



# THE DIGITAL DIVIDE – A RESEARCH PERSPECTIVE

## A REPORT TO THE G8 OPPORTUNITIES TASK FORCE

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REPORT TO THE G8 DIGITAL OPPORTUNITIES TASK FORCE[1]

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## Executive Summary

The establishment of the Digital Opportunities Task Force by the G8 within the Okinawa Charter in November 2000 indicates political perception of the importance of access to and availability of ICTs, and of participation in the development of the global information society. To find out whether this intuitive perception is supported by empirical research evidence is the objective of this paper. To achieve this, a review, analysis and synthesis of a representative range of research documents was undertaken.

The term 'Digital Divide' is used and defined in many different ways in research. The definition used indicates the angle of approach to this vast field. Theoretical frameworks addressing the nature of the Digital Divide are clearly missing. It has been found that it can be defined in terms of Technology and Infrastructure, ICT Tools and Content, ICT related Knowledge and Skills, and in terms of International Power Relations.

This current situation leads to a rather simplistic approach to the theoretical deficit. In order to apply more focus to this vast field, it makes sense to integrate work on the Digital Divide into the development agenda as a whole. This discussion covers two main areas: The impact of ICTs on developing countries and problems of ICT take up for developing countries.

With regard to the first area, there is disagreement in research on how to assess ICT impact exactly. With ICTs permeating virtually every aspect of economic, political and social life, qualitative assessment of the use of technologies is more revealing than quantitative results. As this cannot be expressed in hard numbers, the intangibility of the results leads to disagreement in assessing the impact of ICT. Linked to this is the notion that there is no "one-size-fits-all" solution to an effective use of ICTs for all developing countries. Varying political and economic landscapes require different approaches. However, there is a general consensus that channeling a large spread of ICTs on a sound regulatory basis is the most effective way to use ICTs. It is also generally agreed that the Internet is very influential because it can provide cheap access to information and knowledge, offer the remote provision of basic public services, allow new ways of working and doing business and create favorable conditions for the growth of SMEs.

At the same time, it becomes clear that there is still a lot of research to be done in this field. Analysis of the links between ICTs and social and economic growth is still very weak. Social impacts are even more difficult to capture in analytical studies. For a better understanding, studies on the following are required: IT distribution and use in relation to social demographics or along regional lines, studies with a wider view that look beyond the private sector or governmental bodies as the principal actors, studies which deliver empirical evidence for or against the leapfrogging of technologies argument, and studies assessing the impact of specific policy implementation .

With regard to the second area, it is generally agreed that there are a number of conditions that favour the take up of ICTs in developing countries. The overall political situation is an important factor in any movement towards digital inclusion. Investment policies and the reform of the telecommunications sector are especially important for building the appropriate infrastructures and providing accessibility. A systematic approach, co-ordinated management at national and local levels, and the articulation of a clear vision and strategy, are all seen as important prerequisites for successful adaptation to the global information society.

A number of conclusions can be drawn from the review of the research in this field. Development and the attraction of investors to developing countries can only be achieved by offering direct financial benefits in return for their investment. Expectations and opportunities alone are not enough. Multi-level and multi-faceted approaches are needed to address the needs of the individual countries and regions in the developing world. Local and global research, which seems to be separate at the moment, needs to be linked. As regards policy, the overriding pressure to open up markets in the developing world and achieve universal access has to be balanced against the implementation of mediated access where advisable.

Furthermore, it can be concluded that the importance of education cannot be over emphasised. Investment in specific ICT skills training and education in general seems to promise a better return than investment in infrastructures. In addition, we need to learn more about the impact of policy implementation. Policy evaluation and assessment studies are needed and there is a definitive need for prospective studies in the area.

In the context of the development agenda as a whole, discussions on which technologies should be implemented, when and at what rate, are ongoing. The validity of ICT implementation as such is not questioned and the benefits in logistics or ICT industry growth are clear.

From a European perspective, there is an interest in the development of coherent policy formulation in a number of areas. It would be useful if Europe could encourage a multi-lingual, multi-cultural approach, based on its own experience. The European institutions and institutes could address the lack of foresight studies and prospective work. Policy and project evaluation in developing countries can also have an important impact on European policy formulation. Indeed, research on the Digital Divide and ICTs and development needs a home. The establishment of a permanent observatory in this area, with the extensive collection and classification of research, is required.

## Background and Structure of the Report

This report, a European Commission contribution to the G8 Dot Force, describes the status of current research on the Digital Divide. The work was carried out by the EC's Joint Research Centre, at its Institute for Prospective Technological Studies (IPTS) based in Seville, Spain.

The purpose of the contribution is to ensure that, as far as possible, the Dot Force's work is properly informed by the progress of current relevant research. A secondary purpose is to help address some of the "either/or" arguments that have suggested that the role of information and communication technologies (ICTs) in development is irrelevant to the needs of developing countries.

The problem of the relation between access to and availability of ICTs and participation in the development of the (global) information society is clearly recognised politically. There are no strong pointers, however, on where to go or which policy measures to take, though there is an instinctive assumption that countries without advanced telecommunications infrastructure will be left behind. The question is therefore, can evidence to support this and other assumptions be found in current scientific and economic research?

To answer this question, an effort has been made to carry out a review, analysis and synthesis of research into the impact of ICTs on development already carried out by a wide range of academic, research and intergovernmental organisations[3], with a view to:

- establishing the status of current research and summarising its main results (including an attempt to define the meaning of divides such as north/south, rich/poor, etc. in the light of information society developments),
- contributing to the Dot Force's recommendations and policy formulations by identifying promising areas for future research and gaps in current academic work.

Following this introduction, the report is divided into four parts:

1. A summary of the different definitions and viewpoints on the Digital Divide and the role of ICTs in development encountered in reviewing the research.
2. Discussion on research findings with regard to the impacts of ICTs in developing countries.

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[3] Two conditions have influenced the conduct of this study: (1) the time and human resources available meant that the work was based on what the authors considered to be a limited but representative selection of the most important research findings; (2) IPTS has competencies in ICT foresight, impacts and policies, but its experience of development issues has been limited to its work on EU enlargement. It therefore sought the help of researchers familiar with the global issues in a review workshop held in Venice at the end of March. Their significant contribution is acknowledged in the bibliography [78].

3. Discussion on issues affecting the take-up of ICTs in developing countries.
4. Some conclusions with regard to the ‘state of the art’ in research related to the Digital Divide.

A bibliography of the sources used to reach these conclusions is appended to the report.

# 1 DEFINING THE DIGITAL DIVIDE

## 1.1 Introduction

The term Digital Divide is used and defined in many different ways in the research. It is often defined as *a result from differential access to telecommunications* comprising the accessibility and availability of communications infrastructure, technologies, applications and services [16]. However, some studies also focus on accessibility and availability of appropriate content and/or on the availability of the knowledge and skills required to develop and use the services.

More generally, the 'Digital Divide' is defined as the gap between nations which can and cannot afford the technology, between the businesses and consumers enjoying the advantages of the Information age and those still awaiting its benefits, as the divide which separates the haves from the have-nots in the sphere of information, or as the exclusion of those who are poor, illiterate, rural or non-English speaking [26,32,29]. Determining who has access to information resources is considered a critical first step towards closing the Digital Divide and ensuring that no group continues to fall through the Net [21].

Thus, a large group of publications related to the Digital Divide focus on the availability and accessibility of the telecommunications infrastructure, in particular the basic telephone service. Most recent publications assess these issues not only on the basis of tele-density, but also of Internet penetration, and access to computers and data services by households, public institutions, private sector, etc. They see the limited availability of information and communication infrastructure as the most crucial barrier in many developing countries.

However, the research recognizes that physical access is not the only obstacle faced by developing countries in their attempts to join the global information society. The economic conditions in which the relevant systems, networks and services may be put to use are also an important factor. These can differ greatly from country to country. In many cases, high access and usage costs and other price structures appear as a self-inflicted barrier hindering developing countries' abilities to compete in global markets [32,8,16].

According to UNCTAD, other major problems or challenges of a more generic nature include [32]:

- the low level of economic development and small per-capita incomes;
- the limited skills base with which to build new services;
- the number of Internet users needed to build a critical mass of online consumers;
- a lack of familiarity with the use of ICT-based services.

Following this line of thinking, there are also attempts to analyse the Digital Divide in terms of "e-readiness attributes" – connectivity, e-leadership, information security, human capital, e-business climate.

## 1.2 The Divide defined in terms of Technology and Infrastructure

***Telecommunications Infrastructure and Services***

In so far as infrastructure development and access are concerned, the Digital Divide issue is very well covered by the research. A number of studies assess the level of telecommunications infrastructure in developing countries, regional and international connectivity, transmission capacities and main operators in the market [10,15,16,1,20,21,22,31,1]. Included in key elements of connectivity are [25]:

- the availability of fixed and wireless communication services, community access centres (free and paid), and networked computers in businesses, schools, and homes;
- the affordability and reliability of network access, including the cost of service, downtime, and the prevalence of sharing access among individuals;
- the underlying infrastructure, including the reliability of electrical supplies for business-critical computer operations.

In the World Telecommunication Development Report 1998 access to communications is considered to be a basic human right [8]. Tele-density, affordability of telephone services, global and regional development towards supplying access using different technologies have been addressed in research. Both country and region specific data for the various communications services offered and their means of access are presented (e.g. for Africa, Latin America) [1,8,10,22,27,32].

A recent world-wide project carried out by Pyramid Research presents a set of indicators and a methodology for assessing the information infrastructure with special emphasis on developing countries. The infrastructure development indicators by region (Latin America and the Caribbean; South Asia, East Asia and Pacific, Eastern Europe, Middle East and North Africa, and sub-Saharan Africa) are based on actual data and projections for total investment, revenue, infrastructure and traffic for the period 1990-2010 [16].

The issue of Universal Service is important in any policy discussions about closing the gap in access to telecommunications services – its definition, objectives and scope, and the practicalities of its provision. The issue of enhancing access and redefining Universal Service (basically broadening the scope of the concept) is widely studied and discussed [2,5,15,24,32,34,35], and not only in the context of developing economies. Linked to this are considerations of Internet growth, quality and bandwidth of access, cost structure of services, etc.

At the same it is considered that this progressive vision of Universal Service is not the entire solution to closing the access gap. Universal Service policies will be effective in developing countries only where literacy and basic education are guaranteed. A Northern-inspired concept of Universal Service based on service to individuals everywhere may therefore be ill-adapted to the needs of developing countries, which have to ensure access in a very different cultural and social environment. One example of a different structure emerging in

developing countries is illustrated by the growth of so-called Intelligent Intermediaries. These latter-day scribes act as a bridge enabling the illiterate and uneducated to use ICTs [78].

The problem of unfavourable levels and structures of telecommunication costs for users in developing countries is stressed in a number of studies [1,2,8,10,16,1,22,32,34,35]. The correlation between Internet use and per-capita income levels is seen as an explanation of low Internet penetration. Comparisons of the costs of communications per unit time are revealing: an UNCTAD, study shows that developing countries are paying about 3 times more than the OECD average [32]. The more complex and expensive cost structures of telecommunications services, in particular installation costs, local call charges and line rentals, are seen as obstacles to the penetration of advanced services. Indeed, it is argued that more important than the concept of accessibility is the notion of affordability [78]. By imposing such high access costs, latecomers are penalised and development is hampered. Without affordability there is no real access.

***Rural telecommunications***

Historically, developing rural telecommunications was seen as the key to solving communications problems in the Third World. However, demographic trends, including urban migration, have led to a recognition that network roll-out in rural areas is now regarded as a separate, though related, issue. Studies on rural telecommunications generally focus on the special characteristics of rural environments and their implications for the development of telecommunication networks and universal service provision [5,7,22].

The planning of networks in rural and remote areas and the related engineering, financial, fiscal and regulatory aspects were addressed in the ITU Handbook on "New developments in rural telecommunications" [5]. Various network technologies have been examined for implementation in rural telecommunications, with an emphasis on radio technologies. The main focus, however, is on existing or emerging technologies capable of providing cost-effective solutions appropriate to the needs of rural areas in developing countries. The implementation, operation and maintenance of rural telecommunication networks themselves have also been taken into account. A recent ITU-D study focuses on the mechanisms to promote the development of new telecommunication technologies for rural applications (wireless access systems, applications for small businesses, tele-health, tele-education, disaster control, etc.) [7].

The simple fact that the deployment of telecommunications systems requires a reliable energy supply appears as an important problem in several studies. Even some capital cities in Africa have power sharing and many rural areas may only have power for limited periods in the evening, if at all. Hence there is a need for renewable and off-grid energy solutions [7,10,32]. Various criteria related to infrastructure, energy, social benefit and cost have been determined for the selection of technologies for rural applications [7].

According to several studies, the development of rural communications and the provision of affordable access to new services and applications can benefit from

community or public access in multipurpose centres [6,12,22,24,32,1]. With the very low penetration levels and limited resources of consumers in developing countries, e.g. in Africa, shared multi-purpose public access facilities run by entrepreneurs and communities, commonly known as tele-centres, can have positive effects. A number of publications and case studies are devoted to tele-centre objectives and planning [6,12,13]. They put an emphasis on the role of national and local authorities, the identification of potential partners and funding opportunities, as well as on developing the business plan and/or project proposal.

In a recent Council of Europe report, the term *e-gateways* is used for tele-cottages, cyber-cafes and similar organisations, to highlight their role in supporting access to the information society in a social setting, different from work or home [24]. Their hybrid names, 'cyber-café', 'tele-cottage' and 'electronic village-hall', emphasise their role in bridging the gap between familiar social locations and the virtual world. Like the technology they use, these organisations cross the traditional boundaries between learning, information retrieval, and communication.. Organisations which focus on only one of these aspects risk missing the breadth and significance of the information society There is a widely held belief that the availability of local e-commerce services is expected to increase radically the demand for multi-purpose tele-centre services. This is expected to improve the centres' sustainability by providing more useful and relevant applications for rural areas, provided they can be coupled with efficient transport and delivery systems for physical goods [32]. Evidence of such a virtuous circle, however, is hard to find.

## 1.3 The Divide defined in terms of Use of ICT Tools and Content

The level of computerisation in developing countries is very low, primarily because of the high cost of equipment relative to the low levels of economic development and the lack of the necessary skills[10,16,32]. Many import tax regimes treat ICTs as luxury items, further adding to their cost. Some studies also show a lower penetration of computers in the public sector caused by the lack of resources, IT use being concentrated in private companies. Even then, the organisation and utilisation of computer resources is often limited to stand-alone PCs, which are not connected to the Internet or to a Local Area Network.

An important issue is the availability of local Internet and data services in developing countries [10,1]. The development in Africa towards provision of local Internet services shows a positive trend – in 1996 only 12 countries had local access, while by the end of 1999 almost all had local access. Another positive trend in bridging the Digital Divide is an accelerating growth of the number of Internet hosts. However, Internet penetration, especially in rural areas in Sub-Saharan Africa, is still very low [10,32,1]. At the same time, largely due to high international tariffs and a general lack of network capacity, it is difficult in most countries to obtain sufficient international bandwidth for delivering web_pages over the Internet. As a result a growing number of Internet sites in developing countries are hosted on servers in Europe and United States A lack of local interconnections (peering) of ISPs, or the relatively high web hosting costs of local providers [16,1,32] also add to this trend.

In the area of Internet content development, there are some data that indicate a rapid expansion and availability of the number of local or internationally hosted web servers of developing countries. However, the quantity of web information is still considered to be very limited, sometimes giving only basic descriptive and contact information. Some studies report a higher web presence in particular sectors, for example, tourism and foreign investment [10,32].

A few studies examine the lack of skills and capacity for developing local content for the web [10]. Availability of content in an appropriate language affects the diffusion of the Internet in several countries [7,16,1,10]. Internet content in the local language is limited in most developing countries. According to the Internet Society, more than 80% of web pages are in English, although only 57% of Internet users have English as their mother tongue [1,1]. This figure is likely to decline with the growth of the Internet use in non-English-speaking countries.

In addition to this supply-sided view of content provision, it is also argued that a lack of demand undermines a larger scale distribution of native language content. The small number of such content providers is matched by a lack of market and other incentives to provide native language content. Without reaching some sort of critical mass in the user base, it is very difficult to justify a viable business model for its provision. It would appear that the problem of native language content development represents an area for further research, in order to formulate policies directed at the market failure mechanisms involved.

Studies show a number of activities focused on the use of ICT applications in developing countries [1,2,4,7,10,12,17,22,24,28,33]. These aim, for example, to help groups of users gain access to the Internet through training, equipment donations and communication subsidies, or by developing local information resources. Others focus on Internet connection assistance for local organisations, assistance for national and regional electronic network development, and the development of local information resources. The main emphasis is therefore on general Internet infrastructure development, but there are an increasing number of activities directed towards improving ICT use in specific areas such as environment, research, education, government, agriculture, trade and healthcare. This seems to be in line with general research findings that projects have to be close to the interests of the users.

## 1.4 The Divide defined in terms of Knowledge and Skills

Some studies give an overview of the socio-economic landscape and of education and human resources development in the countries, regions or sectors to which they relate [3,10,14,15,1,27]. The availability of sufficient human resources, in particular the capacity to exploit the opportunities and deal with the rapid changes resulting from the use of new technologies, is considered to be an overriding issue for bridging the Digital Divide [14,15,16,1,19,22,32]. A critical mass of skilled labour is needed in developing countries to supply the necessary applications, provide support, and disseminate relevant technical knowledge. The main shortages (and not only in the developing countries) are in four areas [25]:

- managers capable of completing complex technology projects;
- policy analysts who understand the tendency of government regulation to dampen business, particularly in a changing technology environment;
- local content creators aware of the network's potential;
- software, hardware, and communications engineers.

A major problem in the area of human resources development is that the pool of expertise in these countries is relatively small (at all levels, from policy-making to users) [7,27]. Rural areas are particular short of expertise in infrastructure operation, installation, computer maintenance and software troubleshooting. There are a number of international initiatives under way, but the availability of specialist training is limited, particularly in Africa. Moreover, there is some evidence that the labour market situation in the North is exacerbating the situation in developing countries, because experienced local technicians can easily find higher paying jobs in Europe and North America [25,32].

Beyond the need for specialised knowledge and skills, development could benefit from an educated population, able to use computer networks and with an interest in new services and tools. This leads to a general emphasis on the importance of the qualities of the educational system. Some studies focus on the various sectoral needs, for example, those of farmers and human rights and advocacy organisations. These studies concentrate on the barriers for acquiring information, to accessing the Internet, the availability of ICT skills, principal training needs, etc [11,27].

There is a huge gap between the North and South in the exploitation of ICTs in education. The costs, infrastructure and expertise necessary for the production or acquisition of these rapidly evolving technologies, as well as their installation, maintenance and full exploitation, is beyond the reach of many poor countries whose education systems lack even more basic teaching and learning resources. The development of virtual education in schools, colleges, universities is assessed in terms of technology, financial and human resource impact and learners' and teachers' acceptance. The accessibility of the Internet in educational institutions and the language problems in most developing countries have also been pointed out [17,19,28]. It seems that the problem is largely put in practical and technical terms. But even in rich countries, it is still not very clear how ICT-based educational reforms are going to develop. With greater needs and fewer resources, developing countries urgently need a clear vision on ICT-based educational reforms.

## 1.5 The Divide defined in terms of Power Relations

A number of studies on the Digital Divide enter the highly politicised area of power relations, in the context of ICTs and development. In general, access to information resources is considered to be increasingly critical to every individual. Access to information facilitates looking for a job, working with colleagues in and outside the workplace, taking courses, researching information on new products or other developments, accessing public information in order to exercise one's citizens rights, and many other less critical applications.

A recent paper from Demos (a British think-tank) argues that most efforts to tackle the "Digital Divide" are wrongly focused [77]. The authors show that the real challenge is not exclusion from information, but exclusion by information. The rise of a digital economy based on detailed personal profiles means that organisations - public, private and voluntary - are increasingly able to exclude large numbers of people from access to basic services and opportunities on the grounds that they constitute 'bad risks'. In the long term, the growth of exclusion by information raises fundamental questions about social mobility and the role of the state.

This is also in line with the notion of "systems of disabling regulation", a remainder from colonial times used to prevent local competition for resources, and the reason why the largest customers of the developed world are the governments of countries in the developing world. This way local competition for resources is eliminated and demand is suppressed. However it has been established that a demand-led strategy towards progress and development is more fruitful than a supply-led one. [4] Therefore it is in the interests of the Western world to realise that this also has a dampening effect on their development and prosperity, and to consider constructive rather than destructive policies.

This notion of accessibility and the exclusion of minority groups is not unique to the developing world. Access discrimination against the poor, the illiterate, the disabled, ethnic minorities or non English speaking people is well documented in the United States, for example. There has been some fairly extensive research carried out there into the distribution of access in relation to social demographics, carried out by both government [20,21] and private research institutes [44,45]. However, this type of exclusion needs to be studied far more in the context of developing countries.

One also has to take account of problems of control and management of (international) networks and of information flows and content. The issue of Internet governance is considered to be an important aspect of Internet development. Domain name management, domain name registering companies and Internet machine numbering (IP address allocation) are becoming important resources. There are, however, hardly any detailed studies of their impact on the Digital Divide.

## 1.6 Conclusive and conceptual remarks on the Digital Divide

The establishment of a theoretical framework addressing the nature of the Digital Divide is clearly lacking in the research. The current framework paints a rather simplistic and linear relationship between the ‘haves’ and ‘have-nots’, largely ignoring the many diverse factors, both internal and external, which come into play. The Divide is, in fact, a varying landscape which manifests itself in a range of indigenous factors and external structures. Indeed, the very structure of the present chapter illustrates this point; it attempts to address the theoretical deficit by outlining at least four different angles of analysis.

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[4] See point 8 of the concluding remarks, page 16

At the same time, this structure reflects the rather one-sided approach to the Digital Divide found in the literature. It is the developed world's view of what is lacking in the developing countries, of what developed countries have and developing countries have not, that tends to shape current perceptions of the Divide. Technology & Infrastructure, or Knowledge & Skills are so-called "enablers", yet there is an argument that states that even with these enablers in place, developing countries would still not be able close the gap [78]. The question is whether developing countries would actually be able to use all the information and technologies once they have been placed at their disposal. Consideration of the drivers as well as the enablers would be needed to answer this question. Indeed, a sound theoretical framework would aim to translate the information and technologies into action by taking all indigenous and exogenous factors into account. Research on these aspects is scarce and leaves the work on the Digital Divide incomplete.

Finally, it has also been argued that the lack of research can be explained by the sheer size of the topic. To examine the Digital Divide in all its facets is such an extensive task that it is difficult to bring together the required research skills and to synthesise the results. As one observer stated, saying there is a lack of research on the Digital Divide is like saying there is a lack of research on life [78].

One way of resolving the dilemma would be to integrate work on the Digital Divide into the development agenda as a whole. This would give some focus and meaning to the term and serve to recognise the essential nature of the contribution of ICTs to development in general.

The following section discusses how current research views that contribution.

# 2 THE IMPACT OF ICTS ON DEVELOPING COUNTRIES

## 2.1 Assessing the Impact of ICTs

The role of ICTs in development and economic growth is widely covered by research [69, 63, 1, 50]. Several studies attempt to answer questions such as 'what makes ICTs different from technologies of the past?', 'what are the channels through which ICTs can promote development?' and 'what justifies the confidence placed in ICTs as a tool for development?' [22]. At the same time all of these studies lack consensus on how exactly to assess the impact of ICTs on the political, economic and social sphere. ICTs permeate almost every aspect of society and life and their impact is usually assessed by looking at the way they are used, not how much they are used [40]. Qualitative results instead of quantitative ones are required; this is a cause and effect relationship which cannot be expressed in hard numbers. There are soft barriers, processes and implications that cannot be isolated or pinpointed as individual entities.

This also leads to the argument expressed in many studies that ICTs and their impact have to be seen within the environment in which they operate [22]. It is not a "one-size-fits-all" solution for a developing country to install an information infrastructure as the saviour of its frail economy, political structure or social cohesion. Similarly, the development of an ICT industry cannot rescue the whole economy on its own. The impact of ICTs is extremely difficult to assess, but the general consensus is that a large-scale spread of ICTs, and a sound regulatory basis channelling its distribution in a qualitative manner, make the most sense for using ICTs in the most efficient way [40]. This duality between hard numbers and soft qualitative assessment is reflected in the research. While on the one hand there are extensive studies of ICT impact in certain fields or in specific technologies, there are also vast fields where research is lacking or incomplete. This chapter aims at highlighting what research is available and where it is lacking or incomplete.

## 2.2 The Internet and E-Commerce

A large number of studies identify the Internet as the real engine of the new economy and assess e-commerce feasibility as in the interest of western companies [71, 52]. The role and impact of ICTs has been found to be of increasing proportions, along with liberalisation and the privatisation of the telecommunications sector, in many developing countries [76, 65, 63, 50, 49]. While still being hampered by an under-investment in low income countries and a general lack of regulation, the Internet has become an influential factor in developing countries. This is not only because economic and business potential is envisaged and evaluated but also for the educational, interactive and informative abilities it offers.

Due to its specific characteristics – effective digital technologies, capable of interactive and asymmetric transmission of data, text, images and video at low cost – there is a widely held belief that the Internet is offering new opportunities, including [1]:

- relatively cheap access to various sources of information and knowledge;
- remote provision of basic public services – health and education;
- new forms for working and doing business;
- conditions for rapid growth, in particular for small- and medium-sized enterprises (SMEs).

These general challenges for ICTs and the Internet are outlined in a number of studies [1,2,1,19,22,31,1]. Some focus more specifically on the digital opportunities for developing countries. A World Bank study on global economic prospects, for example, focuses on e-commerce in developing countries, outlining its potential effects on productivity and international trade [1].

There is a strong motivation and commitment to tele-medicine in developing countries. This is often backed by a willingness to pay for systems which are expected to improve public health and lower medical costs in the long run. Tele-medicine services may be perceived as more necessary in developing countries than they are in the industrialized world, resulting in a greater willingness among the former to change established methods of doctor-patient interaction and healthcare administration.

Tele-medicine and tele-health applications are not limited exclusively to expensive, high bandwidth services. As long as the local medical community remains motivated and committed to implementing tele-medicine and tele-health programs, there is a wide range of health benefits that can be achieved through remote patient monitoring and diagnosis, multimedia communication links between urban and remote facilities, and broadcast of health information over radio and television [7].

## 2.3 Information and Development

It is widely accepted that, in the digital age, information is becoming a powerful tool for development. The Internet might be the engine, but ‘content’ can be considered as the ‘fuel’ of the new economy. At present intangible goods – services, content and software – represent a growing part of the economy. Access to content, information and knowledge is a prerequisite for the use of experience, knowledge and ideas, and thus for higher efficiency, innovation and creativity. Even if some studies claim that such intangible values are difficult to assess, the mere fact that anticipated benefits for education and knowledge diffusion create a vision and incite policy-makers to argue for this, can also be seen as a result of the impact of ICTs.

In this light many ‘closing the gap’ initiatives simply start from the assertion that ICTs are important as a prerequisite for growth, or as a potential source, in developing countries. Many studies outline the opportunities offered by the use of ICTs. Although this is intuitively correct, it is precisely the analysis of the linkages between ICTs and economic and social growth that seems to be weak. Much of this is limited to the well-known statistical relationship between GDP and the number of phone lines, or modern derivatives of such an analysis. On the one hand this is not so surprising - the discussion on the productivity

paradox precisely shows how difficult it is to establish a clear relationship between investments in ICTs and economic growth. ICTs as a source of economic growth are very difficult to measure and assess, and reliable data or ways to interpret this data are scarce. Research data on human capital in developing countries, the "braindrain" exodus[5] of skilled labour to higher income countries, are lacking. Social impacts are even harder to capture in clear figures. Again this refers to intangible values involved in assessing ICT impact.

## 2.4 Areas where research is lacking

While the discussion on the issues outlined in the previous section is fairly animated, there are a number of areas where research is lacking, incomplete or just starting. There are a great number of studies which deal with every aspect of Telecommunications such as infrastructures and indicators relating to use, accessibility and distribution, but there is still a lack of similar investigations in the field of Information Technologies [66, 63, 60, 59]. Estimates of the number PCs per country or per capita Internet Hosts are easily available, but these are also short-lived and due to the rapid growth in this sector, out of date by the time they are published. IT penetration in real terms, studies on distribution and use in relation to social demographics or regional divides, as found for example in the United States, are scarce for developing countries [44, 45]. This can certainly be partly explained by a lack of funding for such studies, but possibly also by a lack of awareness at the political level which has frequently been criticised. Indeed it has also been argued that there is a general lack of a broader view and vision by the parties involved. Observers argue that research in the field of ICT and development focuses almost exclusively on the private sector or governmental bodies. However, development is not only pushed by industry and government but by a wide range of other institutions, organisations and bodies. Non-governmental institutions, pressure groups or research bodies in general can have a shaping influence and contribute to creating a vision or enforcing policies or regulation, and therefore influence the impact of ICTs.

An issue that has received increasing attention is the ability of developing countries to leapfrog technologies. The need for fixed line terrestrial infrastructures, for example, is questioned when the jump to mobile communications can be made instantly. Yet these arguments are not supported by research evidence. Nor does research point to the opposing argument: a lack of appropriate technologies and a lack of local ability to use and convert technologies to their advantage. The fact that developing countries are, in many cases, not ready for modern technology or that they cannot use this to their advantage therefore leads them to opt for a step-by-step approach instead of leapfrogging into the unknown. The inconclusive nature of research on the meaning of appropriate technologies in this high-technology field (are low-tech

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5 It is interesting to note that although "braindrain" is often presented in a negative light, it does have a number of positive effects and is not necessarily seen as a long-term loss of skilled labour. Skilled people working and studying in other countries often create mutually beneficial networks with developed and home countries and refer lucrative contracts and projects back home. The net effect is often regarded as more beneficial than harmful.

ICTs possible or even useful?), and on the merits of technology leap-frogging in greenfield situations points to yet another area of further work.

Lastly, with regard to the implementation of development policies, there are some hypotheses that suggest that the different approaches for the development of an information infrastructure, top-down or grassroots respectively, best apply to the pursuit of different objectives. Top-down approaches are seen as more efficient when working in spheres of government, general education policies or nation/region wide programmes while the grassroots bottom-up approach seems better suited for localised training programmes and the provision of access targeting minority groups. This is however an instinctive assumption which similarly has not yet been proven by research and studies.

# 3 PROBLEMS OF ICT TAKE-UP

## 3.1 Regulatory environment and investments

The development towards a digital economy and the narrowing of the North-South divide are closely related to financial resources and investments, restructuring and liberalisation of the telecommunications sector, international trade agreements and policies with regard to market structures in developing countries. Internet growth in the less developed regions of Africa, Latin America, Asia and Europe not only depends on the availability of appropriate infrastructure and international connectivity, but is also very dependent on the political and regulatory environment [1,2,9,10,15,19,22].

The overall political situation in and between countries is assessed as an important factor for activities towards digital inclusion. Very early in the debate, concerns were raised about the lack of coherent national and regional IT policies and about the understanding of the Internet by governments. Restrictive government policies regarding intellectual property rights, security, privacy and censorship have also been studied as potential barriers to a wider use of Internet [10]. Inadequate public funding and market distortions help deny technological benefits to many developing countries [67]

Investment policies and the reform of the telecommunications sector are especially important for building the appropriate (access) infrastructures [10,32,1]. The high costs and the complex cost structure of telecommunications services in many developing countries are seen as a result of the structure of the industry and of the inertia in policy choices which do not yet adequately take into account the challenges of the Internet era. An early liberalisation of the market for value-added services in some countries has resulted in growth in the number of data, paging and other service providers. The introduction of competition is perceived as a positive step which in some countries has led to lower Internet service prices. Privatisation of the incumbent operators and the inflow of foreign investments in the telecommunications sector have shown some positive effects, but do not generally lead to the country-wide expansion of infrastructures. And in some cases the short-term profit-driven behaviour of local monopolies and some commercial ISPs has worked against longer term community interests [16,1,22].

Still, a systematic effort to create efficient market institutions and regulations is seen as the central element to avoid further deepening of the global Digital Divide and aggravation of social inequalities [2,8,10,16,32]. In some countries regulation prohibits the use of alternative Internet access methods (e.g. VSAT and other wireless technologies). Therefore a policy that reduces the high (and often prohibitively high) Internet licensing and subscription fees, and facilitates the licensing process and obtaining frequencies is considered a basic tool for higher digital inclusion. For closing the urban-rural divide, a universal service policy, referred to earlier, remains an important mechanism.

Indeed, it can be argued that liberalisation and an appropriate regulatory environment are instrumental in fostering the take-up of ICTs in a developing

country. While it is important to bear in mind that there is no single exemplary solution for progress, the research does point to a number of prerequisites that can be actively promoted. These refer especially to the liberalisation of the telecommunications sector, as a way of facilitating a quicker and wider development of infrastructure and availability, coupled with a non-restrictive regulatory framework to facilitate the creation of new markets and the expansion of existing ones. However these prerequisites are supply-oriented and it is important to remember that the other end of the market spectrum, the demand side, can be promoted equally through the same governmental instances. Promotional policies aimed at enhancing a demand-side approach, complementary to the current emphasis on regulatory frameworks, can help build the critical mass of users needed to push the development of infrastructure and to build a market.

In a report dedicated to educational problems in developing countries, special emphasis is put on investments in education and human capital [30]. Some data are provided on the rates of returns on these investments, which show that they are sometimes equal or higher than the returns on government investments in physical infrastructures. On this basis a number of actions are recommended for national education strategies, teacher training programs, introduction of ICTs in the national education strategies and for providing private sector investments, etc [25,30]. These strategies must be adjusted to the new realities of the labour market. They relate to the importance of developing "hybrid skills" - ie the combination of an understanding of the business environment with the operations and functionality of technologies. It is familiarity with both fields which provides the highest impact in terms of development as people with these skills have the ability to push progress at the technical level as well as in the market

## 3.2 Co-ordination and raising awareness

Co-ordinated management at both national and local levels is seen as very important for development towards an information society [10,16]. Information sharing and partnership among all concerned in different initiatives is considered important. This can avoid conflicts arising out of uneven distribution of financial resources and helps spread initiatives and support over sectors, groups and regions. It is also stressed that a degree of central planning is necessary, but one which respects and nurtures local enterprise.

Most importantly, it helps if governments are capable of articulating a national vision and information society strategy. Though it is hard to assess in quantitative terms the effect of a clear plan for the kind of development to aim for, and the setting of policy goals, on the relationships between ICTs and economic growth as well as political stability and social cohesion, it is, nevertheless, this notion of vision that is of paramount importance in the development of an information society. The impressive growth of the Indian Software industry, Malaysian development in the ICT sector and Singapore's development of an information society have all progressed under the strong leadership of governments with a clear vision of what was to be achieved. Whether such a high degree of government intervention is desirable for these

countries, or others, is a different question. For the sector, however, clear strategy and vision have proven beneficial. How best to transfer such a visionary approach into other forms of government and different environments would constitute a useful avenue of research.

Thus, the establishment of national cross-sectoral working groups comprising telecoms operators, companies, users, NGOs and government is considered to be of particular importance for Internet development both by researchers and policy makers. Regional and international co-operation and support influences development towards digital inclusion of countries and regions.

Awareness-raising initiatives, including conferences, workshops, seminars, etc. are therefore necessary to educate governments, ICT decision-making bodies, players in different sectors, etc. on important issues for IT policy development. This will help them pay more attention to the positive and negative implications of the introduction of ICTs [1,7,10,16,22,25,27].

# 4 CONCLUSIONS AND RECOMMENDATIONS

This section presents some conclusions from the literature review. These are largely based on an interpretation of the material discussed above and not necessarily directly traceable to the sources themselves. The conclusions are grouped under five different headings: the status of current research in this field, areas in need of research, some pointers for positive take-up policies, the role of education, policy evaluation and vision, and the relevance of promoting ICTs as part of the overall development process. A final section sets out some recommendations for further action, drawn up from a European perspective.

## 4.1 The Status of Current Research

***Types of research***. There appears to be some dissonance between the two broad types of research encountered during this study:

- practice-oriented descriptive research, involving factual analysis and case-studies that aim at analysing and supporting local development and embedding of ICT-applications. The case-study approach usually has good linkages to the affected parties (i.e. developing country representatives), and
- more academic, policy-oriented research aimed at assessing the impact of ICTs on community development. Such policy-oriented research covers a wide range of approaches from straightforward promotion of business interests to very elaborate and balanced analyses of business and policy opportunities, and is usually carried out by international groups of researchers or consultants. One criticism levelled at this type is that it does not involve the affected parties sufficiently.

Bridging this gap may enrich the debate on solving the Digital Divide, and eventually contribute to the construction of a theoretical framework embracing all facets of the problem.

***The dynamics of the Divide.*** The possibility of a growing North–South divide is real. A lack of access to Digital technology does not cause this. It adds an extra dimension of access, availability and usability of information to a divide which already has many facets. The research is not very conclusive about the question of whether the growing global importance of ICTs worsens the situation. A large part of the research that deals with the question is of a prospective nature and talks about missing opportunities for growth. There is a general lack of linking measurement of ICTs (well underway), monitoring of developments (some initiatives taken), and comparative assessment of impacts (very scarce).

## 4.2 Areas in need of research

***Many issues remain to be researched****:* Current research portrays a general image of ICTs and development, including many of the affected issues and areas. Assessment of this research, however, also reveals gaps that need to be filled to provide a better understanding of the issues at hand. In-depth analysis of specialised fields and also broad statistical studies are still lacking for many

geographical areas. Clearly identifiable areas in need of further research are:

- studies on IT distribution and use in relation to social demographics or along regional lines
- studies with a wider view, looking beyond the private sector or governmental bodies as the principal actors
- studies which deliver empirical evidence for or against the leapfrogging of technologies argument
- studies assessing the impact of specific policy implementation

## 4.3 Some pointers for positive take-up policies

***Direct benefits from investment need to be clear.*** Research also points to a need for direct economic benefits of electronic commerce and for direct social opportunities of community centres. With direct benefits it is possible attract more enterprises, more individuals and more institutions from developing countries to the actual use of information technologies and information networks. In the present stage of development, mere opportunities and expectations are not enough to attract investment (as was the case in developed countries). There is some research that shows that a focus on special interest user-groups (within the context of a universal service policy) has positive effects on development. This may very well include groups of small enterprises. In relation to this, the research also advises promotion of entrepreneurship, identification of sources of low-cost computer hardware and software and of sources of soft finance for local business start-ups.

***Multi-level/multi-faceted approaches.*** Reading through the research, we tend to conclude that the research itself (and certainly the policies) needs a holistic approach. Some of the more prospective work is simple technology push (which can sometimes be explained by looking at the companies supporting the research). Most of the research now, however, recognises that the emphasis on infrastructure and tools development needs to be balanced by more complex and far-reaching research and actions around communication needs, local content, development of intellectual property, and preservation/exploitation of cultural heritage. In other words, it advocates the balancing of global economic and political interests with local community interests. This is also an area where European research, with its diverse cultural and linguistic background, coupled with its experience of the enlargement processes, can make a substantial contribution.

***Local and global in terms of language.*** Many projects aim at developing local markets for the Internet and building capacity for its use within a particular developing country. This creates a risk that as soon as any external support ends, the network may collapse. It also explains perhaps why there is some evidence from the research that the development of networks and the level of assistance for ICTs in Africa follow linguistic and cultural patterns. Development in English-speaking countries seems to be ahead, simply because English is the lingua franca of the Internet, followed by the French, Portuguese and Spanish speaking countries (with assistance most needed in East and West African regions). There is also a line of research that tends to concentrate on

local issues and local projects. This research should consider links with the more extensive information economies of developed countries in order to contribute to sustainable projects in the long run.

***Mediated Access***. In the same perspective of linking local and global developments, there is support for arguments in favour of universal service strategies and preferential treatment of public sector initiatives in, for example, education and health care. In this respect the research shows a more varied picture than dominant policies tend to show. There are good reasons for the dominant policy pressure to open up developing markets to (global) competition, but at the same time these pressures make it hard to follow more mixed strategies. However research evidence for mixed strategies is scarce. The question as to whether such universal access models are viable, and where mediated access makes more sense, puts another emphasis on the discussion.

## 4.4 The roles of Education, Policy Evaluation and Vision

***Specific ICT skills.*** Several surveys show the need for educational facilities to train systems operators and to upgrade the skills of the existing operators, as well as to assist ISPs in planning and maintenance activities. There are also some local institutional deficiencies in the provision of technical skills and training to provide the human resources needed to build low-cost Internet/Intranet access and web-site building services. Related to this is the need for system installation and maintenance documentation in appropriate languages and for support for translation and adaptation of imported software. Additionally there is a need for mechanisms to improve the circulation of information about non-commercial software, systems and information resources, for exploiting archives of existing multimedia material, for storage and retrieval via the Internet. All of the above needs to be supported by extensive market research, which is painfully lacking in this field.

***The importance of general education.*** There is evidence to show that investment in education delivers a better return than investment in information infrastructures. This underlines the importance of general education as the major mechanism to increase demand for information and ICTs. It also supports the conclusion that demand-led strategies in general perform better than supply-oriented strategies.

***Evaluation and learning.*** There seems to be a lack of systematic and comparative policy evaluation, which is necessary for the development of more complex policies. In the short term it is important to gather information for evaluating Internet development support roles and to guide strategy development for new assistance programmes. This includes evaluation of existing national case studies, pilot projects and initiatives to provide examples and to avoid overlapping of regional or sub-regional initiatives. In the long run, all the elements of a policy learning strategy need to be put in place, e.g. monitoring, benchmarking, best practices, diffusion, etc. Regional and national observatories have been proposed as a start.

***Vision and foresight.*** In order to maximise the benefits gained from evaluation and learning, it has become clear that there is a need for prospective and

foresight studies in the ICT sector. These would not only make developing countries aware of what is already happening in their economies and establish trends, but also enable them to create a vision of goals and objectives.

## 4.5 The relevance of ICTs to Development

The question is whether ICTs are in fact a prerequisite for economic and social development, or whether policy should prioritise other areas.

The research raises a valid debate on which technologies to promote, at what rate, and in which geographical areas. There also appears to be a more immediate benefit to be had from ICT support in solving the logistical problems of aid delivery. The answer, however, to the overriding question of the role of ICTs in overall development policies appears to be both complementary and substantive.

ICTs are complementary in terms of the inherent support they give to a broad spectrum of economic activity, and their increasing importance as the essential ingredient of the new economy. Certainly, discussion of the post-industrial knowledge society has been conducted almost exclusively in the context of a potential transformation of the developed world. It is difficult to argue that this transformation will bypass the developing world; it is more probable that, as the North develops, so the gap between North and South will widen. However, much more research is needed to establish the relationship between economic transformations brought about in the North, and their impact on the South.

The substantive role of ICTs arises from the new industry they are spawning and the increasingly local support upon which that industry must rely. There is ample evidence of the creation of a nascent, but fast-growing, sustainable ICT industry in developing countries [78]. The fact that it appears market-driven and sustainable is further evidence of the complementary role the industry has in support of the general economic development.

## 4.6 Recommendations from a European perspective

A number of recommendations for further action arise from this study. However brief and constrained by time, the study shows clearly that many areas need to be developed if coherent policy lines are to be formulated. Given the source of this contribution to the Dot Force work, the recommendations are viewed from a European perspective.

Research which goes beyond the "one size fits all" approach to development should be promoted. The multi-cultural and multi-lingual approach and the use of experiences from European enlargement should be beneficial. For example, European work on the management and encouragement of linguistic and cultural diversity, or on the European model of the Information Society embracing both social and economic goals, could provide useful contributions to global policy development.

Foresight and prospective research capacities of European institutions and institutes should contribute to a future-oriented and visionary research effort, up until now lacking in this field.

Priority should be given to drawing lessons from development efforts, including policy and project evaluation, learning what works and what does not, and looking at successful and failed projects. Up until now few attempts at this have been made in research.

There is a general need for an extensive survey of research, which at present is scattered over many areas and research fields. This requires the establishment of a permanent research observatory, and an extensive collection and classification of research documents. Research on the Digital Divide and ICTs and Development needs a home.

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