BEYOND CONNECTIVITY. FUTURE CHALLENGES FOR E-INCLUSION POLICIES

Radu Gheorghiu, Manuela Unguru*

Abstract**. *The information society stays at the core of the Lisbon Strategy, despite the dot-com crisis and the still hidden macroeconomic impact of information and communication technology (ICT). Thus, i2010 has been the first concrete initiative of the revised Lisbon Strategy in 2005, while ICT represents by far the field with the largest budget in the 7th Framework Programme (FP7). On the industry side, the stakes are still high in the global competition, where Europe hopes for a place at least for communication technologies and services. However, the extreme dynamics of technology with its sometimes breathtaking promises, poses new challenges for e-inclusion. Firstly, the accelerating pace of innovation maintains a generation type of digital divide between countries with different level of development. Secondly, the changing nature of the network (e.g. web 2.0 with virtual communities; web 3.0 with location based interaction; semantic web; ambient intelligence and "the internet of things") blurs the very distinction between inside and outside the information space. The paper explores these challenges and the associated policy options.*

Keywords: *Information society, e-inclusion, i2010, EU Framework Programme, ICT industry*

JEL: *O33, O38, I28, L63, L86*

Introduction

Throughout the development of the information society, the benefits were not equally distributed inside and among countries. The concerns about unequal social and economic opportunities have been initially gathered under the generic name of *digital divide*, term replaced in the last years by digital *inclusion* or *e-inclusion*, which further express the implicit role the information society has gained for the life of the citizens.

The year 2006 represents a turning point in understanding and monitoring e-inclusion at European level. With the

---

* **Radu Gheorghiu** is a researcher at the Institute of World Economics (Romanian Academy), where he runs the Competitiveness and Innovation Department. His research interests cover the dynamics of knowledge based economy (e.g. the information society, R&D and human capital development). In the last years he has been also involved in the coordination of large foresight projects aiming at supporting policy-making in these fields.
E-mail:gheorghiu.radu.cristian@gmail.com
Manuela Unguru is working with the Institute of World Economics - Competitiveness and Innovation Department for analysis of economic policies and comparative studies. She worked as an expert in a number of national and international research projects, such as the World Bank and Phare Projects.
E-mail: m.unguru@gmail.com

** This paper has been elaborated as part of the project Dynamic model for supporting e-inclusion policy making, financed by the programme IDEI of the Romanian National Plan for Research, Development and Innovation 2007-2013.

Riga Declaration, the European policy switches from the objective of increasing the capacity of accessing information and communication technologies (ICT) to the utilization of the technology for achieving the social inclusion objectives (see Riga Declaration, point 4). The Riga Declaration has identified six relevant themes for e-inclusion: *e-accessibility* (guarantee of the accessibility to ICT technologies by all the categories of population, especially for disable people), *e-ageing* (ensuring to elderly people the possibility to continue taking part to economic and social life); *e-skills* (ensuring to all the citizens the necessary level of education and skills); *socio–cultural e-inclusion* (facilitation of the social integration of minorities, immigrants and periphery groups through ICT access); geographical *e-inclusion*; and promotion of an *inclusive e-Government* (by providing better and more diversified services and by encouraging democratic participation of the citizens to the set-up and implementation of policies).

Up to now, the achievements of e-inclusion initiatives are below the targets. Riga Dashboard, which measures the progress towards the commitments of the European e-Inclusion Initiative, concluded in 2007 that "progress towards the Riga targets is only happening at half the speed which is necessary to reach them by 2010. Without policy intervention disparities are deemed to stay and in some cases widen."

Unfortunately, improving e-inclusion is not a linear process, but one with moving targets. On one hand the technologies permanently evolve, creating new waves of diffusion and so new temporary disparities, on the other hand the intensity of ICT use is also under constant transformations, as new patterns of ICT consumption emerge not only at individual level, but also at communities' level (e.g. web 2.0).

After a brief introduction into the evolution of the digital divide and e-inclusion concepts, the paper analyses the dynamics of the ICT penetration rates and of the gaps between the EU countries on the life cycle of already mature technologies, as fixed and mobile telephony and broadband. Further on, the paper describes the emergent ICT generations, having as drivers of change the convergence of technologies, semantic web, the geo-positioning systems or the "Internet of things" with the associated changes in interaction behaviour, and tries to identify the factors of new types of digital divide. Finally, the policy challenges are discussed and several conclusions are drawn.

Digital divide and e-inclusion: evolving concepts

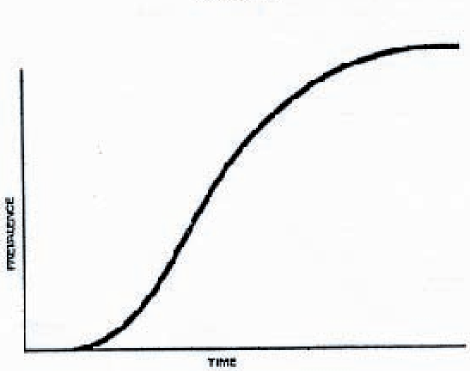
The distinction between *information haves* and *information have-nots* dates back from the early 1990s, as part of the US debate regarding the universal service obligations. From the initial issue of universal access to telephony, it gradually extended to computer equipment, Internet and broadband. With the 1996 Telecommunication Act, in US the discussions focused on Internet access and the role of education to fill the divide.

The project of the European Information Society, launched with the Bangemann Report (EC 1994), mirrors the American experience, trying to take advantage of the Internet opportunities by ensuring a large adoption of the technologies and the associated services.

From a moral perspective, the digital divide concerns have been initially connected with the access to the democratic life. Today, although e-democracy represents an issue in itself, it is shadowed by the preoccupations for equal economic and social opportunities. Given the importance ICT has gained, the Nobel owner Amartya Sen considered the digital inclusion or e-inclusion as one of the positive liberties. Based on Sen's acceptation, the eEurope Advisory Group (Kaplan, 2005) states that „ICT are becoming key enablers of the modern life" and that e-inclusion refers to the effective participation of individuals and communities in all dimensions of the knowledge based economy and society.

Beyond the moral issue, e-inclusion is an outcome of the ICT adoption cycle, which is a gradual process by its nature. The general framework of the adoption models (tested on different technologies, from corn hybrids 80 years ago, to steel and television) is represented by a logistic curve (the S curve): after a slow start, the technology adoption enters a rapid diffusion and then slows, continuing asymptotically towards the total potential population (Figure 1). The first stage, in which the increase is quite slow, is called *expansion period*. It follows the *maturity*

FIGURE 1



The S-curve of adoption of an innovation

period, and then the slope's curve is diminishing again, the technology getting close to the *saturation* level. The latter differs according to the technology: for the fixed telephony it might be the number of households, for the mobile one, it might be the number of individuals in a certain age group (or greater, since there are individuals with several mobile phones), while for internet the number of households and/or companies (or lower, since the internet access at the workplace or school could be a substitute for the internet access at home).

The idea of saturation level determined by the target population has been contested because it ignores the resistance against innovation (Rogers, 2003). We consider that this phenomenon is less pregnant in the case of ICT, due to the fact that these are general purpose *technologies*. Nevertheless, it is possible that a share of population rejects ICT adoption (e.g. for reasons of psychological discomfort), raising serious problems on long term, when public services and the majority of jobs would necessarily demand certain ICT skills.

The general framework of the S adoption curve has been completed in the literature by the models of the adoption decision. The decision for adoption is based according to the literature on the cost-benefit analysis (models called "probit") and the number of existing adopters (new adopters are encouraged by the existing ones in the "order" models, while new adopters avoid a technology with already too many adopters in the "stock" models).

But the ICT adoption, while presents the characteristics of other general purpose technologies (e.g. steam engine, electricity), involves also specific aspects. Warschauer (2003) observed that e-inclusion is not assured by mere connectivity, and that different other authors suggested the need for a multimodal definition of e-inclusion. Inspired by the specific challenges of Latin America, Tambascia (2006) identified three layers of bottlenecks towards e-inclusion: *connectivity* (i.e. access to the equipments and networks), *accessibility and usability* (i.e. the cognitive and physical capacities for using the technology, including by the persons with disabilities, and interpreting the digital content); *intelligibility* (i.e. the adequacy of the digital content to the local culture, including the availability of content in the national language).

The Riga Dashboard is monitoring the progress towards meeting the targets of i2010 initiative by four indicators, two of them dealing with the supply side (*broadband coverage and e-Accessibility of public websites*) and the other two with the demand side (*internet use and digital literacy*). Although the target of this monitoring exercise is on the average value of indicators, it reveals some issues of digital divide. Regarding the **use of internet**, the gap between *groups at-risk of exclusion* (unemployed, age 65-74, inactive and low educated) is closing very slowly. As for the **broadband coverage**, *geographical disparities* are persisting, this indicator being much lower in rural areas (71%), with lower traffic speeds available than in urban areas and less competition between alternative providers. Finally, regarding **digital literacy**, *gaps in internet and computer skills* are still important especially for groups at risk with low education, economically inactive, and the older population. These are also the groups which have shown to have larger disparities in the rate of regular internet usage, and will not likely meet the Riga targets by 2010.

The digital divide between countries

Understanding the digital gaps between countries requires a dynamic analysis of the ICT penetration rates, i.e. comparing the adoption curves between technologies and between countries and understanding the digital divide as following the life cycles of technologies.

For instance, while it is largely acknowledged that GDP represents an important explanatory variable for the digital divide between countries, most of the literature ignores that GDP is more relevant in the maturity period of technologies than in the expansion and saturation periods. The graph below reveals the evolution in time of the GDP disparities as explanatory variables for the digital divide between EU countries for three technologies: fixed telephony, mobile telephony and broadband.

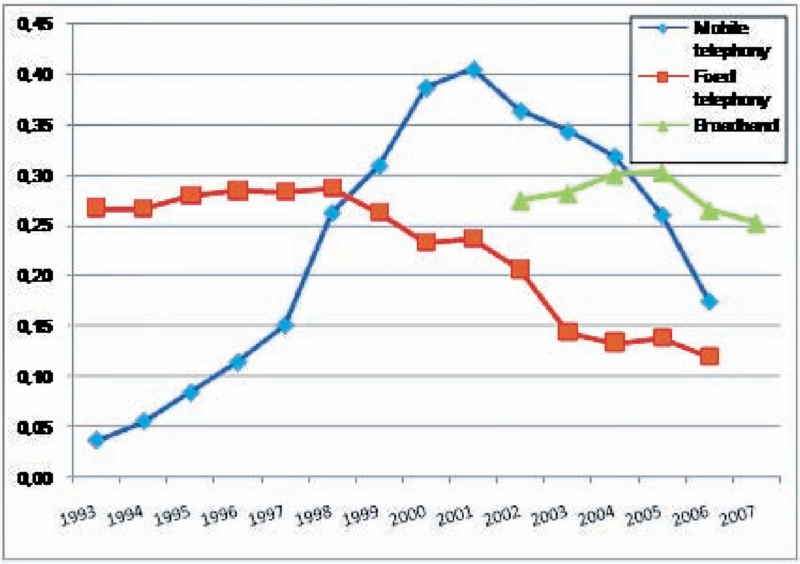
GDP has been a significant driver for the adoption of fixed telephony until the technology has reached saturation and started to compete with the mobile[1]. Similarly, for the mobile telephony in EU countries GDP per capita has been a significant driver for adoption only over the expansion period, up to the maturity ceiling of this technology.[2]

The starting moment is also important for the shape of the adoption curve. An

[1] The statement is based on the estimation in a panel of a fixed effects model, data for fixed and mobile telephones for 12 European countries, 1995-2006

[2] We have considered 10% expansion ceiling and 80% the ceiling for the maturity period in the process of adopting mobile telephones

Graph 1: The dynamics of the importance of GDP for the digital divide between countries*



* The values were computed as yearly slopes of the linear function between GDP in PPS as exogenous, and ICT penetration rates as endogenous, for a set of 31 European countries

Source: own computations, based on EUROSTAT data

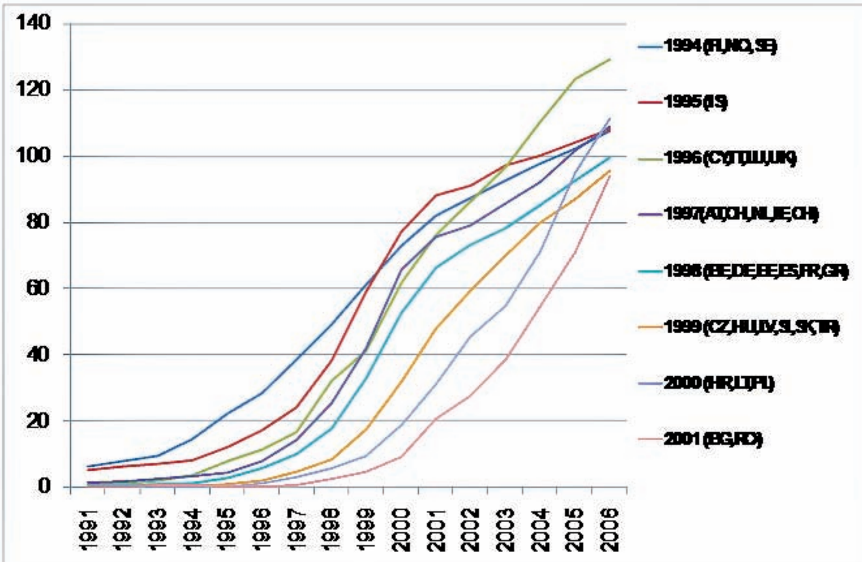
analysis of the mobile phone adoption in the European Union (EU) countries shows that the countries which first reached the expansion ceiling (i.e. 10% penetration rate) maintained their advance and reached earlier the saturation point. The graph below presents the average mobile penetration rates by groups of countries that completed the expansion period in the same year. For the groups of countries that started earlier, the S shape is obvious and they have reached faster the saturation level, while, for countries with a delayed start the shape of the curve is smoother and its second inflexion point of the 'S' shape is practically missing (see Graph 2).

When comparing the role GDP played in the speed of completing the expansion stage, the econometric analysis show that it represented a major variable for telephony and a less important, but still significant one, for broadband. This suggests that, given the larger complexity of the broadband adoption capacity, other factors than GDP might play an important role. A recent study (OECD, 2007) finds as significant factors for the broadband adoption the size of the domestic market, education and the degree of urbanisation.

Other types of analyses underline the benefits among the explanatory variables of broadband adoption. The benefits may differ between countries based on the implementation (e.g. different studies show that US managed to increase much more than EU the economic productivity, due to ICT) or the local network effect.

The network benefits increase for each participant with the growth of the number of participants (Kelly, 1999). In the case

Graph 2: Penetration rate of mobile phones, by groups of countries, according to the year of completing the expansion period*



* We have considered 10% as ceiling for the expansion period
Source: own computations, based on EUROSTAT data

of global networks, as the Internet, the network benefits could be considered either equally distributed between the countries, or, on the contrary, the benefits could be rather related with the national and local level of development, being complementary to the flows from the real economy. The evidence from the literature rather indicates the complementarity between national virtual networks and global networks, with smaller differences for English speaking countries.

A technology-driven future of e-inclusion

Most experts agree that ICT are very dynamic and that the technologies expected to be developed and adopted in the next ten years will induce important transformations in work and private life. Several years ago the Institute of Prospective Technological Studies of the European Commission provided as a possible scenario for 2010 the "ambient intelligence" (IPTS 2001; Cai and Abascal, 2006), namely an environment enriched by complex information interactions reducing the need for administrative real interactions. Other overall concepts as the "disappearing computer" (Streitz et al. 2007), or the "always on" type of connection, suggest the huge transformations which are ahead of us on relatively short term.

As reaction to the growing diversity of technologies, menacing with uncontrolable complexity, both the industry and the governments encouraged in the last years the **convergence of technologies**. According to Ganswindt (2006), the convergence takes place on three levels: *network* (i.e. fixed telephony, mobile and data networks), *devices* (i.e. telephones and computers) and *applications* (i.e. voice and data applications). The convergence of technologies often results in new types of usage and new types of offers (Afeche, 2006), including bundling of services. An effect of contamination of services is thus supported, as for instance the digital television may encourage the Internet adoption.

A complementary trend contributing to an increased usability of ICT is represented by the **hidden interaction of the networks**. Still in the infancy, the collaboration of networks would enable the users of laptops, cell phones or PDAs not to pay attention to the transmission standards they are using, which dynamically adapt to their needs and location. Such user oriented services would also enable the user to be accessible at all times at a single number, wherever they are.

Different prospective exercises (e.g. Silberglitt et al, 2006) announce already as a strong trend the **multimodal access**: the ICT users may chose different communication devices or channels to interact with the online content. As a result, the already traditional connection between a user and a certain device blurs, the user gaining freedom to interact dynamically with the online content.

After human to human asynchronous interaction and computer to computer negotiations, the Internet may exponentially increase by the **interaction of objects**. With the promises of new Internet protocols, different devices (i.e. computers, sensors, actuators, mobile phones, other electronic devices) may become addressable and identifiable, thus being able to collaboratively perform different tasks. The range of applications is practically unlimited: from improving car safety by increased interaction of the car with the external environment sensors; energy optimisation systems; crops monitoring; to fully automated supply networks. The power of distributed intelligent systems has been acknowledged in the literature as very high, even when the intelligence of each participant unit is quite limited. "The Internet of Things will become a reality over the next 20 years; with omnipresent smart devices wirelessly communicating over hybrid and ad-hoc networks of devices, sensors and actuators working in synergy to improve the quality of our lives and consistently reducing the ecological impact of mankind on the planet" (EC, 2008a).

The "net of things" may dramatically increase internet traffic and create a competition between "private" users and business users of the network. The new intelligent distributed systems may raise new concerns about trust and privacy and also about their sustainable energy consumption.

The signs of the net of things are already strong: while the PC market is slowing, the market for embedded software and machine to machine software is registering growth rates over 50% per year. The drivers of the convergence are the standards, not as much in the IT industry, but in the network industry. There is a need for putting everything over an Internet Protocol (IP), but the current IP is inadequate, because although it enables data exchange, it does not have an "intelligence of the network", i.e. the language of the application it is not yet understood by the network and vice versa (Ganswindt, 2006).

A transformation in the nature of the

network itself is already announced by the telecommunication operators under the term **New Generation Network (NGN)**. The novelty is given by a shift from the classic model of telephony (with circuit switched networks and end-to-end quality service) to the package model of the Internet. Instead of dedicated lines between a sender and a receiver, the transfer of data (including voice or image) will be made by an intelligent network on alternative routes optimised by the network itself. This developing network would represent an evolution compared to the current Internet, as would enable a certain control over the traffic.

"From the Internet community standpoint, NGN is in contrast with some of the basic principles of the Internet structure, based on a dumb "*cheap and cheerful*" core technology allowing constant and spontaneous innovation at the edges" (OECD 2006a). Hence, the emergence of NGN calls for a redefinition of universal service obligations, their coverage, how they are financed and who is responsible for providing them (OECD 2006b). NGN may substantially increase availability and affordability of the telecommunication services, while contributing to an explosion of services and technologies. As the digital inclusion issues are not supposed to end with NGN, future e-inclusion policies require additional efforts to focus on users' needs simultaneously with care for technological neutrality.

While NGN involves a transformation in the intelligence of the network, a similar intelligence upgrade is announced for the content in the form of the **semantic web**. Currently the web pages do not contain information about their contents and the subjects to which they refer and therefore the search engines select the relevant pages based on frequency of words and the historical reputation of the pages (links towards the page). With the semantic web the pages would include alongside their content brief descriptions according to standard classifications of the content called ontology. This would enable very accurate reach of information and even automatic computation (e.g. compare prices of hotels from different sites). The impact of semantic web will be huge, as currently only a very small amount of total information on the web is actually read by somebody. At the same time, the semantic web enables machine to machine interaction, populating the web with electronic agents that grasp information and negotiate with different sites in the name of certain users (e.g. prepare a trip with all details).

A different type of transformation in the information society has been produced not so much by the evolution of technology, but by a leap in the peers' behaviour with the emergence of **web 2.0**. Web 2.0 has a rather large spectrum of definitions, however, the experts agree on the importance of online communities and their asynchronous interaction. Two types of online communities can be now distinguished: *commercial communities* (e.g. eBay, Amazon) and *communities of practice* (i.e. sharing knowledge or video content).

At the beginning of the 1990's the virtual space was supposed to act as a substitute for the physical one (Rallet and Rochelander, 2007) and when the online communities emerged, they have been considered as very similar to the real ones. Recent studies show that, although there are similarities between the real communities and the online ones, in the latter the participants have a much loose involvement in time, their participation is more focused on the topic of the community. Instead of the distinction between members and non-members, a more feasible one is between different degrees of participation.

Online communities are more dynamic than the real ones – the number of participants can explode in days, but can also vanish quickly. Most of the active online communities are based on a relatively small number of dedicated participants. The motivations of the contributors in the same community may have a large variety, from intellectual motivations to professional visibility.

The collaborative level of communities may reach unexpected levels as in the case of open source software. The contributors to open source are usually unpaid, the supervision is minimal, while the intellectual property rights content are modest (Lerne and Tirole, 2004). A study (Lakhami and Wolf, 2005) shows that 29% of open source contributors are motivated by education/ intellectual stimulation, 25% by hobby, 25% by professional interest and 19% by communitarian reasons. The psycho-social reasons are often connected to signalling, many contributors managing to obtain paid contacts from the software companies.

Less integrated, but with higher success are the online communities sharing video and music content. YouTube, with its over 40 million shared video recordings and 200 terabytes of data, and the growing number of blogs, show that on the Internet the production exceeds the capacity of absorption. The participative web competes with the editing industry and the television: certain blogs reached larger audience than public television or newspapers, forcing some of them to migrate from providing content to enabling content collection.

More recently, at the European level, mainly under the influence of the large companies such as Nokia, the concept of **web 3.0** has been launched. While its definition is even more debated than of web 2.0, it is generally agreed that it involves community collaboration augmented by positioning. The Global Position Systems (GPS) are already largely spread, but their integration into communication is still explorative. Future applications may enable new types of interaction for the groups of persons located in short distances (e.g. meet friends in the city) and location oriented services (e.g. search for the closest bank or restaurant).

Development of interaction with determined position is also boosted by the set of short range communication technologies, as Bluetooth for computers and DECT for cordless phones.[3] The combination of long and short range communication technologies will be critical for the development of location based interaction. Certain experts take into account also the possibility that in large cities the communication may rely on a large number of short range communication devices, creating the so called "dust networks".

Impact on e-inclusion of technological trends

The expected changes into the nature of the information society draw us apart from the classic representation of

[3] Webb (2007) provides a review of such technologies which include: UWB, W-LAN, DECT, BlooTooth, Zigbee, RFID.

a gradual diffusion of information and communication technologies and poses new challenges for e-inclusion. Let's take one by one the above trends and chase for their possible future impact on e-inclusion issues:

- The convergence of technologies reduces some of the complexity the users are confronted within the context of very rapid technological development and encourage the contamination between the diffusion mechanisms of different technologies. At the same time, the bundling of services does not guarantee a real use of some of these services.
- The multimodal access and the disappearing computer increase the chances for access to the network, and a new type of gap between the users may emerge from the quality of services used.
- The Internet of things, expected to reach over a thousand sensors per capita in the next ten years, practically interwave the real space and the virtual one. This fact fades the classic abilities of using the technology for a personally defined purpose, towards the understanding and exploiting the functions of the different environments the person is in (e.g. an intelligent house).
- The New Generation Network provides the promises of cheap communication of voice, image and data, simultaneously with an increasing diversity of technologies, which calls for a redefinition of the universal service obligations.
- Semantic web may contribute to a spectacular openness of "the deep Internet", the Internet which is beyond three clicks and which is now practically inaccessible. In this environment the persons will be able to define electronic agents for negotiating in the network in their benefit (e.g. finding best price for a product). The definition of such tasks involves a completely new type of skills.
- The online communities already proved able to contribute to the development of consistent shared knowledge and reputation mechanisms. However, the language barrier represents an important issue for accessing some of the communities.
- Web 3.0 with position-based interaction may bring completely new forms of collaboration. At the same time, the short-range communication seems to be much more relevant in highly populated regions with creating a new form of natural urban-rural gap.

Policy challenges

Throughout the first three years of the revised Lisbon Agenda, there has been an increasing focus by Member States on the ICT policies. National strategic plans are increasingly addressing a variety of information society issues, often with dedicated strategies along the lines of the EU i2010 initiative, but commitments are not homogenous among the EU countries.

As shown in the previous section, the technology is very fast moving. Compared to the United States (US), Europe is lagging behind in IT, but has some advance in telecommunication technologies. Trying to close the gap with the US, the EU policy in Research and Development is focused on the ICT, which became the most important subject in FP7, cumulating 43% of total funds dedicated to Partnership Programme.

Since the Riga Declaration, e-inclusion means both inclusive ICT and the use of the ICT in order to achieve wider inclusion objectives, and includes issues in the fields of active ageing, geographical digital divide, accessibility, digital literacy and competences, cultural diversity and inclusive e-Government. EU considers that particular attention must be paid to further improve user motivation, as well as trust and confidence through better security and privacy protection. Furthermore, greater gender balance in the information society remains a key objective.

To convincingly address e-Inclusion, the gaps in Internet usage of the older population, people with disabilities, women, and low-education groups, unemployed and less-developed regions are committed to be reduced to a half, from 2005 to 2010, according to the Riga Declaration. For a more inclusive e-Government, there is need to develop further the infrastructure and the services. As revealed by a recent study (Niehaves and Becker 2008), measures should also take into account the important changes that ICT developments in network capacity, in wireless and mobile technologies, as well as in collaborative applications are bringing to economies and societies.

The critical directions for the e-inclusion in the EU are the access of individuals to the labour market; stimulation of the participation to public life and policy; stimulation of long-life learning; minimization of effects of ageing, illness and handicap (Bianchi et al. 2006).

The dynamics and the deep transformations the new ICT generations call for reconsidering the idea of general service obligations, producing a shift in the policies of developed countries, from ensuring simple access for disadvantaged categories (e.g. persons living in remote areas), towards monitoring the competition (OECD, 2007). An example is that of the Voice over Internet Protocol (VoIP) services offering lower prices compared with the fixed telephony services.

Conclusion

At the European level the information society is no longer emergent, and entered its maturity stage: the Internet penetration rates in most developed countries are already approaching the saturation level, with the promise of a pervasive access and a definitive integration of the ICT in life and work routines.

But the benefits of the information society are not evenly distributed, at least at a certain moment of time. First of all, the digital divide between the European countries, while apparently narrowing in absolute terms, persists when considering the different ICT generations (e.g. telephony, Internet, broadband). Secondly, in front of us new ICT generations, poses new challenges, not only in the inclusion of individuals into the information sphere, but also for the very distinction between in and out of this sphere.

These suggest the need for understanding the digital divide and its drivers during the life cycle of technologies. The apparent diminishing gaps should not be seen only in relative terms, but in temporal terms.

The digital divide between countries could be explained for the maturity period of technologies by the differences in the general level of development. The various technologies exist in parallel and they could be either substitute of complement overlaps that should be dynamically analysed. Our estimations show that GDP has been significant for the fixed telephony until the technology has reached saturation and started to compete with the mobile. The mobile itself followed the same pattern, while broadband is still in the maturity stage. Beside GDP, there are other factors that may speed the adoption of the ICT technology as market size, education, degree of urbanisation or local content available.

The starting moment for the technology adoption is also important for explaining the long term digital gaps between countries. An analysis of the mobile phone adoption in the EU countries shows that the countries which started earlier have faster reached the saturation level (like Finland, Norway, Sweden, Iceland), while for countries with a delayed start (Croatia, Latvia, Poland, Bulgaria and Romania) the shape of the penetration rate curve is smoother and the gap between countries is maintained.

The rapid evolution of the information society is supported by the continous technological development and the assotiated changes in users' behavior. The new ICT generation in expected to bring more user-friendly ICT and greater benefits in day-by-day life. At the same time, the border between inside and outside information society will gradually vanish, as the whole environment will be pointed with interaction forms of electronic informational type.

The increasing pace of technological development creates faster and faster waves of ICT adoption, maintaining the digital divide. In this context the e-inclusion policy responses are challenged not only to maintain technological neutrality, but also to use anticipatory intelligence.

BIBLIOGRAPHY

- Afeche P. (2006), *The Economics of Data Communications*, in Hendershott (ed), Economics and Information Systems, Elsevier;
- Bianchi A., Barrios S., Cabrera M., Cachia R., Compañó R., Malanowski N., Punie Y., Turlea G., Zinnbauer D., Centeno C. (2006), *Revisiting e-Inclusion: from Vision to Action*, IPTS;
- Cai Y., Abascal J. (2006), *Ambient Intelligence in Everyday Life*, Springer
- Chinn M.D., Fairlie R.W (2004), *The Determinants of the Global Digital Divide. A Cross-Country Analysis of Computer and Internet Penetration*;
- de Holanda G.M., Dall'Antonia J.C. (2006), *An Approach for e-inclusion: Bringing illiterates and disabled people into play*, Journal of Technology and Management Innovation, Vol.1, issue 3;
- EC (1994), Bangemann Report, *Europe and the Global Information Society*;
- EC (2008a), *Internet of Things in 2020. A Roadmap for the Future*, European Platform for Smart Systems Integration;
- EC (2008b) Preparing Europe's digital future i2010 Mid-Term Review. Volume 1: i2010 — Annual Information Society Report 2008. Benchmarking i2010: Progress and Fragmentation in the European Information Society;

- Ganswindt T. (2006), *Telecommunication Industries in Transition: Winning the Future through Innovation and Change*, in Picot A. (ed), *The future of telecommunicatios Industry*, Springer;
- Kaplan D. (2005), E-Inclusion: *New Challenges and Policy Recommendations – The Report*;
- Kelly K. (1999), *New rules for the new economy. 10 radical strategies for a connected world*, Penguin Press;
- Lerne J., Tirole J. (2004), *The economics of technology sharing: open source and beyond*, NBER Working paper 10956;
- Niehaves B., Becker J. (2008), The Age-Divide in E-Government – Data, Interpretations, Theory Fragments, in Towards sustainable society on ubiquitous networks, *The 8th IFIP Conference on e-Business, e-Services and e-Society (I3E 2008), September 24-16, 2008, Tokyo, Japan*
- OECD (2006), OECD Foresight Forum *Next Generation Networks: Evolution and Policy Considerations*
- OECD (2007), *Catching-up in broadband. What will it take?*;
- OECD (2007a), *Fixed-Mobile Convergence: Market Developments and Policy Issues*;
- OECD (2007b), *Rethinking Universal Service for a Next Generation Network Environment*;
- OECD (2008), *Broadband Growth and Policies in OECD Countries*;
- Picot A. (ed.) (2006), *The Future of the Telecommunicatios Industries*, Springer;
- Rallet A., Rochelandet F. (2007), *ICTs and inequalities: the digital divide*, in Brousseau E., Curien N., Internet and Digital Economics, Cambridge University Press;
- Rogers E. M. (2003), *Diffusion of Innovations,* Free Press, New York;
- Silberglitt R., Antón P.S., Howell D.R., Wong A. (2006), *The Global Technology Revolution 2020*, In-Depth Analyses, Bio/Nano/Materials/Information Trends, Drivers, Barriers, and Social Implications, RAND;
- Streitz N., Kameas A., Mavrommati I. (Eds.) (2007), *The Disappearing Computer*, Springer;
- Tambascia et al. (2006), *Mapping Solutions – Telecommunication Solutions for Digital Inclusion Project*;
- Vicente M.R, Lopez A.J. (2006), *Patterns of TIC diffusion across the European Union*, Economics Letter;
- Warschauer (2003), *Technology and social inclusion: rethinking the digital divide*;
- Webb W. (2007), *Wireless Communications: The Future*, John Wiley & Sons Ltd;
- **** IT Roadmap to a Geospatial Future*, National Research Council, Washington, 2003 http://www.nap.edu/catalog/10661.html