ICTs and Inequalities: The Digital Divide
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Abstract:
Reducing the digital divide is often considered as a major political matter in the digital economy. In fact, that very huge blurred notion encompasses many different questions mixing social, economic, and spatial dimensions. However, it proves to be insufficiently defined from a conceptual perspective. Our paper tries to fill this gap by exploring the very impact of ICTs on inequalities. It is organised in three major sections. The first one makes a critical survey of the various existing approaches and measures of the digital divide. The second major section addresses the specific issues of the geographical side of the digital divide through the impact of the geographical concentration of ICTs industries and the spatial discrimination by telecommunication networks. The last section suggests three main research issues beyond the digital divide rhetoric, that is (1) The respective role of market and public policies to reduce the divide; (2) The irrelevance of the sole access/use dimensions; (3) The need for giving up the idea of one single (American) universal model and then for substituting the concept of differentiated trajectories of diffusion for the notion of 'backwardness'.
Introduction

At the beginning of the 90’s, authors argued that globalization went hand with the "end of geography," implying the declining relevance of spatial considerations in shaping patterns of industry organization, owing to the development of Information and Communication Technologies (ICTs) and Internet (O'Brien 1992). Virtual space was supposed to act as a substitute for physical space. This naïve thesis was quickly criticized insofar as Internet is a virtual network strongly rooted in the physical space of geography. But how does space matter to analyze a network such as Internet and its economic impacts?

There are several ways to deal with this question. Some papers emphasized the logistical constraints of virtual world, more precisely the dialectics induced by the use of ICTs between 'de-territorialization' and 're-territorialization' of economic activities. Internet allows to virtualize certain aspects of economic activities (on line order for e-commerce for instance) but implies to embed other aspects in physical space (after-sales service or repair service must be closed to customers…). Other papers looked into the geographic impacts of internet: are Internet uses biased in favor of agglomeration or dispersion trends? Models of economic geography (Fujita and Thisse, 2000) shows that the decline of communication costs through geographical space, as transport costs, tends to polarize more and more economic activities because distance is no longer an obstacle for agglomeration factors such as economies of scale, indivisibilities, social interactions….

More recently, attention has been focused on inequalities of access to information society pushed by uneven geographical diffusion of ICTs and Internet. This is the well-known topic of Digital Divide. Digital Divide has not only a geographical dimension. The social side of Digital Divide is important as well (DiMaggio and al., 2004). But the geographical dimension of Digital Divide has been at the center of the public debate, boosted by international institutions such as the UN, the World Bank and the OECD.

Nothing could be more justified that the question raised by the Digital Divide debate: What are the socio-economic or socio-geographic disparities linked to the current technological revolution based on ICTs and Internet? But the debate is rather confused because Digital Divide is a vague and extensive notion (from telecommunication infrastructures to training programs) applied to very different situations (nations, regions, organizations, communities). As it is pointed out by Yu (2002), the notion is so wide and ambiguous as it can be used to support public investments in broadband networks or/and to promote the liberalization of telecommunication markets as well. As a matter of fact, it is only clear that the Digital Divide notion belongs to the rhetoric of institutions which, as Colby (2001) underlines it, have a strong inclination to choose the solution before determining the possible issue. This leads scholars to define how a legitimate but rhetorical question could be turned into an academic research. This is the aim of this paper.

In the first section, the origin, definitions, measures and policies related to the Digital Divide notion are briefly examined. The second section suggests to go beyond an ill-defined notion by distinguishing problems according to different geographical scales and then two different fields (production and use of ICTs). The last section is focused on three major questions to reduce the Digital Divide: market versus public policies, the respective role of infrastructures, uses and contents, the substitution of the traditional delay approach by an evolutionary and contextual approach to rethink geographical inequalities linked to ICTs and Internet.
1- A confused and geometry-variable notion

The analyses on the Digital Divide have given rise to significant data production. But, the notion proves insufficiently defined regarding the conceptual aspect and then remains uncertain and not very operational considering the effects of policies inspired by one or another conception. We will at first recall the origins of the notion before examining its definitions and suggested measures. Recommended policies and their stakes will conclude this section.

1-1 The notion and its origins

The speech on Digital Divide starts at the early nineties with the distinction between Information haves and Information have-nots. The debate in the field of telecommunications is not a new one as it takes root in the problem of universal service in the USA and the telephone gap\(^1\). It has then been extended to gaps in computer equipment rates, Internet access inequalities and more recently to broadband networks inequalities. In addition, the debate which was initially restricted to OECD countries, now involves all countries by adding a new dimension to international inequalities as far as economic development is concerned.

From the early nineties, American studies on the Digital Divide emphasize the risks linked to the exclusion of some social groups from ICTs\(^2\). But the Digital Divide phrase itself would have been evoked in 1995 by Long-Scott (1995) who showed the risks of excluding the poorest people and minorities from communication technologies with regard to the participation in democratic life. The following year, the Digital Divide phrase becomes popular through the debate on regulatory framework in the telecommunication sector in the USA further to Telecommunication Act in 1996. Fitting into the more general issue of universal access, discussions are therefore focused on Internet access inequalities in this country and the role of education to fill the divide as well.

European countries then, intended to take up the Digital Divide message, firstly for emphasizing their delay compared to the USA and then for setting up the hugest project of building an European information society, a project which was initiated by the Bangemann report (1994) and relayed by the “eEurope” ambitious plan in 1999 on which appear many projects on the fields of e-democracy, e-commerce, e-learning, e-health, Internet access for disabled people, and so on. The purpose was to enable Europe to take advantage of Internet opportunities and New Economy promises. Moreover, for each European country, it was the question of filling up the gaps between regions, towns/cities, organisations, social groups, and individuals following the US initiatives.

Lastly, the Digital Divide debate was extended to peripheral economies. Taking into account the contribution of ICTs to the economic growth in the USA and Europe, the aims for these economies were to lower their delay by increasing their hardware equipment rates and connection rates to Internet, as well as liberalizing their telecommunication markets and

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1 At the earlier 90’s, 6% of the population in the USA did not have a telephone line, essentially the elderly, poor minorities and single women with children. See Schement, 1994.

2 In particular, the Rand Corporation studies in 1995, on the universal email opportunity and in 1998, on the necessity to educate citizens and workers to ICTs, as well as the one of American Minister/Secretary of Education on the importance of connecting schools to the Internet.
educating their populations to these new technologies. The UNO continue to be actively working on this issue.

All these debates are referred to Digital Divide. But how can it be defined?

1-2 Which definition?

Whatever its application field may be, the Digital Divide refers to the idea of a potential irreversible division between two groups: on the one hand, those who benefit from the digital economy called the Haves and on the other hand, those who are excluded called the Have-nots. But this definition can be studied at different levels.

First, the Digital Divide was initially conceived as a kind of exclusion of those who do not have access to ICTs. In this analysis, access to computer equipments appears to be the central issue and moreover this technological view presupposes ICTs access as the foremost condition for wealth. These technologies are likely to generate productivity gains in whichever economic, institutional and cultural environment, they are diffused.

A more elaborated perspective focuses on the actual uses of ICTs. It relies on the hypothesis of technological neutrality. The important thing is not to increase the equipment stocks and Internet connections but to make use of them. The Digital Divide is therefore defined as the separation between those (individuals, social groups, regions, countries,...) who use ICTs in an efficient way and those who do not use them or use them inefficiently. The analysis relies not much on equipment and access but on the conditions of effective use, appropriation and ICTs promotion beside excluded people³.

A third perspective relies upon the contents (information, knowledge, services, entertainment...), which provide Internet access. Having access to equipment and networks and knowing how to use them are necessary conditions to benefit from contents, but the contents should exist and consequently, they may have been produced. For example, a worker may have a computer connected to the Intranet Web Server of his company. He may also have acquired the know-how for using and surfing through the internal network of the firm. But the data and knowledge bases needed for an efficient use of the information system are not already elaborated. This aspect of Digital Divide is often neglected but contents are as important as access and uses.

To summarize, according to Baker, the Digital Divide can be defined as a sub-optimal situation from the point of view of (1) the access to equipment (initial conception), (2) the uses and (3) the availability of contents and services.

3 For example, Hargittai (2002) distinguishes a divide in the digital divide –a second degree divide– between connected individuals who have required competences, skills and know how to accomplish rapid and efficient researches on Internet and the other 'connected' individuals.
The OECD definition, to which most of the studies refer to\(^4\), particularly emphasizes the first two levels: "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 (ICTs) and to their use of the Internet for a wide variety of activities. The digital divide reflects various differences among and within countries. The ability of individuals and businesses to take advantage of the Internet varies significantly across the OECD area as well as between OECD and non-member countries. Access to basic telecommunications infrastructures is fundamental to any consideration of the issue, as it precedes and is more widely available than access to and use of the Internet" (OECD, 2001)

Several features are emphasized:

- The application of the Digital Divide notion would be universal: individuals, households, organizations, regions, countries;
- This notion refers to different geographical scales: international (within the OECD countries, between the industrialized countries and the less developed ones) and intra-national (disparities within regions, rural and urban areas);
- Access to ICTs and uses of ICTs are two specific and distinct issues;
- The Digital Divide is primary conditioned by the access to basic telecommunications infrastructures

1-3 Which measures?

According to the definition, several types of indicators are taken in consideration to evaluate the Digital Divide\(^5\). Considering the notion in a wide context –disparities in ICTs access and uses–, the elaboration of relevant, precise and comprehensive indicators requires significant available data on:

- Infrastructures: density of electric networks, telecommunications and Internet penetration rates....
- The level of education within the population: literacy and school attendance; familiarity with computer; number of schools, universities, training programs in computerizing; second language learning and practice (English in particular)....
- Equipments: number of terminals and hosts, equipment rates....

\(^4\) See Montagnier, Muller et Vickery (2002), Johnston (2001). See in particular the analogy made by the latter with automobile: ‘uneven penetration of information and communication technologies in countries both within the OECD and beyond. (…) gap between people who have the opportunity for regular access to the Internet and people who have irregular or no opportunity to access the Internet. (…) The automobile analogy is quite good in this context. The arrival of the combustion engine and the automobile transformed our societies. But an automobile or any number of them are of little use without roads to run on. And their efficient use depends on good access to those roads in all communities. As the roads link to highways and super highways, the system becomes even more efficient by being faster and able to handle greater volumes of traffic. But the vehicles carrying people and produce must have capable drivers. And those drivers must be well trained by competent instructors. So, we need highways, access to highways, vehicles, trained drivers, and instructors. And we also need the rules of the road consistently applied. As applied to ICT and the Internet, the absence of any one of these elements creates a digital divide.’

\(^5\) For a survey of the indicators used, see Montagnier, Muller and Vickery (2002).
- Skills and know-how: value-to-weight ratio of ICT sectors, number of computer science engineers, national network operators, foreign partners, skilled labour...

- The potential access to these infrastructures and equipments: geographical density of hardware equipments and access to telecommunication networks, location of equipments, proportion of collective equipments (tele-centres, cybercafes...), possibility to connect, freedom of expression...

- The actual access and uses of equipment: nature and volume of information flows (texts, video, sound, BtoB...), practices of professional and non-professional users, nature and economic weight of activities using ICTs...

These criteria are unstable as the Digital Divide notion is changing with the technology: it was initially necessary to measure the gaps in computer equipment rates, then in Internet connection rates and nowadays in access rates to broadband networks.

The measures of gaps bring out methodological issues and problems of interpreting results. Data are not available everywhere; series are often incomplete; variables are heterogeneous; the comparison of one geographic area to another one or from a period to another one proves problematical; ICTs producers and users (individuals, firms, associations, non-profit organizations) are very different and change according to periods, geographical areas, cultures and institutional environments....

Nevertheless, in spite of these important drawbacks, more elaborated indicators were suggested by the Canadian Agency for International Development and ORBICOM (Sciadas, 2002) in order to assess the degree of ICTs diffusion in a given economy (the degree of a country's 'ICT-ization'). To do that, a synthetic indicator ('info-state') combines two others, info-density and info-use. 'Info-density' refers to the ICT-based productive capabilities of a country. It combines network indicators (main lines, Internet sites, mobiles users per 1000 inhabitants) and indicators of skills and competences (literacy and schooling rates). 'Info-use' assesses the ICTs' appropriation by households, firms and administration (Internet, radio and PC users, proportion of households with TV and cable-television network per 1000 inhabitants) as well as their effective propensity to use ICTs (ICTs expenses in the gross domestic product, international telecommunications per inhabitant). The Digital Divide is therefore quantified by the disparities of 'info-state' indicators between the different countries at a given point of time and by their evolution over time.

This study aims to set up a more complex measure of the Digital Divide that proves different from the recurrent accumulative data arrays. But few elements are communicated on the methodology. More generally, this kind of analyses integrates a controversial distinction between 'traditional' capital and ICT capital. In fact, with the diffusion of ICTs inside most of equipments, it becomes difficult to see differences between traditional capital and ICT capital. This difficulty also extends to consumption goods: one can watch a movie on a TV as well as on a mobile phone or a computer. It can thus be asked if measuring the digital part of economy is not a blind alley when considering the general-purpose nature of ICTs (Rallet, 2003).

1-4 A controversial institutional view

As we have already pointed it out, the Digital Divide topic particularly aims to define public policies.
Generally, there is a consensus to make ICTs, the driving force of the new industrial revolution (“informational”) boosting economic growth and social welfare. They are supposed to bring productivity gains to all economic activities, to stimulate the development of new processes and products, to increase wages and favour the career of workers who use them, to increase the accessibility to collective services (health, education...) and their efficiency, to enable individuals or organizations to extend their possibilities thanks to an easier access to information and even to democratize political life.

Besides, as many indicators suggest it, no one denies the fact that there are many strong inequalities in the diffusion of ICTs even within industrialized regions and countries. The debate is focused on the possible ways of reducing the divide and thus overcoming the risks of marginalizing activities, people or geographic areas because of their ‘exclusion’ from informational revolution.

From one side, there are those who think that the current inequalities in ICTs diffusion are a major problem which requires public intervention. The Digital Divide may add another inequality to existing socio-economic inequalities between countries, regions, workers, social groups... Specific help policies would therefore be needed to correct observed gaps. Many authors and institutions (Dertouzos, 1997, ONU, 1999, Sachs, 2000) recommend such policies in order to favour the technological adjustment of those excluded compared with those who already benefit from digital revolution.

From the other side, there are those who argue that Digital Divide is only a consequence of existing socio-economic inequalities and must be as such demystified. In this approach, it might be advisable to firstly reduce the socio-economic gaps by encouraging the economic development of the peripheral areas and countries. These economic adjustments will act as the starting point for technological needs and uses similar to central regions and countries. In this approach, the Digital Divide is solved by itself and does not need specific policies anymore.

Moreover, existing inequalities represent an obstacle only if they become permanent. Yet, most of the supporters of public intervention presuppose it but they do not show the real demonstration of it – except for the question of basic infrastructures. At this point, there is a confusion between (1) the effects induced by the ICTs unequal diffusion and (2) the factors of evolution of this unequal diffusion. There cannot be any incidence for increasing inequalities of ICT diffusion because these inequalities have negative effects on growth and social welfare. There are rather links that must be established. Otherwise public policies would be justified by the negative effects of inequalities which factors are not analysed but presupposed.

The advocates of a market self-regulation give an answer to this last question. With the partisans of public intervention, they go along with the idea that unequal diffusion of ICTs tends to widen development gaps as pointed out by Montagnier, Muller and Vickery (2002): ‘because of the network effects associated with ICTs, society as a whole would fail to gain the full benefits from wider use’. But they deny the fact that current inequalities of diffusion might become permanent, as market will enable to share out the technological resources according to actual needs. It will be all the more feasible since ICT markets rely upon dynamic network externalities which ignore social and geographical frontiers. Any public intervention is therefore perceived as a source of mistaken signals sent to economic agents except if it aims to prevent monopoly induced by increasing returns.

6 According to supporters of public policies, however, economic development does require ICTs access and uses.
The position of market supporters relies on a dual belief. The first one (shared with the opposing position) is that ICTs do have positive impact on growth and welfare, and the second one is the idea of a generalized and convergent diffusion of ICTs. From our viewpoint, it seems important to question these two beliefs.

2- Different problems according to the level of development and geographical scale

The Digital Divide term is used to point out regional inequalities as well as inequalities within nations, social groups and categories of firms. These inequalities and their criteria are cumulative: the personal computer penetration and Internet access rates are lower for poor people living in poor regions or countries than for poor people living in wealthy countries. But mechanisms and problems are not the same from one social group, category of enterprise, region or country to another one. And the solutions too: What is good for a region or a country is not necessarily useful for a social group and inversely. For instance, reducing the Digital Divide within regions may increase it within social groups. The probability is very high because the wealthiest social groups in poor territories have a stronger ability of capturing benefits coming from public policies supposed to help these territories. That is a traditional debate in regional economics, to know whether public policies may target geographical areas or individuals ('place prosperity' versus 'people prosperity', see Hoover, 1971).

We are focusing here on the geographical dimensions of Digital Divide. We distinguish the divide within industrialized countries, between industrialized and less developed countries, between regions within the same country, between rural and urban spaces (2.1). Two major problems occur but in different ways, with more or less intensity according to the geographic scale (2.2).

2-1 Different kinds of Digital Divide

*Between developed countries*

As there are significant available data, this dimension of Digital Divide has led to a lot of statistical works concerning OECD countries (OECD, 2001, Montagnier, Muller and Vickery, 2002, Schmitt and Wadsworth, 2002). Two different aspects are considered: On the one hand, the importance of ICT sector in the economy of those countries, on the other hand, the uses of ICTs by firms, government departments and households.

Due to the fact that the ICT sector experienced high rates of growth in the nineties, it was supposed to become the new driving force of economic growth. By cumulating many indicators (relative shares of ICTs in employment, value added, R&D expenditure and international trade), the OECD has classified its member countries in several classes: The highest ICT-intensive countries (Finland, Hungary, Irish republic, South Korea, Sweden, UK, USA), the average ICT-intensive countries (Canada, Denmark, France, Greece, Italy, Japan, Mexico, Netherlands, Norway, Switzerland) and the lowest ICT-intensive countries (Australia, Belgium, Czech republic, Poland, Portugal, Spain, Turkey).

The word 'backwardness' is more often used than 'divide' to qualify the unequal diffusion of digital revolution within OECD countries. But there are still considerable gaps
and the significant advance of the USA in the relative importance of the ICT sector and the diffusion of ICT uses has led to the question of its reversible or irreversible nature. Considering the fact that these inequalities have macroeconomic impacts, European authorities have encouraged the ICT diffusion so to increase the efficiency of organizations (firms and government departments) and to ensure better coordination within European Union markets (Pohjola, 2002).

**Between developed and developing countries**

In the developing countries, the access to computers and infrastructures is the main problem, due to the hardware costs and the weak development of telecommunications networks. Most of studies are based on the data produced by the International Telecommunication Union (www.itu.int/ITU-D/ict/statistics). They show that the lowest rates of access to PCs and the Internet in these countries are essentially explained through socio-economic variables of development level (Chinn and Menzie, 2004, Norris, 2002, Hargittai, 1999, Kiiski and Pohjola, 2002).

**Between regions within a country**

On a regional context, the debate on Digital Divide essentially deals with the unequal deployment of telecommunication networks on national territories. In OECD countries, it is focused on broadband networks (DSL, cable, optical fiber, wireless technologies…) taking account of the good coverage of national territories by previous networks (fixed telephony, cellular phone). Initially launched by Al Gore program on information highways, the debate has been renewed by the development of DSL market. The problem is well-known: in a variable way according to the technology which is used (cable, optical fiber, DSL, radio local loop, 3G mobile, Wi-Fi, Wi-Max, satellite), the diffusion of broadband networks is limited to the more dense and less distant areas for economic reasons—sufficient market size is required to take advantage from investments—and technical reasons, in particular the distance from the local central office to home for tDSL technology.

In this respect, there are three different types of territories:

- Towns which size and density justify private financing in specific broadband infrastructures (cable, optical fibers, radio local loop…) or which have broadband access via telephone network (DSL technology) through competitive operators.

- “Grey” areas which have broadband access via only one operator, more often the incumbent operator. Their size and density are not sufficient enough to recoup private investments in alternative networks7. Access is not really the problem but the cost of this access due to lack of competition.

- Rural areas which are not served neither by DSL technologies due to distance or lack of equipment, nor by alternative technologies for lack of profitability. At present, 90% of households and firms may have DSL access in France (ART 2004).

7 Grey areas represent 40% of residential and business lines at the end of 2004 in France (source: ART, 2004)
Between rural and urban spaces

On the population side, the differences between rural and urban spaces are all the more important since the development level of the country is low because of a lack of telecommunication infrastructures in rural areas or due to archaic networks in these countries. That is especially the case in Africa (see Chénau-Loquay, 2002 and the studies carried out by the Africanti network, www.africanti.org). When this variable is neutralized, especially in the OECD countries, the observed gaps between rural and urban access rates exist but they are not so relevant. In the USA, Internet connection rates in urban and rural populations were mostly equivalent in 2001 (51% versus 48.7%, source: Montagnier, Muller and Vickery, 2002). In the developed countries, the differences between rural and urban areas come mainly from social disparities in terms of households income, education level, and so on. That is clearly seen at a lower scale (suburbs/city centre). Thus, in the USA, Internet connection rates in central urban areas are lower than in other urban areas and seem to get close to the rates prevailing in rural areas. The Digital Divide reflects the “Inner city problem” of American cities. In the same way, a study carried out by the Foundation Getulio Vargas in 2003 and based on micro-data highlights a strong correlation between municipal districts maps of Rio de Janeiro according to income level and digital inclusion factor. The smaller the geographical scale is, the higher the social matter is behind the Digital Divide.

As for firms, ICTs adoption rates at the outset have been lower in rural areas than in urban areas even if variables such as size and sector are controlled. However, in the recent period, adoption rates tend to converge. The inequalities are now observed through the usages or the “second level” divide (Galliano and Roux, 2003, 2004)

### 2-2 Two major problems with variable intensity according to level of development

As it is mentioned above, the geographical dimension of Digital Divide has two aspects. The first one is related to the geographical concentration of ICT sector in some countries or regions. The second one is the territorial discrimination induced by the unequal deployment of telecommunication networks.

**Inequalities linked to ICTs production**

Let us remind that ICTs have two different impacts on growth. First of all, varying from one country to another, the relative importance of ICT sector and its growth rate lead to disparities in economic growth. But insofar as they are used as equipment goods in all sectors, ICTs also impact the whole economy (Colecchia and Schreyer, 2001).

The importance of barriers to entry (significat fixed costs, especially R&D expenditures), the presence of increasing returns and the localization of most of innovations in the more ICT-intensive countries show that it is quite utopian to fill the advance taken by

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8 International comparisons are in fact difficult because statistical definitions of urban and rural areas are different according to countries.
some industrialized regions and countries. It is especially the case with the USA (Sillicon Valley), even if there are some niche market strategies (mobile phones in Europe and Japan, video games in France) and complementary strategies (software co-production in India and more generally, the necessary relocation of this sector in order to reduce costs and follow decreasing prices strategies which enable to keep higher growth rates in the software markets).

Therefore, the foremost question is to know whether a country which does not produce ICTs may be as efficient in ICTs uses as a country which produces them. If yes, the divide would not be extended to the most important impact of ICTs in the economy, i.e. their use as inputs in all activities. In the case of a perfectly competitive economy, productivity gains in the ICT sectors are rapidly transferred to users sectors through the decline of equipment prices (with constant quality).

But:

- There is no perfect competitive economy, particularly in the ICT sectors which are characterised by increasing returns. Thus, the transmission of productivity gains can be done unequally as far as countries are concerned. In the nineties, firms in the USA have acquired their ICT equipments 10% cheaper than in Canada and 30 or 75% cheaper than other countries (Montagnier, Muller and Vickery, 2002).

- In the case of an economy characterized by a rapid technological obsolescence, the delay of accessing new products and processes plays a major role. This delay is very short in countries which produce these technologies.

- The impact of the two variables mentioned above –price of technologies and delays of diffusion– on the Digital Divide depend on how intellectual property rights (IPRs) are defined and experienced. The debates on online piracy or open source software are parts of the Digital Divide issue (CNUCED, 2004). The non-respect of IPRs favours a rapid diffusion of ICTs at short term. But that could turn against developing countries if contents provided by these countries are not protected. That is why the actual driving force for reducing Digital Divide is not piracy at the long run but the race between open source model which gains ground in developing countries and leading firms in the computer industry which are forced to find adapted solutions to these countries (PC discount, specific licenses for second-hand PC, easing of anti-piracy control …). The reduction of Digital Divide will benefit from externalities associated with the worldwide competing battle to connect more and more consumers.

- Linkages between production of ICTs and ICTs uses rely on technological externalities (transfer of know-how, information exchanges, “industrial atmosphere”) which are more strongly dependent upon territorial context than pecuniary externalities. Due to informational localized exchanges and local users-producers interactions, a stronger and more innovative dynamics of ICTs uses will take place in ICTs producers countries than in those which only use ICTs.

- The position of Europe in comparison with the USA is often used to demonstrate this issue (Cohen and Debonneuil, 2000) but it also affects relationship between industrialized and less developed countries.

It raises the problem of channels able to transmit productivity gains, innovations of products and know-how between producer areas and user areas. These channels depend on two types of proximities: a geographical proximity and a relational proximity (Rallet and Torre, 2005). The geographical proximity favours informational externalities between producers and users of technologies because of the easiness of daily contacts. It is a factor of
geographical concentration. But economic agents are also close due to their belonging to the same professional community or the same organisation without being necessarily co-located (relational proximity). That is the case in the Internet world where professional communities or innovative users are organised on a large, often worldwide geographic scale. The members of these communities are generally located in metropolises so that the transmission of ideas and know how is done from metropolis to metropolis, even within global cities (Sassen, 1991). The combined game of the two proximities (physical and relational) explains that the dynamic interactions between production and uses are made in the framework of positive informational externalities provided by the global network of metropolises. This 'archipelago economy' may result in strong inequalities with geographic areas located out of the archipelago.

Territorial discrimination produced by the unequal deployment of telecommunication networks.

The Digital Divide begins with an unequal access to infrastructure networks though it cannot be reduced to it. As in the field of transport means, digital infrastructures are a necessary condition (but non-sufficient) to local and regional development. By digital infrastructures, we mean anything that gives access to networks (i.e. computer equipment and connection to telecommunication networks).

The problem is mostly related to developing countries and peripheral regions because for developed countries and central regions, the liberalization of telecommunication markets has led to a competitive race to connect as many customers as possible, which tends to homogenize the conditions of accessing telecommunication networks9. Price gaps still remain but they may gradually disappear owing to the convergence of the regulatory framework in this sector within the OECD countries (OECD, 2002). In fact, these regions and countries begin to be concerned with excessive infrastructures, except for the last mile connectivity. The matter is not much to develop infrastructures but to know which uses can be done with them. For the moment, the development of broadband networks is mainly drawn by uses such as entertainment (TV, Music on line, Video on demand…) and Peer to Peer file exchanges.

Network access remains a problem for developing countries and peripheral areas because it cannot only be solved by market forces. The race to connections based on network externalities is a strong instrument to reduce geographical inequalities but it faces the problems of insolvency and insufficient market size in less densely populated or poor areas. In industrialized countries, nearly all the population and firms can access to advanced broadband networks. Of course, the coverage is not equal among all areas but the needs too. In developing countries or regions, the territorial discrimination by advanced networks is stronger because facilities are very likely to be concentrated in the biggest cities.

The evolution of Digital Divide based on infrastructure coverage depends upon two types of factors: technological and regulatory ones. The impact of technological change on Digital Divide is contradictory. On the one hand, there is an increase in number of alternative technologies (DSL, cable, fixed and mobile lines, radio, Wi-Fi, satellite) which diversify network access and consequently, ways of reducing “dead areas”. On the other hand, technological innovation tends to reproduce geographical inequalities continuously by

9 This phenomenon has already been observed in the development of telephone network in the USA at the beginning of the twentieth century (Mueller, 1996)
creating new infrastructure needs (mobile phone followed by DSL technology then Wi-Fi, Wi-Max, satellite…) and leading to faster and faster broadband networks. The continuous and very fast rate of technological change left many areas in a constant state of “catch-up”. But, now, firms take their location decisions according to the current state of the network coverage instead of the future one. If access to broadband network becomes a competitive norm for firms, they may need access not in two years but immediately. The unceasing development of network technologies reproduces inequalities of access continuously.

Regulation has two main aspects as well. Firstly the liberalization of telecommunication markets is seen as a tool for bridging the Digital Divide as it is argued by international institutions such as OECD (OECD, 2004). In this respect, these institutions underline the correlation between the liberalization of telecommunication markets and the geographical extension of networks as well as the decreasing access costs and the increasing quality of services. Monopolies which still prevail in some countries are not likely to expand networks but to practice higher prices and provide services with lower quality or old-fashioned as regards to technological change. Such a trend is effectively observed within the OECD countries and even in metropolitan areas of non OECD countries where competition may effectively be more efficient than regulated monopoly to develop networks due to the potential market of these areas. But it left unsolved the problem of remote or less densely populated areas and even the problem of poor areas in rich regions.

It follows the second regulatory aspect, that is authorizing local public authorities to remedy market failures by becoming operators of telecommunication networks. In most of countries, they were allowed to build passive infrastructure that they could rent out to private operators. The problem may not be necessarily solved insofar as initial market size in these areas does not enable private operators to recoup their investments. When becoming an operator of active infrastructures (or more often operator of operators because it generally delegates this task to a third party), local public authorities intend not only to provide facilities instead of private failing operators but also to stimulate local demand for services. However, these public initiatives which are looking complementary to the market – public networks are created where there is no market– are ambiguous because they often consist in subsidizing alternative operators on the market. Their aim is often less giving access to broadband network where it does not exist than building networks in competition with the incumbent operator which initially acted as a local monopoly.

3- Three research issues

The Digital Divide cannot be boiled down to a rhetorical or institutional notion. From our viewpoint, it reflects three main analytical questions. In the first section, we wonder about the respective roles of the market and public intervention so that the divides could be reduced. The second one aims to go beyond the approach of inequalities in terms of access or uses so to link access, uses and contents. In the third section, we suggest substituting an path-dependency approach for the traditional Digital Divide approach based on the notion of 'backwardness' which presupposes a universal model of diffusion.

3-1 Market or public intervention?
At the beginning, the Digital Divide as a notion was developed by partisans of public intervention which was thought to be the only way to prevent the threat for excluded geographic areas or individuals in the information society. Then, by contrast, some authors argued that the market is efficient enough to reduce the divide.

As Piazolo (2001) mentions it, ‘the Digital Divide will diminish with time until the gap in the density of computers and internet hosts just reflects the different economic development stages during the catch-up process.’ In this perspective, many are those who recommend the “laissez-faire” attitude (Wallsten, 2002, Dasgupta, Lall et Wheeler, 2001, Compaine, 2000, Quah, 1999), so that public policies should not interfere. Thus, Quah (1999) suggests to favour the liberalization of telecommunication markets in order to decrease the Internet access costs and accelerate the diffusion of ICTs. To achieve this purpose, financial markets should be developed in order to facilitate financing projects aiming to settle networks and improve their running. In the same way, Becchetti and Adriani (2003), show that economic growth is affected by the quality of telephone network, hardware and telecommunication equipments which role consists in diffusing knowledge. So, competition is the condition for the development of networks.

Furthermore, according to the ‘leapfrogging’ argument, efficient computer and telecommunication markets may potentially enable each country or region to leapfrog some stages which were previously followed by ICT producer countries and ensure a catch-up process often with better conditions thanks to more recent equipments, more adapted training and so on.

These propositions have given rise to many critics. Thus, Steinmueller (2002) argues against each way of universalizing any digital model to catch up. The benefits of catching up strategies based on the liberalization of telecommunication markets are limited to some geographic areas and to some economic agents considering their strict conditions of application. These strategies are unlikely to be followed by positive effects in countries where telecommunication and electric infrastructures are poor, scientific and technical knowledge required for local/national industries is not available locally, skilled labour is sadly lacking… According to Johnston (2001), the liberalization of telecommunication markets has enabled and will enable to reduce Digital Divide in developed countries by decreasing Internet access costs but it is not the same for the North/South divide because infrastructures do not exist or are insufficient in most of less developed countries and peripheral regions. Several conditions are required for developing countries to increase access to ICTs, in particular by giving private investors the confidence they need to make sustainable investments in fixed and mobile telecommunication networks : previous stabilization of the

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10 Becchetti and Adriani (2003) analyse the digital divide from the perspective of endogenous growth theory and the incidence of technological progress on gaps between wealthy and poor countries. According to them, the mistake of the studies in this field is to consider the knowledge merely as a non rival good which can be reproduced and diffused on a wide scale through informational devices such as software and data bases. As a consequence, knowledge is implicitly considered as integrated to methods of production which are freely accessed in all countries. However, the diffusion and access to this reproduced knowledge with low costs are governed by the lifting of technical constraints such as network ability to transmit rapidly the highest volume of knowledge, the network access to individuals and the use of performing computers and terminals connected to networks. Under this hypothesis, they test the relation between ICT diffusion and gross domestic product per inhabitant for 115 countries and show that ICT diffusion is a condition for economic growth.

11 According to Steinmueller (2002), four conditions must be met for an effective implementation of these types of strategies: (1) acquisition of specific competences and adaptation of existing equipment, (2) some market initial conditions for equipment and knowledge exchanges, (3) the necessity of acquiring technologies and complementary abilities and (4) downstream integrated requirements.
institutional framework, elimination of corruption, implementation of independent regulation agencies with significant power, national training programs…

From our point of view, it seems important:

-Not to under-estimate market ability to diffuse ICTs because of the very economic nature of these markets

Due to the presence of high fixed costs and network externalities, they are characterized by an exponential growth (Shapiro and Varian, 1998). Technologies such as mobile phones have been rapidly diffused in all geographical areas and social categories and not only in the OECD countries (see the current Chinese case). This trend will go on. In fact, ICT industry faced severe slowdown in its growth since the year 2000. Except the bursting of the Internet bubble, this slowdown has been caused by the slowness in the design of new contents and services, as well as too high prices of computer hardware and network access for a large part of people, especially in developing countries. This industry is forced to reduce its costs so that it will continue to base its growth on an enlarged dynamics supplied by strong network externalities.

The relocation of computer and telecommunication industries which were so far limited to hardware is a possible answer such as developing software in India and locating R&D centres for mobile phones in China. It means that some developing countries and peripheral regions may attract some industry segments and contribute to a less concentrated geography of ICTs production.

-To precise the nature of the current limits of the market

The market expansion faces the insolvency of one part of the potential demand, i.e. insufficient levels of incomes, distance and low density of some geographical areas.

To get round the income constraint, the industry has to decrease its costs. But the model of ICTs diffusion which is spread in developing countries by manufacturers and operators (one private computer per individual/household, one private access to Internet) limits the ability to increase the demand of ICT products in these countries. The reduction of the divide relies on the adoption of other models of diffusion (cheaper terminals as in the network computer configuration, renting instead of purchasing, collective access rather than private one, use of open source software…). ‘Market boundaries’ are not much those of the ICTs market in general but those of the diffusion model initiated in the USA. Other models of diffusion may enable to solve the problem. But they may go against the current economic interests of leading manufacturers.

In the case where the market size is not enough due to low density in rural and distant areas, public initiative is needed. But it may face three risks: (1) the opposition of private operators (as noted above); (2) a waste of public funds in case of wrong technological choices (high level of sunk costs associated with rapid technological change); and (3) excessive technological investment regarding the actual or anticipated needs.

-To extend the market/public intervention debate to other stages of Digital Divide instead of the mere question of access to infrastructure

As it was mentioned, the current debate is focused on access. Of course, it proves a necessary condition for reducing the divide. And having access to equipments and networks is now the dominant issue for developing countries and regions. But even though the access issue were solved, Digital Divide would still exist at other levels, that is those of usages and contents. It is obviously more difficult to overcome the divide at these other levels.
3-2 Access, usages and contents

Having access to computer equipments and network infrastructures is often considered as an end in itself. But the impact of access on economic performances and social welfare depends on actual uses and particularly the availability of contents. The relation between ICTs and growth relies on two linkages which are not spontaneously ensured.

From access to usages

Having a computer or Internet access does not mean using it. Ultimately, usage matters. Unlike computer equipment and network connection, usages are not acquired because of a mere decision to purchase them. They require time and learning process.

To focus on access rather than usages is now topical for public institutions. This shift of emphasis is also supported by scholars. As new competences are required to be able to use ICTs, the recommended solution is to increase investments in human capital –which are often neglected in favour of equipment investments– and to overcome literacy.

But, moving from access to usages is not sufficient. Why are these technologies used? What are they used for? Are there available services?

From usages to services and contents

Behind the Digital Divide topic, there is a fear of an increasing divergence in economic performances resulting from an uneven capacity of regions and countries to innovate through new products or processes by using ICTs. The expected performances are mainly related to the improvement of organizational efficiency and the development of new markets. It implies not only using technologies but also creating new services and contents.

The relation between ICTs and economic performances has been largely discussed and analysed in the ‘productivity paradox’ framework. Whichever result may come out (refutation or confirmation of the productivity paradox, see Mairesse, 2002), the great merit of this debate has been to attract attention on the very conditions for ICTs to give rise to economic performance.

In fact, two conditions must be met:

(1) As an output, the use of ICTs must lead to new products or services, i.e. the development of new markets. But it takes some time.

(2) As an input, an efficient use of ICTs requires some organisational changes (Brynjolfsson, Hitt, 2000). At the stage of networks, ICTs turn out to be coordination technologies that improve the efficiency of organisations by reducing internal running costs, improving inter-relations firms and customer relationships or strengthening ties between public services and citizens, hospitals and patients, universities and students as well. It implies the implementation of new intra or inter-organizational services (intranets, ERP, extranets, CRM, electronic marketplaces…) and the production of new contents such as databases, knowledge bases and informational services.
The process has just started because innovation has so far been mainly focused on hardware and network infrastructures. Final services are still not really well developed by comparison with the importance of infrastructures. They might be in the future, a source of significant divergence of growth between geographic areas. Regions and countries will differ not only due to uneven capabilities to use ICTs but to make efficient usages of ICTs leading to new products and organisational innovations.

To address this issue, relations between access, uses and contents should be stated precisely. In the traditional case of telephone, network access, usage and contents are one and the same thing. Having access to network and benefit from voice service are just similar because there is one access, one terminal and one service. The duplication of network accesses, as well as the diversification of terminals and the development of different services on the Internet lead to more complex links between access, uses and contents.

Literature on Digital Divide is grounded in a “push” linear relationship between access, contents and services. The easier is the access, the more intense are the uses. And the more intense are the uses, the greater is the number of the new services which come out. In these conditions, it proves rational to bear efforts on access. The current policies focused on access might limit disparities. This thesis is partially justified : easy access to technologies and intensive uses are in favour of the emergence of new services and contents. The justification relies on the fact that ICTs are general-purpose technologies which applications are not defined ex ante. Taking advantage from easy access to ICTs and getting accustomed to their use create favourable environment to the emergence of value-added services and new contents.

However, there is no mechanical link, especially between usages and contents. Developed uses may not necessarily lead to new contents. For instance, having a DVD player and knowing how to use it, do not imply that there are contents ready to be read on this player. The production of contents and services requires: (1) complementary investments, ii) some favourable conditions to the emergence of a market. Services and contents may be considered as complementary goods to access and uses. A large installed base favours the production of contents but does not resolve the famous ‘egg and chicken’ problem induced by the existence of indirect network externalities (Rohlfs, 2003). In the Digital Divide debate, these problems are neglected because everything is done as if the only services which can be developed on the Internet are communication services. For these services, having a terminal is sufficient condition for their existence, because they are self-produced by network users (direct externalities). All you have to do is to plug in. That is not the same for informational or transactional services and for contents which must be produced.

However, the production of services (except communication services) and contents strongly depends on institutional and economic environment. The development of intra-organisational or Business to Business services and contents depends on the very nature of firms and the specific features of industrial organisation of their sector. A country or a sector bureaucratic organisations are dominant and business practices are weakly organised, will face difficulties to bring out new services and digital contents improving the competitiveness of these firms. The ability of producing services and digital contents for final market depends on the specialization of a country or a region in competences and know-how required for their implementation. It is easier to produce audiovisual digital contents in regions specialized in cultural industries, e-health services in towns which have important medical competences, e-learning where there is already a concentration of educational institutions, on-line games where there are video games industries and so on.
The capacity to produce services and digital contents is not only pushed by access to infrastructures. It is also pulled by existing competences and resources required for services as well as the ability to increase their value through their digitalisation. Bigger towns and areas specialized in digitalized services turn out to be mostly favoured by taking advantage from complementary competences and favourable environment to innovation such as “creative atmosphere” (Florida, 2001), venture capital, etc. In this perspective, the Digital Divide comes from an unequal ability of geographical areas to benefit from network access, i.e. transforming competences and resources into value-added services and digital contents.

The Digital Divide will be all the more important that the development in wealthy regions is simultaneously pushed by an easier access to network infrastructures and pulled by an supply of services and digital contents which lies on specific competences and favourable environment. By contrast, providing an easier access in a peripheral region will not be sufficient enough to reduce it.

3-3 Different paths of diffusion

The debate on Digital Divide implicitly sets up the American model of ICTs and Internet diffusion as the reference model whereby the level of diffusion in other countries and regions should be evaluated. It is thus dominated by the ‘backwardness’ issue which measures the way to go through at a period t between the most advanced experience and the necessarily delayed one in other countries and regions.

Benchmarking methods support this issue which explicitly aims to line up less advanced experiences on characteristics of the most advanced experience. At a first stage, the purpose is to compare the different access levels with the American levels (proportion of households having a computer, Internet access…). Secondly, this aim is extended to contents: e-commerce, e-learning, e-health… It is thus observed that some developing countries adopt policies to promote e-commerce under the pressure of international institutions (CNUCED 2004) though their retail trade is still dominated by traditional methods and logistical networks do not exist or are in an embryonic state. In the same way, countries launch themselves into projects of school of the future (e-learning) though their school system is not good. The reproduction of experiences inspired by the most advanced countries can thus lead to inefficient uses. Antonelli (2003) argues that the development of ICTs reflects the specific conditions of the US economy in the earlier 90s, which was characterized by a great number of skilled workers. The use of these technologies in other countries or regions with different local factors endowments and relative prices, cannot lead to the same economic performances. Following this way, the Digital Divide could be redefined as the application of technologies initially built and implemented in a particular economic environment to different environments.

The idea of an universal model which would permit to assess and classify all experiences comes down to accept technological determinism : ICTs may generate determined models of organization and business boosting competitiveness. However, ICTs are compatible with very different organizational models (Brousseau and Rallet, 1999). The impact of ICTs depends upon organisational, institutional, social and cultural environments into which they are implemented. So it proves difficult to anticipate a priori their future effects. Because they are general-purpose technologies, ICTs do not have generic but contingent effects. Even within OECD countries, the models of ICTs diffusion are diversified despite similar levels of development. Scandinavia and Europe have got an advance in mobile
phones, Japan in some contents and i-mode, USA in network technologies and some contents and services such as e-commerce. It corresponds to the trajectories taken by ICTs industry in these countries as well as previous economic specializations, urban organization and ways of life.

It is more interesting to show the diversified paths of diffusion from explanatory variables concerning access, usages and provided services and then redefining the inequalities of diffusion into these paths. It seems clear for example that individual computer equipment and access to the Internet cannot constitute a model of reference enabling the evaluation of Digital Divide which separates the USA from Africa. Considering the lack of infrastructure and lower incomes, access in Africa is provided via privately or publicly-owned collective access points (Chénau-Loquay, 2002). By contrast, it is meaningful to compare regions or countries which access relies upon collective solutions.

To simply characterize these various trajectories, let us give two possible values to each part of our three-layer model (access, uses and services).

- Access could be private/individual or public/collective.
- Usages can be sophisticated or simple. These complexity and simplicity depend essentially on the nature of terminal. If the terminal is a computer, uses are rather sophisticated because they are based on the 'Do it yourself' model which characterizes computer products. By contrast, there is the 'Ready for use' model based on electronic consumer goods industry. Terminals such as mobile phones, TV and so on are easier to use and then usages are simplified due to the ergonomic know-how of this industry.
- Services may result from a commercial supply or a cooperative model based on the role of communities in an economy grounded on non-rival informational goods (see Gensollen in this book).

Therefore, some combinations can be distinguished as many access/uses/service possible paths. The 'Occidental' path, prevailing in the USA and Europe, combines private and individual accesses with 'Do it Yourself' uses and with informational services which are mainly cooperative given the current difficulty of selling informational goods on Internet. The 'Asian' path is quite different because it tends to substitute the 'Ready to Use' usages for computer usages model. From this model emerges an economy of informational commercial services and online transactions (mainly on mobile phone networks). The 'Asian' path is mixing 'individual private access/simplified uses/online commercial services'. The third path concerns developing countries. It is built from collective and public accesses when it takes the way of 'Do it Yourself' uses but this way seems hopeless. The future is rather on the side of private access/simplified uses from mobile phones/commercial services which are basic, cheaper or subsidized.

**Conclusion**

This paper has sketched the different ways of switching the Digital Divide issue into a research topic. Beyond its legitimate nature –which are inequalities linked to ICTs and Internet diffusion?–, this issue should be analysed thoroughly so as to elaborate more appropriate policies orientated against Digital Divide.
We have first observed that there are different problems according to the level of development and geographical scales (industrialized countries, developing countries, regions, rural/urban). Two major problems are underlined but with unequal intensity according to geographical environment: the concentration of ICTs production and its linkages to ICTs uses, territorial discrimination by network infrastructures. We have then defined three main research issues: to clarify the 'market versus public intervention' debate, to analyse the interdependences between access, uses and contents into a three-layer model, to define diversified paths of diffusion in order to give sense to the notion of Digital Divide.

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