The Internet and socio-economic development: exploring the interaction

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Abstract *This article attempts to gain an understanding of the current and potential impact of the Internet on the four-fifths of the world's population living in developing countries, two-thirds of them poor. First, it attempts to put today's rapid advances in information and communication technology in a broader debate about development and the role of information. Next, it explores the interaction between the Internet and key dimensions of development. Finally, it discusses some key policy implications of Internet diffusion and usage which governments of developing countries will have to address. These include an increasing role for intermediary institutions in the creation and dissemination of relevant knowledge on the Internet in order that the technology is used in a way that is compatible with local development goals.*

Introduction

The importance of expanding the access of developing countries to the Internet has been recognised by governments and international agencies with increasing consensus that the Internet and related telecommunications technology should be regarded as strategic national infrastructure (Kenney, 1995; Mansell and Wehn, 1998). This has led to significant rates of increase in the regional distribution of Internet host connections over the last few years (ITU, 1999). The establishment of such strategic infrastructure is considered critical for developing countries where the marginal impact of improved network communications can be very high, leading to improved economic productivity, governance, education, health and quality of life, particularly in rural areas (Adam, 1996; Press, 1996). For example, in Africa, the growth of small scale, low cost electronic networks has been influential in building an academic and research community within the continent that discusses and shares topics of concern (Adam, 1996; Panos, 1998). Another example is the networking project launched by the Commonwealth Secretariat in 1990 called COMNET-IT. The project aims to improve government collaboration within the commonwealth group of countries using electronic networks to facilitate the sharing of data on administrative reform experiences (Qureshi and Cornford, 1994). These findings suggest that wider connectivity within developing countries would improve the overall information infrastructure in these countries and thereby promote positive changes in socio-economic development.

Despite increases in the provision of information services that are available through the Internet for users in the developing world, there is considerable scepticism regarding the potential of the technology for socio-economic development. For example, most Internet diffusion statistics, although

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impressive, tell us little about Internet density since they do not take into account the size of the population in each country or region. More recently, Harris (1998) computed rates of Internet density by taking into account the size of the population in each region. His figures, shown in Table I, reveal that North America has 168 times the number of hosts compared with Africa, but that Africa has 396 times the number of people per host than North America. Even when Internet access is available, Mansell (1998) argues that the value of a technology that permits communications with a distant correspondent across the world is of limited use to someone grappling with the day-to-day problems of poverty and hunger. Another fear often expressed in the literature is that the poor financial, technical and human resources in developing countries would perpetuate further ties of dependency such that developing countries would be kept economically subservient by the need for Western equipment and expertise (Wehn, 1998).

In this paper, we examine the extent to which the knowledge and information revolution manifested today in the Internet will affect the quality of life of more than 4 billion people in developing countries, particularly the poorest and most vulnerable among them. Connecting countries is just the beginning and, though expensive, perhaps the easiest part. Individuals, organisations, even countries must have the incentives and the capabilities to use information effectively. Especially for the poor and vulnerable, strengthening their capability to receive and use knowledge will require special effort, and knowledge that comes from outside will need to be adapted to fit local contexts and needs. This perspective suggests that development must focus on alleviating poverty and on creating a social environment that is conducive for providing universal access to basic welfare systems. This view differs significantly from the traditional form of development in terms of stages of economic growth. It implies that the impact of the Internet should not be measured in terms of the number of connected individuals alone, but also in terms of its accessibility and contribution to social progress (Uimonen, 1997).

The paper is organised as follows. The next section traces the evolution of development thinking discussing the role of information and knowledge in

	Hosts	Population ('000s)	People per host
North America	21,540,474	285,940	13
Latin America	241,898	448,688	1,855
Western Europe	4,793,544	408,675	85
Eastern Europe	350,117	322,697	922
Middle East	73,060	138,927	1,902
Africa	128,570	661,062	5,142
Asia	1,705,240	3,016,940	1,769
Pacific	836,708	53,435	64
	29,669,611	5,336,164	180

Table I.
Regional distribution of Internet host identity

Notes: Compiled by Harris (1998) using figures of Internet hosts from *Internet Domain Survey*, January 1998 and world population statistics taken from the *World Bank Atlas*

achieving more sustainable, equitable forms of human development. Section three raises key issues related to the diffusion and usage of the Internet in developing countries in terms of various dimensions of development discussed in section two. The final section explores some policy directions for governments in developing countries in terms of creating, disseminating and using the Internet in a locally relevant way.

Trends in development thinking

Behind every policy intervention lies some theoretical assumption, either overt or covert, about the nature of development. In this section, we trace the evolution of these assumptions and aim to develop a conceptual framework to guide us in categorising issues of relevance in the interaction between the Internet and socio-economic development.

There has been considerable debate over the definition, explanation and practice of development over the past few decades. Modernisation was perhaps the earliest theoretical approach to development, which was intimately linked to decolonisation through the idea of nations gaining political independence to pursue national economic development. Development was perceived as a universal process consisting of a number of stages similar to those that the countries of Western Europe and America had experienced. Within this model, cities were seen as "engines" of national economic development through their concentration of scientific and technical institutions, and information and support services. It was assumed that developing countries would be able to experience this urban-industrial route to development as long as the benefits of scientific advances and industrial progress were made available to them (Rostow, 1960; Hettne, 1990). Like the modernists, the classical Marxists also subscribed to the evolutionary notion of development prevalent in the nineteenth century, although they were ultimately concerned with conflicts between the capitalist and working classes at each stage of growth (Roxborough, 1979). The rise of the neo-Marxist Dependency School after the Second World War saw underdevelopment as a continuous process rather than an original state, and capitalist penetration was perceived to be the main cause of underdevelopment. Dependency was seen from two perspectives. First, in terms of the ability of an independent developing society to make decisions within the prevailing international power structure. Second, in terms of social equity within the developing country by empowering the poor with basic needs for human development (Rodney, 1972; Amin, 1974; 1985). During the 1960s and 1970s, there was increasing evidence to suggest that only a few developing countries had managed to increase their growth rates, restructure their economies, and take advantage of the benefits of scientific and technological advancement. The majority of low-income countries were unable to achieve economic growth as they were plagued with increased poverty, growing indebtedness, political repression, social inequality, displacement of traditional values and environmental damage (Conyers and Hills, 1984; McMichael, 1996).

Contemporary responses to the development experience have been twofold. The first response is that of the globalists who speak a similar language to the modernists arguing in favour of a stages of growth model of development, and who advocate a thoroughly global marketplace to expand trade and spread wealth. The globalists draw on the arguments made by the post-industrialists in favour of a new stage of development centred on the production, diffusion and use of information and communication technologies throughout society – a vision which first took hold in the USA in the 1960s, against a context of increasing prosperity and automation (Bell, 1973; Castells, 1989; Castells and Hall, 1996). Information and knowledge have come to be projected as the "engine" or major force in shaping economies with their potential to transform any kind of activity into new ways of functioning and new forms of organisation and management. Many economists, notably Porat (1977), tried to measure the extent to which countries had achieved an advanced stage of development called an "information economy" by counting the numbers of people employed in information-related occupations. On the whole, there was agreement that the twentieth century had witnessed a shift of one-third to one-half of the population within leading economies into occupations that deal with information.

In many developing countries, noticeable trends were observed towards achieving an information economy in terms of the numbers of people engaged in information-related occupations (Katz, 1986). At the same time, however, Katz brought evidence to suggest that, in low-income countries, an increase in the number of information workers is a sign of underdevelopment rather than prosperity. Most organisations in the developing world are striving to achieve operational efficiency rather than to restructure their processes towards improved effectiveness. In particular, large armies of information workers are required to cope with the provision of administrative services in the light of dramatic increases in population, as well as to absorb surplus educated workers due to lack of capacity in the industrial sectors. Notwithstanding these findings, in recent years, many writers have begun to calculate the extent to which individual nations around the world had achieved "knowledge societies" using indexes related to the consumption and production levels of information technology, including an Internet host index (Kenney, 1995; Mansell and Wehn, 1998). This model of development has resulted in telecommunications and global networks becoming important issues for discussion amongst government policy-makers and international agencies (Panos, 1995; Press, 1996).

The second response to the development experience is that of the localists or neo-populists. Since 1975, a major new paradigm has come to the fore in development studies under the term neo-populist thinking. It is forcefully articulated by non-government organisations and others giving much importance to the views, desires and ambitions of those about to be developed. Such views offer an alternative development strategy to the linear growth model. This alternative view is based on the notion that developing countries have their own trajectory of development which does not necessarily follow the same pattern as experienced by the advanced, industrialised countries (Hettne,

1990). The neo-populists argue for the retention of traditional peasant agricultural systems and small-scale enterprises, for direct policies aimed at reducing poverty among target groups of the population, and for local sustainable development projects. For example, Julius Nyerere's attempt to establish a revitalised and improved traditional African socialism in Tanzania in the 1960s and 1970s is a good example of neo-populism in action. Another example can be taken from the basic needs policies implemented by national governments and international agencies during the 1970s which gave higher priority to redistribution of wealth through programmes directed at poverty alleviation, rather than economic growth. Similarly, the main message of the sustainable development movement that arose in the 1970s and 1980s was that development depended on the ecology and culture of the locality rather than on a western model of economic growth. More recently, in the context of Africa, McGeary and Michaels (1998) observe that a new spirit of self-reliance is taking root among many Africans as they seize control of their destiny through local models of development.

These experiences have led to a redefinition of the goals of development with much greater emphasis on non-economic aspects. Development has come to be conceived of and measured not only in economic terms, but also in terms of social wellbeing and political structures, as well as in terms of the physical environment as reflected in the UNDP Report on Human Development published annually since 1992 (UNDP, 1991). This report takes increasing account of alternative dimensions of development such as social welfare, social equity, democracy, empowerment and sustainable development. Incorporating this multi-faceted approach to development, Press recently brought evidence to show a positive correlation between the number of Internet hosts in a country and the UNDP Human Development Index (Press, 1997).

The foregoing discussion suggests that equitable forms of human development do not depend on economic growth or modern technology alone. Other dimensions of development such as social welfare and equity, political wellbeing and the physical environment come into play. At the same time, it is undeniable that some kind of interaction between the diffusion and usage of this technology and development is occurring. As increasing amounts of information about scientific and technological developments are now available only on the Internet, this technology appears to have opened up new options that shape and are shaped by the context within which it is embedded. The next session examines these options focusing on certain key dimensions of development.

The impact of Internet usage on key dimensions of development

As usage of the Internet widens beyond the research and academic community, its developmental impact in terms of economic growth, social wellbeing, political structures and the physical environment needs to be closely monitored. This section explores this impact by examining six key application areas of the

Internet in developing countries, namely economic productivity, health, education, poverty alleviation and empowerment, democracy, and sustainable development.

Economic productivity

Commercial connections are the fastest-growing component of the Internet today as more and more companies are establishing closer links with customers, business partners, vendors, and information resources via the network (Press, 1996). However, to date, little research has been carried out on the impact of Internet usage by commercial organisations in developing countries, although many commentators have speculated that the Internet represents a tool for improved economic productivity and growth. For example, the World Bank estimates rates of return to the local economy of between 13 and 20 per cent (World Bank, 1995). Jayaram *et al.* (1997) predict that the Internet will enable local companies to market their products and services abroad and thereby overcome one of the most important barriers to global competitiveness facing developing countries. They observe that, while companies in India find it prohibitively expensive to advertise extensively in print publications, advertising on the Internet is relatively cheap. Along similar lines, in a recent study on Argentina, Buttazzoni (1997) reports that, while the total number of Argentinian companies that have set up Web sites represents only a small proportion of the total number of businesses in the country, these companies are gaining greater exposure in the global market. Network connections also promise improved regional collaboration and competitiveness in trade and research. The Common Market for Eastern and Southern Africa (COMESA) and the United Nations Conference on Training and Development (UNCTAD) have both commented on the positive potential impact of trade information networks on interregional and intraregional trade (Adam, 1996).

However, despite the potential of Internet connectivity for commercial activity, there is evidence to suggest that the return on investment in information technology investment in developing country organisations is poor. For example, a recent survey carried out by Dewan and Kraemer (1998) reveals that, together with investment in information technology, there is need to ensure that organisations have the necessary capacity to restructure themselves to promote efficiency and effectiveness. Countries with strong managerial capabilities such as the newly industrialising economies of south-east Asia have been able to acquire and retain competitiveness and build adequate bases to keep up with the pace of progress by devoting major efforts to investigate indigenous managerial trends (Montealegre, 1996). These findings suggest that more research is needed on the way the Internet is influencing economic activities, and on how local institutions can help to develop the skills and capabilities to tackle local and national problems. Many writers have described successful indigenous approaches to management in developing countries (Srinivas, 1990; Sinha, 1990). For example, Srinivas identifies the inadequacy of conventional Western strategies and proposes a set of holistic strategies for

worker delineation in developing countries. Similarly, Sinha describes an effective leadership/supervision model consistent with culture-based expectations of both superiors and subordinates in Indian organisations.

Health

We are beginning to witness the application of networks to health care in developing countries. One such example is HealthNet which links health-care workers in 16 African countries and four Asian countries with each other and with colleagues and databases in developed countries using a variety of communications protocols (Panos, 1995, 1998). The network provides e-mail, a list server, electronic publications and database access. Another example is the Programme for Monitoring Emerging Diseases mailing list established during the recent Ebola virus outbreak in Zaire by 60 researchers in September 1993. Today, the network has over 1,600 members in 80 countries. The list first heard of the outbreak in 1976 and circulated information from various international health organisations. Information was then passed to and from affected countries helping to control the spread of the virus and to treat the disease. For example, Zambia was able to use the Internet to check details about similar cases in the Copperbelt region of the country (Press, 1996). In general, most connectivity that takes place in HealthNet is from developing countries to information resources in developed countries. Intranational connectivity amongst developing countries themselves is still very sparse although one can imagine many useful health networking applications in developing countries where barefoot doctors and other paramedics serve poor communities and rural areas.

An increasing number of Internet sites concerned with health matters in Africa appear to be relevant for the achievement of long-term socio-economic development. For example, Asiru (1998) recently analysed data from a random search of 100 Internet sites concerned with health matters in sub-Saharan Africa. He found that 58 per cent of the sites were sponsored or funded by non-government organisations that had strong links with African communities and academics.

Education

Networks in developing countries have usually started in the university and research community where their impact has been positive. For example, a survey undertaken in Ethiopia, Uganda, Zambia and Senegal on the impact of electronic communications technology shows that academic and research institutions have been able to conduct joint projects effectively, improve resource mobilisation, and carry out research between distant sites inexpensively (NRC, 1996).

The use of networks for primary and secondary schools has also revealed some interesting examples. Two countries which have good examples of education networks are Cuba and Chile. Both have strong records of investment in human capital and have continued allocating resources to education

networking. For example, in 1992, the Catholic University in Chile embarked on a five-year project to develop and evaluate an elementary school network. Today, there are 144 networked schools each having between three and ten computers and an Ethernet, some gaining connectivity to the Internet. The network provides a variety of services student and teacher newsletters, educational software, curriculum notes, computer conferences, e-mail and access to databases. The network has been evaluated and shows a significant effect on student creativity. With World Bank funding, the goal is to reach all secondary schools and half of all primary schools in the country by 2000. Cuba's school networking project began in 1987 and stressed grassroots participation of schools in rural areas. There are now 150 centres spread around the country, 80 of which have modems used to dial into personal computers (PCs) running Unix in Havana for onward connection to the Internet (Press, 1996).

In recent years, distance learning has been earmarked as especially relevant for developing countries where there is a need to educate large numbers of geographically dispersed people (UNESCO, 1985). There has been increasing interest in the use of electronic networks to support distance learning around the world by enabling computer-media conferencing and collaborative learning to take place, and by providing access to electronic libraries and to the multimedia education market (Hall, 1996; Panos, 1998). However, at the same time, some commentators have argued that the generation of distance learning material is capital intensive, and may therefore lead to the exclusion of the mass of the population in developing countries from this form of education (Bates, 1993).

Poverty alleviation and empowerment

Harnessing networks to deliver benefits in developing countries means ensuring that those facilities are responsive to the poorest and most disadvantaged communities. Electronic communication can assist in the management of crises and poverty alleviation amongst international organisations. One such effort is the Greater Horn of Africa Electronic Communications Network project funded by the United States Agency for International Development (USAID) which aims to link member states of the region in order to exchange crisis-related information. Another potentially beneficial area identified by international aid organisations for the application of electronic networks relates to the problem of food insecurity in Africa. One of the main problems characterising the African economic situation is food insecurity, which contributes to local competition for resources between groups often resulting in civil war. Electronic networking can deliver critical information to farmers, extension workers and researchers fighting crises caused by famine (Adam, 1996; Panos, 1998). Electronic networks are also being used by international non-government organisations such as Action Aid in order to restructure the functioning of their projects towards a more team-based approach with the use of electronic networks. The aim of the network is to create a "virtual team" of experts from around the world on particular development priorities.

There are many experiences recorded of Internet usage at the national and sub-national levels for poverty alleviation and empowerment. The Village Internet Programme of the Grameen Bank in Bangladesh aims to promote poverty alleviation by reducing migration from villages to cities, creating information technology-related job opportunities for the rural poor, and by creating familiarity with computers among the rural population of the country (Grameen Communications, 1998). Another example is the Honey Bee network established in 1990 as a pilot experiment in India. This electronic network aims to create a repository of indigenous knowledge and to link knowledge-rich grass-roots innovations within a region in order to promote activities within poor communities, which are both economically and ecologically viable. Green technologies such as herbal pesticides, herbal drugs for animals and humans, and vegetable dyes are only some of the ideas in which the network is very rich (Gupta, 1997).

The Internet offers an opportunity for direct communication between developing countries and many activists and non-government organisations (NGOs) that share political goals are connected into the electronic Web. There are many examples of activists who have used the Net to help empower marginalised groups throughout the world and have established grass-roots nets for this purpose by posting debates and policies on bulletin boards in order to solicit responses and organise protests. In another example, NGO women's group charities use e-mail to keep in touch with women in Bosnia. It can be extremely difficult to make a phone call to find out what aid they need, but e-mail keeps on trying until it finds a route to deliver the message (Annis, 1991; Frederick, 1994). Perhaps the organisation that has really helped to empower marginalised groups throughout the world is the Association for Progressive Communications (APC) which has been a leader in co-ordinating the development and operation of networks devoted to peace, ecology, human rights and other "progressive" causes since 1989 (Frederick, 1994). The APC network has become the main medium through which NGOs obtain reports and official documents to intervene in policy-making. By August 1995, there were 18 member networks serving over 31,000 activists, educators, and NGOs in over 133 countries. In September 1995, APC was granted Consultative Status Category 1 with the Economic and Social Council of the United Nations (UN) enabling the organisation to have a permanent representative at the UN assembly.

Web upon web of grass-roots groups are forming as poor people are not only better organised, but better connected to each other, to the state, and to people abroad. These new social networks which are enforced by new electronic connections can generate powerful channels of political expression. However, further research is needed to indicate to what extent these knowledge networks have contributed to development in different countries.

Democracy

The prevalence of democratic institutions in a country is considered a key criterion for socio-economic development as reflected in the recent development indexes. Although little research has been carried out to explore the link between the openness of information and democracy, some writers have speculated that Internet connectivity does promote democracy (Goodman *et al.*, 1994; Press, 1996; Mueller and Tan, 1997). For example, Mueller and Tan assume that the Internet encourages democracy by providing people living under dictatorship with outside information and ideas, and by enabling them to share ideas and to co-ordinate political activity within their countries. For example, during the attempted coup in the Soviet Union in August 1991, APC set up links through the Baltic States on to NordNet in Sweden and then on to the London based GreenNet which in turn kept an open link with the rest of the APC network allowing information flow from Moscow and Leningrad. Along similar lines, the Net has been used for both inter- and intranational communication during events in Tiam an men Square in 1993. It is precisely the difficulty of political censorship on the Net that has been an invaluable tool for activists and journalists involved in sensitive political topics.

However, this freedom of expression made possible via the Internet poses a serious dilemma for authoritarian regimes as it threatens to undermine their control structures. In many parts of the world, strong government control exists on electronic communication. For example, in China, Singapore and Vietnam plans have been announced to control information that the Internet brings to their territory. China's Post and Telecommunications Minister announced that by linking to the Internet absolute freedom of information is not intended. But it remains unclear how China plans to achieve this (Clough, 1996; Mueller and Tan, 1997). Singapore plans to introduce two or three levels of filters applying different levels of censorship for academics, businesspeople and the general public. However, improved telecommunications and the Internet seriously undermine the capabilities of authoritarian governments to restrict flows of information.

Sustainable development

The UN Conference on Environment and Development held in 1992 saw an unprecedented level of involvement from international agencies and NGOs in policy-making. For example, the UNDP is currently involved in the Sustainable Development Networking Project for linking users and suppliers of information on sustainable development. The programme has helped to provide information to some governments on environmental hazards such as how to safely dispose of toxic material. The UN has recently commissioned a feasibility study for setting up a sustainable development networking project in China (UNDP, 1995).

Another example of Internet usage promoting global policy was in 1994 following Clinton's announcement that he was about to sign the convention on biodiversity. Indian environmental activists hijacked the convention that was

for the benefit of industry after they had received a draft copy of the announcement over the Internet. These activists contacted the Malaysian office of a development media organisation and their message was posted on various bulletin boards on the Net. Almost immediately, protest faxes and e-mail messages from NGOs around the world were being sent to the White House (Panos, 1997).

Today, the Internet is playing a significant role in creating awareness about issues of sustainable development. For example, the rapid and concentrated economic growth of the type occurring in urban centres in developing countries is often at the expense of the environment. In recognition of this, Unesco is currently commissioning research institutes around the world to focus attention on the key issues of managing megacities in developing countries. These issues are being electronically documented and it is expected that by 2000 the database of core issues would have reached a significant size to be offered to the president of Unesco. The Internet will be used to stimulate and organise an easy exchange between workers in the field, including scientists, planners, UN experts and consultants (Madon and Sahay, 1998).

This section has explored the interaction between Internet usage and certain key dimensions of development in low-income countries. Although the discussion of each dimension is somewhat cursory, the main message we wish to convey is that the attainment of development goals does not depend on the existence of Internet connections alone, but on the acquisition, usage and dissemination of relevant information and knowledge (Rogerson and Itoh, 1998; Mansell, 1998). Pursuing the theme of relevant knowledge for development, the recent World Development Report examines the role of indigenous knowledge and communication systems. The report begins with the realisation that economies are built not merely through the accumulation of physical capital, but on a foundation of learning and adaptation (World Bank, 1999). In the discussion section, we focus on the role of intermediary institutions in this learning and adaptation process focusing on the creation and dissemination of relevant knowledge and on the generation of appropriate skills for its use.

Discussion

The past decade has witnessed the eruption of neo-populist development perspectives which focus on the priorities of the locality and its social, political and ecological wellbeing. Despite the appeal of localism as an antidote to globalism, it is argued that localities must eventually come to terms with the nation state and market institutions within which they exist and which connect them to the broader global context (Amin, 1985; McMichael, 1996). As Amin (1985) argues, localism is a symptom of the crisis of development and not an answer to it. It indicates the powerlessness of societies who have not yet found a way of effectively bringing together renovation and historical continuity. For some writers, therefore, the terms global and local can more usefully be thought of in terms of networks that are neither global nor local, but are more or less connected through intermediary institutions (Latour, 1993). A concept we find

particularly relevant to the role of intermediary institutions is that of delinking (Amin, 1985). The notion draws from theories of dependency according to which development of low-income countries can only be achieved if they delink from the world capitalist system and refuse to subject their national development strategy to the imperatives of worldwide expansion. Amin forcefully articulates that delinking does not mean total renunciation of any relations with the exterior. Rather, it subjects external relations between countries to the logic of an internal development that is based on local priorities and context. Within this model of development, priority is given to the involvement of the whole country, the entire people, in the process of change, which is mediated through the activities of intermediary institutions.

The question of technology can be considered in the context of the delinking notion. Delinking does not imply rejection of all foreign technology, simply for being foreign, in the name of some culturalist nationalism. Rather, it implies awareness that technology is malleable and thus adaptable to the local context within which it is embedded (Castells, 1996; Ciborra, 1996). In the previous section, we discussed how intermediary institutions such as NGOs, international government organisations, indigenous research institutions, and national level organisations such as Grameen Bank have heavily influenced Internet usage. In this section, we outline areas where these intermediary institutions could play a greater role in adapting Internet technology in a way that will not only benefit the nation within the international power structure, but also assist vulnerable groups to access the technology to their advantage.

The first area is in creating knowledge. For developing countries, there are major trade-offs between creating knowledge locally and acquiring it from abroad. Just because a very large and rapidly increasing stock of knowledge can be tapped quickly through the Internet the issue at stake is the extent to which developing countries should focus primarily on the acquisition, dissemination and use of globally available knowledge or promote the generation of indigenous knowledge. Most of the Internet's key resources such as software, information libraries, e-mail and newsgroup services are in English. In countries where only a minority speak English there appears to be a real need to localise interfaces to promote a more equitable network usage (Keniston, 1997). For example, the language question is keenly felt at present in Latin America where indigenous information in Spanish is available on the Internet but foreign sources are likely to be in English. As Internet usage widens beyond the research and academic community, the problem may be serious because the vast majority of the world's population who do not and will not in the foreseeable future speak English will be excluded from the system.

Many writers argue that indigenous knowledge systems need to become a fundamental building block for the future transformation of societies not only in developing countries but also in advanced countries (Mundy and Compton, 1995; Mansell, 1998). Mundy and Compton argue that these systems which enable economically poor people to survive have involved blending secular with sacred, reductionism with holism, short-term options with long-term options in

material as well as non-material pursuits. The higher the physical, technological, economic, and social stress, the greater the probability that disadvantaged communities have been able to generate innovative and creative alternatives. However, these innovations have often remained isolated and unconnected and there is need for intermediary institutions to intervene in order to establish a network for indigenous knowledge in the vernacular language.

A second area for government action lies in disseminating knowledge. Government policy for the dissemination of externally and internally generated knowledge needs to be reviewed. Attention should be given to the openness of global knowledge flows, and to the standards and regulations for the telecommunications industry. Issues of market structure, private ownership and regulation in telecommunications need to be investigated with special emphasis on ensuring greater access for groups and individuals who have not had access to basic telecommunications services, despite long-standing government policies that espouse universal access. A few studies on Internet usage in developing countries have focused on issues related to the inadequacies of the telecommunications infrastructure and the need for major institutional changes in telecommunications infrastructure in developing countries in order to promote its use (Ahmad *et al.*, 1996; Barry, 1996; Chapelier, 1996). However, as telecommunications industries in developing countries open up to competition, there is increasing concern about the goal of universal access for those who cannot afford to pay for access or who live in remote areas where it is simply not profitable to provide a service. Some writers argue that liberalisation should take place only after basic communication needs of the majority of the population have been satisfied. However, recent experience calls into question this trade-off between universal access and liberalisation. The counter-argument is that demands for universal access and advanced telecommunications services are complementary and therefore attracting private capital is a necessary prerequisite for network development (Panos, 1997).

A third area for government action relates to human resource development for network users. Countries need some capabilities even to follow, assess and select from the global stock of knowledge. Network technicians, while in short supply in developing countries, are being trained in universities and at workshops (Mansell, 1998). But the toughest challenge is training users. The most important networking resource in the USA is the user community – the millions of students and office workers who are familiar with the components and capabilities of the computer. These people can easily make the technical and conceptual shift to the Internet. However, the advanced industrialised countries have had some 20 years since the introduction of the commercial PC to achieve this level of awareness. In terms of creating awareness amongst the general public in low-income countries, policy-makers need to decide what level of education deserves most investment in developing countries – primary schools or university. Since literacy drives the information revolution, this would suggest that significant resources need to go to early education in order to

ensure that access to this technology is not restricted to the privileged élite in developing countries (Song and Akhtar, 1995; Mohammadi and Youngs, 1998). Basic development projects initiated by intermediary institutions can serve as a channel for the transfer of information and communication skills to the poor (Annis, 1991). A typical development project today concentrates more on training, data handling, software, monitoring and management, and relatively less on hardware and equipment. While most of these projects are designed to deliver services, few are analysed as a means to transfer information or technology to the poor.

We can summarise our discussions diagrammatically in Figure 1 which conceptualises the link between the Internet and socio-economic development. The current and potential role of intermediary institutions is considered crucial in ensuring that the technology is applied in a manner that is consistent with internal development priorities. Finally, it is important to note that the term developing countries refers to a large category of diverse nations. The same strategy of Internet diffusion and usage therefore cannot be applied across the board, though groups of countries with the need for similar strategies could perhaps be identified. Greater country-to-country co-operation to take advantage of the broad range of lessons should be a primary goal.

Conclusion

The debate over the impact of the Internet on developing countries is not a discrete semantic debate conducted by academics, but has a direct impact on the lives of billions of people. Developing countries who are eager to explore the commercial application of the Internet cannot afford to ignore the social

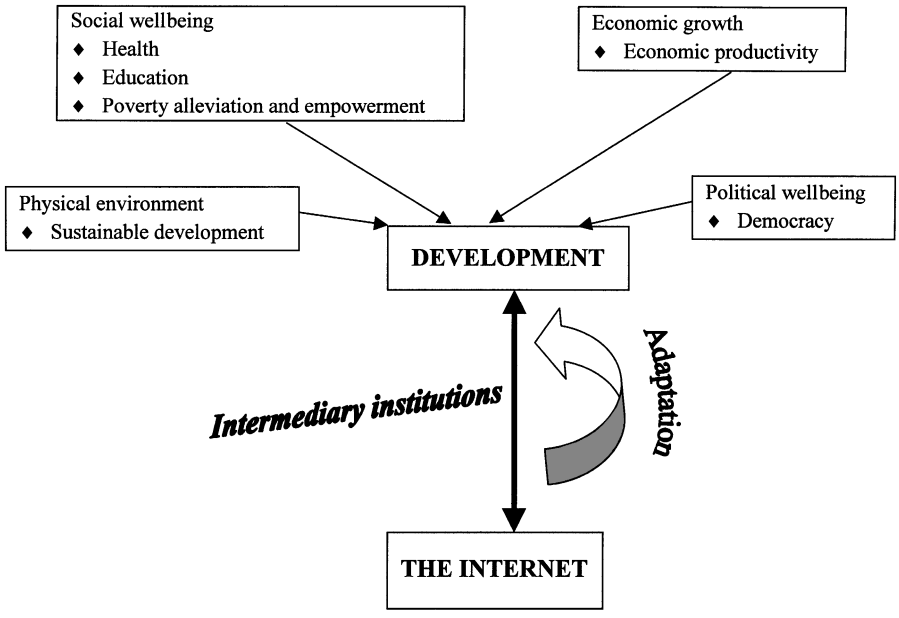

Figure 1.
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implications of the Internet. Hence, examining the social impact of the Internet should be a frontier in research for the next decade. This requires combining analysis of economic indicators with other dimensions to investigate how rapid diffusion and usage of the Internet affects the social fabric of developing countries in terms of alleviating poverty, improving access to health care and education, conserving and fairly distributing resources, and strengthening participation in decision-making processes. Ultimately, the success of the Internet should be measured less in terms of sheer numbers of connected individuals and more in terms of accessibility and contribution to social progress.

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