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Sara Bentivegna  
Paolo Guerrieri  
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Sara Bentivegna

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### ***The Research Team***

Paolo Guerrieri - Director

Sara Bentivegna

Roberta Bracciale

Giovanni Di Franco

Isabella Mingo

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## Premise

Differences in economic performances between industrialised countries are significantly affected by the level, diffusion and use of ICT, and by the competitiveness of the information society and media industries. ICT services, skills, media and content are a growing part of the economy and society.

Progress in ICT e-Inclusion, however, is still lacking and social differences in ICT use persist and in some cases are even widening. Most of the Riga targets are difficult to be achieved if current trends continue. Therefore much more should be done to achieve e-Inclusion and EU intervention is justified to guarantee equal access and effective participation in the information society, internal market coherence and e-Inclusion co-ordination actions.

Even more so, since e-Inclusion should not be seen as a problem only; it is also an economic opportunity. On economic grounds an inclusive information society brings large market opportunities for the ICT sector, contributes to productivity growth and reduces the cost of social and economic exclusion. In other terms, bridging broadband and accessibility gaps, or improving digital competences, creates new jobs and services.

Despite a growing literature on digital inequalities and e-Inclusion, the quantitative and qualitative understanding of ICT and e-services usage remains extremely poor and uncoordinated; it is not yet possible to find fully consolidated and reliable quantitative datasets and indicators to provide a broad quantitative perspective and facilitate benchmarking for monitoring the process of e-Inclusion.

The purpose of our study, which is going to be completed by the first part of 2010, is to start to fill this gap and strengthen the evidence on the e-Inclusion and the economic benefits (and costs) deriving from investment in inclusive information society technology and services. The study will gather data, propose indicators and composite indexes of e-Inclusion and use econometric models to assess the relationship between inclusive ICT and wider economic and social performances.

In this Report we present a brief summary of the first part of our research (completed by December 2009) which was dedicated to provide a quantitative evaluation of the e-Inclusion in Europe. In order to define and measure e-Inclusion, we move beyond the traditional distinction between “haves” and “have-nots” in terms of access only and we propose a multi-focal approach to this complex concept in continual evolution. More specifically, we adopt a multi-perspective (*households/individual and enterprises*) and multi-dimensional approach (*access, usage, impact of quality of life*). Throughout this approach, we will be able to provide a quantitative evaluation, indicators and a dataset to monitor e-Inclusion for all 27 EU Member States.

On the operational front our goal is to produce the European Index of Digital Inclusion (EIDI) which wants to monitor and capture the level of advancement of digital inclusion in the EU27 and in all member countries and compare progress made between 2004 and 2009. The composite and longitudinal nature of the EIDI – based on the indexes measuring the sub-dimensions of access, usage and impact from 2004 to 2009 – will contribute to individuate the main obstacles to close the digital exclusion and to monitor progress that have been made in terms of the Riga targets. Its main objective is to provide policy makers with a useful tool to benchmark and assess the e-Inclusion processes. In this perspective, and though is still under further elaborations, we offer in this Report a first anticipation of the main results stemming from the application of EIDI.

## The definition of e-Inclusion

The acknowledgment of the central role of e-Inclusion in present-day societies represents the first step along the road leading to the creation of a new form of social cohesion based on the use of ICTs. In order to achieve this objective, however, there is a need not only for ad hoc policy-making interventions, but also to identify the analytical and measurement instruments.

The definition of e-Inclusion provided by the Riga Ministerial Conference (2006), understood as a focus “on participation of all individuals and communities in all aspects of the information society” and such as to produce an improvement in economic performance, in employment opportunities, in social participation and cohesion, indicates the general coordinates required to identify the dimensions which make up the concept. On the one hand, in fact, reference is made to the broad range of subjects who should be involved (all individuals and communities), on the other hand, explicit reference is made to the consequences of the digital inclusion processes.

This attempt to provide a definition is the first step in a process which, at a later time, identifies the measure instruments and, finally, condenses them into empirical indicators. Before proceeding in this direction, however, it is important to introduce certain conceptual dimensions of the digital inclusion.

Firstly in the early phase of study on the diffusion of ICTs, the predominant approach is clearly based on the distinction between ‘haves’ and ‘have-nots’. This distinction became widely known as the digital divide, defined as *the gap between those who have access to the new technologies and those who do not*. What is being criticized are the limitations of a term that is essentially centred on the element of access, to the disadvantage of other equally important factors, thereby overlooking the fact that access is different from use and that there are a variety of ways in which this technology is actually employed. We are also liable to forget that the adoption of a similar interpretation could generate some serious misunderstandings with regards to the reduction of inequalities between individuals: data concerning the proliferation of the Internet among the population, as well as the reduction of certain inequalities, risks overshadowing those inequalities that persist - or increase progressively - in the way that technology is used and the role it plays in expanding personal opportunities.

To go beyond the concept of digital divide and, above all, beyond a one-dimensional approach centred on access, it is vital to identify the other areas where the relation between Internet and the individuals in present-day societies can be explored. This involves both piecing together the picture of how individuals relate to the Internet and identifying the ‘moving’ aspects of existing inequality.

We could thus define e-Inclusion as a “moving target”: that is, a phenomenon which is closely connected with the changes in the technological innovation process. As technological applications change, the connected e-Inclusion process inevitably changes. Hence, by way of example, it will suffice to refer to the digital inclusion process in 2009 – based on broadband availability – in order to note the considerable differences that exist between the same process in 2004 – characterized by slower connections. In brief, in order to understand the real nature of the e-Inclusion process its “in progress” nature must be constantly taken into consideration.

Another factor which needs to be taken into consideration is that the e-Inclusion process aims not only to increase the number of individuals who are able to improve their quality of life as a result of ICT-related developments, but also to affect the overall level of a country’s economic and social development. This means that e-Inclusion has an impact at the individual level as much as at the social level, and at the micro level as much as at the macro and meso levels.

Lastly, it is important to remember that the e-Inclusion has its flip-side in e-Exclusion. More than on the measurement aspect, the similarity between the two concepts is based on their dimensions: that which connotes e-Inclusion in positive terms becomes negative with respect to e-Exclusion.

## **Modelling e-Inclusion as a multi-dimensional process: access, usage, impact**

After having introduced and briefly presented these elements which together define the concept of e-Inclusion, we can now move on to define its dimensions and sub-dimensions. In the light of the observations formulated in the previous pages, one of the dimensions which make up the concept is that of *access*. The dimension of *access* comprises the physical and material access which refers to the prerequisites for the appropriation of ICTs, or rather the conditions of physical access and quality. The provision of access points and forms of connection is the first step in the process of domestication of technology and its use in improving quality of life and participation in an information society. This is particularly relevant for broadband connection, which enables a dramatic change in the use of multimedia products and enables individuals to assume the role of content producers.

### **The dimensions of Access**

<b>A</b>	<b>NETWORK</b>
<b>C</b>	
<b>C</b>	<b>AFFORDABILITY</b>
<b>E</b>	
<b>S</b>	<b>AVAILABILITY AND QUALITY</b>
<b>S</b>	

It is in any case true that the access dimension does not fully define the concept of e-Inclusion – as has been widely discussed in the literature – but certainly no digital inclusion process can be implemented without it. Unlike e-Inclusion in the past, when it was interpreted in dichotomist terms (haves and have-nots) and constituted the pillar of the digital divide paradigm, the dimension of access of modern-day e-Inclusion can only be structured into sub-dimensions capable of representing the large number of existing nuances. It is thought that the sub-dimensions of the e-Inclusion can be identified first in the availability (of a home computer, Internet connection at home) and in the quality of connection (broadband connection), that is, in the full control of access and in the possibility to access all available services. In order to establish the conditions of autonomy and a good quality of access, however, there are a number of pre-requisites which must be fulfilled or which make these two sub-dimensions actually significant.

First, it is essential that a technological network be available to the subjects (whether individuals, households or enterprises) to stimulate the context in which they are set, creating the necessary conditions for making Internet access actually attainable.

Another essential element for a correct interpretation is accessibility in economic terms. In addition to the availability of a technological network, in fact, it appears self-evident that there is a need for accessibility in terms of reduced and affordable rates, equipment costs not so expensive. This, in brief, is a form of access in economic terms which is useful in describing the effective availability of the technological supply.

In the light of these considerations, the dimension of access can be structured into three sub-dimensions, considered fit to represent and reproduce its full meaning: *network, affordability, availability and connection quality*.

The evidence from the literature established at international level identifies the dimension of *usage* as a further dimension of the concept of e-Inclusion: indeed, it is widely acknowledged that, for the digital inclusion processes to be successful and to produce positive outcomes at the overall level, it is essential to possess the necessary skills to guarantee a satisfactory technological appropriation. The second dimension of the e-Inclusion, therefore, is that of *usage*, intended as autonomy, practice, capability and confidence. *Autonomy* in Internet usage is a fundamental element in determining the success of the technological appropriation process: only when the possibility to navigate in full autonomy exists – understood as access availability and

choice of content – it is possible to establish the conditions for fully realizing the digital experience, and for individuals to search for new applications and uses. The conditions of autonomy go hand in hand with those of *intensity*: also in the latter case, a frequent use of the Internet facilitates the acquisition of greater skills necessary to carry out more complex activities.

Access autonomy and intensity of use prepare the ground on which the sub-dimensions of *skills* are applied. As regards the first type of skills, which consist in a basic knowledge of the personal computer and how it works, they are required to carry out certain operations of an increasing level of complexity: from copy and paste to the installation of programmes. These basic features of technological literacy, although they are related to a specific connection device such as the personal computer, constitute the common basis for the use of the Internet.

It is clear that autonomy and intensity of use, combined with advanced and composite skills, facilitate the digital inclusion process: the ability to carry out complex operations facilitates and affects the size of the scope as well as the daily quality of life. In this regard, it is useful to refer to the values of Pearson’s correlation: in 2009 the value between autonomy and skill was .850, and between intensity and skill was .847. In the light of this evidence, it is proposed that the dimension of usage be structured into three sub-dimensions: *autonomy, intensity, skills*.

### The dimensions of Usage

<b>U S A G E</b>	<b>AUTONOMY</b>
	<b>INTENSITY</b>
	<b>SKILLS</b>

The last dimension of the e-Inclusion concept presumably lies in the spheres in which the most significant outcomes, both at individual and social level, occur. Unfortunately, as it is known, detecting the “impact of digital inclusion is often very difficult to isolate or to quantify” (FreshMinds, 2008). Nevertheless, during the structuring of the concept, it is possible to assume a number of sub-dimensions on the basis of the definition of e-Inclusion formulated during the Riga Conference. Within the *impact* dimension, the following sub-dimensions can be identified: *economic area, educational area, employment and labour area, health area, government interaction, cultural, communicative and entertainment area*. Such sub-dimensions, although they certainly do not address the full complexity of the concept, render part of its meaning and, at the same time, are the most easily translatable (into indicators) in empirical terms. The impact of e-Inclusion at the various levels, for example, can be brought together in the illustrated representation of the *economic* sub-dimension: from the use of e-banking to that of e-commerce. The numerous activities pertaining to individual training both for personal cultural growth and for professional improvement with a view to entry in employment can be brought together in the *educational* sub-dimension.

### The dimensions of Impact

I M P A C T	ECONOMIC
	EMPLOYMENT AND LABOUR
	EDUCATIONAL
	HEALTH
	GOVERNMENT
	CULTURE, COMMUNICATION, ENTERTAINMENT

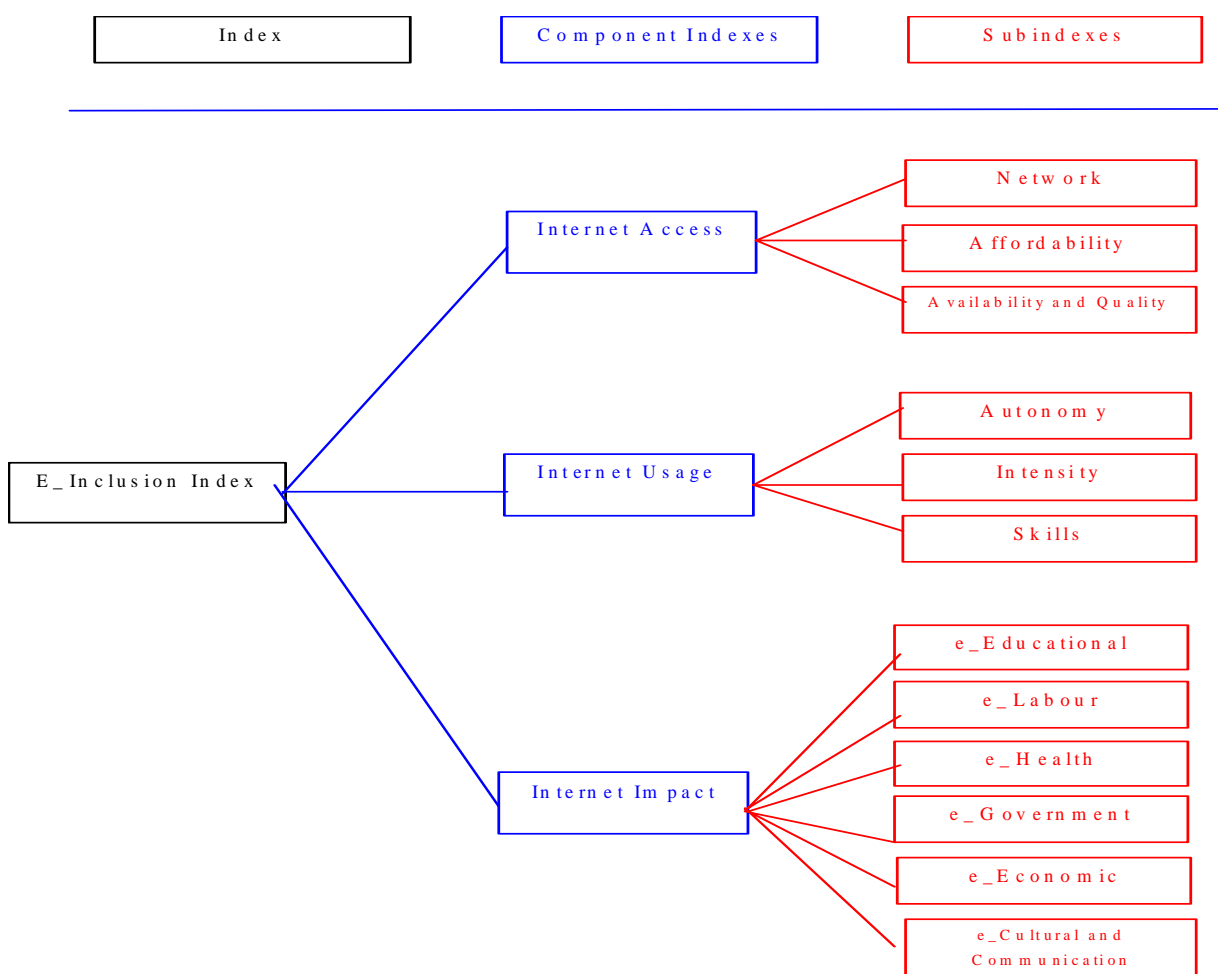
Employment-seeking activities as well as other spheres of employment in which the ICTs constitute a specialization or delocalization feature can be brought together in the *employment and labour* sub-dimension. The activities related to the search for health information and medical assistance provided through online consultation and prescriptions are grouped together in the *health* sub-dimension. And the various activities pertaining to relations between citizens and the public administrations, in a range of possibilities from a simple information request to the full management of procedures online can be brought together in the *government interaction* sub-dimension. Lastly, the chaotic and lively sphere of communication and entertainment developed in terms of media product consumption (TV and newspapers), downloading games and music, communication production and cultural products can be brought together in the *cultural, communicative and recreational* sub-dimension. Indeed, the sub-dimensions identified above do not render the full meaning of the concept of e-Inclusion with respect to its impact on individuals. The choice of transforming the dimensions into indicators inevitably entails a selection which is inspired by the availability of data rather than by their evocative ability. Despite such limit, however, the sub-dimensions of *economic area*, *educational area*, *employment and labour area*, *health and wellness area*, *government interaction*, *cultural, communicative and recreational area* have the ability, in our opinion, to faithfully represent the consequences of the digital inclusion process both at individual and social level.

#### The e-Inclusion Index

In order to define and measure e-Inclusion we thus propose a multi-focal approach to this complex concept in continual evolution. The analytical framework underlying the construction of the e-Inclusion index is structured into three components (dimensions of the general concept: access, usage, impact on quality of life) and into twelve sub-indexes (see Fig.1).

Obviously, the sub-indexes, the dimensions and the final index are strongly interdependent. So, without Internet infrastructure and access, there is no Internet usage.

**Fig. 1 – e-Inclusion Index**



It should be noted that composite indexes by nature are subject to questioning and have to be interpreted with caution. They do serve one important purpose, though: they raise awareness among policy makers of areas that deserve particular attention in future policy decisions. This is also the case for information-society related policies.

The main objectives of the Index are to track progress in the development of ICTs in EU countries and to monitor the e-Inclusion. In particular the index is intended to measure:

- The level of advancement of ICT in *all* EU countries.
- The *e-Inclusion*, i.e. differences among EU countries with different levels of ICT development.
- The *development potential* of ICT or the extent to which countries can make use of ICT to enhance growth and development, based on available capabilities and skills.

The overall process of constructing the index was undertaken following the guidelines recommended by the OECD<sup>1</sup>. For a diachronic assessment of the development of the e-Inclusion, the historical series from 2004 to 2009 has been taken into account.

In order to construct the twelve sub-indexes, various indicators were selected to properly represent the different concepts under analysis. For each type of dimension, a list of potential indicators was established. Despite the growing literature on digital inequalities and e-Inclusion, it

<sup>1</sup> OECD (2008).

is not yet possible to find fully consolidated and reliable quantitative datasets and indicators to provide a broad quantitative perspective and facilitate benchmarking for monitoring the process of e-Inclusion. In order to find indicators able to represent dimensions and sub-dimensions of the e-Inclusion concept we have consulted a number of databases containing information on ICTs (see Box 1).

Starting from a list of variables and following the analyses subsequently conducted, a final selection have been made of the indicators considered most representative of each dimension and sub-dimension. The final selection of the indicators had taken into account the following criteria:

- The availability of the data (and their quality) for a large number of EU countries;
- The results of multivariate analyses. Principal components analysis (Pca) has been carried out to analyse the underlying nature of the data, to explore whether the different dimensions are statistically well-balanced and to reveal how different indicators are correlated and change in relation to each other.
- The relevance of a particular indicator for contributing to the main goals of the index.

Following the selection of the indicators, the data set has been completed for the years 2004 to 2009, whereby missing values has been estimated (see Box 2).

### **Box 1 – The selection of the databases**

The database with the largest quantity of information related to the diffusion and use of ICTs is undoubtedly that of Eurostat, as a result of its institutional task of providing material useful for benchmarking the process of e-Inclusion as requested in numerous interventions by the European Commission.

Other databases, which contain interesting information, although emphasizing more the economic side, are those provided by the OECD and by the WDI.

Finally, the ITU database is also available, which pays careful attention to recording the changes in the technological infrastructure and costs.

### **Box 2 – The calculation of the missing data**

The technique to calculate the missing data is based on the application of the principal component analysis (Pca). An analysis was conducted for each year which took into account all the variables showing complete data in all European countries. This analysis produced the first principal component, and the component scores for each of the 27 European countries were saved.

These component scores are expressed in the form of standard values of a linear mix of all the variables entered in the analysis, and represent the best possible synthesis of the data.

### **Box 3 – The calculation of the e-Inclusion Index**

The index of each sub-dimension is calculated as the arithmetic mean of the number of indicators included in the latter. The calculation of indexes using the arithmetic mean is made necessary for the purpose of normalizing the various indexes and sub-indexes with respect to the different number of indicators each time used.

Once all the indexes of a given sub-dimension have been calculated, the index of the dimension may be calculated. The procedure consists in calculating the arithmetic mean by adding the values of the indexes of the sub-dimensions and dividing by their number.

The calculation of the e-Inclusion Index consists in the arithmetic mean between the indexes of the three dimensions:  $(\text{Access} + \text{Usage} + \text{Impact})/3$ .

The normalization technique selected makes it easier to read the results obtained from the various indexes. If a country registered the maximum value, that is 1, for all the indicators, then the final result of the e-Inclusion index would also be equal to 1. This would represent the maximum level of inclusion possible, equal to 100% of the population.

According to the above, the various values of each single country on the e-Inclusion index considered over the years may also determine the adjustment path towards maximum inclusion at diachronic level.

## The dimensions of Access

The availability of a good technological infrastructure and of a qualitative connection is the *sine qua non* condition for a positive outcome of the technological appropriation process. On the basis of this consideration, the access dimension has been broken down into three sub-dimensions, which are able to shed light on various aspects of the real access opportunities offered to individuals: *network, affordability, availability and quality*.

### **Box 4 – Sub-dimensions and indicators of Access Index**

Starting with an initial dataset comprising 35 indicators, on which a number of “quality” inspections and analyses in principal components were conducted to identify the most significant factors, we obtained a final dataset containing the following 10 indicators divided between the three access sub-dimensions:

**NETWORK:** *broadband penetration rate; International Internet Bandwidth per inhabitant (bit/s); Secure Internet servers (per 1 million people);*

**AFFORDABILITY:** *Information and Communication technology expenditure per capita (US\$);*

**AVAILABILITY and QUALITY:** *Internet subscribers (DSL); Internet subscribers (total fixed broadband) per 100 inhabitants; Internet subscribers (total fixed) per 100 inhabitants; Level of Internet access of households; Percentage of households using a broadband connection; percentage of households using a DSL connection.*

The *network sub-dimension* comprises the indicators that describe the degree of development of the infrastructure which makes it possible, and makes the difference in terms of quality, to use the Internet. In the aim of providing information on the network existing in Europe and in the various Member States, three indicators have been used: *broadband penetration rate, International Internet Bandwidth per inhabitant, Secure Internet Service per 1 million people*.

The role played by the *affordability sub-dimension* is related to the economic cost of using the Internet which represents a major and direct obstacle to its diffusion. Unfortunately, there are no indicators available to directly measure the presence of such obstacle, such as, for example, those designed to register the cost of tariffs<sup>2</sup>. There is only one indicator available (the fixed broadband Internet access tariffs per month) which helps to determine the value of the Price Basket<sup>3</sup> recently developed by ITU and WDI. Unfortunately, this indicator is available only for the year 2008 and, consequently, it cannot be applied to the dynamic approach adopted in this study. Therefore, in order to register the role played by the cost variable it was deemed appropriate to use the Information and Communication Technology expenditure per capita indicator, developed by WDI, which is available for a sufficient number of years<sup>4</sup>.

Finally, the third dimension - the *availability and quality* of Internet connections - comprises indicators describing the conditions of user access. In the latter case, emphasis is placed on the availability of a network and on its quality. The indicators which refer to the diffusion of subscriptions to the Internet constitute a sort of “framework” on which the indicators connected to the actual access to the Internet on the part of households and individuals is based (*Level of Internet access of households; Percentage of households using a broadband connection; percentage of households using a DSL connection*).

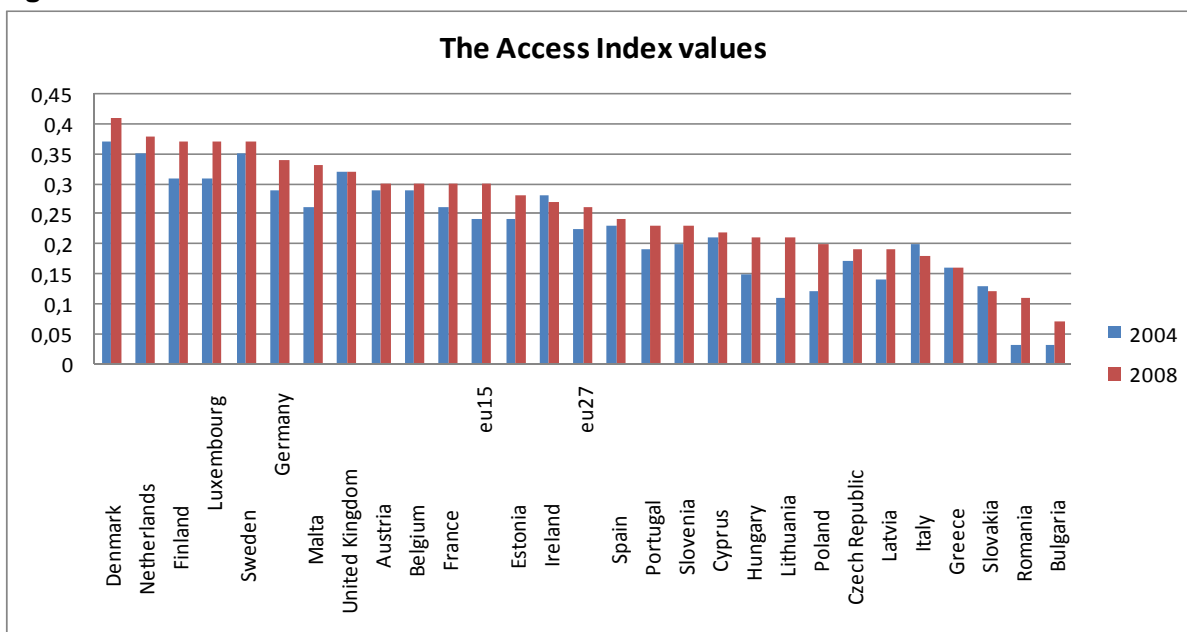
<sup>2</sup> At least, there are not indicators available for past years, from 2004 for instance.

<sup>3</sup> The Price Basket contains three indicators: 1- Fixed broadband Internet access tariffs per month (in US\$ or PPP), 2- Mobile cellular prepaid tariff per month (in US\$ or PPP), 3- Residential fixed line telephone tariff per month (in US\$ or PPP).

<sup>4</sup> This indicator is available from the database of WDI from 2003 to 2007. In order to obtain the data related to 2008, an estimate was made.

A joint reading of the indicators selected depicts a rather complex Internet access situation in Europe (see Fig.1)<sup>5</sup>. First, it indicates a slight increase of what may be defined as the Internet access infrastructure for the European countries (EU27) as a whole. Secondly, it shows a different speed for each of the various groups of European countries: the EU-15 increased from 0,28 in 2004 to 0,30 in 2008, while the EU-27 from 0,22 to 0,26.

**Fig. 2 - The Access Index Values**



Now, if we classify the European countries into various groups on the basis of the Index values registered in the period 2004-2008, we obtain an overview of the main trends and of the most significant differences across countries (see Tab. 2). The front runner group (their value of the Access Index was 0,38 in 2008) includes a platoon of countries - Denmark, Netherlands, Sweden, and Finland – which is relatively stable (except for sporadic changes registered in the past). Next to these countries, on the other hand, are Luxembourg and UK, both of which occupy a fluctuating position. Such variable position is mostly due, in the case of Luxembourg, to a delay registered in the past regarding broadband penetration while in the case of the UK is to be attributed to a more limited amount of the ICT expenditure per capita.

Also in the case of group 2 (Germany, Austria, Belgium, and France), a certain stability of composition was registered with lower values compared to the first group for all the indicators used. It should be noted, however, the relatively positive performance of these countries, which enabled the group to rank above the EU-15 average for several years.

In the third group, a stable performance was registered on the part of countries such as Italy, Spain, Slovenia, Portugal, and Cyprus combined with the fluctuating positions of Lithuania, Czech Republic, and Hungary. But the technological infrastructure of these three countries, despite a slight improvements in the diffusion of broadband, is still rather weak, as shown by the values of indicators fluctuating between those of the last two groups. In the group 4 many countries of Central and Eastern Europe figure on a regular basis, with the addition of Greece and more recently, in 2008, of Italy.

One should also note that Group 1 constantly registered values which are more than double – and often even triple – than those registered by Group 4. These substantial differences can also be found if we compare Group 2 with Group 4, thus offering evidence of the existence of a multi-speed Europe in the Access performance.

<sup>5</sup> The 2009 data were not yet available for some indicators so the Access sub-dimension has been analyzed for the period from 2004 to 2008 while we could update the other two sub-dimensions (usage and impact) up to 2009.

**Tab. 1 – Access Index in groups of countries**

Year	Group 1	Group 2	Group 3	Group 4
<b>2008</b>  EU27 = 0,26 EU15 = 0,30	Denmark Netherlands Finland Luxembourg Sweden Germany <b>Group 1 = 0,37</b>	Malta United Kingdom Austria Belgium France Estonia Ireland <b>Group 2 = 0,30</b>	Spain Portugal Slovenia Cyprus Hungary Lithuania Poland <b>Group 3 = 0,22</b>	Czech Republic Latvia Italy Greece Slovakia Romania Bulgaria <b>Group 4 = 0,15</b>
<b>2007</b>  EU27 = 0,23 EU15 = 0,29	Sweden Netherlands Denmark Luxembourg Finland United Kingdom <b>Group 1 = 0,37</b>	Germany Belgium Austria France Ireland Estonia Malta <b>Group 2 = 0,28</b>	Spain Slovenia Italy Cyprus Lithuania Portugal <b>Group 3 = 0,19</b>	Czech Republic Latvia Hungary Greece Slovakia Poland Bulgaria Romania <b>Group 4 = 0,12</b>
<b>2006</b>  EU27 = 0,25 EU15 = 0,31	Denmark Netherlands Sweden Finland Luxembourg United Kingdom <b>Group 1 = 0,39</b>	Germany Belgium Austria Estonia Ireland France Malta <b>Group 2 = 0,30</b>	Spain Slovenia Italy Portugal Czech Republic Latvia <b>Group 3 = 0,22</b>	Hungary Lithuania Cyprus Poland Slovakia Greece Bulgaria Romania <b>Group 4 = 0,14</b>
<b>2005</b>  EU27 = 0,21 EU15 = 0,27	Denmark Sweden Netherlands Luxembourg United Kingdom <b>Group 1 = 0,35</b>	Finland Belgium Germany Austria France Ireland Malta Estonia <b>Group 2 = 0,27</b>	Spain Italy Slovenia Cyprus Portugal Czech Republic Hungary <b>Group 3 = 0,17</b>	Greece Lithuania Latvia Slovakia Poland Bulgaria Romania <b>Group 4 = 0,09</b>
<b>2004</b>  EU27 = 0,22 EU15 = 0,28	Denmark Netherlands Sweden United Kingdom Finland Luxembourg <b>Group 1 = 0,34</b>	Austria Belgium Germany Ireland France Malta <b>Group 2 = 0,28</b>	Estonia Italy Spain Cyprus Slovenia Portugal Czech Republic Greece <b>Group 3 = 0,21</b>	Hungary Latvia Slovakia Poland Lithuania Bulgaria Romania <b>Group 4 = 0,10</b>

By a regression analysis we were able to identify the different contribution over time of the various sub-dimensions to the patterns and trends of Access Index data. The results show a stable significant contribution from the *network* sub-dimension and an equally strong and increasing contribution from the *availability and quality* sub-dimension. On the other hand, the *affordability* sub-dimension reveals much lower and significantly decreasing values. One should note that our affordability indicator measures the propensity to expenditure in the ICT sector rather than the costs of Internet access in the various countries. Therefore the decreasing contribution of affordability in explaining the dynamic of Access must be interpreted as the result of the increasingly reduced impact of ICTs upon per-capita expenditure. In other words, as the costs (prices) of access to ICTs has decreased in more recent period – specifically for the broadband connection – the impact of expenditure has decreased as well.<sup>6</sup> This does not imply, however, that the economic dimension has become irrelevant in determining our access Index. If we break down the data across countries, the role of affordability dimension shows persistent differences: a significant reduction occurred in the countries with the higher income per-capita whilst, conversely, the index values increased in the lower per-capita countries.

**Tab. 2 – Contribution of each single dimension to the construction of the Access Index**

	Network	Affordability	Availability and Quality
<b>2008</b>	.454	.133	.473
<b>2007</b>	.364	.228	.444
<b>2006</b>	.398	.238	.407
<b>2005</b>	.385	.269	.387
<b>2004</b>	.430	.305	.302

Beta coefficients values.

<sup>6</sup> CEC, (2009<sub>a</sub>).

## The dimension of Usage

The development of Internet applications, the broadening of the user base, the difference in the ability to use the new technologies are the elements which have led digital inequality researchers to coin new expressions for the various forms of divide: “digital use divide”, “second digital divide” and so on. As set out in our study, identifying new forms of differentiation in the use of the Internet becomes essential when the access dimension loses its significance, in favor of the dimension that measures the actual empowerment of individuals in their daily lives. The hypothesis formulated in this paper is that, in order to verify such empowerment, a more intense use of the Internet, under conditions which are fit to guarantee a full technological appropriation of the means, is required. In other words, individuals must “use” and “know how to use” the web.

In order to describe and monitor such use, an *ad hoc* index was constructed (Usage Index), which is the result of the synthesis of indicators which measure autonomy (place of connection), intensity (frequency of connection) and ability (skills).

The two dimensions of autonomy and frequency of use are the indispensable prerequisite to universal digital inclusion. The same autonomy and frequency of use are then reflected on the acquisition of skills necessary to concretely seize the opportunities offered by the web. From an operational point of view, this has led to a selection of the 11 indicators for the three sub-dimensions identified.

In addition to the aforementioned “general” internet users indicator, we have included indicators which can help to measure the degree of autonomy of individuals in using the web. Obviously, the condition of maximum autonomy occurs in the case of a ubiquitous use of the internet: this is exactly what is offered by Wi-Fi connections through the use of handheld computers. Unfortunately, the available data provided by Eurostat (on the connecting device used such as the mobile or handheld computer) are fragmented and, for many countries, they are incomplete and show very low performances.

### **Box 5 – The sub-dimensions and indicators of the Usage Index**

For the three subdimensions of *usage* the following 11 indicators have been used:

*AUTONOMY: percentage of individuals who accessed Internet at home; percentage of individuals who accessed Internet at place of work; percentage of individuals who accessed Internet at place of education;*

*INTENSITY: percentage of individuals who accessed Internet every day or almost every day; percentage of individuals who accessed Internet at least once a week;*

*SKILL: individuals who have copied or moved a file or folder; individuals who have used copy or cut and paste tools to duplicate or move information on screen; individuals who have used basic arithmetic formulae; individuals who have compressed files; individuals who have written a computer program; individuals who have connected and installed new devices.*

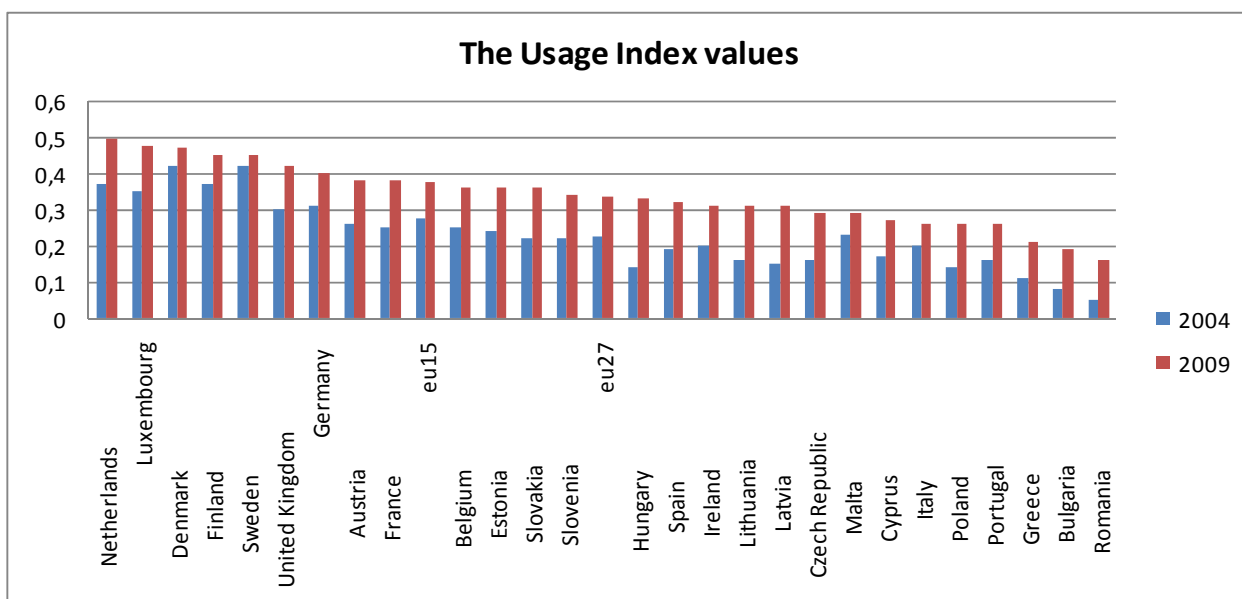
As regards the place of connection, in 2009, approximately one third of the internet users in the EU-15 countries connected from home, from the place of work or from the place of education. Over a five-year period, there was a significant increase of such values, rising from 0,24 (2004) to 0,36 (2009). If we take Europe as a whole (EU-27), these values, although increasing, are lower (0,20 in 2004 and 0,32 in 2009).

As to the intensity of Internet access of individuals, it is interesting to note the increasing importance of the Internet in the daily life of individuals: in 2009, approximately one third of the EU-15 community navigated the net on a daily basis or, at least several times a week. If we consider the EU-27, this figure is lower although it still reveals a good figure.

Finally as to Internet skills, from 2004 to 2009 the average value of the EU-27 increased from 0,29 to 0,39 whilst that of the EU-15 from 0,36 to 0,44.

The values of the Usage Index, which was constructed on the basis of the indicators described in Box 5, are represented in Fig.3.

**Fig. 3. The Usage Index Values**



First one should note the significant increase in index values for all the European countries over the period here considered (2004-2009): the EU-15 index increased from 0.28 to 0.38 and from 0.23 to 0.34 in the case of the EU27.

There are significant differences, however, across individual country performances in the same period:

- there are “consolidating performances” – such as those manifested by countries with a solid technological tradition as in the cases of Netherlands, Denmark, Finland, and Sweden. Their indexes did increase significantly over the period (with a performance that is almost equal to or slightly higher than average), and registered the highest values by virtue of their good initial conditions;
- there are “virtuous performances” – such as those manifested by countries which have been able to quickly recover lost ground in their digitalization process as in the cases of Austria, France, and Hungary, which increased their indexes higher than average, thus revealing a rapid diffusion in the usage of Internet;
- finally, there are “resigned performances” – such as those manifested by countries which are stuck in a situation of digitalization backwardness as in the cases of Italy – which started from an unfavorable initial condition and performed below the European average

Also in the case of the Internet Usage, we classified the EU27 countries into four groups according to the average values of their Indexes (see Tab.8)<sup>7</sup>.

<sup>7</sup> The four groups of countries have been derived by calculating the quartiles’ value obtained in the single frequency distributions.

**Tab.3 - Usage Index in groups of countries (2004-2009)**

Year	Group 1	Group 2	Group 3	Group 4
2009  EU 27 = 0,34 EU 15 = 0,38	Netherlands Luxembourg Denmark Finland Sweden United Kingdom <b>Group 1 = 0,46</b>	Germany Austria France Belgium Estonia Slovakia Slovenia <b>Group 2 = 0,37</b>	Hungary Spain Ireland Lithuania Latvia Czech Republic Malta <b>Group 3 = 0,31</b>	Cyprus Italy Poland Portugal Greece Bulgaria Romania <b>Group 4 = 0,23</b>
2008  EU 27= 0,32 EU 15= 0,36	Netherlands Denmark Finland Luxembourg Sweden <b>Group 1 = 0,46</b>	Germany United Kingdom Austria France Slovakia Belgium Estonia Slovenia <b>Group 2 = 0,35</b>	Hungary Ireland Spain Czech Republic Lithuania Latvia Malta <b>Group 3 = 0,28</b>	Italy Portugal Cyprus Poland Greece Bulgaria Romania <b>Group 4 = 0,20</b>
2007  EU 27= 0,30 EU 15= 0,34	Netherlands Denmark Luxembourg Finland Sweden Germany <b>Group 1 = 0,43</b>	Austria United Kingdom Belgium Estonia France Slovenia Slovakia <b>Group 2 = 0,33</b>	Hungary Spain Ireland Latvia Lithuania Czech Republic Malta <b>Group 3 = 0,27</b>	Poland Portugal Cyprus Italy Greece Bulgaria Romania <b>Group 4 = 0,19</b>
2006  EU 27= 0,27 EU 15= 0,32	Denmark Sweden Netherlands Finland Luxembourg Germany <b>Group 1 = 0,42</b>	United Kingdom Austria Belgium Estonia Slovenia <b>Group 2 = 0,32</b>	Spain Hungary Slovakia France Ireland Czech Republic Latvia Lithuania Malta <b>Group 3 = 0,24</b>	Cyprus Italy Portugal Poland Greece Bulgaria Romania <b>Group 4 = 0,17</b>
2005  EU 27= 0, 25 EU 15= 0,30	Denmark Sweden Netherlands Luxembourg Finland United Kingdom <b>Group 1 = 0,40</b>	Germany Austria France Belgium Estonia Slovenia Slovakia <b>Group 2 = 0,29</b>	Spain Hungary Malta Latvia Portugal <b>Group 3 = 0,20</b>	Czech Republic Ireland Italy Lithuania Cyprus Poland Bulgaria Greece Romania <b>Group 4 = 0,16</b>
2004  EU 27= 0,23 EU 15= 0,28	Denmark Sweden Finland Netherlands Luxembourg Germany <b>Group 1 = 0,37</b>	United Kingdom Austria Belgium France Estonia Malta <b>Group 2 = 0,26</b>	Slovenia Slovakia Ireland Italy Spain Cyprus <b>Group 3 = 0,20</b>	Czech Republic Lithuania Portugal Latvia Hungary Poland Greece Bulgaria Romania <b>Group 4 = 0,13</b>

Group 1 comprises a hard core of countries (the Netherlands, Denmark, Sweden, Finland and Luxembourg) - plus UK in 2009 – which registered the highest performances (their index was even three times higher than those of the last group). In the group 2 there are countries which were able to improve significantly their performance in terms of internet usage though they had a medium quality access infrastructure, as in the case of Estonia. The countries included in Group 3, such as Malta, Spain and some Eastern European countries, and in the last group confirmed in the period here considered a significant backwardness with respect to both Internet usage and access infrastructures: the gap which divides this two groups from the first one was and still is very high.

The usage data thus offer the confirmation of a multi-speed Europe. Furthermore these data essentially confirm, on the one hand, the importance of the technological infrastructure in the diffusion of the Internet – in fact, not a single low-performing country in the Access Index ranks among the best performing countries in terms of Internet usage – and, on the other hand, they underline the key role of individuals who use the Internet also under conditions of low quality and slow speed of connection.

The data relating to some of the countries that have recently joined the EU indicate, on the one hand, the willingness of the population to use the internet and, on the other hand, the need to stimulate the development of technological infrastructures so as to increase the number of possible applications and their take-up by the community

## **The Digital Usage Divide : where does Europe stand?**

The goal of promoting a more inclusive information society such as it was formulated in the i2010 initiative implies that to all individuals should be offered the possibility of gaining access to ICTs. More specifically, the Riga Ministerial Declaration identified and proposed a set of well-defined parameters that can help to monitor the state of progress of the digital inclusion process: “to convincingly address e-Inclusion, the differences in Internet usage between current average use by the EU population and use by older people, people with disabilities, women, lower education groups, unemployed and ‘less-developed’ regions should be reduced to a half from 2005 to 2010”<sup>8</sup>. Based on these goals – we decided to calculate the Usage Index with reference to seven disadvantaged groups (*individuals aged from 55 to 64, individuals aged from 65 to 74, women, individuals with no or low formal education, the unemployed, retirees and other inactive individuals living in sparsely populated areas*) in order to verify whether or not the gap in Internet usage has been reduced.

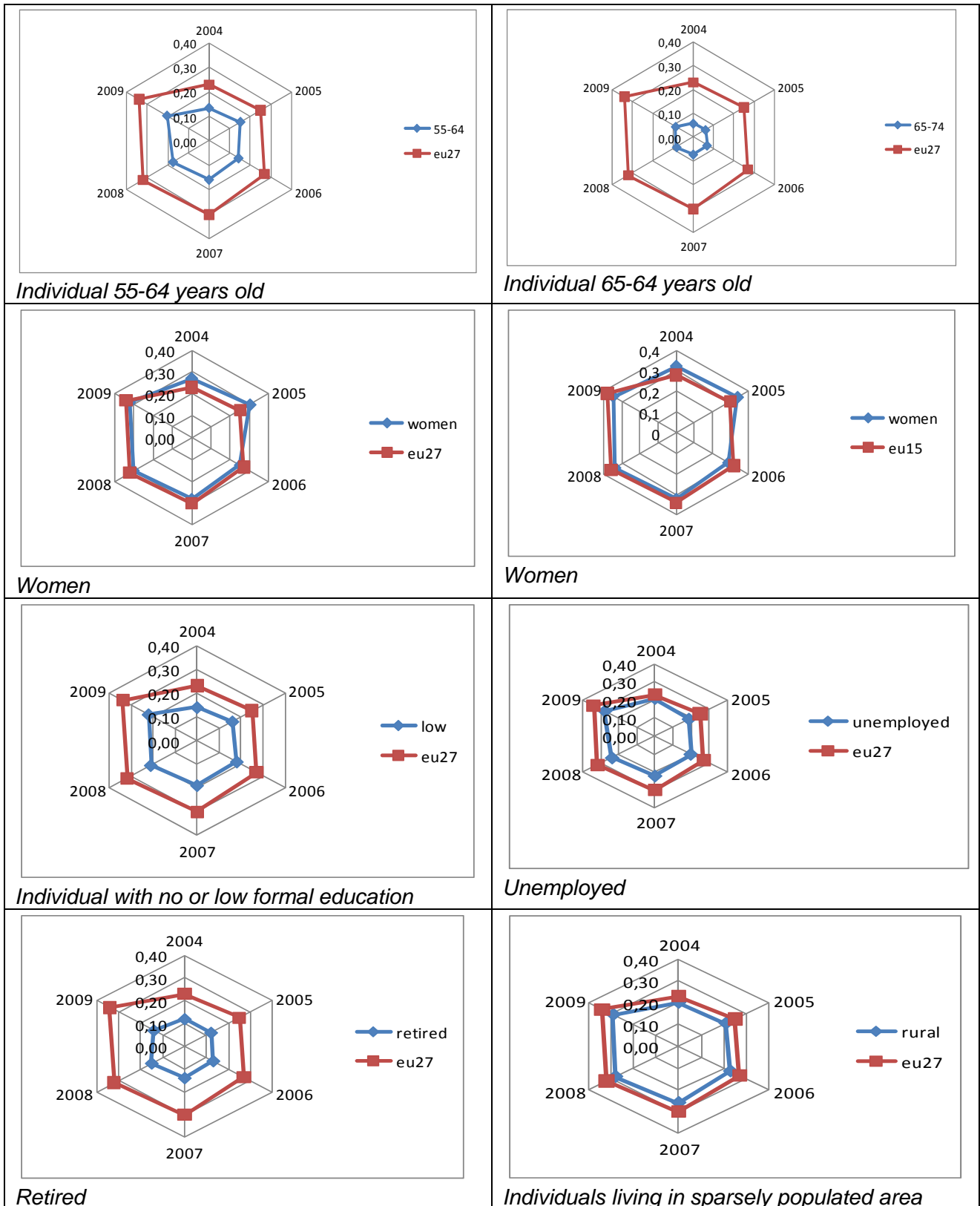
Looking first at internet usage among older people, we immediately notice a huge gap between this group and the EU population as a whole, which confirms that older citizens are still very far from the technological world. As to the group 55-64 years old, the number of older people using internet, however, has been increasing during recent years (a yearly increase of 2 points in the period 2006-2008), although it remained well below the European average. It is important to note that, in the case of the “high-performing” group of countries with respect to internet diffusion and usage, the Index values relating to older people groups (aged 55-64) are higher than the overall European average.

With regards to the subsequent age bracket (from 65 to 74), which is divided from the employment world and the technological universe even more than the previous one, the related Index values indicate a gap of 17 points in 2004 and 25 in 2009 with respect to the EU average, thus revealing in this case a widening divide. As in the previous age bracket, however, the lesser use of the internet on the part of older people does not spread evenly across countries.

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<sup>8</sup> The Riga Ministerial Declaration was approved unanimously on 11 June 2006 in Riga, Latvia. The text of Declaration is available at:  
[http://europa.eu.int/infromation\\_society/events/ict\\_riga\\_2006/doc/declaration\\_riga-pdf](http://europa.eu.int/infromation_society/events/ict_riga_2006/doc/declaration_riga-pdf).

**Fig. 4 – Disparities in the Usage Index in disadvantaged groups**



Also retired persons are definitely “lagging behind”: in 2004, the group’s performance was 11 points below the EU-27 average; in 2009, this gap widened to 20 points. A comparison with the EU-15 values provides additional negative confirmation of the lagging condition of this group.

It is evident that these data, together with those related to individuals aged between 65 and 74, confirm the difficult relationship that exists between older people and new ICT technologies.

As to other traditionally disadvantaged groups, it is interesting to note that women, performed nearly as well as the European average (at least that of the EU-27) with respect to Internet usage. Over the course of the years considered in our study, women improved their position which was only two points away from the EU-27 average in 2009: 0.32 versus 0.34. Consequently, at least for this group, the Riga objectives have been achieved. In the next few years, however, monitoring should be continued taking as reference the EU-15. In that context, a 3-point gap still divided the index values obtained with respect to the female population (0.35) from those relating to the EU as a whole (0.38) in 2009.

The group of individuals with a low or no level of education also registered a positive trend. Its index value increased over the course of time (from 0.14 in 2004 to 0.22 in 2009), showing a moderate digital improvement. In reality, this was only a partial improvement, given that the index continued to perform much below the European average and the gap widened in the course of the years (9 points in 2004 and 12 in 2009).

Individuals belonging to the unemployed group show a gradual progression of their Index from a value of 0.21 in 2004 to 0.28 in 2009, with a total increase of approximately 7 points. Such progress can be partially attributed to the presence in the group of a large number of young people, who face difficulties in first entering the labor market but are quite familiar with the digital world.

The last group of disadvantaged individuals considered comprises persons who live in sparsely populated areas (less than 100 inhabitants). This is the group which is most subject to the difficulties connected to the presence of weak technological infrastructures, with obvious consequences in terms of availability and quality of connection. At any rate, the data show that the group is moving gradually closer to the European average: in 2009, for example, compared to the EU-27 average of 0.34, the group's Index was 0.29, that is, a 5-point gap, the same as in 2004 – the first year of the period here considered.

To sum up, the Usage Index values for the disadvantaged groups show the following trends in terms of digital inclusion:

- a- the groups of individuals aged between 65 and 74 and that of retired persons confirm the major and long-lasting difficulties in the appropriation of domestic technologies, showing low performances and moderate increases compared to the European average;
- b- the group of individuals aged between 55 and 64 shows some progress, although it still maintains a large gap as against the EU-27 average;
- c- in more recent years, the women's group registered the most significant increase and achieved its Riga target;
- d- the group of individuals living in sparsely populated areas has recently had a very positive performance, ranking immediately below the European average.
- e- the group of individuals with a low or no level of education and that of the unemployed are still lagging far behind the European average, despite some improvements.

### **The dimensions of Impact**

In the definition of e-Inclusion adopted in our study, an important role is played along with the internet access and usage by the Internet impact dimension, that is, the whole area in which the positive effects of individual and social empowerment resulting from the appropriation of technology are felt.

From an empirical research perspective, however, assessing the impact of digital inclusion is often very difficult due to a lack of evidence and data. In this study by taking into account the interpretation of e-Inclusion offered by the Riga Conference – “it can improve economic performance, employment opportunities, quality of life, social participation and cohesion” – we have identified a certain number of sub-dimensions and various indicators. The sub-dimensions that were examined are the following: *economic, employment and labor, educational, health, government, culture, communication and entertainment*. (For the indicators see Box 6).

## Box 6 – The indicators of the Impact Index

Based on an initial dataset comprising 31 indicators, which were subjected to “quality” tests and principal component analyses so as to identify the most significant factors, we have come up with a final dataset containing 22 indicators.

The list of indicators used for our analysis is the following:

**EDUCATION:** *Percentage of individuals who used Internet for training and education; Percentage of individuals who used Internet for looking about education, training and course offers; Percentage of individuals who used Internet for doing an online course;*

**LABOR:** *Percentage of individuals who used Internet for looking for a job or sending a job application; Percentage of persons employed using computers connected to the Internet in their normal routine;*

**HEALTH:** *Percentage of individuals who used Internet for seeking health information on injury, disease or nutrition;*

**GOVERNMENT:** *Percentage of individuals who used Internet for obtaining information from public authorities web sites; Percentage of individuals who used Internet for downloading official forms; Percentage of individuals who used Internet for sending filled forms; Percentage of individuals who used Internet for interaction with public authorities;*

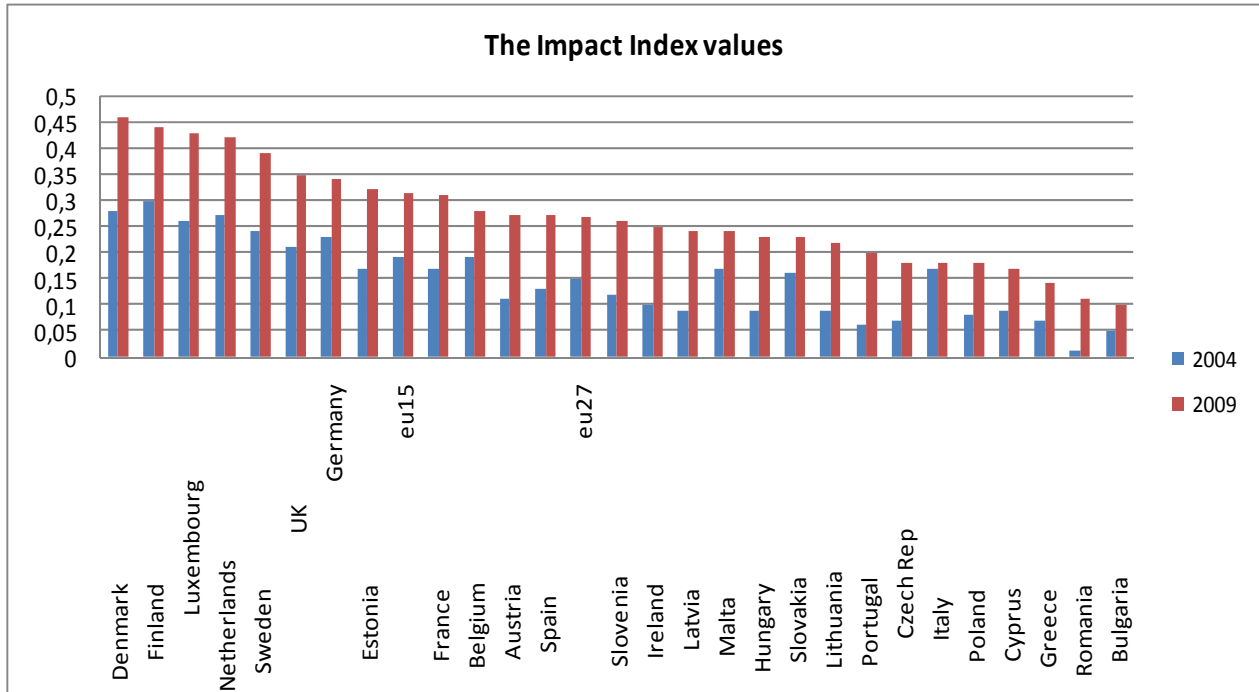
**ECONOMIC:** *Percentage of individuals who used Internet for Internet banking; Percentage of individuals who used Internet for selling goods and services; Percentage of individuals who used Internet for using services related to travel and accommodation;*

**COMMUNICATION, CULTURE AND ENTERTAINMENT:** *Percentage of individuals who used Internet for sending /receiving e-mails; Percentage of individuals who used Internet for playing/downloading games and music; Percentage of individuals who used Internet for reading/downloading online newspapers/news magazines; Percentage of individuals who used Internet for listening to Web radios / for watching Web television; Percentage of individuals who ordered film/music, books/magazines/e-learning material or computer software; Percentage of individuals who used Internet for downloading software; Percentage of individuals who used Internet for other communication uses (chat, etc.); Percentage of individuals who used Internet for subscribing to news services or products to receive them regularly.*

Before analyzing each sub-dimension, it is worthwhile to examine the overall Internet Impact Index.

First, over the period 2004-2009 period, the performance of the Impact Index improved constantly and significantly for the various European groups (from 0,19 to 0,32 and from 0,15 to 0,27 in the EU15 and EU27 respectively). If we consider the performance of individual countries, however, we notice great differences, which were even more pronounced than those with respect to access and usage dimensions. On one hand there are countries which showed a very rapid growth pattern, so that their impact Index increased around 10 points; on the other hand, there are countries which registered very limited progress. In the first group, characterized by what can be defined as a “technological enthusiasm”, are countries such as Austria (+16), Finland and Denmark (+ 16); in the second group figure Greece (+7), Malta (+7) and Italy (1), dominated by what may be defined as “technological indifference”.

**Fig. 5 - Impact Index values**



As done for the other two dimensions, we constructed four groups of countries in relation to the values of the Impact Index to have an overall view. Group 1, which comprises traditionally “strong” countries in terms of Internet diffusion such as those of Northern Europe, later joined by Germany and the UK, constantly outperformed the EU-27 and EU-15 average. 20-point gap in terms of the Impact Index divide this first group from the last group (Poland, Greece, Romania and Bulgaria) and confirm the different speeds at which the two set of countries are transforming their everyday life as a result of internet use and diffusion. It is also important to note that this gap has been increasing over the course of time: 19 points separated the two groups in 2004, 20 in 2005, 23 in 2006, 25 in 2007, and 27 in 2009.

Group 2, lagging behind the first group by 13 points in 2009, shows gradual but smaller improvements (their Index increased 11 points). This group includes many countries which possess a good technological infrastructure and have always promoted the “internet culture”, as in the cases of Estonia, Ireland, and Slovenia. In addition, there are other countries which are permanently fluctuating between an outstanding and a good position, namely Austria, Belgium and Luxembourg. Group 3, which constantly performed below the European average, comprises countries having different profiles: some of them are geared toward improvement, fluctuating between group 2 – Ireland and Spain, for example – others are stably positioned in the group – Malta and Latvia, for example – and others still which are poised to join group 4 – Italy, Cyprus and Czech Republic.

**Tab. 4 - Impact Index in groups of countries**

Year	Group 1	Group 2	Group 3	Group 4
2009  EU27= 0,27 EU15= 0,32	Denmark Finland Luxembourg Sweden Netherlands UK <b>Group 1 = 0, 42</b>	Germany Estonia France Belgium Austria Spain Slovenia <b>Group 2 = 0, 29</b>	Ireland Latvia Malta Hungary Slovakia Lithuania Portugal <b>Group 3 = 0, 23</b>	Czech Rep Italy Poland Cyprus Greece Romania Bulgaria <b>Group 4 = 0, 15</b>
2008  EU27= 0, 21 EU15= 0, 26	Finland Denmark Netherlands Luxembourg Sweden France <b>Group 1 = 0, 34</b>	Germany UK Estonia Austria Spain Ireland Slovenia <b>Group 2 = 0, 24</b>	Belgium Hungary Latvia Slovakia Malta Lithuania Portugal <b>Group 3 = 0, 18</b>	Czech Rep Italy Poland Cyprus Greece Romania Bulgaria <b>Group 4 = 0, 12</b>
2007  EU27= 0, 21 EU15= 0, 26	Denmark Finland Netherlands Luxembourg Germany Sweden <b>Group 1 = 0, 36</b>	UK France Estonia Austria Slovenia Belgium Spain <b>Group 2 = 0, 22</b>	Ireland Hungary Malta Lithuania Slovakia Latvia Portugal <b>Group 3 = 0, 17</b>	Cyprus Italy Czech Rep Poland Greece Bulgaria Romania <b>Group 4 = 0, 11</b>
2006  EU27= 0, 18 EU15= 0, 22	Finland Netherlands Denmark Sweden Germany <b>Group 1 = 0, 33</b>	Luxembourg UK Belgium Estonia Slovenia Austria Slovakia <b>Group 2 = 0, 21</b>	Spain Ireland Lithuania Malta France Hungary Latvia Czech Republic <b>Group 3 = 0, 15</b>	Italy Portugal Poland Cyprus Greece Bulgaria Romania <b>Group 4 = 0, 10</b>
2005  EU27= 0, 15 EU15= 0,19	Finland Netherlands Sweden Denmark Luxembourg <b>Group 1 = 0, 27</b>	Germany UK Estonia France Belgium Slovenia Austria Malta <b>Group 2 = 0, 18</b>	Slovakia Spain Ireland Lithuania <b>Group 3 = 0, 12</b>	Hungary Italy Latvia Portugal Cyprus Poland Czech Republic Greece Bulgaria Romania <b>Group 4 = 0, 7</b>
2004  EU27= 0, 15 EU15= 0, 19	Finland Denmark Netherlands Luxembourg Sweden Germany <b>Group 1 = 0, 26</b>	UK Belgium Estonia France Italy Malta Slovakia <b>Group 2 = 0, 18</b>	Spain Slovenia Austria Ireland <b>Group 3 = 0, 12</b>	Cyprus Hungary Latvia Lithuania Poland Czech Republic Greece Portugal Bulgaria Romania <b>Group 4 = 0, 7</b>

**The Internet Impact in everyday life**

Over the course of the years examined in this study, the increase of internet take-up in the various spheres of people’s daily lives has been constant and evenly distributed. We measured the weight of each sub-dimension on the construction of the Impact Index – and consequently the transformations that have occurred over time – by a regression analysis. Over the course of the years, many sub-dimensions of the impact-Index continued to register high growth rates, although the specific individual contributions slowly changed and new combinations emerged: in 2009, the economic area gained ground, becoming the top sub-dimension (.225), followed by those of health (.198), government (.196) and communication (.184). The role of the labor sub-dimension, on the other hand, was greatly reduced. These data confirm the progressive diffusion of Internet use in people’s daily lives in a perspective of individual and collective empowerment: from economic benefits to those deriving from a significant broadening of the spectrum of communication, cultural and entertainment opportunities available, from the gradual transformation of relations with public administrations to autonomous search for health information.

**Tab. 5 – The weight of each sub-dimension on the construction of the Impact Index**

	2004	2005	2006	2007	2008	2009
	Beta	Beta	Beta	Beta	Beta	Beta
<b>Economic Area</b>	.200	.244	.246	.220	.321	.225
<b>Labour Area</b>	.263	.223	.232	.152	.112	.135
<b>Educational Area</b>	.090	.086	.092	.122	.114	.123
<b>Health</b>	.231	.214	.211	.216	.142	.198
<b>Government</b>	.181	.162	.190	.203	.218	.196
<b>Culture, Communication</b>	.135	.169	.159	.140	.149	.184

Standard Error = .000

Looking first at the economic area – including e-banking, e-trading and e-travelling activities – it is important to note its gradual and constant annual rate of growth (around 2- 4 points) over the years. The existence of a multi-speed Europe is fully confirmed: in 2009, while the indexes of the Netherlands, Denmark and Finland reached 0.49 points, Romania, Bulgaria, Cyprus and Portugal, performed around the 0.10 level. In-between these two extremes, the other groups of countries fluctuate: immediately below the leading countries are Sweden (0.45), Luxembourg (0.43), UK (0.39) and Germany (0.36); slightly above the trailing countries are Italy (0.15), Poland (0.14), Hungary (0.13), Czech Republic (0.16). Finally, Spain (0.22), Austria (0.24), Belgium (0.32), Estonia (0.29), and France (0.30) are positioned in the middle.

The employment and labour area, on the other hand, is broadly stable. Worthy of note is the good performance of Finland, with a substantial lead over the EU-27 average of 15 points. Other particularly positive performances can be observed in the countries of Northern Europe, while Romania, Bulgaria, Portugal, Czech Republic, and Poland continue to be among the worst performers.

The educational area showed a significantly positive trend over time. The opportunity to follow online courses – whether formal or informal and on the most varied subjects – appears to be particularly welcome by European citizens.

Another very popular activity among European citizens is the search for health information on the internet. This sub-dimension, which has been constantly growing by 18 points, is one of the most dynamic over time. In this area, in 2009, the countries of Northern Europe occupy the top position - Finland (0.56), the Netherlands (0.50), and Denmark (0.46) – with Luxembourg (0.54), Germany (0.48) and France (0.37) are following closely behind. The lowest rates were registered, as in other cases, by Romania (0.16), Bulgaria (0.10) and Greece (0.15).

Conversely, the use of the internet for performing tasks involving the public administrations is still quite limited. The very low rates registered in many European countries clash with the numerous initiatives undertaken over the years for promoting the use of the internet with public authorities. Only in the cases where a fairly elaborate and advanced digital culture has long existed such as, for example, in the countries of Northern Europe, the rates registered are fairly high: in 2009, the Denmark achieved the highest score (0,50), followed by Netherlands (0.43) and Sweden (0.42).

The last sub-dimension containing indicators relating to communication (e-mail and other forms), entertainment (downloading music, game, movies), information (reading of newspaper), remediation of media (listening to radio, watching TV) and technological upgrading (downloading software) was particularly dynamic, registering 17-point increases in the period from 2004 to 2009. The greatest capacity in exploiting the new opportunities is once again attributed to Denmark (from 0.25 to 0.57), Sweden (from 0.25 to 0.44), Finland (from 0.29 to 0.43) the Netherlands (from 0.26 to 0.51) and the UK (from 0.20 to 0.47). The greatest difficulties, on the other hand, continue to be experienced in Romania (from 0.04 to 0.16), Bulgaria (from 0.08 to 0.18), and Greece (from 0.08 to 0.16).

### **Old and new forms of digital inequalities**

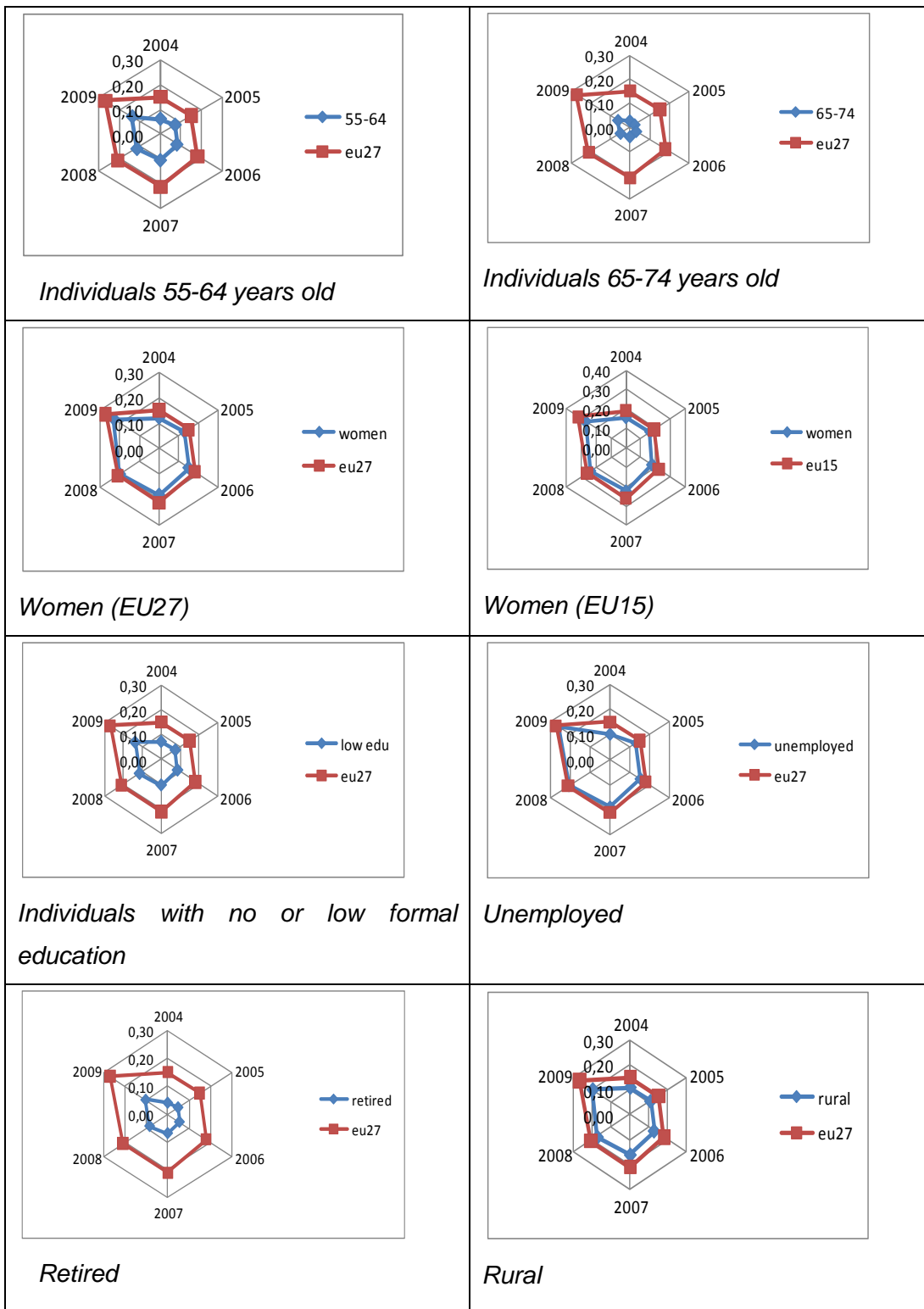
Major differences between the various European countries and a multi-speed Europe emerge from the Impact Index results shown above, not only in the development of technological infrastructures and in the diffusion of Internet use, but also in the individual empowerment resulting from the ability to seize the internet opportunities. This new and, in fact, more insidious digital divide is felt even deeper in traditionally disadvantaged groups, which rather than benefiting from the new opportunities, are almost completely left out of the ongoing transformations.

In this respect, it will suffice to analyze the data related to individuals aged between 55 and 64 years to be immediately reminded that, despite a constantly growing trend (one point yearly), the group is unable to narrow the 13-point gap separating it from the EU-27 average. In some areas the performance is particularly poor as in the case of the complex government sub-dimension, more often frequented by adult individuals faced with the complex and multi-form relations with public administrations. Another surprising element consists in the low performance shown by the economic sub-dimension. With a gap fluctuating between 4 and 7 points, the individuals included in this group show that they do not positively evaluate the benefits deriving from the online management of activities such as e-banking, the purchase of airline or railway tickets, or the trading of goods and services. Finally, limited interest is shown in the education, health and culture sub-dimensions. In all the cases, the divergence from the EU-27 average fluctuated at around 9 points (2009), albeit with lower peak rates for the traditionally digitally advanced countries.

A case of even greater and more general divergence can be observed in the group aged between 65 and 74 years, with a gap as against the average performance which is constantly and gradually widening (from 12 points in 2004 to 21 in 2009). Among the disadvantaged groups, the group of older people is positioned on an alternative trajectory to the main one, and such as to preclude the possibility of a major recovery in the medium term. The rootedness of the condition of foreignness to technology proper to this group, an issue already raised above with regards to the Usage Index, appears difficult to resolve with the traditional initiatives undertaken over the course of the years. Very similar values to those measured in this group of subjects can be found in the group of retired people. The slightly higher rates (4 points in 2009) that distinguish this group from that of the older people are perhaps to be attributed to the opportunities of technological familiarization that were presented to them in the past, when they still had a place in the labor market. Nevertheless, this group is also positioned outside the main trajectory, suggesting that it will not recover in the medium term.

A clear reversal of trend can be observed, on the other hand, in the women's group. With a very small gap as against the EU-27 average, as we have already observed in the usage dimension, this group has qualified for promotion and is poised to leave the so-called disadvantaged groups. Its performance on the Impact Index, moreover, is to be attributed to what is considered standard practice for all the sub-dimensions considered. Over the course of 2009, for example, women registered the same values obtained by the EU population as a whole in the educational and government sub-dimensions, whilst they obtained nearly identical values in the economic and culture sub-dimensions. As regards the health sub-dimension, women performed even better than the overall rates (0.35 versus 0.32). In the labour sub-dimension only, women registered much lower rates than those achieved by the EU as a whole (0.15 versus 0.27), indicating a recurrence of past difficulties with relations to the labor world.

**Fig. 6 – Disparities in the Impact Index in disadvantaged groups**



A similar performance to that of women was observed in the group of unemployed persons: they showed a 16-point recovery over a 6-year period and a 1-point gap as against the EU-27 average in 2009. A more detailed analysis of the values in all sub-dimensions provides us with a very interesting picture that is worthy of consideration. By reading the values related to 2009, for example, we observe a strong interest on the part of these individuals in exploiting the educational opportunities offered by the web (0.22 vs. 0.21) and in using the Internet in a work context (0.41 vs. 0.27). Given the unemployed status of the subjects, it appears evident that the indicator which measures the employment seeking activity through the internet prevails. Moreover, we observe a fairly strong interest (0.25 vs. 0.32) in using the Internet for

communication, entertainment and cultural activities. All these factors contribute to outlining the profile of the unemployed as “young” individuals, well familiarized with technology, and capable of utilizing it as a tool.

On the other hand, completely different trends can be observed with regards to individuals with a lack or low level of education. With a gap fluctuating between 13 and 14 points, these individuals testify to a great cultural distance from the world of technology. Such distance prevents them from exploiting the educational opportunities presented by the web and, at the same time, from interacting with the public administrations, carrying out business activities, and gaining access to the cultural and recreational offer made available by the web. In order to identify any policies and initiatives in the most effective way, a set of data on level of education and age bracket breakdown of the subjects examined would be useful. It will be important to note, in fact, the great difference separating a “young” individual with a low level of education from an “older” individual with a low level of education.

Lastly, the group living in sparsely populated areas continues to gain ground, showing a gap as against the EU-27 average of approximately 4-7 points. Moving on with the analysis of the values of Indexes for the year 2009, first of all it is important to note the diffusion of educational practices carried out on the web by the individual considered (0.18 vs. 0.21). Geographical and environmental constraints probably contribute to the adoption of these practices, which provide access to what would otherwise be inaccessible. The indexes which measure the diffusion of the activities included in the government sub-dimension (0.20 vs. 0.23) as well as in the economic sub-dimension (0.21 vs. 0.25) point in the same direction.

We can summarize our analysis of the Impact Index values in the so-called disadvantaged groups in terms of digital inclusion situation as follows:

- 1- The group of women is poised to leave the group of disadvantaged subjects in terms of digital inclusion;
- 2- The group of individuals aged between 55 and 64 years continues to progress slowly, although it is still performing far below the EU-27 average;
- 3- The group of individuals aged between 64 and 75 years and that of retired continue to experience great difficulties in gaining access to the digital world, although they show limited increase over time;
- 4- The group of individuals with a lack or low level of education has difficulties in using the internet to complete specific activities, which is reflected in the modest growth of the measured Index over the course of the years;
- 5- The group of unemployed, like that of women, gains ground with respect to the EU-27, with approximately a 2-point annual growth;
- 6- The group of individuals living in sparsely populated areas, finally, shows modest progress, which, however, brings it closer to the EU-27 value.

### **The European Index of Digital Inclusion (EIDI)**

The analysis articulated in single dimensions in the previous pages, can be now summed up in a single value, which is the European Index of Digital Inclusion. Though still under further elaborations, we are going to anticipate in this last part of our Report some main results related to the application of EIDI, in order to highlight its logical content and to show its usefulness in monitoring, assessing and benchmarking the digital inclusion processes in Europe.

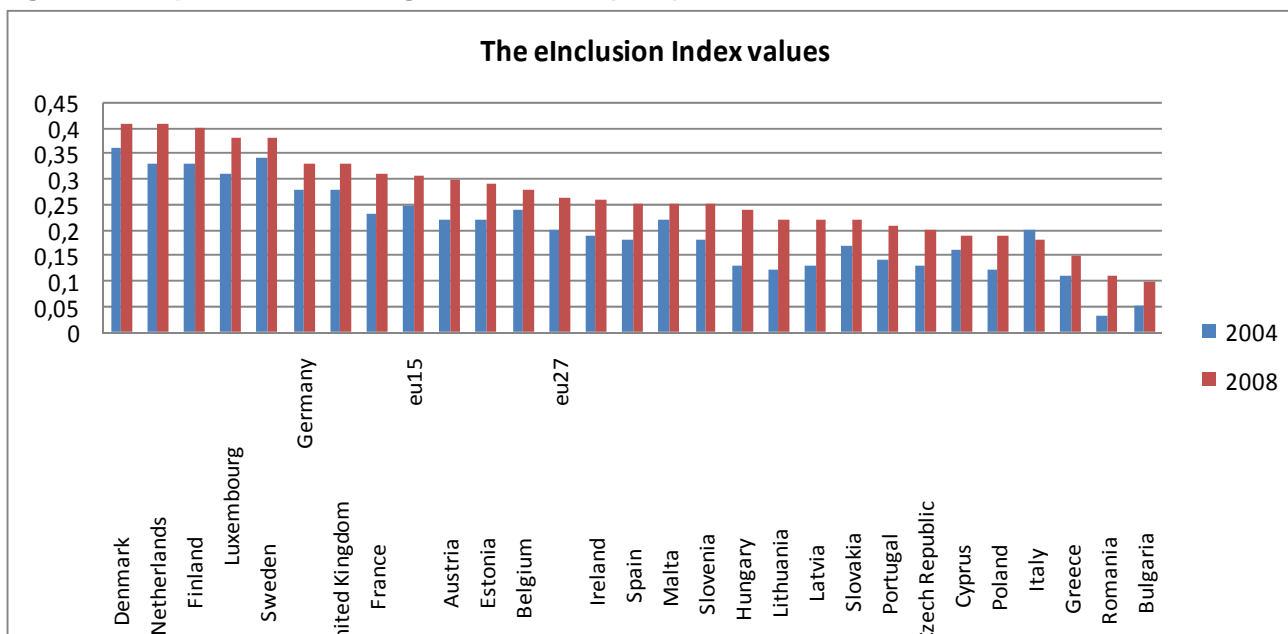
Over the years 2004-2008<sup>9</sup>, the reference period for the calculation of EIDI, the Index reveals that e-Inclusion has increased around 6 points either in the EU27 (from 0,20 to 0,26) and in the EU15 (from 0,25 to 0,31). It is a confirmation both of the diffusion of the digital inclusion processes in Europe and of the first concrete evidence of its related effects. These first data, however, also

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<sup>9</sup> The values of EIDI have been calculated up to 2008 because the 2009 data in the access dimension are not yet available.

show the existence of a persistent gap (around 5 points) between the EU15 and the EU27, attesting the long unequal pattern of digital development in Europe. If we look at the individual country trends (fig. 7) very contrasting performances emerge: on one hand those registering high and constantly increasing index values of e-Inclusion, on the other, EU members showing low values and yet unable to catching up the leading countries. Despite overall growth rates, major differences in digital inclusion between European countries remain.

**Fig. 7 – European Index of Digital Inclusion (EIDI) values**



The Index beyond providing an overall assessment of the e-Inclusion processes of the European countries, thus offering the possibility of monitoring progress that has been made with respect to the entire populations and the disadvantaged groups, is able to reveal the single ICT dimensions - and even the sub-dimensions – which contributed to the final result. We can reach this aim throughout a simple regression analysis useful to identify different contribution over time of the various dimensions to the patterns and trend of the Index (see Tab.6).

At the beginning of the period here considered, in 2004, the Usage dimension followed by that of Access were offering the major contributions to the value of EIDI, whilst the Impact dimension was relatively less important. This composite mix suggests an interpretation of the digital inclusion mainly based upon the enlargement of the catchment area of Internet access associated with the technological appropriation processes related to increasing autonomy and intensity of usage and development of skills. In other words, Internet diffusion and usage capability seemed to play the major role rather than the different areas in which empowerment effects can be felt at individual and social level.

**Tab. 6 – The contribution of the three dimensions to the construction of EIDI**

	2004	2005	2006	2007	2008
	Beta	Beta	Beta	Beta	Beta
<b>Access</b>	.355	.369	.367	.346	.335
<b>Usage</b>	.380	.365	.347	.319	.345
<b>Impact</b>	.300	.296	.312	.349	.353

By the end of the period in 2008 the contributions of the three dimensions appear significantly modified. The highest value is registered by the Impact by a persistent increase from 0,30 in 2004 to 0,35 in 2008, followed by the Usage dimension which shows a decreasing trend, from 0,38 to 0,34. The Access' rank is down to the third position by persistent diminishing value trend from 2005 on. This new balance between the three dimensions stems from a relative consolidation of

the infrastructure – which have occurred during the previous years – and from the significant increase of the number of individuals using Internet in the various spheres of people's daily lives.

To confirm the relevance of these trends one could look at the performances of the two countries which registered respectively (in 2008) the highest (Netherlands) and the lowest (Romania) e-Inclusion levels according to our composite Index. In Netherlands, the increase of the EIDI Index over the period from 2004-2008 are due to the increase, first, of the Impact Index (+15), then, of the Usage Index (+13) and, finally, of the Access Index (+9). In Romania, the highest contribution derives from the Usage Index (+11) followed by the Impact Index (+10) and finally the Access Index (+9). In a nutshell, these trends confirm the changing composition balance over time of the different dimensions of digital inclusion processes and the need of interpreting and measuring them through composite indices which allow grouping various key dimension indicators. According to the different roles played by various dimensions, in fact one could assess the existing criticalities in order to plan specific policies and interventions.

At the end of this brief anticipation on the functioning of EIDI, is well worth to reaffirm that the complex processes sparked off by the diffusion of ICTs requires the individuation of metrics more articulated than in the past. If in the past it was considered sufficient to have information on the ICTs diffusion, we need today new evidence on the effective empowerment of individuals with respect to the increase of internet take-up in the various spheres of people's daily lives. Data and indicators able to grasp these transformations are useful tool to benchmark and assess e-Inclusion developments in single European countries and in Europe as a whole.

## **ANNEX I**

# **Proposal for a set of New Useful Internet Indicators to be collected annually**

### **A. Indicators related to our Dimension of ACCESS:**

1. % of households without broadband connection because it is not available in the area (this is an indicator already present in the Eurostat questionnaire but not always collected)
2. Average download speed of fixed broadband
3. Degree of satisfaction for the downloading speed
4. Average monthly price of a broadband access
5. Average monthly price of a broadband access by mobile
6. Mobile Internet subscribers per 100 inhabitants (USB device, phone)
7. Set of indicators related to the **Internet affordability** in terms of cost (these indicators are already present in the Eurostat questionnaire but they are collected with irregular pace; instead, we think that they should be collected yearly):
  1. % of households without Internet access because access costs too high
  2. % of households without Internet access because equipment costs too high
  3. % of households without broadband connection because is too expensive
8. Set of indicators related to cultural barriers to Internet ((these indicators are already present in the Eurostat questionnaire but they are collected with irregular pace; instead, we think that they should be collected yearly):
  1. Refusing Internet because content harmful
  2. Refusing Internet because not useful, not interesting
  3. Refusing Internet for lack of skills
  4. Refusing Internet for security concerns

### **B. Indicators related to our dimension of USAGE:**

1. Degree of connectivity (Wi-Fi and mobile plus connection at home/work/education place)
2. Time devoted to the Internet in the average day (expressed in hours)
3. Experience in Internet use (number of years)
4. Individualization of the Internet drop-outs
5. Recording of every kind of disabilities such to interfere with satisfactory usage of the Internet (even only perceived)
6. E-Skills (also in this case, few of the following indicators are present in the Eurostat questionnaire but they are collected irregularly). We think that they should be collected yearly.  
Indicator pc skills:
  1. Detecting and solving computer problems (e.g., computer runs slowly)
  2. Connecting and installing new devices
  3. Making safety copies or back up files from the computer on any external storage device

Indicator internet skills:

1. Finding, downloading and installing software
2. Keeping virus, spyware and adware off the computer
3. Stopping unsolicited emails
4. Recognizing fraudulent messages (phishing) or undue requests for personal information (pharming)
5. Sharing data (picture, music, video, texts) between pc, mobile and other devices
6. Producing content
7. Experience in Internet use (number of years)
8. Individualization of the Internet drop-outs
9. Recording of every kind of disabilities such to interfere with satisfactory usage of the Internet (even only perceived)

### **C. Indicators related to our dimension of IMPACT:**

1. Diffusion of multitasking activities
2. Personal expression in political area throughout blog, chat, profiles on social networks,
3. Participation in political activities at local/national/international level

### **D. Socio-demographics background characteristics**

1. "country of birth" and "country of citizenship" should be considered mandatory information and not optional information in order to collect data about the Internet use by immigrants.
2. "household income" should be considered mandatory and not optional information even if it is quite difficult to have truthful data.

### **To realize deeper analysis it should also be useful to have more articulated broken data. For instance:**

sex, age, education;  
sex, education, income;  
sex, education, employment situation;  
sex, employment situation, income;  
age, education, employment situation;  
age, education, income;  
education, employment situation, income;  
country of birth, age, education;  
country of birth, sex, education;  
country of birth, education, employment situation;  
country of birth, employment situation, income;  
country of citizenship, age, education;  
country of citizenship, sex, education;  
country of citizenship, education, employment situation;  
country of citizenship, employment situation, income;

**Internet information not available at present that we suggest it would be very useful to collect annually in the future**

1. Average download speed of fixed broadband
2. Degree of satisfaction for the downloading speed
3. Average monthly price of a broadband access
4. Average monthly price of a broadband access by mobile
5. Degree of connectivity (Wi-Fi and mobile plus connection at home/work/education place)
6. Time devoted to the Internet in the average day (expressed in hours)
7. Recording of every kind of disabilities such to interfere with satisfactory usage of the Internet (even only perceived)
8. Personal expression in political area throughout blog, chat, social networking sites
9. Participation in political activities at local/national/international level

## **ANNEX II**

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