Priorities for a new strategy for the European information society (2010-2015)

Evaluation Sheet

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1. Background

1.1 Scope of the report

The scope of this report is to analyse two main aspects of the Information Society (IS), namely *ICT research and innovation* on the one hand and *High-speed networks and open Internet* on the other, clarifying the roles regional authorities can play and suggesting possible actions to increase prosperity. The report is structured into two main sections treating these two aspects. In each of these sections, the following will be addressed:

- Description of the aspect, evolution and likely prospects;

- Main features shaping issues and policies at the EU, national and regional level and, where relevant, the opinion of concerned stakeholders;

- Examples, wherever available, used to demonstrate types of appropriate initiatives at the local and regional level and to help propose suggestions for possible actions by local and regional authorities (LRAs) and for the positioning of the Committee of the Regions (CoR).

1.2 Methodological note

The IS is a broad concept covering fixed telecommunications, wireless communication (WiFi), mobile telephony, Internet access and their applications. Europe is among the global pioneers in the establishment of Information and Communication Technologies (ICT) infrastructure, in supporting the creation of content, accelerating the services offered and reinforcing the degree of utilisation by the public. In terms of policies, we are now at a crossroads between the ending of the i2010 strategy and the next European Strategy on the Information Society (the so-called Digital Agenda).

Research and innovation and the high-speed Internet infrastructure are two of the main underlying conditions and building blocks for the future of the IS. They constitute the invisible part of the sector. Research and innovation drives new developments and, to a large extent, determines the new products and services developed; sites where ICT research and innovation is performed, and often also those areas where research results are commercialised, offer significant employment opportunities that lead to prosperity. High-speed networks constitute the infrastructure on which all Internet services are offered; changes

in network capabilities and combinations are significant and depend on innovative solutions for both fixed and mobile telephony.

Research and innovation and high-speed networks are closely interconnected in many ways: research and innovation and its commercialisation constantly expand technological frontiers and offer new, more powerful and cheaper solutions for the establishment of infrastructure. In turn, high-speed networks and their merging with mobile telephony facilitate research and commercialisation in an unprecedented way. "Science could be revolutionized as researchers gain access to previously unimaginable amounts of data and develop ways to cross-refer between disciplines."[1]

However, for both research and the infrastructure to be effective in economic and social terms it is important that all European citizens have access to the IS. This increases economies of scale and allows further price reductions, putting the system in a virtuous circle of price reduction and increasing utilisation, but – most importantly – enabling the building of a cohesive society with equal opportunities for all. Unequal access would create a new digital divide, unfair societies and, possibly, social tension.

When analysing the role that LRAs could have with respect to research and innovation and the high-speed Internet infrastructure, it has to be taken into account that in general regions suffer from lower degrees of activity than the EU and national levels. This means that economies of scale are unthinkable for (most) regional initiatives. Their role is thus determined by different underlying principles, namely:

- *Questions of proximity*: being close to the constituency helps identify problems/weaknesses and address them with appropriate rather than generic interventions. Regional strategies are very useful in this sense and this applies both to research and high-speed networks.

- *Agglomeration economies* and *economies of scope* are occasionally as important, or even more important, than economies of scale. The EU and national funding as well as private investments act to ensure the adoption of economies of scale. At the regional level these initiatives are complemented by interventions creating agglomeration economies. Common denominators can be exploited and can benefit from significant economies of scope. Regions can also address niche markets in research and consider very specific areas.

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[1] Financial Time website, FT.com:10 innovations that will reshape business.

Not all regions have the same starting point, underlying performance or potential. Three types of region are customarily distinguished: *black, grey* and *white,* based on the density of their population. Densely populated, rich regions (known as black regions) offer significant profit opportunities, and therefore private investments in research and infrastructure contribute significantly to their integration into the IS. At the other end of the spectrum, for poor or sparsely populated regions (white regions) the market mechanism is insufficient and they need significant incentives to be able to take part in the digital era. Grey regions, in the middle, need to carefully identify their strengths and weaknesses and build/reduce them accordingly.

2. ICT for research and innovation

2.1 ICT research and innovation: description, evolution and likely prospects

ICT for research and innovation is influenced both by generic aspects, determining research and innovation, and by the specific characteristics of ICTs and the IS.

In general, the essential elements determining research and innovation include universities and researchers on the one hand, and the business sector on the other, the latter including small start-up companies and bigger, more mature technology companies. These elements are complemented by the regulatory environment, the financial system (in particular, venture capital and private equity) and intermediaries. Research and innovation has a cumulative character: previous knowledge, specialisation and accumulated capabilities play a crucial role and attract talent (the single most important element for research and innovation), financial resources and infrastructure.[2]

Specific to ICT is the rapid, pervasive and often disruptive character of research. Research in ICT is at the forefront of advance, driven by the fusion of technologies and rapid incremental changes that shape new devices, services and society as a whole. Front end, high-risk research is accompanied by the development of new applications and the diffusion of already tested technologies. A whole spectrum is available with high-risk research promising the highest profit margins, in particular in areas combining the merging technologies with societal needs: "A number of technologies are developed that will allow the creation of ambient intelligent environments, where things communicate continuously with other things. Information on the environment (thus also related to individuals) will grow literally 'by the minute' leading to issues of storage and data protection. The Internet will act like one big computer, all around us in the real world and as in the virtual space - these two environments are likely to merge or flow seamlessly together."[3]

In this very fluid environment the following can be seen:

- In a strict sense, ICT research is undertaken in the areas of telecom equipment, telecom operators, semiconductors, software, computer

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[2] For a review of the properties of research and innovation and their importance for research and innovation policy see Arrow (1963), Abramovitz (1986) and Nelson (1993).
[3] Oranje-Nassau et al, 2009.

services, Internet, computer hardware and electronic office equipment.[4] R&D in the telecommunications sector is increasingly undertaken by equipment manufacturers in the place of telecommunications providers.[5] The Next Generation Networks (NGN) now adopted are at the core of innovative activities, and are expected to completely reshape the present structure of communication systems and access to the Internet. High tech focuses on the "historic" merger of mobile phone technology and the Internet, with the mobile phone being on course to replace the PC as the primary device for getting online. Other leading research topics are in social networking and cloud computing.

- Most of these technologies, in particular basic front-end research and innovations incorporated in mass products (general purpose equipment and specialised large-scale services), are developed in large public and private laboratories in few regions for global application. Other parts, such as incremental adaptations and small-scale customised software are much less centralised. Because of the cumulative character of research activities, it is difficult, but not impossible, for new firms or emerging regions to penetrate the large-scale markets in innovative products. Some highly specialised research organisations (Cambridge being the most prominent case among them, but also certain universities and research centres in Scandinavia) have created a vibrant milieu around their research capabilities, attracting private research laboratories and spinning off research results to create innovative SMEs. Software research is a special case, since software development can be an innovative activity through the diffusion and adaptation of software packages or the development of tailor-made applications.

- The pervasive nature of technological change is the subject of research in social sciences and humanities. Economic and legal research is important for spectrum trading and the liberalisation of the telecommunications market. "Anthropologists and psychologists are investigating how mobile and virtual interaction spices up or challenges physical and offline chemistry, and whether it makes young people in particular more autonomous or more dependent. Architects, property developers and urban planners are changing their thinking about buildings and cities to accommodate the new habits of the nomads that dwell in them. Linguists are chronicling how communication changes language itself, and thus thought."[6]

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[4] The Industrial Research & Innovation website: The EU Industrial R&D Investment Scoreboard
[5] OECD, 2009.
[6] The Economist, 2008.

For regions to understand their position in ICT research and innovation it is important to use *indicators* enabling comparison and measure of progress. IS Observatories have been established at country level (as in Greece[7]) or regional level (as in Wales) to monitor activities and progress in an effort to inform policy makers and help them promote evidence-based policy. Investment in ICT research is measured by means of the same indicators used for research in general, these indicators usually including: R&D expenditure in the sector (as defined in the Frascati manual)[8]; number of researchers and support personnel; patents and copyrights (per head, per researcher or per funds invested); and budgetary expenditure to support the sector. Measuring innovation is more complex and may be done through: the Community Innovation Survey (CIS) indicators[9] at the sectoral level; the number of new products launched or new processes adopted; investments in ICT research capabilities; new organisational models; and expenditure linked to innovation. Concretely for ICT, the diffusion of technologies is measured using the number of businesses and homes connected to the Internet, computer literacy, Internet utilisation broken down by various activities such as information, interaction, B2B, B2C, P2P, sales completed over the Internet, gaming, etc. More complex and refined indicators can include benchmarking of firms' creation and development.

2.2 ICT research and innovation in Europe

The ICT sector in the EU is very research-intensive. It contributes about 3% to total employment and 5% to total GDP, but it drives 26% of overall business expenditure in R&D and employs 32% of business sector researchers. The sector also provides other industries with productivity-enhancing technologies, thereby contributing directly and indirectly to increasing labour productivity and EU competitiveness. The Digital Competitiveness Report states that in the first decade of the 21st century the EU is lagging behind other areas of the world, notably the US, Japan and South Korea, as far as ICT R&D are concerned.[10,11] Ambitious research programmes to counter the deficit and to support forward-looking R&D have therefore been launched and an objective has been adopted to achieve world class performance in research and innovation in ICT by closing the gap with Europe's leading competitors.

Currently, the main financial instruments that support ICT research and innovation are the FP7 and its associated initiatives (such as Joint Technology

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[7] UNESCO IFAP Information Society Observatory
[8] OECD, 2002.
[9] Eurostat, Community Innovation Survey (CIS) indicators
[10] European Commission, 2009a.
[11] Interestingly enough US reports consider that the US is losing ground vis-à-vis certain EU Member States (Benhamou et al, 2010).

Initiatives[12] and AAL[13]), and the Competitiveness and Innovation framework Programme (CIP) 2007-2013, within which is the multi-annual Information and Communication Technologies Policy Support Programme (ICT PSP).[14] Financial support is complemented by a set of demand-side measures for innovation, such as the Lead Market Initiative (LMI).[15] The LMI concentrates on high-potential markets in Europe and relies on a mix of research and innovation financing, public procurement of innovatory technologies, regulatory instruments, and coordination and partnership with Member States (MS) and stakeholders. It sets the conditions for take-off in those markets (principally eHealth, sustainability, and environmental and ecological domains) where there is clear demand. GEANT, grids, supercomputers and data repositories are the main elements in this direction.[16]

ICT research and innovation in Europe may lag behind global leaders in many markets but it is world class and quite competitive in some areas. The strengths of the European industry are in the telecom equipment industry (with emphasis on mobile), telecom operators, the semiconductor industry and software, while Internet companies (search engines and social networks) are practically inexistent.[17] ICT research is highly concentrated in a small number of leading firms and universities located mainly in the wealthier and highly specialised regions. Telecom equipment, telecom operators, the semiconductor industry and software are highly concentrated in the hands of a very few companies with global research and sales. Only regions where these companies have R&D and production facilities (such as Eindhoven, Dresden, Leuven, Grenoble for specialised semiconductors, Bavaria, Southern Finland and Sweden for telecommunications, Ireland, Paris and London for software development) may benefit from this research and have a vibrant regional innovation milieu.[18] R&D expenditure and human capital constitute significant determinants of ICT specialisation and these regions are characterised by opportunities to attract talent.

A renewed strategy for ICT research and innovation in Europe was launched for consultation in March 2009, the aim being to establish Europe's leadership in ICT, facilitate the emergence of new markets and businesses for ICT and make Europe more attractive to investment in skills, research and innovation.[19] The consultation focused on the need to dedicate more resources into ICT research

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[12] EC CORDIS website .
[13] The Ambient Assisted Living (AAL) Joint Programme.
[14] EC Information society Portal
[15] EC Enterprise & Industry Portal, Innovation
[16] European Commission, 2009a.
[17] The Industrial Research & Innovation website: The EU Industrial R&D Investment Scoreboard
[18] European Commission 2009a.
[19] European Commission, 2009b.

and innovation in Europe and make Europe home to a few world-class poles of excellence. The most strategic areas of ICT research are Energy & Environment, Software products & services, and Education & Culture. Today, Europe is thought to most excel in the field of Energy & Environment research, and its comparative advantage is not considered to be largely at risk. Apart from infrastructure, the growth of Internet services is essential to sustain the Internet as a driver of innovation. The future of the Internet is in the design and development of services online where important challenges lie in the semantic web, the Internet of Things, scalability, mobility, and security.

Stakeholders have been actively interested in this new policy with a 2020 horizon. Incumbent fixed-line telecommunication operators, mobile service providers and production companies consider that increasing research funding and more European coordination is a positive step towards increasing European competitiveness. The Conference of Rectors is also in favour of increasing research funding. In several of its opinions, the CoR has stressed the relevance of ICT for research and innovation; more specifically, it supports the need to promote scientific research and the creation of the European Research Area and to link research with education (including e-Learning) and stresses the importance of ICT innovation for job creation and prosperity. In its most recent and explicit opinion,[20] the CoR considers that European-scale ICT projects spanning from R&D to deployment have the potential to deliver substantial socio-economic benefits for their associated cities and regions and calls on the European Commission and the MS governments to actively foster the involvement of LRAs in the various stages of R&D processes as well as the use of ICT innovations in the public sector, namely by promoting best European practices and providing advice and methodological recommendations. In particular, the CoR sees the role of LRAs in developing regional research and innovation strategies, where the IS is crucial, and identifies a need to play an active role when LRAs govern research institutions.

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[20] CdR 156/2009 fin.

2.3 The role of LRAs

IS strategies are regarded today by policy-makers and stakeholders as powerful instruments for societal change, and for the building of competitive, equitable and sustainable knowledge economies. "Their mandates have progressively broadened, and now pursue ambitious socio-economic objectives such as promoting sustainable economic growth, boosting productivity, creating employment opportunities and improving the effectiveness of public services and citizens' quality of life. Since IS strategies are multifaceted, complex, and large-scale, adequate governance frameworks and mechanisms are necessary to ensure that objectives, resources and tools are aligned to maximize results for end-users. The good governance of these strategies, then, depends on consideration for a number of issues such as: priority- setting, inclusion and consultation, cross-sectoral and governmental coordination, effective implementation tools, appropriate legal and regulatory frameworks, and monitoring performance. Getting these governance mechanisms right can be key determinants of success."[21] A variety of strategies starting with pilots already in place at the end of the 1990s were financed by the ERDF for less prosperous regions benefiting from structural funds. Eris@ has been supporting regions in this process for over a decade.[22]

Complementing the strategies with specific initiatives tailored to the needs of each region is the next step. While the idea of creating regional or local IS strategies has influenced policy-making in all types of regions, complementary interventions are very different and depend on the initial position and structure of the production and utilisation of IS products and services. Three archetypes of regions are distinguished below with regard to research and innovation; while some general recommendations are included for each type, their implementation should not take place before assuring the real need for local intervention, since there are increasingly global initiatives that can make local initiatives redundant. This is very much the case in social networking, but also in scientific networking, as demonstrated by the ResearchGATE, a virtual scientific community and leading professional network for scientists, free of charge and designed to meet researchers' needs.[23]

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[21] OECD, Directorate for Public Governance and Territorial Development, Good Governance in Information Society Strategies portal.
[22] eRegion Hub.
[23] ResearchGATE website.

2.3.1 The ICT specialised regions

Pioneering regions are typically those regions where prestigious universities, public research centres and private research laboratories are located. In such regions these actors are in a position to mobilise research funding and launch new products on the market. LRAs have a crucial role to play in supporting individual actors, and the cluster in general, to maintain and further nurture this competitive advantage. Authorities are expected to reinforce the integration of the companies into the region, through the promotion of linkages with regional public research facilities and other supporting networking. High-quality education across the broad range of disciplines needed is a prerequisite for maintaining the attractiveness of the region for new investments in research and innovation. As these regions are almost all relatively prosperous, interventions at the local level should prioritise:

- Supporting leading organisations to maintain their infrastructure. Universities, research centres and SMEs may need local support so they can grow at the pace necessary to follow global changes and to compete for national and European funding;

- Ensuring that the region remains an attractive pole for talented individuals. Creating agglomeration economies is mainly a regional responsibility;

- Offering support for start-ups so as to continuously renew the productive fabric.

2.3.2 Regions with strong capabilities

Many European regions, although not specialising in ICT, have strong capabilities in either their research systems or business activities other than ICT itself. For these regions it is important to link their current strengths to ICT. Strengths may be in non-ICT business activities or in ICT research.

Regions with strong capabilities in non-ICT: as research is shifting towards new applications in ICT-enabled sectors and high value-added software applications, the regional authorities need to encourage existing businesses to become active users of ICT. As lead users they will then reinforce their international competitiveness.[24] Incentives can take the form of direct financial support but also of regional procurement. The clusters of design in the automotive industry in Frankfurt are a typical case of a concentration of research in software design

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[24] Von Hippel Eric, Franke, Nikolaus, and Martin Schreier (2006).

based on ICT as an enabler. Capital and other major cities in southern Europe present similar characteristics. The financial sector in London is another example of this kind.

Less prosperous regions with ICT capabilities: in some regions, in particular in the southern and eastern MS, there are strong ICT research capabilities in universities (or research centres) but no corresponding business activities. Based on national educational policies, EU support and repatriation trends, these research establishments have succeeded in creating core teams of good scientists, often cooperating trans-regionally or trans-nationally and neglecting their local environment if it does not offer any opportunities to apply their high-tech knowledge. This has often been addressed in R&D literature as "building cathedrals in the desert". The role of the LRAs in this case is to upgrade these research teams into main European players and to create linkages between these "islands of knowledge" and the environment: in other words, to gradually start to build clusters around the available knowledge.

IST-BONUS is a good example of **upgrading the role of research teams based in less prosperous regions.** This trans-regional project aims to facilitate the transition of competent New Member States (NMS) and Accession Countries (ACC) organisations from "research followers" (that is, partners with low capability to influence the course of research) to "research leaders" (coordinators or major partners of RTD projects), both in quantitative and qualitative terms, particularly in the two broad areas of e-business and e-working technologies and related state-of-the-art applications, that can both have a significant impact on Europe's competitiveness, sustainability and societal cohesion. IST-BONUS encompasses conventional activities (targeted at a large number of organisations and aiming to increase participation mainly in quantitative terms through promotion, publicity, awareness raising, info days, tutorials, networking and brokerage events within the context of international IST conferences) and "go beyond" activities (targeted at a selected number of highly motivated and competent organisations and based on a set of "Research BONUS" services such as audits, SWOTs, PR research profiles, action plans and roadmaps to excellence in IST, networking with EU-15 research leaders and EC services). The "go beyond" activities focus on qualitative aspects and aim to increase the number of highly networked organisations from the NMS and ACC, major research players and competent coordinators.

Source: IST-BONUS: [Identify and Support Research and Business Excellence to Enhance NMS - ACC Participation in the Development and Pilot Implementation-Demonstration of ICT Business Applications and Services](#)

Corallia, acknowledging the **power of clusters as an important framework for industrial development**, is a programme placing primary focus on the advancement of Greece's core competence from a model of "low cost labour" to a model of "added-value services". While adopting a knowledge-economy orientation, Corallia has introduced a programme framework for the utilisation of clusters, with the aim of promoting Innovation Made in Greece and boosting competitiveness. A Greek Programme for Microelectronics Cluster Development is its first success story, mobilising a large number of research centres and business enterprises in common activities. Driven by foreign direct investments in the Greek semiconductors sector, Intense and innovative Research and Development has been carried out by the Hellenic Semiconductor Industry Association members (demonstrated through strong participation in EC Framework Programmes and Greek R&D programmes), as well as corporate and industrial development of prototypes and new products. Due to the global magnitude and multi-billion-euro market of the semiconductors and embedded systems sector, if clustering activities are successfully applied, HSIA members will experience exponential growth, allowing them to penetrate mature markets with high-tech, value-added products instead of cheap labour, and to increase exports and direct foreign investments, attract additional companies that are active in the sector and create more jobs for scientists and executives who have studied in Greece or are Greeks living abroad.

Source: Corallia Clusters Initiative

2.3.3   Regions with weak capabilities

These regions are the most critical as there is neither demand for, nor supply of, ICT knowledge. In this case concentration of resources and a clear mission statement are necessary. Such endeavours are ambitious and need to have a longer-term horizon. The availability of ERDF and ESF support encourages such systematic and strategic approaches. But regions alone are not in a position to make such a change and the initial priority should be to mobilise a variety of actors in this direction. The ICT Wielkopolska Project is an interesting example of this kind.

In Autumn 2007, a group of commercial companies in the Wielkopolska province, local municipal authorities supported by the Regional Marshal's Office, economic consultants, PR and marketing specialists as well as highly-ranked research and development institutions running research activities within European consortia and EC framework programmes decided to build an open-regional initiative to enable the deployment of new ICT solutions. The result was an agreement to establish the **ICT research-driven cluster in Wielkopolska**. The mission of the cluster is to maximise the benefits of regional ICT research infrastructure for the economic development of Wielkopolska province through the deployment of new information technologies. ICT sector development is one of the main priorities of the regional strategy geared to structural changes in high technology and closer cooperation with similar initiatives as well to strengthening knowledge-based European economic cooperation and competing with regions and economies outside Europe. Inter alia, the initiative aims at: deploying ICT technologies, especially those derived from EC-funded projects (framework programmes, structural funds, and others); promoting new solutions and innovations in Europe and outside; supporting the construction of a knowledge-based and information society, preventing the digital divide; improving the exchange of information about the results of ICT projects, partner searching, and the creation of national and international project consortia.

Source: ICT Wielkopolska Project

3. High-speed networks and open Internet

3.1 Description, evolution and likely prospects

High-speed networks are the infrastructure on which all IS applications are built. Countries, regions, localities or individuals without access to high speed are condemned to lag behind in social services and economic growth. As applications increase and content is enriched, a potential new divide is emerging. For this reason, all developed – and increasingly even developing – countries are investing in networks that will enable all citizens to enjoy high-speed access. At the same time they are thereby abolishing monopolies and reinforcing competition.

Communication infrastructure investment plays an increasingly important role in total investment within a country. In 2007, telecommunication investment grew to 2.2% of the gross fixed capital formation within the OECD and telecommunication operators are commonly among the largest private investors in their respective economies. Some governments, recognising the importance of broadband networks within the economy, are investing in extending and upgrading high-speed access as part of fiscal stimulus packages. Operators are investing heavily in new, high-speed broadband networks and this enables a much richer audio-visual experience than early broadband connections were capable of transmitting. As a result, the audio visual landscape is rapidly changing with audio and video now delivered over a range of different networks and devices. Television is no longer the sole conduit for diffusion of video data as consumers now watch video content on an array of devices.[25] "The uncoupling of applications and networks allow applications to be defined directly at the service level and provided seamlessly over different platforms, allowing for market entry by multiple service providers on a non-discriminatory basis. These features may foster the development and provision of new services and constitute a new opportunity for innovation, allowing different market players to create value at the separate functional levels of access, transport, control and services."[26] The emerging paradigm of "cloud computing" makes the necessity for high-speed access even more important for the future: through cloud computing, processing power and data storage will be concentrated in massive, centralised data centres. Making available so much information and processing power at very low cost will produce new breakthroughs. Billions of intelligent personal devices will plug into this centralised system.[27] According to a recent study, 69% of Americans connected to the web use some kind of "cloud

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[25] OECD 2009.
[26] OECD 2008.
[27] FT.Com, Financial Times 10 innovations that will reshape business

service", including web-based e-mail or online data storage. The best example is Google, which now offers a plethora of web-based applications such as word-processing and online spreadsheets. Companies, too, have been moving into the cloud, albeit much more cautiously. Financial institutions, in particular, have for some time been building "computing grids". Firms such as Salesforce.com and NetSuite, which provide enterprise software as a service (SaaS) over the Internet, have been growing steadily.[28] But cloud computing will make it impossible to participate in developed society without high speed.

Nevertheless, simply providing the infrastructure is insufficient: for every individual to be able to use the opportunity of the available high speed, affordability is also important and all potential users need to be able to learn how to use it. Three aspects are therefore important:

- Availability of access (physical infrastructure available to every citizen)

- Affordability of access (depending on the income of users)

- Facility of utilisation (e-literacy).

The debate has so far focused primarily on the creation of infrastructure. But technological improvements have made it possible to significantly increase speed and to bring high speed to the end point (business or home) of users. Technological progress has also allowed wireless networks, under certain circumstances, to be more viable than fixed lines (in particular in the case of sparsely populated areas). While the first wave of fibre investment was in high-capacity network backbones, feeding traditional cable and copper networks, a second wave of fibre investments installing optical fibre networks is currently taking place. These networks will be the foundation of wired data communication for at least the next 25 years, supporting high-speed data, high definition television and voice services.[29] Mobile operators are competing with fixed line incumbents and regulators have distinguished between the basic service and distribution, allowing competition to flourish and prices to fall. In this vibrant environment, discussions focus on how to implement NGN, allowing for high-speed access to all. National regulatory authorities focus on the role of Significant Market Power Operators (remedies for opening up the market), Radio Frequency Identification (RFID) and management as well as transparency rules. These are by large national competences and the regions have a limited (advisory) role to play.

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[28] The Economist, 2008.
[29] OECD, 2009.

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There are other very important issues at stake, where regional authorities can, and should, play a role. Investment requirements for NGN are high and risky. Private investments cover only those areas where they expect to reach their target profit margins and, because of the crisis and liquidity problems, financial opportunities are reduced and hence more regions may appear to be less profitable investment opportunities than in the past. Policies need to ensure that risks and uncertain returns are compensated for while ensuring the existence of competition since, without competition the benefits of high-speed broadband and NGN will not be realised.

Technological innovations associated with next generation networks will be able to offer end-users access to content and services through a variety of networks and platforms, including fixed networks, cable, terrestrial wireless (mobile and fixed), satellite, or mesh networks. In addition, being IP-based, NGN may rely on cheaper connectivity, to more easily make available a wider range of services. However, the transition from legacy networks to converged next generation networks may not take place evenly across different customer groups or geographic areas. In this context, the realisation of the potential of NGN to provide more, better and cheaper services may be limited to certain geographic areas or population groups, at least in the short- to medium-term.

Technological innovations have already started to transform the way universal access is being extended to rural and remote areas. In some countries, mobile technologies have been instrumental in extending access to communication services to disadvantaged parts of the population. Mobile technologies may offer access to data services at speeds that – though not similar to fixed broadband technologies – provide a wide national coverage. However, high prices for data access and bit caps, which are, at times, quite restrictive, has meant that mobile broadband access technologies are still far from being a substitute for fixed broadband access technologies, although some operators are now offering flat rate data pricing. New technologies, such as WiMAX, have the potential to complement fixed broadband access technologies and provide access in rural and remote areas where it is not economically feasible to invest in fibre networks.[30] The extent to which local wireless networks represent a good investment has not been universally resolved. Evidence suggests that due to constant technological changes it is impossible at this stage to assess whether encouraging or restraining municipal entry into communication services will harm the public interest. Public involvement in communication services may be a substitute for, or a complement to, private provisioning. Although traditional incumbent local telephone and cable companies have mostly opposed municipal entry (including lobbying for state laws to block such entry), new types of

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[30] OECD, 2008.

carriers (WISPs) have obviously benefited from such entry. The impact of municipal entry into private sector alternatives (and vice versa) is complex.[31]

The need for subsidies to support these technologies is likely to depend on the specificities within each country. A technology-neutral approach to universal service allows the flexibility necessary for the most competitive and effective technology available to address the challenge of universal service, as well as allowing for the different relative costs of different technologies to be taken into account. Spectrum trading and liberalisation are separate developments. Even without liberalisation of spectrum use, spectrum trading has some benefits. However, liberalisation allows the required flexibility, giving spectrum users the freedom to adopt new technologies and offer new services. Combining spectrum trading with liberalisation may: help the market to decide how much spectrum should be allocated to different uses; enable faster flexible access to spectrum, including unused and underused spectrum; help to promote the development of new, spectrum–efficient technologies; and boost innovation in the use of the spectrum and spectrum-based products and services.[32]

The landscape is changing rapidly and so are profitability calculations and the alternatives for investments, depending on the individual characteristics of each area. Revenue and subscriptions are growing, prices are falling. At the same time, the result of the global financial crisis in 2008-2009 may well be to dampen the investment plans of many operators and may slow investment plans in core networks. The crisis may also negatively impact on a number of new entrants who depend on access to capital in order to expand and compete with better-funded incumbents.[33]

As the debate about NGA becomes increasingly important, alternative models are being discussed, such as the idea of privately-financed optical fibres (a "condominium model" for private ownership under which private individuals would own fibre links, but the trunk network passing through their neighbourhood would be collectively owned) because many telecom operators are reluctant to extend fibre links all the way into customers' homes (fibre to the home) and instead prefer the cheaper option of running fibre into each neighbourhood (fibre to the node) and then using existing copper wires. Of course, this model would exacerbate existing inequalities, but combined with public intervention it might provide for new solutions.[34]

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[31] Lehr William et al, 2006.
[32] OECD, 2008.
[33] OECD, 2009.
[34] The Economist, 2009.

While the debate on the best available plans for the development of infrastructure is ongoing, depending on territorial specificities, the issue of openness is also developing. It is recommended that the Internet can be kept available and open, by ensuring safe access and use – primarily by "light touch" measures aimed at raising awareness rather than coercive intervention; and by embracing the Better Regulation principles of minimal, flexible and accountable regulation through appropriate self- and co-regulation, with special attention to issues of participation, transparency, compliance and control of spill-over (e.g. market distortions). Any residual, adverse socio-political fallout should be dealt with through "traditional" public policy measures. Transparency, responsibility allocations, fair self-organising, the respect of diversity, building up trust as an essential component and universal availability and affordability are the critical issues to ensure openness.[35] In the context of self-organisation LRAs can play an important pilot and pioneering role.[36]

3.2 European policies

Access of European citizens to high-speed networks has improved considerably in recent years. However, because of the higher potential offered by new technologies, the state of the art is shifting towards more ambitious infrastructure and ever-higher speed. A substantial disparity also remains in terms of infrastructure, between urban centres and remote areas, and between the old and new Member States.[37]

The EU is fully aware of the potential offered by high speed and by the role it can play both in harmonising the Single Market and in supporting less-favoured regions with funding. But it is increasingly difficult to bring stakeholders under a common denominator. Incumbent operators with significant market power wish for regulatory remedies to open up their networks, new entrants seek maximum liberty and investors want a framework that enables amortisation in a reasonable period of time, taking increased risks (higher cost and potentially lower number of subscriptions / utilisation of the new infrastructure) related to the current crisis into consideration.

The difficulty of the exercise can be assessed by the delay of the NGA recommendation. Key issues, such as the liberalisation of the NGA, the way operators with significant market power give access to providers, pricing transparency etc. are major issues for the future of open and affordable Internet. These are resolved at the national level by the national regulatory authorities. NGAs are access networks that have been substantially upgraded either wholly

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[35] RAND Europe
[36] Oranje-Nassau et al, 2009.
[37] CdR 272/2006 fin, CdR 304/2008.

or in part, using existing local access infrastructures and technologies and/or using new optical fibre infrastructures, and which are capable of delivering broadband access services with bandwidths significantly higher than those currently widely available.[38] However, at the beginning of 2010 the EC announced that it would shelve its long-awaited recommendation to boost investment in optical fibre networks, at least until the end of the year.[39]

Because of difficulties reaching compromises, the EU has launched a consultation in the transition from its i2010 to a new i2020 strategy. Major current challenges in this consultation appear to be: upgrading to very high-speed infrastructure so as to not lag behind other parts of the world, avoiding the emergence of new bottlenecks in the infrastructure, and maintaining high levels of investment in both fixed and mobile communications. From the consultation, it was clear (88% of respondents agreed) that public authorities should continue to invest in passive infrastructures while conducting other civil engineering works such as facility deployment for transport, energy and water. The incentive to invest in fixed and wireless networks is best supported by emphasising the opening of markets to competition, fostering a change in business models, and relaxing access obligations. With regard to the European right of access to the Internet, respondents considered the most useful targets to be non-discrimination of services, transparency and speed. The transparency of openness of networks is fundamental. It is important for policy-makers to emphasise open standards, net neutrality and the interoperability/portability of services to promote the growth of Internet services. One of the most important issues for Internet users is the fundamental right of both citizens and businesses in terms of Internet access, the right to certain services, and the portability of services. User empowerment is another crucial theme. It is clear that this is considered to be the number one overall visionary focus for the post-i2010 strategy in this consultation. The control by users of their privacy and the use of personal data empower users to manage their own Internet usage. It is important to emphasise freedom of speech as a fundamental right on the World Wide Web since the Internet can be used as a driver of democracy and of an open society. For this, the take-up of broadband, user participation, media literacy, ICT skills, content creation, privacy and trust are essential.

The CoR has been a strong advocate of the promotion of broadband and considers "that the availability of broadband access at affordable rates across the EU is vital to ensuring quality public services, regional competitiveness and productivity and a more even development of the information and knowledge society, covering areas traditionally excluded".[40] The CoR recognised back in

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[38] European Commission, 2008.
[39] Euractive press, Commission shelves NGN recommendation
[40] CdR 272/2006 fin.

2006 the crucial role of ICT in meeting the goals of the Lisbon strategy and put the pan-European information infrastructure at the core of the debate. Equal opportunities must be counted as one of the rights of European citizens as regards interconnectedness and services, independently of the type of user, their social situation and their location. The importance of infrastructure is best highlighted in the statement that: "The information infrastructure and the broadband provision will need to be regarded and managed in the same way as water and electricity supplies."[41]

The CoR has identified ICT as a driver for increasing competitiveness and better public services and stresses, inter alia, the importance of the universal service for electronic communications, which requires that a defined minimum service of specified quality or speed be made available to all users to close the digital divide in future. Universal service must be brought up to date. In particular, the CoR endorses the four specific elements in the scope of the Universal Service Directive and stresses that the future development of broadband access, universal service and the Internet will have important implications for social, economic and territorial cohesion in the EU Member States. There is a need not only for the EU to guarantee that services and high quality communications are offered at reasonable prices to all residents or consumers, independently of their social or geographical situation, but also to take the regional dimension more into account when considering the consequences of the measures. The CoR is particularly worried about regional equity and stresses that a lasting digital divide causes social and economic exclusion. In this spirit, it expresses very serious concerns that a common pitfall in broadband deployment is the risk of market failure, where private operators perceive little return on infrastructural investment in areas where deployment is particularly complex and onerous. The Committee proposes the inclusion of mechanisms for the promotion of functional broadband Internet access in remote and outermost regions, rural areas, and regions with low population density. If necessary, there should be support for investment in the development of ICT and infrastructure by LRAs or, in cooperation with them, by SMEs or through local initiatives. It considers, however, that there is no "one-size-fits-all" solution and issues such as competency, socio-economic characteristics and geographical components need to be taken into consideration to plan for the most appropriate solution in each case.

The CoR also expresses the view that the success of telecommunications regulatory policy cannot be reliably evaluated at national level, as differences in telecommunications and services provision do not exist solely between EU regions but within regions (e.g. with densely populated towns and rural areas in

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[41] CdR 52/2005 fin.

each region diverging substantially from national averages). The provisions on universal service need to be constantly, pro-actively revised in order to guarantee truly universal access to the IS. Most importantly, the CoR proposes the inclusion of broadband services within the scope of the existing Universal Service Directive and requires national regulators to set out transparently the range of measures, taking into account how technologies and speeds are evolving, detail resources and ultimately the sanctions they will use to help implement a functional and open Internet.[42] In addition to high speed, the CoR emphasises the need for special provision to ensure the inclusion of all European citizens and their opportunity to benefit from the new infrastructure.[43]

3.3 The role of LRAs

The driving forces behind the development of the high-speed technology lie with the private sector, which is willing to invest only if profitability ensures early amortisation with limited risk. This inevitably delays progress and leads to unequal opportunities. It may also cause Europe to fall behind its main competitors in the area of high-speed access, and gaps within Europe risk being aggravated. Regions with limited access will see their competitiveness and welfare eroded.

The EU and national authorities play a crucial role in the regulation of competition, radio frequency, transparency and State Aid rules. While these are issues that need to be tackled at supranational level, if discrepancies are to be avoided and the Single Market guaranteed, regional specificities may be important and thus regional authorities need to be consulted on the question of regulatory issues. Certain issues of policy are independent of the position of the region in the IS. These include strategic aspects and a proactive role in alliances:

- The most important role for LRAs is to guarantee constant monitoring of the progress, needs and possibilities of their territory. Because of the technological changes mentioned above and the changes in business expectations (determined largely by the pace at which countries and regions emerge from the economic crisis) decisions on private investments may change frequently. LRAs need to know the plans of the private sector and how they should design incentives to be used as catalytic forces to speed up access, without, however, crowding out private investments. The most appropriate types of interventions may be supporting supply or demand, in the latter case assuring e-Inclusion and open Internet and at the same time improving business prospects, since

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[42] CdR 304/2008 fin.
[43] CdR 5/2008 fin.

investors will know that demand will thereby be higher than if left to market forces alone.

- Public-private partnerships are crucial and in each region the actors are different. Using the influence of the LRAs to create sustainable partnerships is a significant element for progress. Private initiatives may be worth supporting and extended or may be self-sufficient and indicate that the role of the LRAs is not necessary.[44]

The problem is significantly more important for sparsely populated regions, regions with geographical constraints (ultra-peripheral, island and mountainous regions) and areas where low GDP or e-skills suggest that investments will be costly and demand-limited. In this case LRAs need to ensure EU, national or own state aid support, get the necessary regulatory exceptions and monitor early and effective implementation.

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[44] An example is the Athens Wireless Metropolitan Network, an interesting private initiative created by a small group of skilled people in 2002 who offered access to anyone wanting to link with them using a wireless antenna at the cost of 100 Euro. This infrastructure gives free access to games, distance learning etc; it is a kind of www but it does not compete with providers. In 8 years it has grown to 2500 members.

4. Conclusions

ICT research and innovation and *High-speed networks and open Internet* are closely interconnected and mutually reinforcing. Their development and local integration depend on the overall technological progress and on the specific characteristics of each region. High-speed networks constitute the infrastructure on which all IS services are offered. Changes in network capabilities and combinations are significant; they are determined by inventions, innovations and relative prices of fibre optics, wireless connections and mobile telephony. The array of constantly emerging new technologies makes it difficult to select optimal solutions in the long run, as costs and benefits change rapidly. Beside changes in network technology, the new modes of services and utilisation, such as cloud computing and peer to peer networks, are determinants of opportunities and threats to taking the right decisions for investments.

While all stakeholders agree that high-speed Internet is a condition for future prosperity, its cost and profitability make progress very asymmetric. Private investors limit investments to the most profitable areas; utilisation is significantly higher among the younger generation, the more wealthy and skilled citizens. This asymmetrical development constitutes market failures and is behind the rationale for public intervention. Regulating competition and frequency concerns the EU and the national levels, without neglecting the views of LRAs with regard to specific issues, but LRAs play an important role because of their privileged position to identify specificities and create agglomeration economies. In particular:

- *Intelligence is crucial*: because of the rapidly changing technologies, a good knowledge of the state of the art is essential for effective local policies. LRAs need evidence and constantly updated information to be able to adopt tailor-made but flexible strategies for the optimal combination of network infrastructure and the positioning of the region in the global technological development. LRAs also need performance indicators to monitor success both for infrastructure and research and innovation. Intelligence may be an internal responsibility of the administration or may be delegated to an observatory, nevertheless it is important not rely on external advice only.

- *Partnerships are important*: LRAs cannot act alone in this complex environment. They need to mobilise all forces locally available, join trans-regional and global networks as necessary and, most importantly, build public-private partnerships that will empower the regional plans. As

stakeholders' interests may differ significantly, blending their position is also a responsibility of LRAs.

- *Financial support needs to be mobilised and skills built up.* Regions with local strengths in ICT technologies can build on these strengths and maintain their competitive edge by supporting local companies and research capabilities and investing heavily in human resources. Regions with limited strengths in ICT research or in other clusters but not in ICT have to adopt strategies to complement these strengths. Weak regions, without sufficient local funding, need to ensure regional development funding for both infrastructure and research/innovation development from national or EU sources.

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