Chapter 3

Wired World

The World Bank, the United Nations and the G-8 have expressed alarm that poorer societies lacking technological investment will drift further behind their wired rivals in the global marketplace, while advanced industrialized societies will surge even further ahead on the back of dramatic productivity gains. Multiple policy initiatives have been proposed, such as investment in technological infrastructure in Malaysia, computer training and education in schools in Latvia, and innovative community-level schemes in Bangladesh. Yet understanding the role of the state and the market in this process, and predicting which initiatives will succeed or fail in widening access in poorer societies, remains difficult unless we understand the reasons for the North-South divide. To unravel this issue we need to map the global spread of the information society and analyze the underlying conditions driving the process of technological transfer[1]. Many studies by historians, development theorists and communication scholars have tried to characterize the mechanics of the diffusion process, and economists and marketing specialists have attempted to identify the driving factors behind the demand for new products[2]. Drawing upon this literature, after discussing the theoretical debate, this chapter focuses on four inter-related questions:

- ?? What is the global pattern of Internet diffusion?
- ?? Does this pattern represent the particular characteristics of Internet diffusion *per se*, or does it reflect similar trends found in the adoption of older forms of info-tech, such as radios, telephones, and televisions?
- ?? In exploring the reasons for inequalities of Internet access, how far do cross-national differences reflect basic economic divisions between rich and poor societies, so that we can predict the uptake of info-tech from standard economic indicators like level of per capita GDP and investment in R&D?
- ?? Lastly, what non-economic factors determine technological diffusion across societies, including the role of human capital and democratic development?

In all cases we are interested in mapping and exploring the patterns common across different nations to establish the underlying conditions facilitating Internet access. But we also want to

understand the exceptions to these generalizations, that is, those countries that have adapted to the information society far more successfully than would be predicted by their level of socioeconomic development alone. The outliers provide important clues to successful state interventions and market conditions.

Theories of the Global Divide

International agencies have sounded the alarm over worldwide inequalities in the information revolution. UN Secretary General Kofi Anan warned of the danger of excluding the world's poor from the Internet: "People lack many things: jobs, shelter, food, health care and drinkable water. Today, being cut off from basic telecommunications services is a hardship almost as acute as these other deprivations, and may indeed reduce the chances of finding remedies to them." James D. Wolfensohn, president of the World Bank, has stressed the need to bridge the technological gap between rich and poor nations. 'The digital divide is one of the greatest impediments to development", he argued, "and it is growing exponentially.' The poorest societies face fundamental problems of basic survival and multiple difficulties with nutrition, literacy, and health, whether Mozambique ravaged by floods, Ethiopia decimated by ethnic conflict, or Zimbabwe plagued by aids. But for developing countries rising above the minimum economic threshold, such as Taiwan, Malaysia, and Brazil, access to information technologies has become important for integration into the global economy[3]. Info-tech has become a vital engine of growth for the world economy enabling many enterprising firms and communities to address economic and social challenges with greater efficiency. In poorer villages and isolated communities, a well-placed computer, like a communal well or an irrigation pump, may become another development tool, providing essential information about storm warnings and crop prices for farmers, or medical services and legal land records for villagers[4].

In contrast, cyber-optimists agree that the current situation shows a sharp North-South global divide but they believe that these inequalities will gradually fade over time, although not wholly disappear, under certain conditions: if access costs decline through falling prices for microprocessors and components and the growth of cheaper hand-held digital devices, mobile phones with web-enabled technology, and community centers/Internet cafes; if the contents of the Web gradually diversifies to become everybody's local radio and newspaper, community telephone exchange, and world marketplace; and if innovative programs by governments, non-profits and the private sector

succeed in widening access to info-tech in developing nations[5]. A recent OECD report on the outlook for information technology concluded that industrialized countries account for more than 80% of the world market for information and communication technology, nevertheless expenditure in non-OECD countries has been growing at more than double the OECD average, with especially rapid expansion in telecommunications and IT hardware investments in Brazil and China[6]. Carlos Braga presents an optimistic scenario for developing countries' participation in the emerging knowledge economy: "Although, no doubt, income and wealth inequality may increase in the initial stages of the process, catch-up can also happen at a much faster pace than in the past. ICT spending, for example, grew more quickly in most developing regions than in high-income economies in the 1992-97 period. And countries like South Africa and Brazil already boast a higher share of networked personal computers than most industrialized economies."[7]

Numerous examples can be cited to show the expansion of digital opportunities in developing societies around the world[8]. Many South East Asian nations seek to emulate the Japanese model of development in the post-war era of reconstruction, and the knowledge-based economy in Singapore, South Korea and Taiwan. In Malaysia, for example, the Multimedia Super Corridor has been developed to bring investment from telecommunications, multimedia and electronics companies, and the production of silicon wafers and software. The corridor has attracted major players such as Microsoft, Sun Systems and NTT (Japanese telecom). Under the 'Vision 2020' plan, Malaysia now boasts cellular telephone penetration rates of one in every ten people, more and more wired schools, and 21 Internet hosts per 1000 people. Revenue generated by the production of information and communication technology goods, like office equipment, telecommunications and consumer audiovisuals, shows that the U.S. leads the world but many Asian countries are close rivals, including Japan (2nd), Korea (3rd), Singapore (4th), Taiwan (7th) and Malaysia (8th)[9]. Southern India is most often cited as an important area of software development, producing an estimated $3.8 billion in revenues, with this figure doubling in the past few years. Over one-half of India's software services are exported to the United States[10]. The Bangalore area has attracted inward investment from many major corporations, not least from the diaspora of the Asian dot.com entrepreneurs thriving in California's Silicon Valley and Cambridge's Technology Park[11].

In rural Bangladesh many isolated communities lack landline telephones. An innovative program by Grameen Telecom supplies cellular mobile phones to village women, who rent calls in

their community to repay the loan and sustain thriving micro enterprises[12]. With this service, local communities benefit by direct links to job, weather and health information, as well as more efficient markets for their produce. Village Telecom Centers are being developed with email and fax services, along with computer literacy projects in selected school.

In Central and Eastern Europe, Slovenia, Estonia and Slovakia have made great strides in moving their populations online, moving well ahead of Portugal, Greece and Austria in levels of connectivity. Hungary's ambitious Schoolnet program has allowed students in two-thirds of all secondary schools to browse the Web from their classrooms, with extensive teaching resources, interactive discussion forums, events, and competitions[13]. In the Baltic, the Estonian government has provided public access points for the Internet throughout the country, using schools, post offices, community centers, libraries, police stations and health clinics. The program has been highly successful; today more than one in ten Estonians is on-line, with personal computer ownership well above average for Central and Eastern Europe[14].

Progress has been slower in Africa, but nevertheless plans have been announced by Global Crossing, Lucent Technologies and Africa One for an ambitious $1.9 billion project to link up the whole continent by 2002 through a high-speed underwater fiber optic cable, with interior countries connected through terrestrial cables, microwave or satellite facilities, overcoming many of the current problems of the inadequate telephony infrastructure[15]. Given a high-speed backbone, and market liberalization of telecommunication services, African nations may also be able to 'leapfrog' stages of industrialization through new technology by investing in fully digitized telecommunications networks rather than outdated analog-based systems. Cellular telephony is rapidly expanding as an alternative to conventional network services; the number of subscribers in the OECD region reached almost one quarter of the population in 1998[16]. This growth has had even greater impact in the developing world. In postindustrial economies there were 20 times as many mobile phones in 1998 as there were in 1990, and in developing economies there 160 times as many, an astonishing rise[17]. Over a third of all telephone subscribers in Cote d'Ivoire, Cambodia and Paraguay, for instance, are now connected via mobiles, a far higher proportion than in the United States[18]. But which of these schemes for promoting access to new technologies will succeed or fail? Do international agencies, non-profit organizations and national governments need to intervene or will the market eventually widen access? And what are the underlying social, economic and political factors driving diffusion?

To examine these questions we first need to establish which societies have moved ahead in the Information Society and which have lagged behind.

Where Are People Online?

As yet no official government statistics on the online population are collected by international agencies like UNESCO and the International Telecommunications Union (ITU), although indirect measures of technological diffusion are available, including investment in scientific Research and Development, the spread of computer hardware, and the rate of telephone density. The most comprehensive worldwide guide estimating the size of the online population is provided by NUA. This organization regularly monitors and collates survey results conducted by different market research companies in each nation. The surveys ask a representative sample of the public in each country about use of the Internet from home, work or elsewhere during the previous three months. NUA's database *'How Many Online'* currently collects data from 179 countries, covering 5.7 billion people[19].

A word of caution is needed about these estimates. First, the measure of Internet use is simple and limited. Surveys only monitor whether people were online, not how many days a week, still less how long people used the Internet every day[20]. Yet patterns of use can be very different between those who occasionally click on the web as a reference source in a public library or Internet cafe, and others constantly online via a 24/7 broadband cable link from home and a high-speed LAN connection at the office. Some include 'regular users', others anyone who has accessed the Internet within the past year or month. Moreover, without a common methodology, the reliability of these estimates depends upon the quality of the individual surveys. Market research companies vary substantially in their fieldwork, questionnaire design, and sampling methods, for example in how far they include rural and illiterate populations. Different responses in surveys can be produced by even modest variations in question framing, wording, or order. Some data collected by NUA may therefore represent little more than approximate 'guesstimates', especially in poorer countries where market research companies have little track record. These are important limitations but fortunately there are two ways to check the consistency and reliability of the available data. First, NUA maintains a record of all survey results within the database. This means that we can compare the estimates provided by different companies in each country around the same dates. Where two or three data points were provided within a three-month period, the results were averaged to reduce random

fluctuations by outliers. Even more importantly, the reliability of figures can be crosschecked against independent indicators by comparing the survey estimates of the online population with the distribution of Internet hosts and computers in each country. If a high correlation exists between independent sources this increases confidence in the reliability of the estimates.

Systematic trend analysis is available from 1995 onwards. Networked computing and computer-mediated email have existed for the scientific elite since the early 1960s but the number of users was too small to monitor through mass surveys. As discussed in the last chapter, the key historic development transforming the Internet into the world's favorite virtual reference library, post office and shopping mall were a series of rapid innovations: the birth of the World Wide Web (1990) and the launch of popular browsers to access materials including those by Mosaic (1993), Netscape Navigator (1994), and Microsoft Internet Explorer (1995). Subsequent technological applications, like the easy transfer of .mp3 music files and video formats, and WAP-enabled digital telephony, while representing important innovations, cannot yet claim to have had an impact equal to the basic invention of point-and-click browsers. Rather than a slow and steady process of evolution, development of the Internet has been one of modest incremental spread for thirty years, then a punctuated break in the early 1990s, followed by a rapid surge following the 'S'-time curve among early adaptor nations. The NUA evidence highlights the dramatic rise in popularity of the Internet in recent years: between 1995 and 2000 the total number of Internet users surged from about 26 to 377 million worldwide, an explosive jump within the space of a few years. The Internet became a truly global phenomenon as more and more users came online from around the world and the proportion of Americans in the online community dropped from 70% to 40% in 1995-2000 (see Figure 2.1). Despite this remarkable expansion, today about one in twenty of the world's population is online, with highly uneven diffusion worldwide.

[Table 3.1 and Figure 3.1 about here]

What has been the development of the Information Society elsewhere? The diffusion of the Internet today shows dramatic contrasts between and within regions of the world. Table 3.1 and Figure 3.1 display the proportion of the population online, estimated from NUA figures for Spring 2000 in 179 nations. Among the early adopters, Scandinavia and North America lead the world in rates of Internet penetration, with one third or more of the population online, followed by Western Europe, with about one in ten online. Central and Eastern Europe, Asia, the Middle East and South America fall below the world average, all with less than one in twenty online, while minimal diffusion

is evident in Sub-Saharan Africa, with only 36 users per 1000 people. In terms of levels of human development, Table 3.1 highlights the stark contrasts between rich and poor nations. In Spring 2000, most of the world's online community (87%) lives in highly developed nations[21]. In comparison, the thirty-five societies classified by the UNDP with low levels of human development, like Nigeria, Bangladesh and Uganda, contained only 5% of the online population, although home to half a billion people.

[Figure 3.2 about here]

A finer-grained comparison of countries ranked in Figure 3.2, excluding nations where less that 0.5% of the population were online, reveals a pattern of widespread adoption in four clusters of societies: throughout the *smaller Nordic social democratic welfare states*, especially Sweden, Norway, Iceland and Finland; in larger *Anglo-American and English-speaking nations* including the US, Canada, Australia, and Britain; in the *Asian 'tiger' economies* of Singapore, South Korea, and Taiwan, as well as Japan; and in a few *smaller European nations* with above-average Internet use such as the Netherlands, Belgium, Switzerland, Slovenia, and Estonia. The 29 OECD member states representing industrialized nations dominate Internet users yet there are substantial contrasts even among neighboring countries within this category, for example between the United States and Mexico, or between Australia and New Zealand, as well as between Italy and Greece. European Union member states are all affluent, advanced economies with a large service sector, a well-trained workforce, and high levels of personal income. Nevertheless following rapid growth in Internet usage in the late 1990s, there is widespread diffusion today in Sweden, Denmark and Finland, moderate use of the Internet in the UK, Germany and the Netherlands, but few online in Greece and Portugal, the latter ranking well below developing societies such as South Africa, Estonia and Taiwan[22]. At the bottom of the national rankings, with less that 0.5% of the population online, few Internet users are found throughout most of the poorer countries of sub-Saharan Africa (with the exception of South Africa), as well as in many states in central Europe, the Middle East, Asia, and Latin America.

The predominance of the United States on the Internet has gradually declined over time as more and more people have come online elsewhere, although still one third of all users worldwide are American (106 out of 300 million users). The vast region of Asia-Pacific, including the massive populations of China, India, and Indonesia, contains another 53 million users, and about the same number live in West Europe. In contrast sub-Saharan Africa, home to over half a billion people, contains only 2.5 million Internet users, or less than 1% of the world's online community.

To check reliability, these estimates can be compared with the geographic location of Internet hosts based on data provided by agencies such as Network Wizards, the Internet Software Consortium, and Netcraft. To function as part of the Internet all computer hosts require a domain name (like www.yahoo.com) and an associated Internet Protocol address record (in numeric form such as 193.51.65.17). Domain Name System (DNS) servers translate back and forth automatically between names and numbers to locate a site. Domain names are divided into two categories: *national* top level domains such as those ending in .fr (France), .uk (United Kingdom), or .be (Belgium), and *generic* top level domains like the dot.coms, dot.nets and dot.orgs. The analysis of domain names provides the best available estimates of the location of Internet hosts although there are some important limitations to this data as well. The existence of 'company firewalls' means that the figures provide a minimum estimate of the number of hosts and it remains impossible to tell how many users are online via each host. Another major problem with the generic domains (like dot.coms) is that it is difficult to analyze them on a geographic basis. Following the methodology used by the OECD, this difficulty can be overcome by allocating them on a weighted basis according to the country of registration of generic domains[23].

[Figure 3.3 about here]

The maps in Figure 3.3 confirm the pattern of global inequalities already observed. The distribution of hosts according to the Netcraft data is strongly correlated with the proportion of the population online in each country provided in the NUA estimates (R = .854 Sig. .001), increasing confidence in the reliability of the data sources. The comparison again shows the striking predominance of a few countries including Finland, the United States, Norway, Iceland, Canada, Sweden and Australia, and the significant absence of hosts and online users throughout large swathes of the rest of the world. There are almost as many hosts located in France as in all of Latin America and the Caribbean, and there are more hosts in New York alone that in all of sub-Saharan Africa[24].

Relative Inequalities in the Information Society

The fact that there are *absolute* inequalities between rich and poor nations in the virtual world is hardly surprising; it would be naïve to expect otherwise given the substantial disparities in every other dimension of life from health care and nutrition to education and longevity. Despite the more exaggerated hopes of some cyber-optimists, the Internet is not going to suddenly eradicate the fundamental and intractable problems of disease, debt and disadvantage facing developing countries.

The more interesting question, with important implications for understanding the new media, concerns the *relative* inequality of opportunities. Is it easier or more difficult to go online in different societies, compared with inequalities of access to other types of communication technologies, like telephones and TVs?

On the one hand, the pattern we have established in the distribution of the online population may represent a particular characteristic of Internet diffusion *per se*. If this is the case, then it would be appropriate to search for possible causes related to this particular form of technology, including such factors as the costs of computer hardware, software and ISP connection charges, the need for computing and literacy skills to go online, and the predominance of English-language contents. The availability of computers is often assumed to be one of the most fundamental barriers to current use of the Internet for most people. Worldwide the number of personal computers tripled in the last decade, from 25 PCs per 1000 people in 1990 to 71 in 1998. But again the regional disparities are marked: there are 459 computers per 1000 people in the United States but only 7 per thousand in sub-Saharan Africa[25]. Most Internet connections in developing countries still travels down mainline telephone lines so the rate of teledensity would also be expected to be related to patterns of Internet access. If this analysis is correct, then it suggests that the solution lies in equalizing technological resources, such as through the distribution of computer hardware, skills training and network connections.

On the other hand, the global patterns of inequality on Internet use may mirror the broader pattern of access to the Information Society. If so, then we would expect to find a strong correlation between the spread of digital technologies and the availability of traditional mass media that have been around for decades or longer, such as newspapers, telephones and television. If this is the case, then it suggests that the problems of Internet access in the developing world are not particular to the nature of the medium itself, - you don't need keyboard or literacy skills to switch on a radio - but instead may be due to deep-rooted and endemic problems in poorer societies such as the general lack of income, leisure time, literacy and education that hinder use of traditional media like newspapers. If this is the case, rather than any short-term fix, such as delivering beige desktop PCs to wired schools in Mozambique, Egypt and Bangladesh, the long-term solution would be general aid, debt-relief and economic investment in developing countries. Understanding these issues can provide important clues to the fundamental reasons underlying the process of technological diffusion and therefore the most effective policy initiatives to overcome digital inequalities.

[Table 3.2 and 3.3 about here]

To analyze these questions, the different types of information and communication technologies can be divided into two categories. A standardized 100-point *New Media Index* was calculated by combining the proportion of those online within each country, as already described, with the per capita distribution of hosts and of personal computers. We would expect a strong correlation between these factors. A similarly standardized 100-point *Old Media Index* combines comparable per capita data in each country measuring the distribution of daily newspapers, radios, television sets, mainline telephones, and mobile phones (see Table 3.2). For an overall summary, multiplying both measures and dividing by two created the composite 100-point *Information Society Index*.

[Figure 3.4 about here]

The results show two important findings. First, use of all forms of communication media are highly inter-correlated, meaning that countries at the forefront of the Information Society on one indicator are likely to lead on many others as well (see Table 3.3 and Figure 3.4). Info-rich countries like Sweden, the United States and Australia are not just ahead in terms of the Internet but also in the distribution of other media such as newspaper readership, radio and television sets, personal computers, and mainline and mobile cell telephones. Correlation revealed that access to all these media fell into a single consistent dimension[26]. There was little distinction between use of old and new media; the proportion of those online in each country was most strongly related to the distribution of hosts, telephones and PCs, but it was also significantly and strongly related to the distribution of radios, TV sets, and newspaper readership in each nation. This means that people living in poorer societies excluded from the world's flow of communications, like Burkina Faso, Yemen and Viet Nam, were largely cut off from all forms of info-tech, including traditional mass media like radios and newspapers as well as modern ones such as mobile phones and personal computers. The vast majority of poorer societies, low on both indicators, cluster together in the bottom left corner of the scatter plot illustrated in Figure 3.4. At a broader level, as cyber-pessimists suggest, this analysis indicates that in the emerging Internet era, the relative inequalities between rich and poor in access to the virtual world reflect, rather than transform, global disparities in the Information Society. Nations that already have many radios and TVs are most likely to also get access to networked computers.

That being said, the comparison also reveals important variations to this general pattern. Some new democracies like Slovenia and South Africa fall below the regression line in Figure 3.4, indicating that these are more advanced in access to the digital technologies than would be expected from their use of television and newspapers. Some countries like Finland, Germany and Spain fall exactly where predicted along the line, suggesting a balance in these societies between new and old media. The United States also falls into this category, leading the world in terms of connections to info-tech. Many less affluent societies like Bolivia, Iran and the Ukraine, as well as Portugal and Greece, while lagging on both scales, are slightly stronger in use of the traditional print and electronic media than in access to digital technologies. Therefore while the analysis reveals that access to old and new media technologies are closely related, the outliers suggest some exceptions to the rule that may have significant implications for policy initiatives designed to broaden the spread of the wired world.

Economic Development and the Digital Divide

How do we explain the diffusion of the Information Society that we observe? Many possible answers can be suggested. If the pattern reflects basic differences in levels of economic development, as many assume, then we would expect to find clear divisions between rich and poor countries. One of the most comprehensive studies seeking to explain the distribution of Internet hosts within post-industrial societies, by Hargittai, concluded that the economic wealth of a country, measured by per capita GNP, was one of the most important predictors[27]. A study for the International Telecommunications Union also found that the number of Internet hosts per country was significantly related to general levels of socio-economic development, using the UN Human Development Index measuring the rate of adult literacy, education, life expectancy, and per capita GDP[28]. Roderiguez and Wilson's research for the World Bank arrived at similar conclusions[29]. If this pattern is confirmed in this study it would suggest that the Internet represents one more disparity reflecting the poverty of those living in developing nations, lacking access to the knowledge economy as well as basic nutrition, education and health care.

[Figure 3.5 about here]

The results of the regression analysis confirms that the relationship between Internet use and economic development, measured by per capita GDP in 1997, is indeed both strong and significant

(r=0.77 Sig. .000). The best-fitting model with logged data, illustrated with the scatter plot in Figure 3.5, shows that there is also a critical threshold: the online population expands exponentially once countries rise about the $9000 level of per capita GNP. Not surprisingly, many of the poorest nations like the Sudan, Rwanda and Bangladesh are among the least wired societies, while at the other extreme many affluent post-industrial economies such as Norway, Finland and New Zealand fall exactly where expected on the regression line. Yet at the same time there are also some important outliers to the general pattern, and particular explanations about these countries may provide important clues to what other factors may contribute towards Internet connectivity beyond economic development.

In one category, many countries, falling below the regression line, are relatively affluent yet display lower than average Internet penetration rates. This includes certain oil-rich Middle Eastern nations such as Bahrain, Kuwait, the United Arab Emirates and Saudi Arabia, as well as South East Asian states such as Singapore, Japan and Brunei. The reasons for this pattern cannot be established systematically here but they can perhaps best be explained by the extreme inequalities of personal income and wealth characteristic of these societies, possibly combined with some cultural restriction on use through restricting Internet Service Providers in some Middle Eastern countries[30].

In contrast, some other societies are above the regression line, with higher than average Internet access that would be predicted by their level of economic development, including Slovakia, Slovenia, Poland and Estonia, as well as in South Korea and Taiwan. These exceptions to the general pattern have important implications for understanding this phenomenon, explored later in the analysis, because they weaken claims of economic determinism and highlight the significance of other factors leading towards technological diffusion. Economic development certainly predicts access to the Internet, as it does to other traditional forms of information and communication, but the wider scatter of countries in the top right corner of Figure 3.5 shows that, once above a certain minimal level, economic development is not necessarily essential to greater online use.

Beyond economic development, other economic factors, which might influence use of the Internet, include the availability and costs of technology in different countries, including the price of computer hardware/software, connection charges through Internet Service Providers, and the provision and availability of mainline and mobile telephone services. This is not just a matter of the familiar income disparities between rich and poor nations, since the relative costs of ISP access are

actually higher in many developing countries. Although some free ISP and email services are becoming available, the OECD estimates that average monthly charges for Internet access in July 1999, based on a 20 hour per month peak rate, were $24 per month in Australia but almost three times as much in Turkey ($65 per month), and almost four times as much in Mexico ($94 per month)[31]. In OECD nations, the cost of ISP access was significantly correlated with the proportion online in each country (R = -.45 Sig. .01). Countries with relatively high Internet penetration rates, like Finland and Sweden, often have lower access prices. ISP charges are gradually falling, making access more affordable for business and consumers, but the costs of local telephone connections may also be an important deterrent, especially in Europe compared with the United States. Hargittai's comparison of OECD member states concluded that telecommunications policy, notably the level of competition under deregulated systems, was significantly associated with levels of Internet connectivity[32].

Another important reason for the spread of digital technology may lie in the broader process of research and development within each country, particularly basic investment in science and technology. One reason why use of mobile phones is so high in Scandinavia, for example, is because Nokkia and Ericsson, two leading telecommunications manufacturing companies, are located there. Expenditure on scientific and technological research and development can be gauged by many indicators, such as the proportion of scientists, engineers and technicians employed in R&D, the proportion of science and engineering students in tertiary education, and the percentage of manufacturing exports from high-tech products. Most of these indicators are highly inter-correlated and information was not available from World Bank and UNESCO data for all the countries under comparison. In this study, therefore, the impact of the technological environment can be compared by examining the impact of per capita spending on Research and Development as a proportion of GNP within each country. The results are illustrated graphically with the scatter plot in Figure 3.6 and this shows a consistent and significant correlation, confirming that R&D investments help boost the market for digital technologies, although there are a few outliers like El Salvador, Bolivia and even Japan and South Korea with lower than average online access given their level of spending on research and development.

[Figure 3.6 about here]

Human Capital and Democratic Development

Therefore economic development goes a long way towards explaining the global disparities between richer and poorer societies, yet by itself this fails to account for the substantial differences in Internet access between relatively similar countries, such as between the Nordic and Mediterranean European nations. What other answers could help to explain the patterns we have found? The evidence here remains more scattered but we can examine some common assumptions, especially the role of human capital and democratic freedom of expression.

The development of human capital – meaning the investment in digital skills and capacities through education, training and lifetime learning – represents one of the most important factors that might facilitate Internet access. Human capital represents the properties that allow people to live and work productively. Education is one of the most significant forms of social development, producing the skills and experiences that are most likely to contribute towards using computers. Secondary and university education provide direct hands-on training in basic and advanced computing techniques, familiarity with standard software packages, and confidence in surfing the Web, as well as the general cognitive skills necessary to make sense of the online information. Academic institutions may also play an important role in spreading digital technologies since they are often among the first institutions in a nation to be wired. Studies have found that more educated people are quicker to adapt to new innovations[33]. Education also contributes directly towards basic literacy, and reading and writing skills are currently essential to using this media. The World Wide Web is rich in visual imagery, such as pictures and streaming video, and audio content is burgeoning through the easy availability of online radio and .mp3 music. These types of content are likely to surge in popularity as broadband fat-pipe delivery increases in capacity, fiber-optic cables becomes capable of carrying more bandwidth, and file compression continues to shrink the storage size of data. Nevertheless currently most material on the Web remains closer to text-based newspapers rather than to audio or visual electronic media like TV. If basic illiteracy is an important barrier to access, most of the world's poor could still be excluded from the information revolution, even if computing equipment became more widely available through Internet cafes, schools, public libraries and community centers. One fifth of the world's population remains illiterate, and the total rises to 40% or more of those living in Sub-Saharan Africa, the Middle East, and Southern Asia, with even higher figures for the female population[34].

Social development also encompasses language skills. Wresch suggests that knowledge of English as a first or secondary language is critical: "English dominates the world of computing. Both the English and the Americans like to claim their nation as the birthplace of computing, but in one way it doesn't matter which did what – both are English speaking nations."[35]. A comprehensive analysis of over one billion unique Web pages by the Inktomi search engine found that 87 percent of all documents were in English, a language understood by an estimated one in ten people worldwide[36]. This picture is confirmed by a more limited search in 1997 by the Babel team for the Internet Society which estimated that 84% of all pages in English, followed by German (4.5%), Japanese (3.1%), and French (1.8%), Spanish (1.2%), Swedish (1.1%) and Italian (1%), with all other languages each below 1%[37]. The technology to overcome language barriers is progressing, with online translation services freely available for the major European languages such as German, Spanish and French, but nevertheless it is striking that many of the societies at the leading edge of the digital revolution are either Anglo-American countries like Canada and Australia, or smaller well-educated welfare states like Norway, Sweden and the Netherlands where English has become the linga franca as the second language taught widely in schools. By most standard economic indicators, major G-8 rivals like France, Germany and Japan should outrank the UK in terms of Internet penetration yet they continue to lag behind, for example there are twice as many users in Britain than France, although this may also be influenced by the checkered history of the French Minitel project. Familiarity with English as a second language among the scientific elite may also help to explain the success of software development and computer manufacturing in ex-British colonies such as India, Malaysia, and Hong Kong. Rao et al. argues that elsewhere in Southern Asia the lack of web content in indigenous languages, as well as the limited local relevance of the available sites, limits the incentive to go online for much of the population[38]. The predominance of the English language may change in coming years, as more and more of the population moves online in China, India and Brazil, but in the meanwhile those who can read English are greatly advantaged in the digital world, and, although we cannot prove the proposition here with the available evidence, this could plausibly help to explain high Internet penetration rates in the United States, Canada, Australia and the UK[39].

Lastly broader issues of *democratic development* may also contribute towards digital diffusion through the expansion of opportunities for freedom of expression and civil liberties commonly available in democratic states. Freedom House has documented many instances where authoritarian regimes have attempted to limit public access to the Internet or censor its contents and freedom of

publications on the Web. The study by Leonard Sussman found although control of the Internet was far more difficult than censorship of television or the press, nevertheless currently about twenty states restrict citizen's access to the Internet to a significant degree[40]. Cited examples include 'cyber dissidents' jailed in China, the need for Burmese owners to report computers to the government, under penalty of a fine, and restricted ISP access to information content 'contrary to Islamic values' in Saudi Arabia, Syria and the United Arab Emirates It is difficult to monitor such incidence on a systematic basis but as an indirect indicator the impact of a country's level of democratization can be compared, using the Freedom House 7-point index measuring political rights and civil liberties, which has become adopted as the standard indicator for cross-national comparisons[41]. If democratization plays a significant role, than we would expect that countries with greater civil liberties and freedom of expression would display more widespread access to digital technologies.

The relative importance of economic development, human capital, and levels of democratization on rates of Internet penetration were analyzed in Table 3.4 using simple correlations and multivariate regression models[42]. Regional dummy variables were also included to see how far these remained significant after controlling for prior levels of economic development, human capital and the democratic background of different areas. For comparison, alternative models (not reported here) were tested before arriving at the final one based on goodness of fit, parsimony and the prior theoretical assumptions that determined the causal ordering of the variables[43]. The models were run to see if similar factors that predicted Internet penetration rates also helped to predict access to new and old media technologies.

[Table 3.4 about here]

Two important findings emerged from this analysis. First the results of the simple correlations, without any prior controls, show that all the selected indicators of economic development, human capital and democratization proved to be strongly and significantly related to use of the Internet, as well as to use of the new media and old media, in the expected direction. That is to say, the proportion of the population online in each country was significantly related to levels of per capita GDP, R&D spending, literacy and secondary education, and level of democratization, according to the available measures. The regional patterns confirmed the significance of the differences observed earlier, even after controls, with higher than average use evident in Scandinavia, North America and Western Europe, and significantly lower than average use in South America and

Africa. Similar strong correlation coefficients were evident using the composite New Media and Old Media Indexes, suggesting a robust relationship that held up to testing across all indicators. The strength of the coefficients varied slightly, for example patterns of literacy were more closely associated with use of the old media than the new, but the overall pattern was highly consistent.

Yet because each of these indicators are closely related to each other, these strong association could prove to be spurious, for example if economic development simultaneously produces a more educated and literate public, higher levels of R&D investment, and the transition to a more democratic regime. There could well be a complex pattern of interaction here. To disentangle these factors we need to turn to the multivariate analysis models which assume that economic and social development come before the process of democratization. The most important finding from the regression models in Table 3.4 is that *economic factors outweighed all others in predicting cross-national differences in access to the information society*. Economic development, measured by per capita GDP, was consistently important across all three models, indicating that more affluent societies have access to a richer range of information and communication technologies, among both traditional and digital media. The poorest developing societies like Mali and Nigeria lack old and new technologies of mass communications. Countries with per capita GDP in the middle region of about $6000-10,000 show a more mixed picture; in particular, African societies tend to be poor in both indicators but Central and Eastern European nations have lower than average income but higher mass media use. Lastly affluent postindustrial societies like the US, Norway and Japan are high in both income and information resources. Moreover, the related economic indicator of levels of technological investment, as measured by per capita spending upon Research and Development as a share of GNP, was also confirmed to be significant across all models, for reasons discussed earlier.

Once these related socioeconomic factors were included in the models, other indicators of human capital and democratization became insignificant. This suggests that literacy, education and democratization do not exert an independent influence upon Internet penetration rates, or access to older forms of information technology[44]. This pattern lends further confirmation to the findings of Hargattai's earlier comparison of OECD states[45]. After controlling for all these factors, the regions of Scandinavia, North America and Western Europe still emerged as significantly ahead of all other areas in levels of digital connectivity, indicating that many other residual factors in these societies not specified in these models contribute to the diffusion process, such as policy initiatives to spread the

Internet through wired schools, community centers and businesses. The economic factors predicting Internet connectivity also serve to explain the diffusion of traditional mass media, suggesting a pervasive and robust pattern irrespective of the specific type of info-tech or the particular indicators selected for analysis. Of course the interrelationship of economic, social and democratic development does create problems for these models, since it is difficult to isolate the influence of each. The models assume that economic development lead to human capital, such as a better-educated workforce, but, of course, the reverse could be equally true. In the same way, although there is no one-to-one relationship, nevertheless consolidated democracies tend to be more affluent countries.

Another major limitation of the analysis is that the Internet is a relatively recent phenomenon, so it might be that patterns of access evident today may change considerably within the medium to long-term. One way to exploring this further is to examine the global diffusion of traditional mass media like radio and television, to see if the gap between rich and poor nations has gradually closed over time in these technologies. Based on UNESCO data, Figure 3.7 indicates trends in the adoption of television sets and radio receivers in developing and postindustrial societies during the last three decades. The results illustrate how these media have grown in popularity worldwide during the late 1980s and early 1990s. But, most importantly, the trends also show that the gap in access to these media between postindustrial and developing societies has not diminished in the last thirty years, if anything the reverse. Because use of TV and radio grew more sharply in postindustrial societies in the 1970s, even with a slight plateau effect, the inequalities of access today between rich and poor nations are actually slightly greater than about three decades ago. If we can extrapolate from this pattern to digital technologies, this suggests that the relative disparities between developing and postindustrial nations that we have observed today will not necessarily close as more and more people go online. The prognostication is that early adopter countries seem likely to maintain their relative lead, leading in digital technologies, even while laggard societies attempt to catch up.

[Figure 3.7 about here]

Conclusions: New Technologies, Old Inequalities

International organizations like the World Bank and the UNDP have raised concern about the growing global digital divide in the 1990s, and the need to overcome this disparity before the situation rigidifies into a new virtual Berlin Wall splitting rich and poor worlds. Potentially digital

technologies may serve the needs of the developing world. As well as the direct economic benefits for trade and tourism, the Internet may accelerate the longer-term investment in human capital. Information infrastructures for distance learning and educational development can facilitate access to the most up-to-date materials for teaching and research. As the World Bank Report expressed these hopes: "ICT greatly facilitates the acquisition and absorption of knowledge, offering developing countries unprecedented opportunities to enhance educational systems, improve policy formation and execution, and widen the range of opportunities for business and the poor. One of the greatest hardships endured by the poor, and by many others who live in the poorest countries, is their sense of isolation. The new communication technologies promise to reduce that sense of isolation, and to open access to knowledge in ways unimaginable not long ago."[46] Hopes about the impact of the Internet can be seen as another example in a long history of technological transfers that promise economic regeneration for poorer regions, from the industries of railroads and textiles in the nineteenth century, to the production of South Korean automobiles, Japanese Walkmans, and Taiwanese silicon chips in the twentieth century. But can these hopes be fulfilled?

Multiple factors may potentially help to explain the global divide in Internet access, like other forms of technological diffusion, and this study has only been able to focus on a limited range of explanations. Other plausible factors that should be considered further in subsequent research include the role of cultural attitudes towards science and technology, the impact of public policy initiatives in education and training, as well interest in the available contents of materials on the Web. The structures of opportunities on the Internet, as well as the resources of particular sections of the population, are likely to prove important reasons explaining patterns of use. We are only starting to explore these cross-national differences systematically and we need to go beyond the limitations of the available national-level aggregate data to understand the reasons why, for example, far more people are online in Finland rather than France, in Malaysia rather than in Vietnam, or in South Africa rather than Sudan.

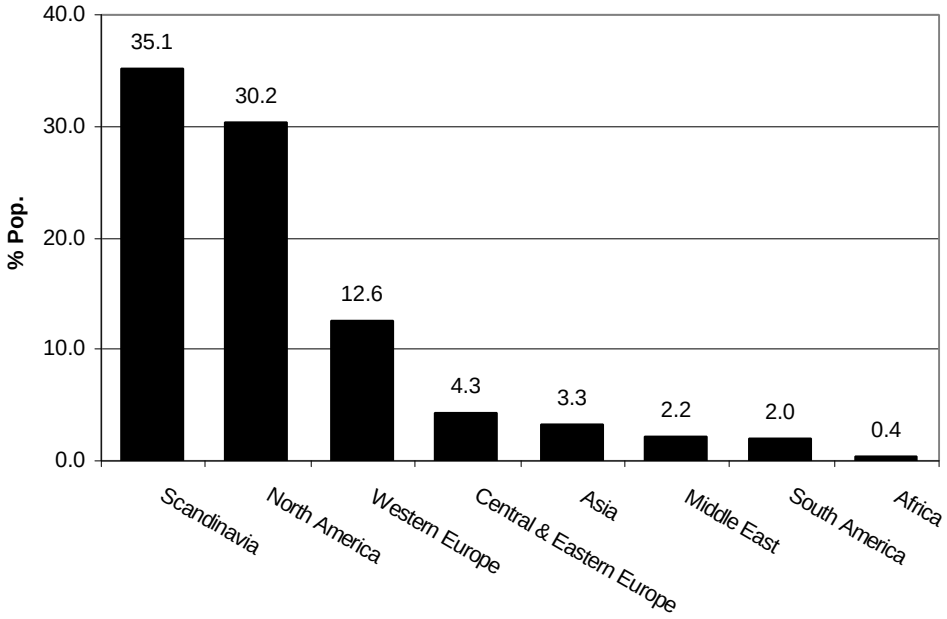
Nevertheless the results of this analysis strongly suggest that the basic reasons for the global divide in Internet access are not strongly related to the particular characteristics of this type of information technology. The problem, it appears, is less whether Namibians lack keyboard skills, whether Brazilians find that few Web sites are available in Portuguese, or whether Bangladesh lacks network connections. Instead the problems of access to the Internet are common to the problems of

access to other communication and information technologies that have been widely available for decades in the West. Many of the poor living in Namibia, Brazil, and Bangladesh lack a rich information environment in terms of newspapers, radios and television, as well as networked computers. In the first decade, the availability of the Internet has therefore reinforced existing economic inequalities, rather than overcoming or transforming them. The reasons are that levels of economic development combined with investments in Research and Development go a long way towards explaining those countries at the forefront of the Internet revolution and those lagging far, far behind. The regression models successfully explain a high level of variance. If countries have the income and affluence then usually (but not always) access to the Internet will follow, along with connectivity to telephones, radios and televisions. There are some important exceptions to this generalization, both affluent countries that lack extensive Internet access such as Kuwait and Greece, and middle-income countries that have made great progress towards online connectivity, like Slovakia and Estonia. Economic determinism does not rule our virtual fate but worldwide, without effective public policy interventions, it goes a long way towards predicting it.

The situation may change within the next few decades. In the West, the costs of access are declining, as computers become more and more affordable for businesses and consumers. US consumer prices for personal computers have dropped by 43% over the last two years, and the costs of information service have fallen by a third during the same period, with slightly slower declines in the price of software and mobile phones[47]. If the costs of Internet communications plummet further in future decades -- for example if Web access becomes widely available via throw-away pre-paid mobile phones, like discardable Kodak cameras, connected to cheap satellite services circling the globe -- then the gap between rich and poor could well change. In the current era, however, general levels of economic development and research investment goes along way towards predicting which countries have widespread access to the information society. Although the Internet remains in its adolescence as a new technology, nevertheless we do not need to throw all our old explanations out of the window. Internet penetration rates can be predicted by economic models that also explain which countries are rich in telephones, radio and television, and even newspapers. Indeed ownership of home computers in European households was strongly correlated with possession of many other prosaic consumer durables, like electric drills, video cameras and clock radios, as well as ownership of a second automobile and holiday home[48]. Internet technology is new. Global economic inequalities explaining technological diffusion are not. The next chapter goes on to explore whether we find a

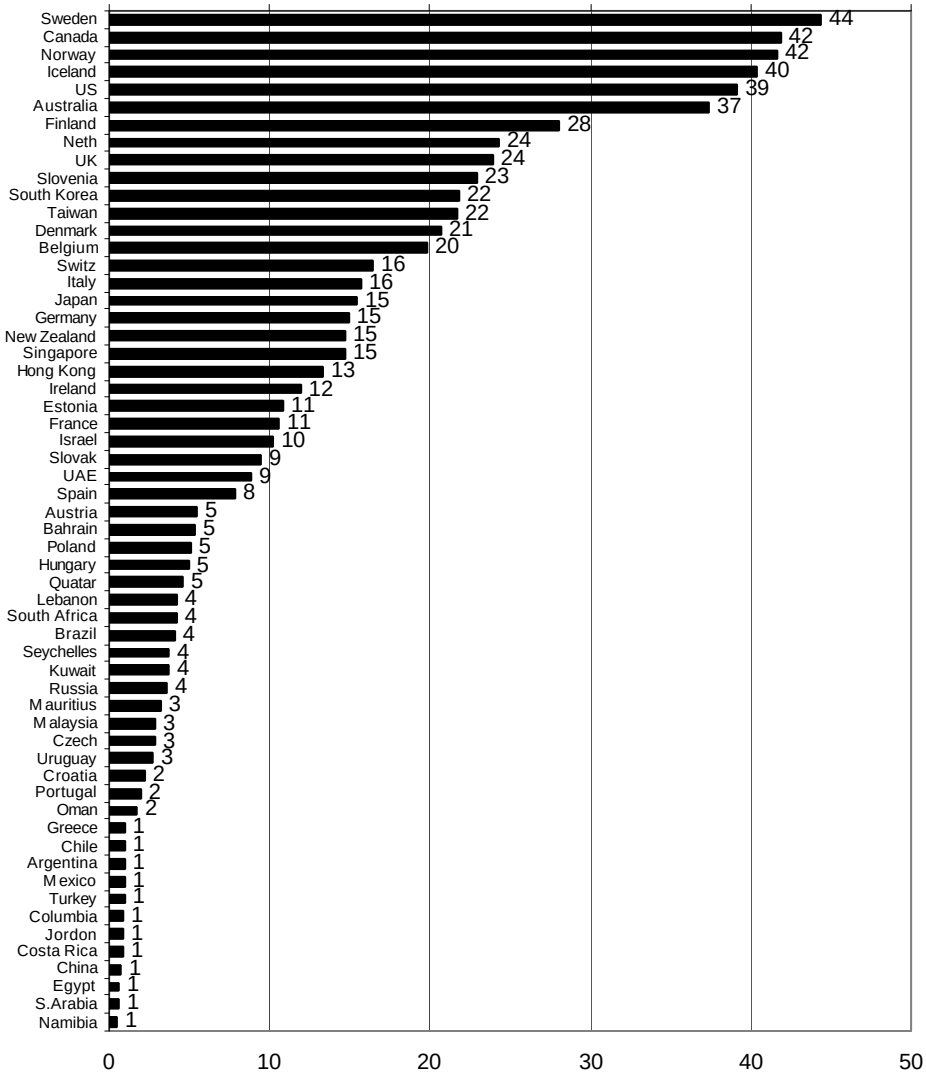
similar pattern that helps to explain the substantial differences in digital access evident between rich and poor within societies, even those at the forefront of the information revolution.

Figure 3.1: The percentage of the population online by major region, 2000



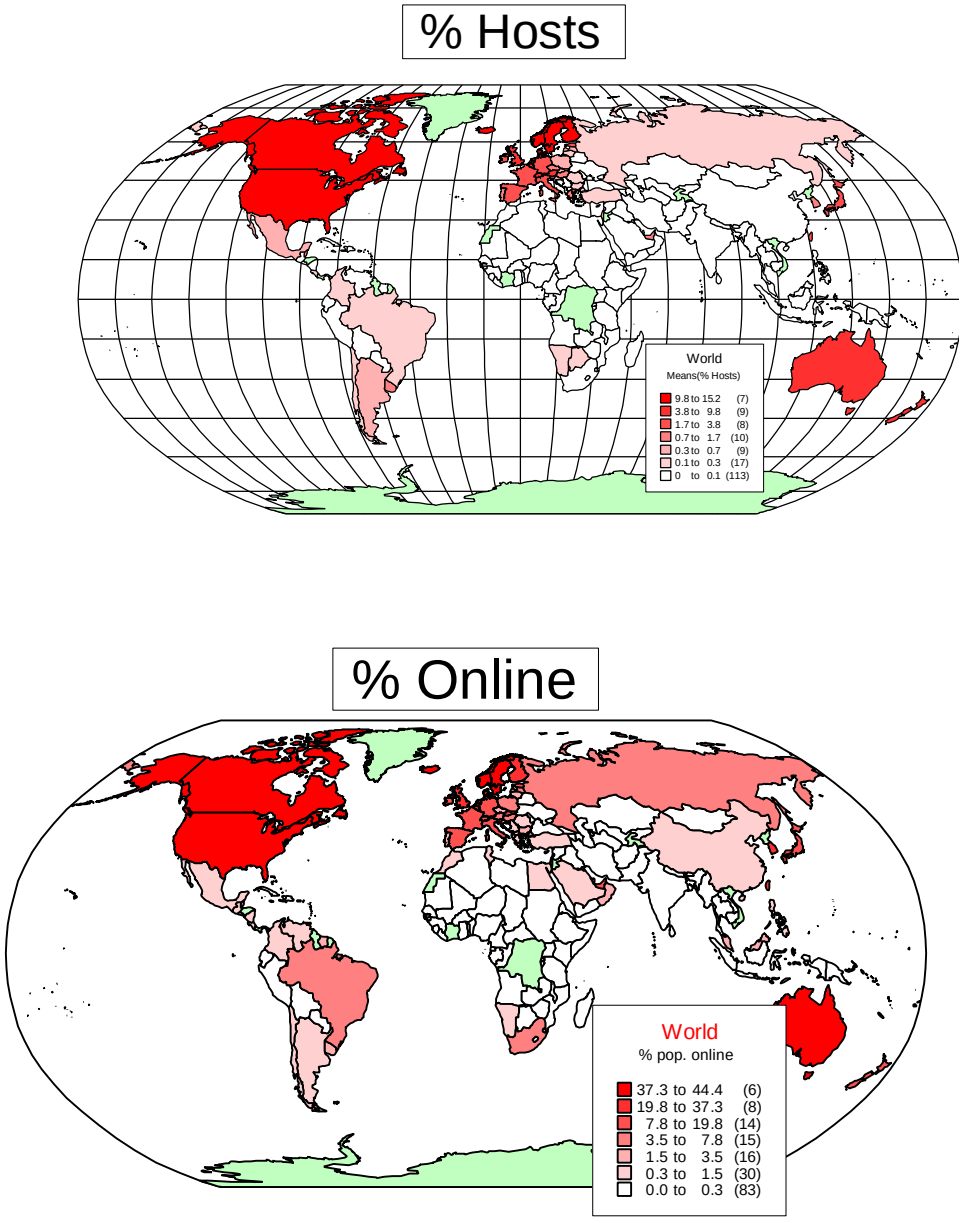
Source: 'How Many Online?' www.NUA.ie Spring 2000

Figure 3.2: The percentage of the population online by nation, 2000



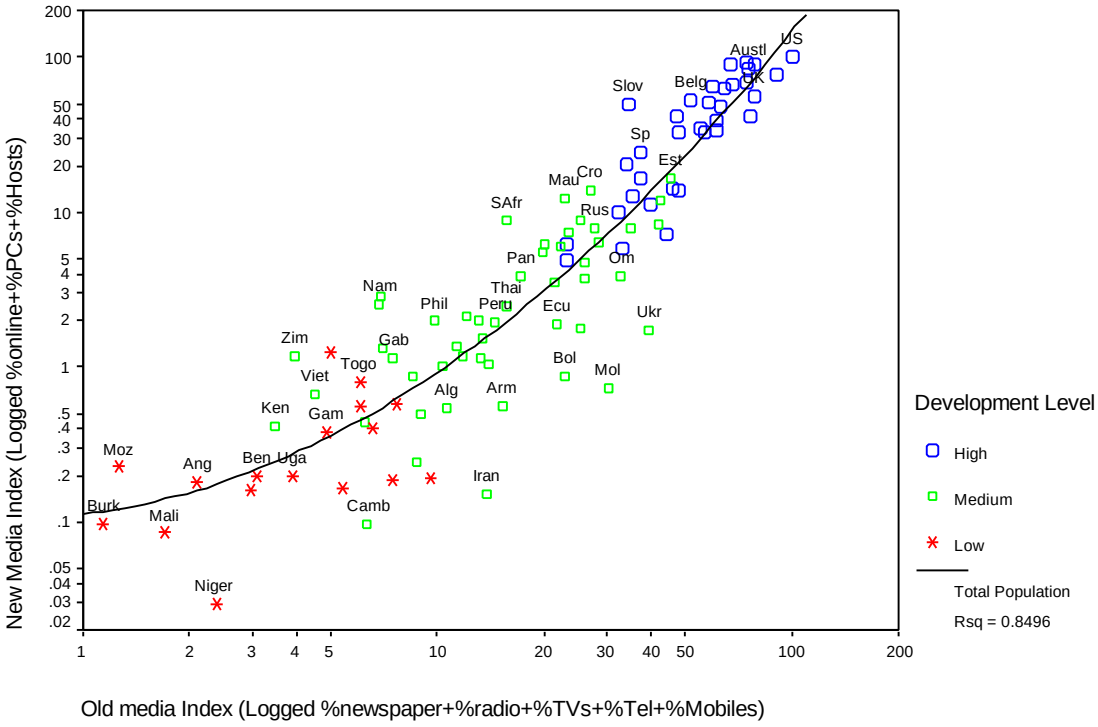
Source: All countries with over 0.5% of the population online. 'How Many Online?' Spring 2000 www.nua.ie

Figure 3.3: The world of Internet hosts and the online population, 2000



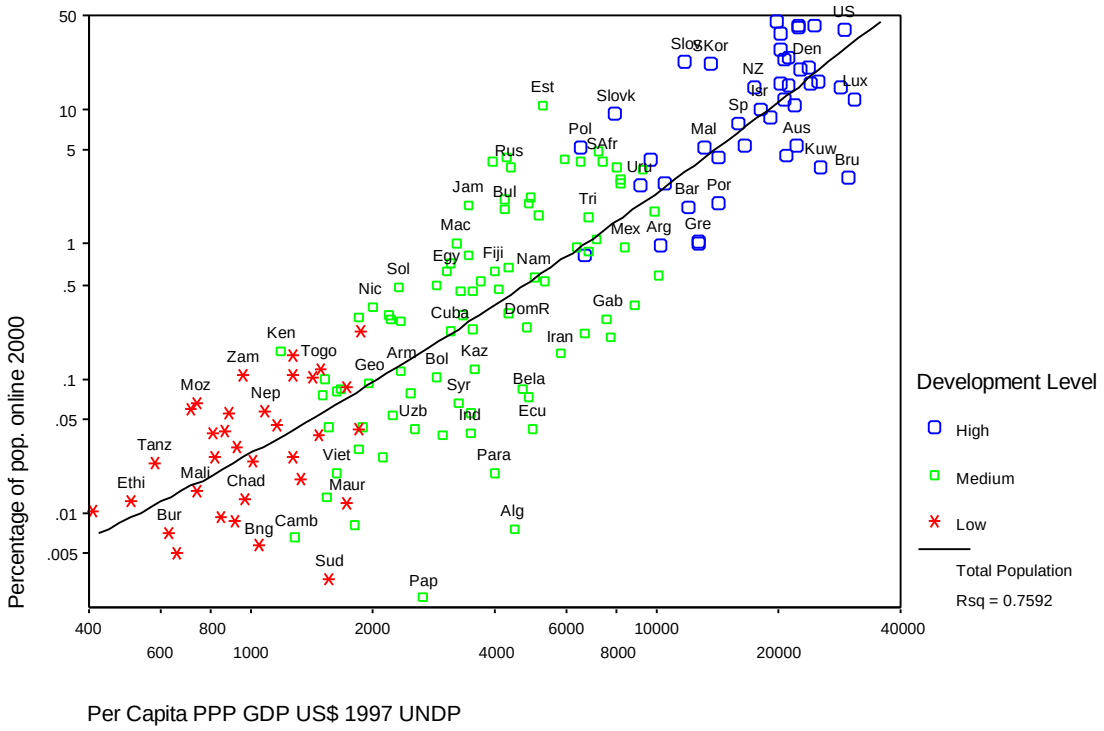
Sources: Online Population How Many Online? www.NUA.ie, Internet Hosts www.Netcraft.com

Figure: 3.4:



Source: For details about the construction of the scales and the data sources see Table 3.2

Figure 3.5:

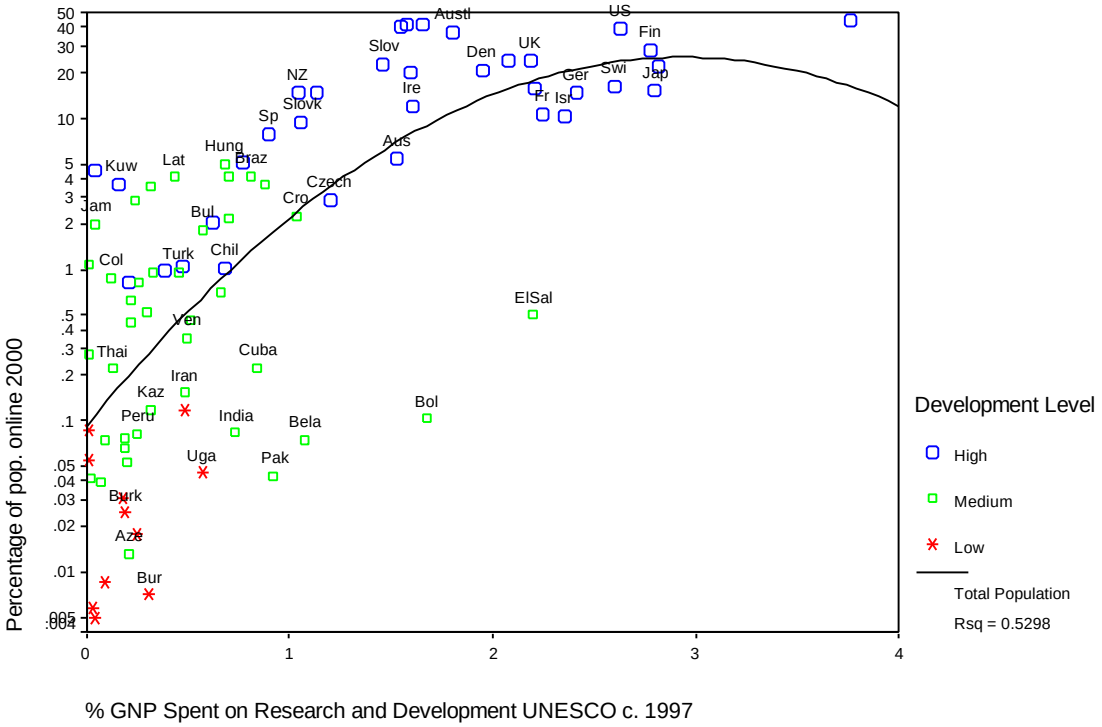


Sources:

Per capita GDP in Purchasing Power Parity, US$ 1999. UNDP *Human Development Report 1999*. New York: UNDP/Oxford University Press.

Percentage of the population online: How many online? www.NUA.ie

Figure 3.6: R&D Spending and Internet use

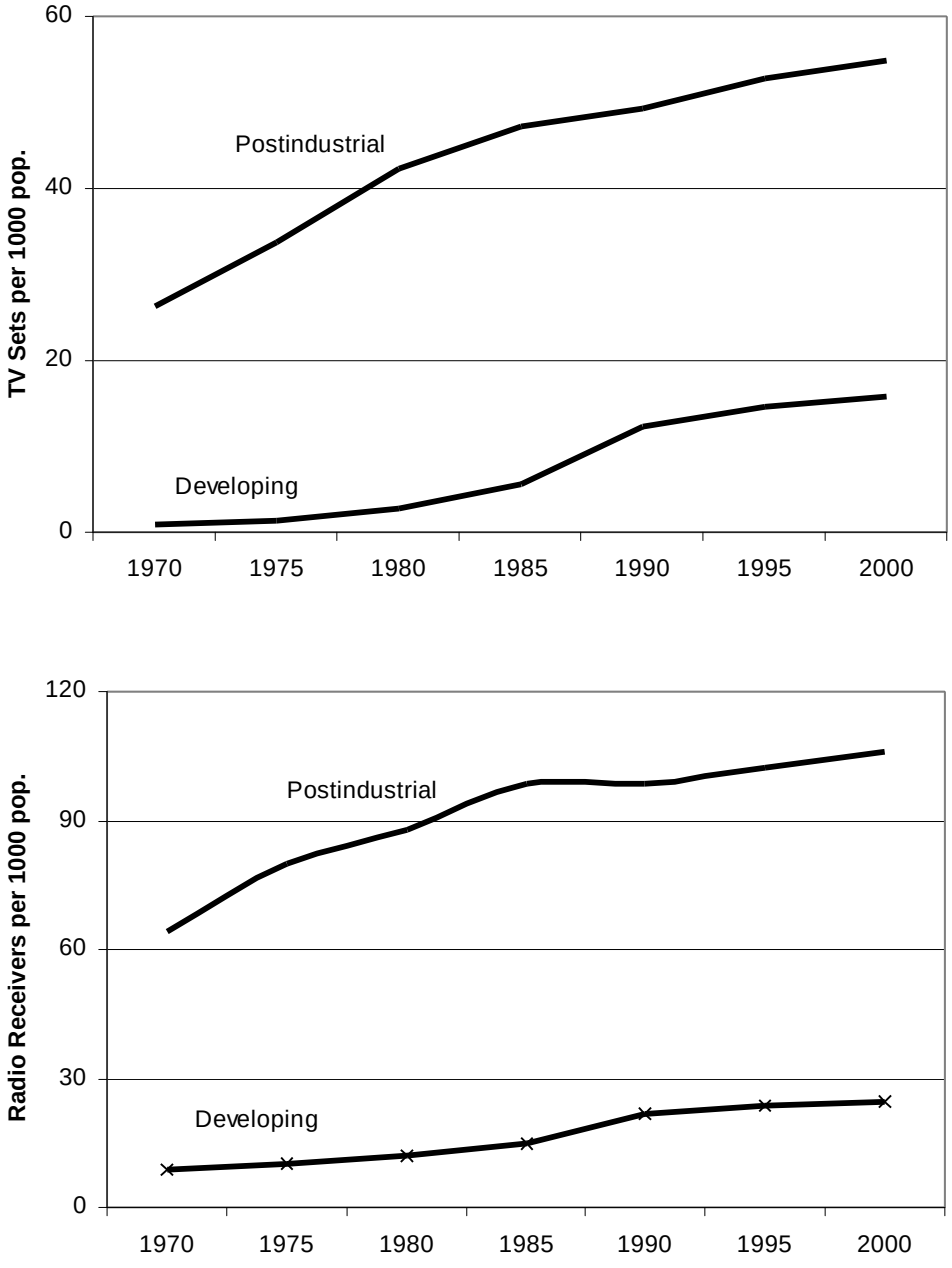


Sources:

Percentage of GDP Spent on Research and Development, 1997. UNDP *Human Development Report 1999*. New York: UNDP/Oxford University Press.

Percentage of the population online: How many online? www.NUA.ie

Figure 3.7: Trends in the worldwide spread of TVs and radios, 1970-2000



Source: UNESCO Yearbooks, Paris: UNESCO

Table 3.1: Internet users by region and type of society, 2000

	Total Population 1997, UNDP	Total Online 2000	Total Weighted Hosts 2000	Number of Nations
Industrialized	1,098,620,000	221,454,374	65,785,669	29
Non-industrialized	4,672,773,000	35,755,180	2,161,528	150
North America	396,400,000	119,900,000	46,123,871	3
Asia-Pacific	3,270,250,000	53,160,500	5,950,661	35
West Europe	362,960,000	52,874,000	11,318,161	16
Central & Eastern Europe	404,180,000	10,219,800	833,419	13
Scandinavia	24,000,000	8,431,074	2,711,261	5
South America	403,893,000	8,180,700	748,279	30
Africa	685,020,000	2,465,580	21,608	52
Middle East	224,690,000	1,977,900	239,936	14
High development	1,011,650,000	222,531,474	65,517,356	43
Medium development	4,102,603,000	29,637,500	1,819,652	89
Low development	583,250,000	143,200	4,520	35
Total	**5,771,393,000**	**257,209,554**	**67,947,197**	**179**

Notes and sources:

Total population 1997 from the *United Nations Development Report, 1999*. NY: UNDP/Oxford University Press *Number online* in 2000 or latest date estimated from www.NUA.ie February 2000, *How Many Online?* and from the International Telecommunications Union *Basic Indicators 1998* www.itu.int

Number of weighted hosts estimated by the International Software Consortium January 2000. The sites for .com, .net and .org were weighted according to the location of registration and reallocated by nation, according to the OECD methodology. See OECD 1999. *Communications Outlook 1999*.Paris: OECD. www.oecd.org

Level of human development defined by the Human Development Index 1999, UNDP. *Human Development Report, 1999*. NY: UNDP/Oxford University Press

Table 3.2: Proportion of the population using new and old media

	New Media			Old Media					
	Online Pop.	Weighted Hosts	PCs	Radios	TV Sets	Newspaper Daily	Mainline Phones	Mobile Phones	Info-Soc Index
	2000	2000	1998	1997	1998	1996	1998	1998	
Region									
Scandinavia	35	11	36	112	58	45	64	47	80
N. America	27	10	28	118	61	16	47	15	63
West Europe	12	3	27	79	53	21	53	24	52
C.&E. Europe	3	0.3	6	45	32	13	21	4	30
Asia-Pacific	5	1	8	35	19	11	13	8	27
Middle East	3	0.2	6	39	25	11	19	8	22
S. America	1	0.1	5	38	22	8	15	3	18
Africa	0.3	0.1	1	17	5	1	3	0.5	6
Development									
High	14	4	23	83	49	26	46	23	53
Medium	1	0.1	3	32	21	6	11	2	15
Low	0.02	0.03	0.3	14	3	1	1	.01	4
Total	***4***	***1***	***9***	***40***	***24***	***10***	***18***	***7***	***38***
N. of Nations	169	179	125	140	139	133	179	139	101

Notes and Sources: All figures are expressed as a percentage of the population. For full details see Table 3.1.

Percentage of radios (1997), Television sets (1998), Mobile phones (1998), and PCs (1998) from *World Development Indicators 2000*. The World Bank.

Level of development is classified according to the UNDP (1999).

The 100-point Info-Soc Index is calculated by combining all indicators into a standardized scale.

Table 3.3 Correlations in use of the new and old media

	New Media			Old Media				
	Online	Hosts	PCs	Radio	TVs	News papers	Phones	Mobile Phones
Hosts	.854							
PCs	.806	.745						
Radio	.788	.708	.818					
TVs	.692	.614	.769	.848				
Newspapers	.725	.715	.788	.749	.734			
Mainline Phones	.791	.710	.886	.837	.861	.839		
Mobile phones	.809	.827	.845	.754	.715	.830	.872	
InfoSoc Index	.883	.810	.924	.937	.917	.858	.954	.888

Note: See Table 3.1 and 3.2 for details of the measures. The figures represent correlations (r). All are significant at the .01 level.

Sources: see Table 3.1 and 2.2.

Table 3.4: Explaining the Spread of Technology

	% Online		New Media Index	Old Media Index
	Correlation	Beta (Sig)	Beta (Sig)	Beta (Sig)
ECONOMIC DEVELOPMENT				
Per Capita GDP	.74 **	.37 **	.57 **	.58 **
% R&D Spending	.46 **	.32 **	.28 **	.32 **
SOCIAL DEVELOPMENT				
% Adult literacy	.40 **	.03	-.05	.09
% Secondary education	.53 **	.07	.01	.01
POLITICAL DEVELOPMENT				
Level of Democratization	.55 **	.08	-.06	.10
REGION				
Scandinavia	.59 **	.26 **	.19 **	.08
North America	.34 **	.17 **	.12 **	.04
Western Europe	.25 **	.07 *	.08	-.06
Middle East	-.04	-.07	-.11	.01
Central & Eastern Europe	-.05	-.06	-.03	.12
South America	-.29 **	-.11	-.09	.01
Africa	-.29 **	.01	-.03	.01
Adjusted R^2.		.80	.57	.91

Notes: The dependent variables include the proportion of the population online (Spring 2000), the New Media Index (% online, % PCs and % hosts), and the Old Media Index (%Newspapers, % Radios, % TVs, % Telephones, % Mobile Phones) (see Table 3.2 for details). The figures represent correlation coefficients (R) without any controls and standardized beta coefficients from multivariate OLS regression analysis models. The regional dummy variables drop Asia. * Sig.= -.01, ** Sig.= .05.

Sources: See previous tables in this chapter for data sources.

[1] See Surendra J. Patel. General editor. 1993-5.*Technological Transformation in the Third World.* 5 vols. Aldershot: Avebury. See also case studies in David J. Jeremy. 1992. *The Transfer of International Technology: Europe, Japan and the USA in the Twentieth Century*. Aldershot: Edward Elgar; Nathan Rosenberg and Claudio Frischtak. Ed. 1985. *International Technology Transfer: Concepts, Methods and Comparisons.* New York: Praeger; David Charles and Jeremy Howells. 1992. *Technology Transfer in Europe*. London: Belhaven Press; Manas Chatterji. 1990. *Technology Transfer in the Developing Countries*. NY: St Martin's Press; S.R. Melkote. 1991. *Communication for Development in the Third World: Theory and Practice*. Newbury Park, CA: Sage Publications; Wilbur Schramm. 1964. *Mass Media and National Development*. Stanford, CA: Stanford University Press.

[2] See, for example, Everett M. Rogers. 1995. *Diffusion of Innovations*. New York: Free Press; Jayati Sarkar. 1998. 'Technological Diffusion: Alternative Theories and Historical Evidence.' *Journal of Economic Surveys*. 12(2): 131-176; Vijay Mahajan, Eitan Muller and Frank M. Bass. 1999. 'New Product Diffusion Models in Marketing: A Review and Direction for Research.' *Journal of Marketing*. 54: 1-16.

[3] Tim Hayward. 1995. *Info-Rich, Info-Poor: Access and Exchange in the Global Information Society*. K.G.Saur; William Wresch. 1996. *Disconnected: Haves and Have-Nots in the Information Age*. New Brunswick: Rutgers University Press; S. Arunachalam. 1999. 'Information and Knowledge in the Age of Electronic Communication: A Developing Country Perspective.' *Journal of Information Science*. 25(6): 465-476.

[4] Celia W. Dugger. 2000. 'Connecting Rural India to the World.' *New York Times* 28 May. http://www.nytimes.com/library/tech/yr/mo/biztech/articles/28india.html

[5] UNDP. 1999. *Human Development Report 1999*. NY: UNDP/Oxford. P.64.

[6] OECD. 2000. *OECD Information and Technology Outlook*. OECD: Paris.

[7] Carlos Alberto Primo Braga 1998. 'Inclusion or Exclusion?' http://www.unesco.org/courier/1998_12

[8] World Economic Forum. 2000. *From the Global Digital Divide to the Global Digital Opportunity: Proposals submitted to the G-8 Kyushu-Okinawa Summit 2000*. www.ceip.org

[9] OECD. 2000. *OECD Information and Technology Outlook*. OECD: Paris. Table 2 p.24.

[10] OECD. 2000. *OECD Information and Technology Outlook*. OECD: Paris.

[11] For a discussion see Ed Yourdon. 1996. *The Rise and Resurrection of the American Programmer*. NY: Prentice Hall.

[12] By Spring 2000, over 1000 phones have been provided, serving 65,000 people, and the eventual target is 40,000 phones. See Don Richardson. 2000. *Grameen's Telecom's Village Phone Programme in Rural Bangladesh*. Telecommons Development Group, Ontario. http://www.telecommons.com. See also http://www.grameenphone.com

[13] http://www.SuliNet.hu

[14] UNDP. 1999. *Human Development Report 1999*. NY: UNDP/Oxford. P.64.

[15] *Wired News*. June 5 2000. 'Africa One Project Targets 2002.' For details see www.AfricaOne.com

[16] OECD. 2000. *OECD Information and Technology Outlook*. OECD: Paris. P. 81.

[17] The World Bank. 2000. *World Development Indicators 2000*. P.299. www.worldbank.org/data.

[18] International Telecommunications Union. 1999. *Challenges to the Network: Internet for Development*. Geneva: ITU.

[19] Data from NUA. http://www.nua.ie.

[20] David C. Niece. 1998. 'Measuring Participation in the Digital Techno-structure: Internet Access.' *ACTS/FAIR Working Paper* 44 Brighton: SPRU.

[21] Human Development is measured using the UNDP index combining three factors: *longevity* as measured by life expectancy at birth; *educational attainment* as measured by adult literacy and school enrolment, and *standard of living* measured by real GDP per capita. See UNDP. 1999. *Human Development Report 1999*. NY: UNDP/Oxford.

[22] Data is drawn from the Spring 1999 Eurobarometer. See Pippa Norris. 1999. 'The Emergent Internet Age in Europe: A New North-South Divide?' *The Harvard International Journal of Press-Politics*. 5(1).

[23] For example, if 5% of the total generic top-level domains are from a particular country, then 5% of the total number of hosts surveyed under generic top level domains are reallocated to that country. For details, see OECD 1999: *Communications Outlook 1999*. Paris: OECD. P. 88-9. Also www.oecd.org.

[24] International Telecommunications Union. 1999. *Challenges to the Network: Internet for Development.* Geneva: ITU.

[25] World Bank. 2000. *World Development Indicators 2000*. www.worldbank.org/data

[26] The analysis was also confirmed by principle component factor analysis, with the results not reported here.

[27] Eszter Hargittai. 1999. 'Weaving the Western Web: Explaining Differences in Internet Connectivity Among OECD Countries.' *Telecommunications Policy*. 23(10-11): 701-718

[28] International Telecommunications Union. 1999. *Challenges to the Network: Internet for Development*. Geneva: ITU. www.itu.org

[29] Francisco Rodriguez and Ernest Wilson III. 2000. 'Are Poor Countries Losing the Information Revolution?' *WorldBank InfoDev* www.infodev/library/wilsonrodriguez.doc

[30] Leonard R. Sussman. 2000. Censor Dot Gov: The Internet and Press Freedom 2000 '*Freedom House Press Freedom Survey 2000*. http://www.freedomhouse.org/pfs2000/sussman.html.

[31] OECD. 1999. *Communications Outlook 1999*. Paris: OECD. Also www.oecd.org. OECD. 2000. *OECD Information and Technology Outlook*. OECD: Paris. P.52.

[32] Eszter Hargittai. 1999. 'Weaving the Western Web: Explaining Differences in Internet Connectivity Among OECD Countries.' *Telecommunications Policy*. 23(10-11): 701-718.

[33] Everett Rogers. 1995. *Diffusion of Innovations*. New York: Free Press.

[34] UNDP. 1999. *Human Development Report 1999.* NY: UNDP/Oxford. P.176.

[35] William Wresch. 1996. *Disconnected: Haves and Have-Nots in the Information Age*. New Brunswick: Rutgers University Press. P.130-132. See also George Barnett and Young Choi. 1995. 'Physical

Distance and Language as Determinants of the International Telecommunications Network.' *International Political Science Review.* 16(3): 249-265.

[36] Inktomi 18 January 2000. Web Surpasses One Billion Documents.'Press release. http://www.Inkotomi.com/new/billion.html.

[37] Internet Society. June 1997. Web Languages Hit Parade.' http://www.isoc.org:8080/palmares.en.html.

[38] M. Rao,, S.R. Bhandari, S.M. Iqbal, A. Sinha and W.U. Siraj. 1999. 'Struggling with the Digital Divide: Internet Infrastructure, Policies and Regulations.' *Economic and Political Weekly.* 34(46-47): 3317-3320.

[39] Although this seems plausible, unfortunately this proposition cannot be systematically tested in this study. Ethnologue provides the most comprehensive data monitoring the proportion of native-speakers in different languages worldwide, but no single source provides reliable information monitoring the proportion of the population familiar with English as a primary *and* secondary language. This measure fails to take account of the high level of familiarity with English as a second language, for example in Sweden, the Netherlands and Norway. For details see www.ethnologue.org.

[40] Leonard R. Sussman. 2000. Censor Dot Gov: The Internet and Press Freedom 2000 '*Freedom House Press Freedom Survey 2000*. http://www.freedomhouse.org/pfs2000/sussman.html .

[41] Freedom House. 2000. http://www.freedomhouse.org

[42] The simple correlations examine the relationship between the independent variables (economic development, human capital and democratic development) and the dependent variable in each country without any prior controls or causal ordering. The Ordinary Least Squared Regression Analysis models use multivariate analysis, assuming that the independent variables are interrelated. Variables are entered into the model in the order shown in the table, based on the prior theoretical assumptions. The analytical models assume that economic and social development are causally prior to democratic development, an assumption that reflects the standard literature on the process of democratization, although, of course the causal relationship could be reversed. Many alternative models were examined and tested with the variables entered in different causal sequences, and with alternative measures for economic and social development, using a series of scatterplots to examine

the relationships, before the final model was selected on the basis of goodness of fit (indicated by the adjusted R squared), parsimony (simplicity), robustness (consistency across different indicators), and the prior theoretical assumptions.

[43] For a discussion of the relationship between economic development and democratization see Seymour Martin Lipset. 1993. 'A Comparative Analysis of the Social Requisites of Democracy.' *International Social Science Journal* 136(2):155-175.

[44] This pattern was further confirmed by the fact that the UNDP Human Development Index (combining literacy and education, longevity and per capita GDP) proved to be more weakly associated with Internet access than the economic development measure used in this study.

[45] Eszter Hargittai. 1999. 'Weaving the Western Web: Explaining Differences in Internet Connectivity Among OECD Countries.' *Telecommunications Policy*. 23(10-11): 701-718.

[46] The World Bank. 1999. *World Development Report*. Washington, DC. P.9.

[47] OECD. 2000. *OECD Information and Technology Outlook*. OECD: Paris. Figure 22. P. 51.

[48] At individual level ownership of home computers was strongly and significantly correlated (R> .75 sig. P.01) with possession of many other household consumer durables including a video camera, clock radio, electric drill, electric deep fat fryer, two or more cars, and a second home. The correlation analysis was based on data in Eurobarometer 44.0 Fall 1995.