

The Blind Men and the Elephant

“It was six men of Indostan
To learning much inclined,
Who went to see the Elephant
(Though all of them were blind),
That each by observation
Might satisfy his mind”

John Godfrey Saxe's (1816-1887)
version of the famous Indian legend.

CHAPTER 1

INTRODUCTION

This study explores the nature, strength and direction of the relation between core aspects of the controversial and emerging “global digital divide” and human development over the last decade. The academic community is currently constructing definitions, analytical frameworks, and conceptual models to answer research questions raised by the the use and non-use of digital information and communication technologies on societies around the globe (Analysys 2000; Aspen Institute 1999; Baker 2001; Crenshaw and Robison 2000; Gage 2000; ITU 1999; Kirkman 1999; Mody and Dahlman 1992; Norris in press; NSF 2001; NTIA 1999; NTIA 2000; Quaynor 2000; SIQSS 2000; Sirimanne 1996; U.S. Census Bureau 1999; Warschauer unpublished manuscript; Wilson 1999; Wilson and Rodriguez 2000).

The term “digital divide” was coined during policy discussions held for the U.S. Telecommunications Act of 1996 which was designed to ensure every American eventual access to advanced telecommunications services, and more immediate access to basic

telephone service.¹ Since then, the term has broadened and defined as *differences in access to all digital information and telecommunications technologies*, including the Internet. More recent definitions focus on describing the divide itself by, for example, classifying it into several divides:

The digital divide is a multidimensional phenomenon encompassing three distinct aspects. The *global divide* refers to the divergence of Internet access between industrialized and developing societies. The *social divide* concerns the gap between information rich and poor in each nation. And lastly within the online community, the *democratic divide* signifies the difference between those who do, and do not, use the panoply of digital resources to engage, mobilize and participate in public life. (Norris in press, p.1).

Other definitions, such as the following, focus on describing the effects created by the divide (or divides):

The digital divide refers to social stratification due to unequal ability to access, adapt, and create knowledge via use of information and communication technologies. (Warschauer unpublished manuscript, p.1).

Several characteristics stand out from these two definitions. First, the *global digital divide* is not simply the difference between countries with or without access to the Internet. Second, in spite of being caused by the use of digital information and communications technologies, the divide is not binary, rather it is a complex social multidimensional phenomenon created by the access, or lack of access, to these technologies. Third, from a global perspective the divide may be deepening prevailing

¹ The Telecommunication Act of 1996 also brought to a close the concept of local monopoly in the provision of telecommunication services, removal of barriers to market entry by operators and relaxation on broadcasting services.

differences between developed (post-industrial) and developing countries. For the purposes of this study the global digital divide is defined as the gap established due to *unequal capacity among countries to access, adapt and create knowledge via the use of digital information and communication technologies.*

Inequalities among countries due to differences in their capacity to *access* information and knowledge have always existed. Whereas in 1998 a U.S. medical library subscribes on average to about 5,000 journals, the Nairobi University Medical School Library, long regarded as a flagship center in East Africa, received only 20 journals (compared with 300 a decade ago). In Brazzaville, Congo, the university had only 40 medical books and a dozen journals, all from before 1993, and the library in a large district hospital was a single bookshelf filled mostly with novels (UN 1999). The new component in the already unequal capacity among countries to access knowledge is the *new* type of digital infrastructure required to increase a country's capacity to access knowledge. The infrastructure required to bridge the divide created by differences in *access* to knowledge and information in the developing world is a whole set of complementary digital and non-digital infrastructures that enable storing, processing and communicating information and knowledge in new ways. Broadly speaking, the complementary set of infrastructures include an underlying electrical and telephonic grid, core computing and networking capacity (like for example, personal computers and internet hosts), and access to digital libraries and online subscriptions.

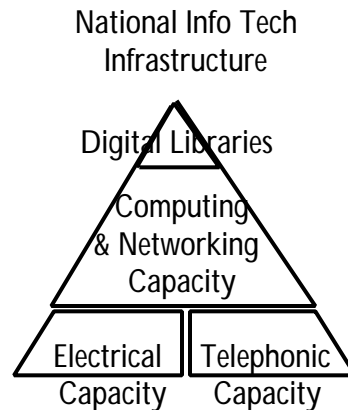


Figure 1.1. Components of a National Info Tech Infrastructure

Second, a country's capacity to *adapt* new knowledge is a function of its human capital. Adaptation of knowledge via the use of digital information technologies is carried out by individuals (Beal, Dissanayake and Konoshima 1986; Langlois 2001). Therefore a country's human capital, i.e. its literacy rates, the quality and quantity of its scientific and technical labor force will create differences in the way knowledge is adapted *among* different countries around the world. So even if countries have equivalent levels of infrastructure, country-level differences in human capital should be useful for explaining differences in adaptation of knowledge. Such was the case of Ireland, comprised of a young population (41% under the age of 25) with strong technological and business skills and access to a strong information and communications infrastructure that became a major software producer over the last decade. In 1997, over 40% of all packaged software for personal computers (including 60% of business application software) sold in Europe was produced in Ireland. By 1998 companies based in Ireland exported software worth \$3.29 billion, whereas U.S. exports totaled \$2.96 billion. By the year 1999, after the U.S., Ireland was exporting more software than any other country in the world, not on a per capita basis, but in absolute terms. In the year 2000, the two countries accounted for 65% of all software exports among the 29 members of the OECD (OECD 2000a; OECD

2000b). Ireland's successful adaptation of knowledge via the use of digital information and telecommunications technologies was possible in part due to its infrastructure, but also to its young and educated workforce. By end of the century, Ireland (the "Celtic Tiger") was considered one of the five healthiest economies in the world (Schindel 2000).

Third, a country's capacity to *create* new knowledge via the use of information technologies depends, among others, on the strength of institutions designed to foster and protect new knowledge (Eliasson 2000; Jang 2000; NSF and NSB 2000; Schofer 1999; Schofer, Ramirez and Meyer 2000; Wad 1988). Even if countries have similar levels of infrastructure and human capital, a country's capacity to produce new knowledge will be linked to its capacity to increase its national scientific and technical publications. Such is the case of Israel that boasts the highest productivity rate in articles published per GDP in the world (67.8), compared to Ireland (24.5), or to the U.S. (21.8) (NSF and NSB 2000). From 1990 to 2000 due in part to skilled immigration, the number of technicians, engineers and scientists in Israel doubled, boasting 135 engineers and technicians for every 10,000 people, compared with only 18 for the U.S. (The Economist 1999 p.27). Besides Ireland and the U.S., Israel is also a major player in the software industry employing 20,000 people with a total revenue of over 1.5 billion U.S. "Israel has emerged as a source of entrepreneurial firms developing software products in areas such as security and anti-virus technology." (Arora et al. 2001 p. 7). Israel trails only behind the U.S. and Canada in its number of new listings on the innovation-driven NASDAQ stock market each year. With such results, the amount of venture capital in Israeli innovations has been increasing by around 35% a year. Not surprisingly, Intel is currently investing its largest R&D center worldwide in Israel, whereas many of the world's largest computer companies such as Microsoft, IBM, Digital, Hewlett Packard, National Semiconductor and Motorola have set up developing centers in Israel (Arora et al. 2001).

Figure 1.2. illustrates the relations between access, adaptation and creation of knowledge via the use of digital information and telecommunications technologies, and national info tech infrastructure, human and intellectual capital.

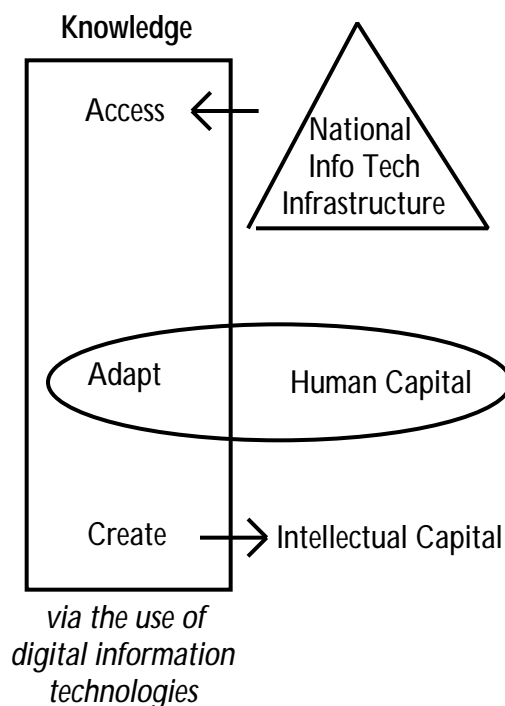


Figure 1.2. Illustration of access, adaptation and creation of knowledge in relation to national info tech infrastructure, human and intellectual capital.

From the perspective of international development, the importance of studying the global digital divide lies in the effects it may have created (and maybe is still creating), on national development, especially in the developing world (Analysys 2000; Aspen Institute 1999; Crenshaw and Robison 2000; Gage 2000; Gurova et al. 2001; Norris in press; NTIA 2000; OECD 1991; Warschauer unpublished manuscript; Wilson and Rodriguez 2000). One of the complexities of studying the global digital divide lies in the fact that each aspect acts as *contributor* and *resultant* of the divide. To illustrate this point, it is of value to examine another example from the development arena: the consequences of disasters in the developing world. Disaster impact measured as loss of

lives is much higher in developing countries than developed ones due to underdeveloped infrastructure and weak institutions for the preparedness, response and mitigation of disasters. The effects of post-disaster scenarios contribute to more underdevelopment in the developing world. Disasters therefore, are one of the *resultants* of underdevelopment, which in turn becomes a *contributor* to more disasters. This describes a complex system which feeds unto itself, controlled by positive, or in the case of disasters, negative feedback loops.²

Similarly, when analyzing the global digital divide, a national info tech infrastructure, human and intellectual capital are affected by a country's level of development. At the same time progress in development³ over time is affected by national info tech infrastructure, human and intellectual capital. When positive, the feedback loop creates a virtuous cycle; when negative it creates a vicious cycle.

The global digital divide may be exacerbating differences *among* countries, but also *within* countries. In what way is the global digital divide affecting the quality of life of individuals in the developing world? Take for example India. Another major player in the software industry, India has been unable to reap the benefits generated by its software industry to produce significant increases in welfare to all of its vast population (approx. 980 million in 1998). Software Indian firms have concentrated in urban southwestern

² Feedback loops are the cycles by which one part of a system influences another part. A positive feedback loop re-inforces itself at each turn. A negative loop folds back on itself, each turn countering the previous one. Even though the words "positive" and "negative" have nothing to do with whether the outcome is good or bad, in this context positive feedback loops produce situations in which progress in development can be achieved, whereas negative feedback loops produce declines in development "stabilizing" the system in its starting point.

³ Progress in development may be affected by many factors such as internal conflict, political, and economic freedom. The simplification is used for illustrative purposes.

regions of India in locations such as Bangalore (with a population of more than 5 million), Bombay, Pune, Madras, and Hyderabad closely mirroring the distribution of engineering colleges. However, today the rural northeastern regions of the country⁴ remain unaffected by India's software industry. In spite of being the undisputed world leader of global software outsourcing having registered an average annual growth of more than 40% over the last decade, and developing US\$3.3 billion worth of software for nearly one third of the U.S. Fortune 500 companies, India's level of earnings per software professional appear to be substantially below that of Israel and Ireland. "Whereas the Irish and Israeli firms appear to earn as much as \$100,000 per employee or more, firms in the Indian software industry earn only \$15,000." (Arora et al. 2001 p. 8). Furthermore, India's domestic software industry has not received the benefits of India's expertise in software. With very few exceptions, software developed packages for the domestic market have not been successful. On the contrary, a large fraction of the domestic software industry consists of resale of software packages developed by foreign, principally U.S. firms. So even though India's software industry has grown fast and is strong in southwestern urban centers, the level of earning per individual is lower compared to its global competition, and the domestic software industry remains weak. In fact, social stratification within India may have deepened due to divides created by access and adaptation of digital information technologies (Heeks 1998). In spite of having made overall progress in development, we are unsure whether the Indian social digital divide may have become another layer in the existing Indian social stratification .

In sum, when referring to the global digital divide, we are referring to the digital divide *among* countries (such as Ireland, Israel, India and other countries), whereas the social digital divide is the social stratification created by the digital divide *within* a

⁴ 72% of India's population live in the rural northeastern regions.

country (such as India). Chapter Two of this study frames the problem of the global digital divide over the last decade, in light of the exponential pace of progress of information and communication technologies.

While fifty years of advances and experience with development interventions provide basis for future planning, the diffusion of information technology in the developing world is a more recent phenomenon.

The year 1989 dawned like any other but, in retrospect, it witnessed two major developments of immense historical significance. One was highly visible and widely celebrated: the symbolic dismantling of the Berlin Wall sparking the brushfire of electoral democracy spreading throughout the post-Communist world and beyond. The other was less generally recognized at the time, beyond a few scientific and technical cognoscenti: the invention of the World Wide Web. Dispersed computers communicating via packet-switching networks, and hence a rudimentary version of the Internet, had linked scientific elites for two decades. It took the invention of the Web by Tim Berners-Lee in CERN and the launch of a graphical browser, Mosaic, four years later to popularize this technology. Like a stone dropping into a pellucid pond, the ripples from this invention are surging throughout industrialized societies at the core, as well as flowing more slowly among developing societies at the periphery. (Norris in press, p.1).

Chapter Three includes an overview of what has been accomplished in the documentation and conceptualization of the phenomenon since the early 1990s. It includes a presentation of analytical frameworks, conceptual models, as well as a discussion of the suggested findings from the very few empirical studies available.

The global digital divide has added new research questions to the development puzzle. Even though a country's infrastructure has always been critical for development, it seems that during the last decade, the underlying "wired" infrastructure for power

generation and telecommunication capacity became increasingly important. The simple fact that the deployment of telecommunications systems requires a reliable energy supply appears as an important problem in several studies⁵. This study explores the nature, direction and strength of the relation between a national computing and networking capacity versus a “wired” infrastructure capacity for explaining national development and progress in development over the last decade. Chapter Four includes a presentation of an analytical framework used to explore these aspects, relations and effects of the global digital divide on development. The framework includes factors considered to have an impact on national development suggested by theory and practice.

Chapter Five includes a presentation of the research strategy, methodology and data sources used in this study to explore the answers to the research questions for a set of 174 developed and developing countries, accounting for more than 93% of the world’s population. In particular, this study is concerned with the exploration of the relation between national computing and networking capacity, national info tech infrastructure and rates of progress in national development around the world from 1990 to 1997. After having established the nature of the relations, the exploration continues by establishing the importance of other factors such as human and intellectual capital, and cultural values within the development context defined in the analytical framework.

National info tech infrastructures composed of wired infrastructures such as power generation and telecommunication capacity, and computing and networking capacity were found to be strongly associated to the level of development in a country. This finding is not surprising; what is surprising is that the core computing and

⁵ A review is included in Gurova, Elissavetta, Christoph Hermann, Jos Leijten, and Bernard Clements. 2001. "The Digital Divide - A Research perspective." Seville: IPTS.

networking national capacity is much better at explaining *progress* in development over the last decade than the entire info tech infrastructure. The digital component of the core computing and networking capacity is much more useful for understanding *changes* in development over the last decade, whereas the entire info tech infrastructure is better for explaining development *levels*. Other findings also suggest the existence of an S-shaped curve in which differences between inadequate and weak infrastructure, or medium and strong infrastructure, are not as significant as those between weak and medium infrastructures. It seems that once a threshold is reached, there is a substantial increase in the rates of progress in human development. Chapter Six includes a presentation of these findings and other relevant findings regarding the role played by human and intellectual capital, and cultural values, as well as a discussion of what the results might be suggesting. Special emphasis is made on discussing the differences found between developed and developing countries.

The global digital divide interests policy makers in multilateral agencies, international organizations, and governments concerned with implementing programs to overcome the divide. *Access, adaptation, and creation* of knowledge in developing countries describe three processes behind another broader process which may be defined as: *technology transfer* (Arora 1991). Technology transfer of digital information and communications technologies is a process that allows developing countries to close the distances created by the global digital divide by the use of the technologies that created the divide in the first place. Should a developing country promote strategies and policies to bridge the digital divide by the use of technology transfer policies, or should it focus on “proven” development strategies, such as public health and education programs? The answer to this question is both. Today, information technology transfer is as important to a country’s development as improvements in education, social services and industrial infrastructure. Such is the case of South Korea, which together with Japan are the biggest

customers for U.S. technology sold as intellectual property, accounting for more than 55% of total U.S. receipts in 1997 (NSF and NSB 2000). However, for most developing countries coping with debt repayment, shrinking social investment budgets, and decreasing international aid, the allocation of funds to both proven development interventions *as well as* an increase in programs to bridge the global digital divide (or the social digital divide within the country) is difficult. What are some examples of positive feedback loops that, instead of creating more divides, create “digital dividends”? Chapter Seven discusses the policy implications and significance of the findings suggested by this study for the implementation of projects designed to overcome the global and social digital divides in the developing world.

As stated before, the fundamental objective of this study is the exploration of some aspects and effects of the global digital divide, i.e. the impact of digital information and communication technologies on national development processes especially in developing countries over the last decade. This complex question cannot be answered by one single study, but the findings produced by the empirical exploration carried out in this study shed light on some aspects and relations between factors of the phenomenon. An exploration of many more research questions are needed for a better understanding of the global and social digital divide. Chapter Eight includes conclusions and suggestions for future directions in research.

“Systems theory says that it doesn't matter where you start, its all elephant and eventually all pieces are put together.”

Abeles, Tom. “The global digital divide.” Online posting. 21 May. 2001. Global Knowledge for Development Forum List moderated by the World Bank.