framework regulating IS development. On the other hand, the findings from the Czech region indicate that regional policy is weak and does not have any influence on the development of an Information Society in the region.

The examples from the countries with the highest level of IS development show that regional level activities play a major role not only at the stage of building a technical capacity for ICT application in the administration, but are also of great importance in popularising knowledge about possible ICT applications and in motivating local communities to make use of ICT.

The Information Society provides many opportunities for improvement, as far as cohesion and polycentricity are concerned. But in order for these opportunities to be efficiently utilised, before everything else, three major requirements must be met: people must be adequately informed about IS, specific skills should be acquired and equality and accessibility should be secured. Local and regional policy makers should concentrate their efforts on introducing policies that are aimed at fulfilling these requirements.

Policies and measures to improve cohesion and polycentricity at regional level should include publicity and sensitisation activities (both general and specific in content), educational, vocational and training activities, as well as activities to remove obstacles that disallow access to small or larger groups within the region (e.g. people in remote areas, infrastructure problems, disadvantaged groups etc.).

8.4.4. Role of governance

Governance is commonly regarded as a factor that can stimulate IS development. For the purpose of the analysis, it was assumed that – in line with the definition adopted in ESPON 2.3.2 "Governance" – governance reaches beyond the traditional, general meaning of the word, and denotes a process oriented on the territory with an aim "to regulate, to 'govern', to manage territorial dynamics through the pilotage of a multiplicity of actors sharing a common agreed objective" (FIR, p.15). A dynamic IS development is heavily dependent on this meaning of this term.

Information compiled in the countries covered by the research indicates, beyond doubt, that a demand for a much more pro-active governance

exists. It is also pointed out (particularly in Dytiki Makedonia) that this correlation works both ways, as the IS can also considerably affect the quality of governance.

Expectations of an increased role for governance are mainly due to the very nature of the IS and the resultant need to enhance understanding, communication and coordination of activities between the public sector, the private sector and the local community. In addition to infrastructural investment, this calls for 'soft' measures, addressed to individuals, government institutions and non-governmental organisations (public awareness raising, incentives to cooperation and coordination of activities). It is pointed out that success largely depends on respecting the autonomy of the decision making of individual actors involved – as shown by the example of the German region.

Regions where a modern institutional system is considered to be the source of success in IS development (Tampere) also see the need for an improved governance. As we can see, deficits exist at the regional level even in successful regions, where there is a need for a greater pressure to develop public-private partnership between the high-tech industries and public research institutions.

Improved governance is also proposed as a solution to the problem encountered in South Moravia, where "lack of mutual communication among relevant partners" is identified, with excessive bureaucracy perceived as the main cause of this situation.

The example of the Polish region offers many strong arguments in favour of increasing the role of governance to overcome social barriers to IS development, which originate from an insufficient pool of qualifications in the region and an overly conservative attitude to modernisation, including modern technologies. This example shows particularly well the complexity of the measures required (education, promotion, coordination of agricultural extension centres and business advisory centres, R&D establishments, enterprises, etc.).

The findings from the research leave no doubt that a dynamic IS development depends to a great extent on the quality of governance. However, any solutions in this sphere must fully consider the specific character of every region and its surroundings. The experiences of the poorly developed, peripheral EU regions highlight the role of broadly understood education and popularisation of knowledge about IS. This problem can also be observed in more developed regions, though not at such a basic level.

In view of the above considerations, in order to overcome problems related to ICT development discussed earlier, it is necessary to ensure pro-active governance that is both flexible and responsive to the local conditions.

9. Policy recommendations

9.1. Policy recommendations – macro level (ESPON space)

9.1.1. The indicators

The ESPON project 1.2.3 encountered a definite data barrier. National statistical systems do not provide statistical information that would be comparable in scope and definitions among the EU member states. By the same token, information available at EUROSTAT is limited both in substantive dimension, as well as at the spatial levels: in fact no common indicators are available for the regional units, even the NUTS 3 tier.

Therefore, the first policy recommendation is that effort should be made to extend and enhance the statistical coverage of information related to different manifestations of the Information Society, in particular through providing comparable indicators not only on technical infrastructure, but also on use and the “softer” spheres, such as social and economic dimensions related to the use of ICT.

Decomposing the national indicators to regional level seems to be the most important recommendation in relation to the spatial/regional analysis conducted within the European Union, which could influence the regional policies of the European Commission.

Improving the statistical database related to the IS will also create richer opportunities for constant monitoring of developments within this sphere, which is now difficult, if at all possible (socially on the sub-national levels) due to scarcity of data and their limited comparability.

9.1.2. Cohesion Policy and the Lisbon Strategy

The Community Strategic Guidelines of July 5, 2005 have strongly related the future cohesion policy of the EU with the Lisbon Strategy, indicating, that competitiveness and efficiency are to assume greater roles in the policy of the European Commission for 2007-2013.

This aim is directly related to the development of the Information Society within the member states and their regions. The goals of the Lisbon Strategy will be better achieved if:

- ICT infrastructure – mainly the development of broadband access - assumes an important role in financial appropriations for infrastructure development, in particular in less developed member states and less favoured regions. Basic infrastructure is in these countries and regions often “more obvious” for policy makers and

the national and regional populations, and in this way the chances for accelerating the pace of modernisation and improvement of “connectivity” may be delayed;

- greater efforts in ICT infrastructure development is particularly important for the rural, peripheral areas, which become marginalised within the “digital divide”, since the processes of metropolisation of growth lead to faster development of the IS in the core metropolitan centres than in the more remote countryside. This holds true also for the educational infrastructure of the sub-metropolitan areas, where – due to commuting to schools – the educational institutions are especially poorly developed with modern ICT facilities, which may further deepen the metropolitan - non-metropolitan divide;
- IS development is regarded as one of the main dimensions of general social education and skill development. Traditional approaches to education and training seem to put more stress on skills and qualifications specific for particular professions and activities – while computer illiteracy is often one of the strongest barriers for those who need retraining due to industrial restructuring;
- e-administration has achieved a very differentiated level of development among the EU member states. Enhancement of this process and improving common standards seem to be two main means of achieving transparency of decision-making processes, procedures and the relationship of public administration with citizens and businesses. The Commission could encourage the national and regional authorities of the member states – especially those less advanced in IS building – to improve the quality of public administration through wider development of computer systems and their wider publicity within societies. This could also make spatial behaviours more efficient, since the demand for travel to offices could be rationalised through emergence of opportunities for dealing with administrative matters through the Internet.

9.1.3. Spatial perspective

The issues of Information Society building and development should become one of the most important streams during the preparation of the next spatial perspective for the enlarged European Union. In the current ESDP these matters are considered in a limited way, since – as indicated on page 38 of this document – at the time of publishing this policy

statement, we have been at the “advent of the information society” (in fact, the IS was mentioned only twice in the entire document). The seven years that have elapsed since publishing the ESDP is an entire epoch in IS progress as well as in the very composition of the European Union, and the spatial processes are shaped by the development of ICT much more and on a much wider territorial scale than had been the case in May 1999, when the ESPD was revealed

9.1.4. Communication policy

A wider spread of best practices within the IS sphere - both at national and regional level - should become one of the core activities of the communication policy of the Commission, and especially of the DG Regio (however, mistakes should also be revealed).

9.2. Policy recommendations – meso level (national)

9.2.1. The general issues

Statistical coverage

As already indicated, all countries of the EU should intensify efforts to provide wider and deeper statistical coverage of the manifestations (in different aspects: technical, economic and social) of the IS, at both national and regional (NUTS2) levels.

IS development within regional policy

Instead of redistribution, knowledge based strategies have emerged in the new regional policy. The most popular measures associated with this policy shift are science parks (co-location), groupings of firms (clustering), and linking knowledge producers with users. These policy measures fit well with the regional development of the IS, but are best suited to more advanced regions. Lagging regions should not copy the more advanced ones: a more individually tailored approach is needed. Public interventions tend to include private partnerships splitting the costs and the risks and creating an environment where local stakeholders may contribute. Similar to the access issues (e.g. universal service obligation) the definition of digital literacy and ICT skills should be an evolving concept, adaptable to different people at different locations. Using the place specific externalities and unused potentials of a region,

IS development should be embedded in a multisector development concept. Lacking experience on the effectiveness of IS policy measures, it is recommended that more room is allowed for experiments and learning through best practices.

MEGA issues

Proximity to major urban centres still matters. The incumbent advantages of major cities on the eve of the IS are still decisive: the adoption of ICT begins sooner, the network roll-outs are faster and the interdependent growth stimulus related to ICT is more intense. However the impact of ICT on basic working and residential functions is relatively little, the existing traditional systems and locations may prevail. The entry and growth prospects of ICT related activities and services follow the spatial structure of regions. MEGAs' IS development tends to be interlinked. The remote areas in the agglomerations still do not have much benefit from the unbounded nature of ICT and it is necessary to strengthen the existing, but sporadic efforts in the agglomeration IS development strategies to compete with the urban centres (business, education, innovation). Relatively backward agglomeration areas must not wait for the spillover effects, they have to rely more heavily on national development programmes. MEGAs should not be satisfied with their incumbent position and relative advantage, they should compete at an international level. The relatively advanced ICT and knowledge based sectors in MEGAs may cause bias towards informatics and hide the inherent subregional inequalities and weaknesses concerning the IS. This needs a more coordinated effort on formulating IS specific MEGA strategies.

Usage policy issues

Having access to ICT, usage patterns differ mainly along the lines of age, income and education, which are positively correlated with access. Better educated and ICT savvy younger generations may replace middle-aged groups very early causing, in the medium to longer term, social tensions in ESPON countries. The presence of children in a household is a major factor in access to ICT and home broadband connections. This implies that it is most important to take into account how people use ICT in their everyday life. Relevant content for different social and professional groups of citizens should be identified and created. In this process the connectivity of those people who are supplying their own content may be a catalyst (Local Nets, eInclusion).

9.2.2. Country-specific issues

Since the situation with regard to the IS development and its role in overall social and economic processes varies, the policy recommendations formulated for particular countries are strongly nationally-oriented and will be presented in this section.

The Czech Republic. The policy documents are aware of the importance of the IS development and its aims are in accordance with the state and situation. However, as has already been mentioned, in reality the policy has barely managed to keep abreast of legislation and the actual state of affairs, and the strategy documents seem more like proclamations than real plans to be implemented.

One of the limitations to IS development in the Czech Republic is still a lack of awareness and understanding of this issue and an underestimation of its importance. Although knowledge-based economy and Information Society are frequent expressions, it seems that they are more fashionable than meaningful. Consequently, such 'fashionable' concepts are being copied from one strategy to another as a result of the 'me too' effect (Blažek, Uhlíř, 2005).

Moreover, this case study has shown that today the ICT infrastructure does not represent such an important factor in the sense of formation of a digital divide at regional level. ICT infrastructure is already available and accessible in most of the areas. Thus, policy and development strategies should no longer concentrate just on developing the infrastructure but should pay more attention to the content and services offered online as well as to increasing the consciousness of the importance of the Information Society. Public representatives therefore should concentrate on developing real policies for increasing demand for ICT, as this is the only way in which the Information Society could really help to increase competitiveness and quality of life even in peripheral areas.

Nevertheless, it would be incorrect to say that there are no positive examples. For example, there is growing awareness of the relevance of research, development and innovations and formulation of regional innovation strategies. As well, the Prague region, where an information strategy has been recently approved, could be considered a serious attempt to develop an Information Society. Yet, still in its infancy, it is hard to say whether it will or not be successful. At least, unlike previous

regional strategies, it is linked to the regional budget and some of the activities have already started. Furthermore, this strategy concentrates mainly on increasing the number of services and information provided electronically by the city administration.

Germany. Although this country is generally quite advanced in terms of its ICT infrastructure, the east-west gap still persists in the context of the IS, especially with regard to the supply of ICT infrastructure. There is still a lack of broadband access in rural/peripheral areas. This lack is, however, not only apparent in the eastern regions but also, to a lesser extent, in the west German peripheral areas. At the same time enterprises in Germany strongly use ICT and the Internet, while the private household use of the Internet could still be increased. Innovation activities are widely found in different regions of Germany. Nevertheless, there is a considerable concentration of R&D activities, patents etc. in a limited number of regions. Such concentration often clusters in the larger towns and metropolitan areas, although this urban concentration is stronger in the eastern rather than in the western parts of Germany. E-government activities have long been delayed in Germany as compared to other European countries, but initiatives are under way to extend e-government services.

Against the background of the different gaps and disparities, policy recommendations can be developed with regard to improved ICT infrastructure supply, increased ICT demand and a wider spread of innovation activities as well as an overall decrease of spatial disparities. In particular, peripheral areas, which are sparsely populated or which are located in geographically disadvantaged regions, suffer from gaps in broadband access. In these areas broadband networks are often not offered because of lack of profitability. New developments with cableless technologies can offer an option for improving the ICT infrastructure supply in these areas.

On the demand side, the elimination of several obstacles could enhance the private households' Internet use. For many households the change from slower Internet access to broadband use is not profitable. This is especially true for households of only one or two. For them broadband access is relatively more costly than ISDN or analogous access modes. In addition, there is a wide variety of providers with permanently changing rates and conditions, which does not support transparency of ICT opportunities. With regard to the so-called 'off-liners', transparency about free options is also lacking, which could be improved by different

information channels. But there are certainly also educational limitations for the 'off-liners' to participate in the IS through Internet use. Not all generations that are now part of the (potential) labour force have been familiar with PCs and modern ICT from their early days. While this appears to become of decreasing importance for the younger generation, large parts of the current work force and unemployed experience a differentiation of opportunities due to varying social affiliation. For these parts of the population qualification enhancement could level professional chances.

Innovation activities depend on entrepreneurial and public location decisions. To some extent the latter can be politically influenced, achieving a somewhat more even distribution of research and related institutions.

Concerning spatial disparities it has also to be recognised that despite the east-west division, at federal level, there are – besides the support for innovation – no special programmes for the development of the Information Society in the eastern regions. These regions' catch up process, which is supported in many other ways, should also take specific account of the IS development in order to avoid another draw back effect.

Finally, federal policies enhancing the IS development, also lack a differentiated approach for different types of regions, which (automatically) is unfavourable for the rural / peripheral areas. Some Länder take account of different types of regions, but this is selective. Consequently, a federal initiative for e.g. peripheral regions could enhance the attempted development of the IS with comparable chances in all regions of the country.

Greece. There are a large number of policies for the development of the Information Society in Greece, which are realised through the Operational Program "Information Society" at national level and through the regional Operational Programs for the Information Society at regional level. These policies have been recently revised and new ones have been added to the "Digital Strategy 2007-2013" which is in its final stages. While there is no shortage of policies there are certain issues that must be seriously considered for future IS policies, both at regional and national level:

- a) *Data/Indicators:* There is an evident lack of data related to the development of the Information Society, especially at the regional level. Even at the national level, where there are annual studies

conducted, there is a shortage of qualitative data. A greater level of detail and analysis is needed. There is a great need for developing common data sets and indicator sets for the Information Society, which should be updated annually and be comparable at regional, national and European level.

- b) *Infrastructure / broadband networks*: While the IS infrastructure in Greece can be called adequate, the development of broadband networks has been lagging behind. Broadband network development should be accelerated and special consideration should be given to what kinds of network the country should invest in.
- c) *Price and quality of services*: It is a fact that IS related services in the country are highly priced, especially services for businesses. This is one of the main reasons that usage of IS technologies by businesses is fairly low in Greece. In order to promote IS, policies that ensure high quality - reasonable cost services available to businesses, private citizens and special social groups are necessary.
- d) *Grants/incentives*: Another problem that has been limiting the success of previous policies and measures is the fact that, while there were many grants and incentives, mostly for businesses, to acquire and use IS related technologies, this was done independently of any greater strategy. As a result, many firms took grants to buy ICT products and services, which were later left unused since they didn't have the know-how to take advantage of them. Future policies should take greater care to integrate the various grants and incentives, relating to the IS, to a broader strategy which will include publicity and training.
- e) *Intermediaries/Collective bodies*: One of the main reasons behind the inability of Greek enterprises to take full advantage of the opportunities presented by the Information Society is the fact that about 98% of them are SMEs (97% employ less than 5 people). That means, in most cases that there is limited capital to invest to ICTs, but it also means that there is limited know-how and limited possibility to acquire know-how. This problem could be solved by increasing the role of intermediaries, collective bodies and associations (such as chambers of commerce, sectoral associations etc.), or even by introducing new structures to specifically facilitate IS related activities. Especially at regional level, the role of support

structures (such as the regional Centres for Research and Technology Development) can prove to be invaluable.

Finland. The technological infrastructure is usually seen to form a key network infrastructure of the Information Society. Although its role is important, access to ICTs and knowledge is only one precondition for the development of the Information Society. For example Viherä (1999) stresses the importance of other factors, such as citizens' competence and motivation, in building of a knowledge-based society. With respect to territorial differences, peripheral and rural areas usually lag behind in all factors. For example in Finland, rural people tend to have lower access to ICTs because of less demand, weaker skills due to less education and older age, and less motivation due to higher access costs and lack of available services. This implies that the availability of a network is a necessary, but far from sufficient, precondition for citizens' participation in an Information Society.

The empirical evidence also shows that territorial differences in the uptake and use of ICT seem to be strongly related to the regional differences in the socio-economic factors (family size, age, education etc.). The most interesting result from these studies, however, is that once people have begun to use modern ICTs, the patterns of use soon become quite similar regardless of user's age, profession, civil status or place of residence. The policy implications of these findings are twofold. Firstly, as the differences in supply-side conditions (access to infrastructure etc.) are likely to decrease as the IS evolves, the regional variations in the supply-side are probably only of secondary importance in the long run. Secondly, as these regional differences are linked with motivation, skills and other demand-side factors, they should also be the focus of policy concern. This, of course, is based on a quite optimistic view of markets and technological change. The existing uneven spatial pattern of the market-based network expansion is seen more or less as a temporary phenomenon: differences in terms of access are perhaps pertinent in the ongoing rapid infrastructure development, but they can be expected to decrease even in the very near future.

The Finnish broadband strategy, published in December 2003 (MINTC, 2003b) is very much in line with this reasoning, relying on market forces, emphasising technological neutrality, and stressing the "soft infrastructure" and "demand pull" (i.e. fostering competition in communications networks, promoting the provision of services and content in the networks, strengthening the demand for broadband, and

developing special actions for low-demand areas). Overall, the strategy reflects the change in the Finnish Information Society policy thinking. Traditionally, the focus has been on the overall availability of ICT infrastructure and particularly broadband. The focus of current attention, however, is on the user's perspective, such as the motivation to use new technologies, the reasonable price of access and the skills and abilities to participate in the IS development.

Hungary. The absence of an agreed, coherent set of IS indicators is a major obstacle in any monitoring or benchmarking process. The efforts of the ESPON 1.2.3 project provide additional experience of the difficulties in the collection and availability of regional IS related data. It cannot be expected that in the near future regional statistical data will become available from international sources. Nor do we have any systematic knowledge on the results of policy instruments used to achieve a desired goal. The IS is another field where policy-making surpasses policy evaluation. Beside (recomm1) fostering the build up of an international data base, an alternative approach should emerge: (recomm2) let regions become more active in collecting information of the experiences of other regions and centrally promote and coordinate the learning and benchmarking process, e.g. by the way of a centrally managed regional and local authorities website as the Digital Divide Forum Report (CEC, Digital Divide Forum Report: Broadband Access and Public Support in Under-served Areas, 15.07.2005, p. 54) has suggested. (recomm3) The intangible nature of many IS development projects makes traditional indicators unworkable, more qualitative evaluations and assessments would be necessary.

A delicate balance should be maintained between market competition and public intervention. As far as innovation is concerned, the spread of new technologies may benefit from technologically neutral regulations. However, in development policies, social goal settings often need efficient industrial policy. The roll-out of broadband technologies shows similarities to the diffusion of other public services: the density of urban areas with network externalities, scale economies compared to the rural areas always offered an irresistible attraction to service providers. The business-led uneven broadband deployment creates new divides: therefore a more even broadband coverage of the territories in many countries has been placed on the policy agenda. On the other hand, the experience of mature saturated markets of other public services show that with high level penetration these services may be considered a universal service, a service which is available for all at an affordable

price. In order to provide these services for everybody, there is room again for public intervention.

Public measures might differ according to the maturity of service markets and may therefore differ in timing.

Italy. No relevant policy recommendations were formulated for this country by the national partner.

Poland. The development of ICT and IS in Poland is strongly regionally and spatially differentiated. This country is also delayed in development of both the ICT and several dimensions of IS development.

However, the IS development policy plays an important role in Poland but mostly in a declaratory way, as the financial resources allocated are slender in comparison with other policies. Therefore, the major policy recommendation for Poland related to revitalisation of several “good”, but not implemented in practice, strategies, and devoted much more attention to these issues by the relevant bodies (it is a sad paradox that the official government website for “Information Society” - <http://www.kbn.gov.pl/gsi/index.html> - was last up-dated in 2002!).

Moreover, the diagnoses of the IS state and trends in Polish strategic documents generally do not have regional breakdown. Although these documents include some spatially relevant statements, assessments or/and proposals, regional decomposition is needed and spatial orientation should also be provided (this last issue has been dealt with in more detail within the Spatial perspective for Poland, prepared in 2005).

Although IS policy is not regionally differentiated, but among recommendations in Proposed Directions of the Information Society Development until 2020 the need for more even development of the IS infrastructure was mentioned. That will, for example, encourage teleworking and in this way influence the standard of living in rural communities. The Operational Program 2007-2013 Development of East Poland is an example of the positive change in this respect. Under the first priority of the program (Modern economy) the activities focused on the universities’ infrastructure, and IS infrastructure and support for innovation were planned.

Only six (out of 16) Polish voivodships have already prepared their IS strategies. Speeding up the preparation of such documents can play an educational role for the regional/local societies.

As it had been revealed by the national case study for Poland, the information infrastructure is unevenly distributed, with marked disparities between towns and countryside. Therefore, further efforts on the development of network infrastructure should be based on the cost-effectiveness principle, which means that network capacity to be developed should be determined by the anticipated demand.

Low educational attainment of the population and their lack of interest in IT issues were identified as reasons for a low use of ICT in less developed regions and localities. Therefore, social and cultural barriers in using ICT should be overcome through a whole-national effort of elevating educational standards and providing ICT equipment in public schools all over the country. This should be done through increasing the expenditures on ICT in schools, which is the role for both national and regional governments.

9.3. Policy recommendations – micro level (regional/local)

The conclusions made in relation to the regional case studies can be generalised for a certain type of regions to a limited extent.

MEGAs in all countries under study – and also in the general statistical framework – are the leaders in developing the Information Society. They are the places where innovations occur and from where they disseminate. Therefore, it can be said that the national policies to a great extent are also the MEGA policies, since if some national-wide processes emerge or regulations are being introduced, the MEGAs will be first to implement them.

However, the regional case studies do allow for the following recommendations:

1) on the supply side:

- provide cheap and general access to broadband, since the ICT infrastructure – mainly the development of broadband access – assumes an important role in financial appropriations for infrastructure development, in particular in less developed member states and less favoured regions;
- accelerate development of ICT infrastructure in less favoured regions, because greater efforts in ICT infrastructure development are particularly important for the rural, peripheral areas, which become marginalised within the “digital divide”.

2) on the demand side:

- introduce ICT techniques into the educational process, make them „part of life“, since the IS development is regarded as one of the main dimensions of general social education and skill development;
- promote e-government and e-administration as a way of everyday life, since the e-administration has achieved a very differentiated level of development among the EU member states.

The policy recommendations formulated for particular regions will be presented in the following section.

Czech Republic/South Moravia. For IS development in South Moravia, regional or national policies do not seem to play a significant role with the exception of the educational system. Additionally, in the educational system, perhaps also due to the short existence of regional self-government, national programmes have been more important. It could be stated that, in the case of introduction of ICT into schools, they have fulfilled their role in guaranteeing provision of the same level of public services.

However, in the private sector (as well as in households) the main role was left to private initiatives. Now that ICT infrastructure is easily available, both regional and national policies can play a vital role in encouraging its use. First, it is necessary to provide more services on-line. Moreover, use of these services must be easy and user-friendly so that it does not require special skills and is not too time-consuming. Only under these conditions might it bring advantages over the usual “paper bureaucracy” and persuade people and companies to use it. Second, national and regional administration can support e-learning initiatives (of which computer literacy is its main prerequisite) to use relevant actors to take a profit from IS development. These initiatives are especially important in case of older people and people with lower qualification, as in a fast developing economy they might lose any possibility of finding an occupation because both private and public sector have changed their requirements for ICT skills for applicants. Finally, the bureaucratic system of public programmes should be simplified or private companies will be discouraged from using it.

Germany/Tuttlingen. The case study in the district of Tuttlingen showed a very successful example of IS development in a rural region. Nevertheless, a few gaps and problems could be identified. Regarding the availability of ICT in the region, the need was expressed to include some

remaining areas to fast data connections. Furthermore, the constant pressure to maintain the ICT infrastructure was stated as a problem in all sectors of society. The fields with reported shortages concerning the use of ICT primarily refer to the growing overflow of information and lack of structures or linkages. Therefore the following policy recommendations can be made:

- fill the last gaps in availability:
 - connect business plots, remote villages to fast data transfer for equal availability (especially relevant for KBE settlements)
 - provide better workplaces for teachers in schools
- make efforts for a better system of maintenance for ICT infrastructure: hardware and software, including better possibilities or services for homepage updates
- provide alternatives and offer support to structure and limit ICT use to the necessary and prior issues
 - improve structures and transparency of web presentations, especially regarding public administrations: ensuring and strengthening accessibility, better linkages between different levels
 - e.g. education: provide instructions for students to focus Internet use on valuable information
- strengthen polycentric structures, find individually differentiated solutions for the above problems according to the respective circumstances.

Greece/Dytiki Makedonia. Drawing from the experience of the case study region and keeping in mind that there are many similarities in most Greek regions (and many other European regions) two significant problems, concerning both citizens and businesses, for the development of the IS can be highlighted. The first is that information regarding the IS – either general information, new technologies or policies and funding opportunities – does not seem to always reach interested parties and potential beneficiaries. This allows for setbacks and delays that could be avoided. The second problem is that businesses in the case study region and the other Greek regions are, at a very high percentage (97%), very small businesses employing less than 10 people. Their size does not allow them to allocate resources (either time or financial) to identify, evaluate and take advantage of investment opportunities with regard to the Information Society.

To solve the above-mentioned problems, two sets of policies can be recommended. In order to maximize the diffusion of information and make sure that all interested parties and potential beneficiaries of measures and funds have access to relevant information, policies regarding publicity and sensitization of the public should include activities with specific target groups. As far as citizens are concerned, this could mean activities targeted to groups of people defined by age, location (e.g. remote areas) or physical disadvantages. In the case of businesses, target groups could include groups of businesses defined by size, location or sector.

In order to overcome the difficulties faced by businesses to invest in IS activities, policies that encourage collective action could be introduced. A major role in this could be played by intermediary organizations, collective business bodies (e.g. chambers of commerce) or professional associations. Another way to encourage collective IS actions would be clustering, with specific IS targeting. Through collective actions, economies of scale, economies of concentration and complementarities can be put to effective use, facilitating the transition of the private sector to the Information Society.

Finland/Tampere. The regional development programme of the Tampere region deals with the two sides of the Information Society. On the consumers' side the emphasis corresponds to the recent shift in Finnish Information Society policy. While in the earlier phase the focus was on the overall availability of ICT infrastructure and particularly broadband, the focus of current attention is on the user's perspective, such as motivation to use new technologies, the reasonable price of access, and the skills and abilities to participate in the IS development. As the technological constraints of the Information Society are being reduced, this shift of emphasis seems reasonable.

On the producers' side the priorities of the regional programme focus on the knowledge-based economy. The measures are mainly formulated to increase the economic performance and competitiveness of the region. This is supposed to happen through the fostering of the "innovative environment", utilization of the newest production technologies, promotion of organisational change (e.g. distance working), and enhancing knowledge diffusion (e.g. university-government-industry collaborations). All these measures place great importance on the diffusion and use of technological knowledge as well as its creation.

Hungary/Budapest. The regions should become more active in collecting information on the experiences of other regions, promote and coordinate centrally the learning and benchmarking process, e.g. by the way of a centrally managed regional and local authorities website. This can be done through:

1. Since the intangible nature of many IS development projects makes traditional indicators unworkable, more qualitative evaluations and assessments would be necessary
2. Elimination, or lowering, of the regulatory barriers (local franchises, spectrum availability) for competitive provision of broadband services (both infrastructure and service providers).
3. Creating a dense network of Public Access Points with guidance and support for the accessibility of public services (eGovernment, eHealth, eLearning) using community sources.

Poland/Podlaskie

In one of the least developed regions of Poland low educational attainment of the population and their lack of interest in IT issues were identified as reasons for a low use of ICT. The solution proposed is to increase the awareness of the importance of ICT and the need to overcome the social and cultural barriers to using ICT should be indicated. It has to be stressed that it is not only the local and regional governments which should be responsible for implementing these activities, but that NGOs also have an important role to play in this sphere.

The interviews conducted in local administration offices indicate that the region's residents only make slight use of on-line services, even though such services are partially available (in Podlasie, the voivodship government and 12 local government units are implementing a pilot project aimed to 'translate' public services into an electronic format. This project will allow for a practical implementation of functions that will in future be offered by the Digital Office (<https://www.wrotapodlasia.pl/pl/cu/default.htm>). This situation is due to a number of reasons, the major of which include: poor level of IT provision in households, low educational attainment among the regional population, insufficient legal provisions (e-signature), and a still limited range of this form of services. In the opinion of the administration's representatives, even though the demand for e-administration is low, activities in this sphere should be continued. The demand for on-line

services will certainly grow if the number of matters that can be settled in a virtual office is increased. If e-administration is to develop, the existing mental barriers must be overcome. They mainly include difficulties involved in getting to use other solutions more easily than before and a sense of attachment to the traditional, face-to-face contact with clients/officials (which is of particular importance in rural areas). In terms of content, the websites of local government units in Podlasie are far from perfect as they are limited to 4-7 categories, mostly devoted to news, tourist and cultural information.

The following solutions can be indicated here:

- improvement of the websites of local and regional authorities (e.g. more information, interactivity),
- speeding up the preparation of e-strategy, as it could play an educational role for the regional/local societies;
- increase awareness of the ICT importance in order to overcome social and cultural barriers in using ICT - role of regional government, intermediary institutions and NGO's.

10. Best practices

Czech Republic/South Moravia

Unfortunately, the representatives interviewed have not mentioned many important projects that could be considered as an example of best or good practices. Rather, they admitted that there is still much to do but actually there are not enough public initiatives, which would help to enhance significantly the ICT penetration and use.

Yet, one planned project seems that it might be considered a good example: how to help to encourage people in using the ICT by facilitating their access to it. Židlochovice municipality is going to provide Wi-Fi connections for a majority of its territory in order to provide a broadband connection to its citizens. This service is intended to be either free of charge, or, more probably, for a low fee. The city of Brno has a similar plan too, yet, due to its size, it is going to provide Wi-Fi connection access in its buildings and in the most visited public places and their surroundings. However, in this case, the access will still be limited as it requires having a laptop or living in these areas.

Another example is on-line services provided by the Tourist Information Centre (TIC) of the city of Brno. TIC provides on its web-pages several services which can be ordered only by completing an on-line form. The response to this form is almost immediate, which is helpful to visitors to the city. Amongst other things, it is possible to book accommodation by choosing type of accommodation for preferred parts of the city (e.g. city centre) for the required period of stay and price range. Thus you do not need to search for accommodation for yourself, ask if there are rooms available or even have any knowledge about the city as TIC will look after all this and send you detailed information of accommodation selected.

Germany/Tuttlingen

- 1) A high flexibility at lower administrative level proves to be supportive for the IS development in a region. If local politicians, such as mayors of small villages, themselves feel responsible for the development of ICT in their region, individual ways e.g. with support from local population, can be found to assist the spread and usage of ICT. In this way faster development is possible, fostering a catching-up process and keeping pace with urban areas.

- 2) A high transparency and information on all developments can be a supportive aspect, since it promotes the integration of all actors in the development of the Information society. In this way, a common responsibility is raised, and problems (such as the low motivation for providers to invest in certain areas) can be addressed together. A much stronger lobby can move things to the better.
- 3) For a rural region, the settlement of economy belonging to a specific economic niche, possibly in the KBE sector, can greatly increase the success in economic as well as IS-related terms. Because of the specified knowledge needed, related business activities tend to settle and stay in the area. Additionally, the businesses of these niches and their suppliers show a higher need of an infrastructure for fast knowledge exchange, thus fostering the overall ICT development in the region. This way, the chances to compete with core areas can be greatly improved.

Greece/Dytiki Makedonia

Two examples of best practice can be drawn for the case study region, both from the prefecture of Kozani. The first best practice example can be drawn from the development of the Information Society in the secondary education system of the prefecture. While IS in secondary education followed the same steps in all Greek prefectures, the prefecture of Kozani seems to be more advanced in this area, in relation to most other prefectures. All secondary education schools in the prefecture have at least one fully functional computer laboratory (while many schools have two and some have three or four), an adequate number of peripheral devices and an abundance of related teaching material. Functionality of computer laboratories ranges from 60 to 100%, with outdated equipment already in the process of being replaced. All schools have their own server and more than half have developed their own website. Indicative of the progress made so far is that, today, the process has moved to primary education, with half of the primary schools having a functional computer laboratory.

Even though the framework for the development of IS in secondary education in Greece was common for all Greek prefectures, there are some things that make a difference in the case of Kozani, and are the factors for turning it into a good example:

- Great care was taken from the beginning to remove obstacles and minimize possible delays in related activities

- The department of secondary education for the prefecture provided (and continues to) constant consulting and technical support to schools.
- Besides funds indented specifically for this purpose, the prefecture administration sought to take advantage of all possible funding opportunities, originating from regional or national programs and even used its own funds in some cases.

The second best practice example is the development of IS in the prefecture administration. A local network with more than 120 PCs connected to it has existed for the last five years. At the same time, the administration is connected to all relevant regional and national networks (managed by various ministries) with computers other than the 120 mentioned above. There are 5 servers in operation (and 5 more are to be operational within the year) which also host the administration's website (designed and updated by the administration's relevant departments). The administration has been implementing pilot programs (like teleconferencing) since before 2000 and specialized software (e.g. e-protocol) is utilized in many tasks and processes of the administration. Factors that can be considered crucial for the successful transition to IS by the prefecture are:

- The importance of the IS was made clear from very early on and the process for purchasing equipment and building appropriate infrastructure began in earnest in the mid 90s.
- The problem of lack of skills of the staff and their reluctance to use new technologies was overcome by a large number of seminars designed not only to teach skills but, also, to encourage an IS culture
- Many specialized applications were slowly introduced, making the use of ICTs crucial to the efficiency of everyday procedures and making the staff's tasks easier.
- All elected administrations treated the development of IS the same way, making it a high priority.

Finland/Tampere

In the Tampere region, the most important public-sector driven regional development programme has been the eTampere programme executed between years 2001 to 2006, aimed at promoting the Information Society development in the Tampere region. One of the key aims of the programme was to develop public online services and bring them within reach of everyone, strengthen skills related to the use of online services,

and to use ICT to promote citizens' opportunities to influence local policymaking. It is of course difficult to assess whether the eTampere programme has had positive impacts on public services or how successful it has been in meeting any of its ambitious goals and objectives during its implementation period. However, at least on the basis of the Tampere region Information Society survey, the citizens seem to have positive attitudes about the availability and content of public e-services in the region.

Hungary/Budapest

It is very difficult to separate national and regional best practice in our case. If we consider the place of initiative as an indicator, all successful national programmes should be mentioned. Sulinet was launched in 1996 by the Ministry of Education to provide infrastructure and access to elementary and secondary schools. By the end of 2002 all secondary schools and 20 per cent of elementary schools have had access to the Internet. In 2003 the Sulinet programme was extended to provide computer and other ICT equipment with tax incentives to teachers and students. The conditions changed in 2004 and the programme now provides incentives to anyone below an income threshold. The Sulinet network became part of the Közháló (PublicNet) project in 2004. The aim of this latter project is to make broadband available in all settlements in Hungary with public Internet access points at local public institutions and civic organizations. Since 2005 all primary and secondary schools have had broadband Internet access and the number of so-called eMagyarország (eHungary) points reached 3000 access points. The PublicNet has connected with 2617 settlements (84 per cent of all) in Hungary at the end of 2005. The third feature is the well-developed network of telecottages in Hungary. This civic initiative, originating in 1995, was supported from 1998 by the government. Today there are 436 telecottages, most located at smaller settlements. 64 per cent of them provide enhanced services, which means more than access facilities. One third of the telecottages run their own website.

There are different efforts at national level to increase the intensity of use of digital contents. On the supply side besides the introduction of online public services and e-administration, the government has established the National Digital Data Archives, which is not a giga or meta archive, but a "continuous endeavour to develop the infrastructure of the content industry and to regulate content industry's procedures, to formulate, sustain and continually support the process and framework of

standardization". Another important element in fostering demand is the Knowledge Base offered by the Sulinet. It is hosted on a portal for students and teachers and offers regular and additional material to public education. It is planned that by September 2006 it will supply material for all classes in primary and secondary schools.

In the Central Hungarian region the technology parks should be first mentioned (Infopark, Graphisoft Park, Talentis) because of its potential and the different innovative method of financing them. Among the programmes aimed at raising awareness of the IS, the grandchild-grandparents competitions are the most successful. These were launched and organized in Budapest in 2004. Since there has been permanent overbooking three other towns are now involved from 2006.

Rome/Italy

No best practice examples were provided from Rome by the Italian partner.

Poland/Podlaskie

- There are few examples of successful companies in ICT applications (at the same time, there are many examples of the modernisation of machinery and increase in the number of digitally-operated machines, digitally-operated buildings, modern solutions in warehousing, distribution and transport of goods);
- There are several examples of web hosting providers and call centres which have started their operations in the region (such as Biznes Polska in Wysokie Mazowieckie);
- The household linen sector, which is robustly developing in the Podlaskie region, is an interesting example of how the Internet can be used to promote and sell goods;
- The general education secondary school (liceum) in Białystok, where the principal is also a very effective manager in raising other than budgetary funds for improving the level of IT provision in the school;
- The gmina of Sokoły: a high level of informatisation at schools; hiring a private company (Szeptel) to develop the telephone and Internet network; a virtual marketplace for animal trading;
- The concept of Gmina Information Centres.

11. Final Statement

The 1.2.3 ESPON Project "*Identification of Spatially Relevant Aspects of the Information Society*" has been the first attempt to include the issues of the Information Society into research conducted in the wide field of spatial development within the enlarged European Union. This was an ambitious and challenging task, which the seven national groups of researchers undertook in a narrow time scale (September 2005 - May 2006).

Although generally positive, the results are not fully satisfactory, which is attributable to both external and internal limitations. The most important external limitation is the lack of comparable data not only at the regional level, but also at the national, especially in the dynamic perspective. This obstacle could have been overcome only partially, through estimates, and the more accurate and deeper picture of the IS development among the EU regions was obtainable only after a considerable effort by the respective services of the national statistical systems of the member states and the EUROSTAT.

The internal difficulties stemmed from lack of strong commitment from all Project partners, which of course can partially be attributed to the deficiencies of the Lead Partner, who was not able to stimulate sufficient efforts from one of the partners. However, the lack of empirical material from one of the countries involved does not seem to have damaged the entire findings, which – in all other cases – have been able to reveal interesting national and regional peculiarities and manifestations of IS development, which, without in-field investigations, would not have been noticed.

This project should be conceived as a pilot endeavour aimed at a "reconnaissance" of research opportunities and obstacles in the sphere of spatial aspects of Information Society development. It seems that these tasks have been fulfilled and that the project results create a good basis for future efforts in this field.

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PART THREE: Appendixes (in the separate files)

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