

# A multivariate framework for the analysis of the digital divide: Evidence for the European Union-15

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## Abstract

Our research was initiated in an attempt to analyse the digital gap between nations. With this aim, we approached the measurement of digital disparities between countries by means of multivariate statistical methods. In particular we used factor and cluster analysis to obtain a classification of the levels of digital development. This framework was applied to the European Union (EU) before its last increase in number of nations. The analysis led to the identification of two factors and four groups of countries in the EU, showing asymmetry in the development of the information society.

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## 1. Introduction

At the World Summit of the Information Society in December 2003, heads of state and government from all over the world declared that the global challenge for the new millennium was to build a society where everyone could access and share information, enabling individuals and communities to achieve their full potential in promoting their development and improving their quality of life. This commitment was reaffirmed in the second phase of the summit in November 2005 [47,48].

To achieve this goal, however, some obstacles needed to be overcome, especially the extreme disparities of access to information technology both between and within nations. Before deciding on suitable actions that must be implemented to bridge those gaps, it was

necessary to be aware of their size. Within this context, the development of accurate indicators and measures of digital disparities between groups and nations became a matter of special importance. This task, however, was not free of difficulties for many reasons, such as the absence of a clear definition of both the information society and the digital divide, the lack of a theoretical framework, and the shortage of adequate and harmonised data.

## 2. Defining the digital divide

As the diffusion of information and communication technologies (ICT) has occurred, the issue of a digital divide emerged to occupy a central position in both international and national forums. This is a key matter, because ICT have the potential to foster economic growth and human development. Moreover, these technologies can help to achieve the Millennium Development Goals. Hence, the digital divide represents a major threat to the harnessing of the opportunities offered by ICT [21].

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According to the OECD [19] “the term digital divide refers to the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities”. The notion of the digital divide is thus complex and multidimensional. As UN General Secretary Kofi Annan pointed out at the World Summit of the Information Society, “there are really several digital divides” that may overlap.

At first the issue of the digital divide was understood in binary terms: the gap between ICT “haves” and “have-nots”. But as the number of Internet users has grown, it has become relevant to look at differences among those who are online [22]. Warschauer [43] suggested that, in addition to the physical aspects of access, other factors (such as content, language, literacy, education, and institutional structures) should also be taken into consideration when assessing the level of ICT use in a community. Hargittai [9] offered a definition of the digital divide involving five factors: quality of equipment, autonomy of use, presence of social support networks, experience, and online skills.

The analysis of the digital disparities focused on two dimensions: the gap between countries (the international digital divide) and between groups within countries (the domestic digital divide). Results of investigation on this topic have shown that the digital divide is an area with overlapping social and economic issues. This holds true both between and within countries.

The international digital divide is largely the consequence of the social and economic imbalances that exist between developing and developed countries. Countries with lower income and lower educational attainment tend to show lower rates of ICT access and use when compared with higher income and better education countries [2,8,16,25].

Concerning the domestic digital divide, some papers have discussed the risk to the nation of digital exclusion of women, the elderly, those with lower income and educational attainment, with disabilities, living in rural areas, and belonging to ethnic minorities [20,30,37–42].

The disparities between countries mirror, to some extent, the disparities within countries. In essence the contribution of ICT to growth and development is not automatic and depends on the appropriate application and effective use of these technologies, as well as on the investment in complementary factors (information infrastructure, human resources, research and development) [17,18]. So when ICT diffusion leaves a portion of the population behind, that part contains untapped

potential which could be used in improving people’s living standards and well-being and consequently aiding the country’s growth and development.

Our analysis focused on the gap between countries. Our approach was consistent with the definition of the digital divide as a multidimensional phenomenon, which implied that making a deep analysis required a broader spectrum of indicators than just the Internet penetration rate.

### 3. Framework and context of the study

#### 3.1. Framework

Given the potential value of ICT in social and economic development, the measurement of progress towards the information society has become a matter of special importance in every country. Nevertheless, to achieve this goal several difficulties must be faced: absence of a clear definition of both the information society and the digital divide, the lack of a theoretical framework, and the shortage of adequate and harmonised data.

It is important to bear in mind that meaningful analyses require a conceptual framework. This framework therefore starts by recognising the nature of ICT as general purpose technologies: these are technologies characterised by their potential for pervasive use in a wide range of sectors and by their technological dynamism [1]. Moreover, the diffusion of ICT is affected by the price of access and use, the quality of the services, and the expected profitability of its use in business or the welfare gains of households. Likewise infrastructure influences diffusion; e.g., the Internet cannot be accessed without telecommunications networks and e-commerce requires secure servers.

In this context, the magnitude of the international digital divide can then be defined as the differences in these factors across countries. This framework would be compatible with analyses of the domestic digital divide in each country. Such analyses also then would require the disaggregation of ICT penetration by socio-economic and demographic criteria (gender, income, age, etc.); business analysis could be assessed according to firm size and activity; the availability of infrastructures could be measured by region.

#### 3.2. Context of the study

Once the framework has been developed, the constraints to the analysis of the digital divide are associated with the availability of data on a country

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