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Article (Accepted version) (Unrefereed)

Original citation:
Mansell, Robin (1999) Information and communication technologies for development: assessing the potential and the risks. *Telecommunications policy*, 23 (1). pp. 35-50
DOI: 10.1016/S0308-5961(98)00074-3

Information and Communication Technologies for Development: Assessing the Potential and the Risks

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Mansell, R. (1999) 'Information and Communication Technologies for Development: Assessing the potential and the risks', ***Telecommunications Policy***, 23(1): 35-50.

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Abstract

This article provides a review of the United Nations Commission on Science and Technology for Development (UNCSTD) Working Group on ICTs and Development Report (1997). The author highlights key issues of ICTs in a development context; and summarizes the Report's assessment of both potential and risks of ICTs for developing countries. A check-list derived from the Report provides guidelines for issues to consider in developing ICT policies and implementation strategies.

Introduction

In some parts of the world, information and communication technologies and services (ICTs) are contributing to revolutionary changes in business and everyday life. In other parts of the world, the lives of people have hardly been touched by these innovations. If people in developing countries are unable to acquire the capabilities for using the new ICT applications, they will be increasingly disadvantaged or excluded from participating in the global information society. The social and economic potential of these new technologies for development is enormous, but so too are the risks of exclusion.

The production of goods and services is paying less and less heed to national boundaries. New services, robotics, computer-aided design and new management techniques made possible by ICTs are contributing to changes in the competitiveness of firms and nations. The implications of these technologies for the social and entertainment sectors and for governance are equally great. Some observers suggest it is only a matter of time before market mechanisms ensure that all the world's citizens enjoy the benefits of a global information society.[1] They argue there is little need for special measures by governments and other stakeholders. Others suggest that the transformative nature of these technologies has been exaggerated.[2] The new ICT applications may destroy more jobs than they create; the gap between rich and poor may widen; and the huge capital investments required to

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1 Tapscott, D. (1995) *The Digital Economy: Promise and Peril in the Age of Networked Intelligence*. New York: McGraw-Hill.

2 Kubicek, H., Dutton, W., Williams, R. (Eds) (1997) *The Social Shaping of Information Superhighways: European and American Roads to the Information Society*. Frankfurt: Campus Verlag and New York: St. Martin's Press; Sussman, G. (1997) *Communication, Technology, and Politics in the Information Age*. London: Sage.

strengthen national capabilities for using ICTs could divert resources from other activities that could have greater development impact.

Proponents of the latter view urge decision makers in developing countries to exercise caution lest they embrace the new technologies too enthusiastically and risk becoming disillusioned when the applications do not resolve their development problems. Others call for the implementation of national or regional ICT strategies aimed at maximising the benefits and minimising the risks associated with the use of these technologies. In an effort to clarify the key issues and to assess the evidence in support of these different positions, a Working Group of the United Nations Commission on Science and Technology for Development (UNCSTD) investigated the implications of ICTs for social and economic development. [3] A major 'sourcebook' summarising the research literature and other available evidence on the potential and risks of ICTs for developing countries was published in 1998. [4]

The Commission concluded that, although the costs of building new information infrastructures are high, the costs of not doing so are likely to be much higher. There was sufficient evidence of the potential of ICTs to justify the promotion of strategies to enable capacity building in order to harness the new applications to development priorities. It was recognised that developing countries are starting from very different positions in developing distinctive ICT strategies in support of their development objectives. The Commission's Working Group recognised that generic 'best practice' models for successful ICT strategies cannot be developed because of the very great differences among countries. However, a set of guidelines was devised as a basic check list for issues that need to be addressed in developing effective ICT strategies aimed at promoting more effective applications and

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[3] A search of existing sources of information on policies and the application of ICTs to meet a wide range of development objectives was undertaken from 1995 to 1997. This was complemented by the commissioning of papers from the United Nations University-Institute for New Technologies (UNU-INTECH) and the Colombian Government Institute for Science and Technology (COLCIENCIAS). This material was supplemented by papers presented at two workshops hosted by UNU-INTECH. The Working Group's summary report and recommendations were submitted to the full Commission in May 1997, see United Nations Commission on Science and Technology for Development (1997) 'Report of the Working Group on Information and Communication Technologies for Development', Prepared for the 3rd Session, Geneva, 12 May, item no. E/CN.16/1997.4, Geneva, 7 March.

[4] Mansell, R. and Wehn, U. (Eds) (1998) *Knowledge Societies: Information Technology for Sustainable Development*. Oxford: Oxford University Press for the United Nations Commission on Science and Technology for Development. A summary of the book (Mansell, R. and Credé, A (1998) *Knowledge Societies … in a Nutshell: Information Technologies for Sustainable Development*, is available in English, French and Spanish published by International Development Research Centre (IDRC), Ottawa, Canada.

especially at finding uses that help to alleviate poverty in the poorest countries. These are listed in Appendix I.

This paper highlights key considerations that led to this assessment of both the potential and risks of ICTs for developing countries. It then looks to the future, pointing to some of the most fundamental issues that must be given a high priority in both the research and policy communities if ICTs are to contribute significantly in facilitating real development.

Technological innovations and opportunity

ICTs include a heterogeneous series of products and services. The ICT sector itself includes semiconductors, voice telephony technologies, and technologies supporting high-speed data and audio-visual systems as well as computers and packaged and customised software. There is no single technological pathway that must be followed by countries that are seeking to enhance and extend their national infrastructures or to connect them to global information networks. Given their different starting points, the technical configurations and the service applications that are selected by the public and private sector actors in developing countries are likely to vary considerably. Their choices are influenced by past investment levels, existing hardware and software production capabilities, experience with the customisation of the new products and services, and the capital available to promote new ICT applications.

Rapid innovations in ICT applications and the availability of high-speed networks are creating opportunities for generating and managing increasing amounts of information that can be tailored to users' needs and which can contribute to development goals. In order to benefit from these developments, however, a wide range of technological and related capabilities need to be strengthened.[5]

In virtually all cases, choices must be made about which technological components and services can be produced within the domestic market and which must be sourced externally. Decisions must also be taken about how the applications should be implemented so as to contribute to national development goals. The variety of products and services and the differences in the economic and social conditions in developing countries make it extremely

[5] Bell, M. and Pavitt, K. (1993) 'Technological Accumulation and Industrial Growth: Contrasts between developed and developing countries', *Industrial and Corporate Change*, 2(2): 157-210.

difficult to generalise about which technologies and human resource capabilities will be most responsive to each country's distinctive national goals.

ICT production opportunities

The producers include creators and owners of content, packagers and intermediaries who provide commercial services, network operators, and developers of various kinds of semiconductors, switching and transmission equipment, personal computers and televisions, fax machines, terminals, etc. They include firms in the telecommunication, broadcasting, publishing, computing and software industries as well as those in other sectors of the economy who develop software and content. For many developing countries, participation in production opportunities has been severely limited and dependent on the location decisions of transnational corporations. But, in some sectors, for some countries, new opportunities may be opening.

The production of semiconductors and hardware components is relatively costly. It requires substantial amounts of capital, significant expertise and technological resources, and it has long development lead times.[6] Although barriers to entry for the production of computer hardware components are diminishing somewhat, attention in some developing countries is now being focused on software development which, in contrast, emphasises human creativity and much lower entry costs. Capital requirements are generally lower, but production is dependent on specific combinations of technical and creative skills. Lower barriers to entry mean that many smaller companies can engage in applications development, but success is dependent on the availability of venture capital or other forms of start-up funding.[7]

In spite of falling costs and new entry opportunities associated with software development, most ICT development work continues to be initiated in a small number of countries and this influences the conditions of ICT deployment and use world-wide. In Asia, countries such as China, Indonesia, Malaysia, South Korea, Singapore and Taiwan, have become very successful in producing consumer electronics and computer technologies. India has found

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6 See Ernst, D. (1997) 'High-Tech Competition Puzzles: How Globalisation Affects Firm Behavior and Market Strucutre in the Electronics Industry', DRUID Seminar, Skagen, Denmark, 1-3 June.

7 See for example, Heeks, R. (1996) *India's Software Industry: State Policy, Liberalisation and Industrial Development*. New Delhi: Sage Publications; Ramesam, V. (1997) 'National Information Infrastructure (NII) Profile of India', Report prepared for the UNCSTD Working Group on ICT and Development for COLCIENCIAS, Colombia, New Delhi.

ways to exploit software development markets by adding value through assembly and testing and the country has captured a small but growing share of the world export market for software.[8] In the case of India, start-up funding from a United Nations agency provided the basis for an expansion into export markets based on cost advantages and, more recently, on quality. Nevertheless, the sustainability of these ventures may be challenged as new generations of components, including microchips and PC motherboards, require less labour-intensive techniques.

Production initiatives in developing countries raise issues about the best balance between hardware and software production and about the need to ensure that the critical mass of skills for sustaining effective ICT use is encouraged. There are questions about whether success in export markets can be translated into the wider diffusion and use of ICTs in domestic markets. Continuous assessments of existing technological capabilities, relative cost advantages, and the viability of target markets for varying combinations of production, maintenance and assembly, and applications development are essential.[9] These assessments can be managed more effectively when an ICT strategy is in place. (See check-list in Appendix I.)

ICT access and constraints

The enormous gap in the accessibility of the basic telephone infrastructure has been recognised for many years. In 1984, the 'Maitland Report' set a target for the beginning of the 21st Century for all the world's people to be brought within easy reach of a telephone,[10] observing that: 'in the industrialized world telecommunication is taken for granted as a key factor in economic, commercial and social activity and as a prime source of cultural enrichment. … The situation in the developing world is in stark contrast. … Neither in the name of common humanity nor on grounds of common interest is such a disparity acceptable'.[11] By the mid-1990s, despite the advent of new mobile satellite services and considerable investment in some countries, little had changed. The extension and upgrading

8 Ramesam, V. (1997), op. cit.

9 Hanna, N., Boyson, S., Gunaratne, S. (1996) 'The East Asian Miracle and Information Technology: Strategic Management of Technological Learning', World Bank Discussion Papers No. 326, Washington DC.

10 Independent Commission for World-wide Telecommunication Development (1984) 'The Missing Link: Report of the Independent Commission for World-wide Telecommunication Development', International Telecommunication Union, Geneva.

of the telecommunication infrastructure in the developing regions of the world continues to require heavy investment even when innovative models of community access are introduced.

The existence of an improved network infrastructure is only one step on the path toward improved connectivity for citizens, businesses and consumers. Terminal equipment and personal computers together with attractive network access and usage charges are also needed. The Internet is being promoted as a means of enabling many more people in developing countries to access global networks and new sources of information, but the strongest growth rates are in the richer countries.[12] Internet host computers are mainly located in the United States, Canada and Western Europe. The concentration of host activity in the industrialised countries has implications for the costs of accessing information and for the types of services that will become available. It accentuates the predominance of basic literacy and English language traditions; and services located in the industrialised countries generally include a disproportionately small number of publications from the developing countries. This has the effect of limiting the extent to which people in the poorer countries, including researchers and policy makers can learn about themselves, their own needs and each other's solutions to common problems.

ICT applications for development

The applications of ICT do not always require access to a network infrastructure as many can be implemented on a 'stand-alone' basis. However, other applications that are likely to support development priorities benefit from a well-functioning telecommunication infrastructure.[13] For example, public-sector applications including distance learning and professional development, road traffic management, disabled support services, air-traffic control, health-care, electronic tendering for contracts, and public administration applications require reliable networks.

Among the applications that are likely to contribute to increased public sector efficiency are 'one stop shopping' for government information, applications designed to limit

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11 Independent Commission for World-wide Telecommunication Development (1984), op. cit., Executive Summary.

12 International Telecommunication Union (1997) 'Challenges to the Network - Telecoms and the Internet', ITU, Geneva; OECD (1995) 'Information Infrastructure Convergence and Pricing: The Internet', OECD, Paris, 11 December.

13 Mansell, R. and Wehn, U. (Eds) (1998), op. cit., see Chapters 6 and 7.

environmental degradation, citizen and emergency support services, and services to support inter-community meetings. ICT applications are playing important roles in contributing to improved food security, weather forecasting, the understanding of disease pathology and in supporting humanitarian initiatives. For example, the Integrated Regional Information Network of the United Nations Department of Humanitarian Affairs allows information exchange with the humanitarian community in the Great Lakes region of Africa. The refugees in this area require humanitarian relief and rehabilitation which are supported by the use of ICT for better information management. The network relies on the use of the Internet, fax, satellite communication, high-frequency radio and telex.

Applications for businesses increasingly include automated information processing systems and systems for data entry and storage. Many domestic companies are adopting distributed computerised systems that support computer-aided design and manufacturing. Corporate networks (and Intranets) are providing the infrastructure for teleworking as well as for teamwork using computer-supported-cooperative-working software. The business sector in many developing countries is relying increasingly on ICTs for electronic commerce and distributed computerised systems for stock control, just-in-time manufacturing, computerised numerical controls, and robotics. These applications have the potential to enable more and more companies to participate more effectively in the local, national and global economy.

If the technical systems supporting the innovative applications illustrated here can be tailored to the specific and often different needs of people in developing countries, there is the potential to enable marginalised populations to participate more actively not only in the economic community but also in the social, political and cultural communities.

ICTs supporting scientific and technical knowledge sharing

ICT applications are essential components of scientific and technical R&D activities.[14] Scientific and technical research plays an important role in the production of ICTs and the use of ICTs is an increasingly crucial part of conducting scientific and technical research. The expansion of network infrastructures is enabling improved access to databases holding technical and scientific information. As research laboratories in the business and public

[14] Hicks, D. M. and Katz, J. S. (1996) 'Where is Science Going?', *Science, Technology and Human Values*, 21(4): 379-406.

sectors increase their connectivity, access to databases becomes essential to the production of ICTs and their uses in the manufacturing and service sectors. The computerisation of search techniques using intelligent agents can put the latest technical information in the hands of scientists, engineers and other experts. However, the capability to assess this information and to customise it to local circumstances is essential. Although, large resources of indigenous scientific and technical expertise may be shared more effectively by developing an extensive information infrastructure, the initial costs are high and this is especially so when such factors as the costs of translation and of gaining the expertise necessary to interpret and use scientific resources are taken into account.

Where they have been introduced, computerised support systems are aiding in the assessment, selection, application, adaptation and development of a broad range of technologies and services, including ICTs themselves. Network applications are supporting collaboration between research institutions in developing countries and in the industrialised countries.[15] The increasing importance of international R&D collaboration suggests that action will be needed to ensure that developing countries contribute to, and share in, such collaboration.

The role of ICTs in supporting and improving the national absorptive capacity for imported technology is also important. Applications in education and training are strengthening primary, secondary and university education systems although there are major issues with respect to the potentially negative implications of the use of foreign training materials. Capacity building requires a literate population and familiarity with the tools and techniques of technology assessment. Strategic planning and the selection of niche markets for the exploitation of scientific and technological expertise can benefit from the use of ICT-based 'expert systems' and scientific instrumentation.[16]

In summary, ICT applications in areas such as integrated resource management, co-ordinated medical centres, environmental research and land management, biodiversity monitoring, biochemical engineering and molecular medicine, solar water heating and other energy conservation applications, and laboratory-based testing and standardisation are providing

[15] Hawkins, R. (1996) 'The Global Research Village - Background Document', Prepared for a conference sponsored by the Danish Ministry of Research and Information Technology and OECD, Snekkersten, Denmark, 13-14 June.

increasing numbers of illustrations of the potential benefits of ICTs for developing countries. Other applications are contributing to the automation of production activities, i.e., weaving and knitting machines, sewing machines, numerically controlled machine tools, and continuous process control in chemical and petrochemical plants. Knowledge sharing between members of scientific and technical research communities is occurring via the Internet, but only where the necessary infrastructure, skills and financial resources are available.

Benefiting socially and economically from ICT innovations

Cultural, social and business norms and values change as people begin to use ICTs more extensively. The speed of communication and electronic transactions is leading to faster decision-making.[17] Global network connectivity magnifies the range of services and price information that are available, leading to greater complexity in decision-making. Decision support systems can facilitate decision-making and access to network services can bring distant or local communities into closer contact, as well as establish cross cultural electronic partnerships in business.

At the same time, new problems arise. The anonymity of communication tends to increase with the growing use of electronic communication services as messages pass through networks leaving no record of origin, destination or content and this has implications for the cultures of business practice.[18] As these systems diffuse more widely, computerised crime presents new problems for policy makers and measures are needed to protect individual privacy and the commercial interests of firms. Developing country participants may be more at risk to these problems than developed countries.

The application of ICTs can be used to reinforce, or to transform, the existing structure of industries, the geographical location of economic and social activity, or the organisation of firms and public-sector organisations.[19] New applications need not be passively adopted by

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16 Whiston, T. G. (1997) 'Information Technology in a Global Context: Developing Country Needs and Challenges - Towards a Theoretical Framework', SPRU University of Sussex, Mimeo, Brighton.

17 Anderson, C. (1997) 'Electronic Commerce', *The Economist*, 10 May.

18 Credé, A. (1997) 'Information Society Security: Trust, Confidence and Technology: ICTs, Information Production and Tacit Authentication', FAIR Working Paper No. 26, Brighton, February.

19 Dutton, W. H. (Ed) (1996) *Information and Communication Technologies: Visions and Realities*. Oxford: Oxford University Press.

citizens, consumers and businesses.[20] They can be shaped to complement social and economic needs and values when the necessary capabilities exist. This shaping process requires financial resources and considerable technical, organisational and local expertise. It is fundamentally important that developing countries obtain the capabilities necessary to evaluate the benefits and risks of alternative ICT applications for their local contexts and to introduce measures that will protect their priorities.

The successful implementation of ICTs generally requires substantial organisational change.[21] Training and retraining are needed as skills appropriate to traditional job functions become inappropriate. The nature of work and the working environment may be transformed by the introduction of ICT systems with accompanying reductions in the size of the workforce.[22] For developing countries, linkages between organisational change, the introduction of ICTs, and new approaches to education are crucial, but national priorities for education must be expected to differ depending on existing capabilities and the structure and organisation of education institutions.

The boundary between ICT users and producers is often blurred when new applications are introduced. Software users play major roles in sectors such as banking and petroleum and in most manufacturing sectors. This accentuates the need to build capabilities for engaging in the design, development and maintenance of these applications. Without the appropriate capabilities, people in developing countries will be unable to devise creative solutions for using ICTs to alleviate development problems. Applications must be customised for local needs.

The successful use of ICT applications requires improved awareness in the public and business sectors, better education and improved literacy rates, user involvement in designing and implementing new services and applications, policies for improved public access to networks, and a readiness on the part of governments and other stakeholders to assume

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20 Mansell, R. and Silverstone, R. (Eds) (1996) *Communication by Design: The Politics of Information and Communication Technologies*. Oxford: Oxford University Press.

21 Bessant, J. (1996) 'Learning to Use Advanced Manufacturing Technology', Paper prepared for UNU/INTECH, Centre for Research in Innovation Management, University of Brighton, October.

22 Department of Education (1996) 'Technology Enhanced Learning Investigation in South Africa - A Discussion Document', Report of the Ministerial Committee for Development Work on the Role of Technology that will Support and Enhance Learning, Pretoria, 31 July; Webster, J. (1996) *Shaping Women's Work: Gender, Employment and Information Technology*. London: Longman.

responsibility for selecting and giving priority to a wide range of policy and practical initiatives.

ICT initiatives and international co-operation

Many ICT products and services are only beginning to become available to some users in many of the developing countries. Although ICTs clearly can play a major role in alleviating poverty, enabling new learning experiences, and reducing the harmful effects of social exclusion, this is only likely to occur if national or regional strategies are effective in mobilising resources. Many governments are initiating strategies to stimulate production capabilities and export performance, but strategies aimed at the use of ICTs by citizens and the majority of small business users and consumers are much less well co-ordinated and resourced.[23]

ICT applications do not offer a panacea for social and economic development problems. There are considerable risks of unemployment and social and economic dislocation. Nevertheless, the risks of failing to participate in the so-called ICT 'revolution' are enormous. A failure to invest in some of the new applications and network services will exacerbate the huge existing gap between rich and poor countries and between the richer and poorer regions within the poorest countries. The greatest challenge is to use ICTs to encourage the accumulation of experience by the excluded and most deprived groups whose needs are not likely to be met by market forces.

In the industrialised countries and some of the newly industrializing countries, major efforts are being made to combine the use of advanced information infrastructures with informal knowledge to enable businesses to sustain economic growth and to improve the overall quality of life of citizens. Representatives of both the public and business sectors in these countries are shaping the design and use network infrastructure and services. Stakeholders are actively involved in negotiating the new international 'rules of the game' or governance systems in many areas in ways that are responsive mainly to their shorter-term interests. These include the terms of trade in goods and services (business and cultural products), competition and regulatory policy and the conditions of market access, information security, standards, the protection of intellectual property, and employment conditions. At the same

[23] Mansell, R. and Wehn, U. (Eds) (1998), op. cit.

time, the representatives of developing countries are seeking to introduce national initiatives to improve the transfer of expertise from the industrialised countries and to strengthen their national capabilities in the ICT sector so as to contribute to their particular development goals.

National and regional ICT strategies have been put place by some countries while others are formulating new strategies. The African Information Society Initiative (AISI) of the United Nations Economic Commission for Africa has developed an action framework which calls for 'the elaboration and implementation of national information and communication infrastructure plans involving development of institutional frameworks, human, information and technological resources in all African countries and the pursuit of priority strategies, programmes and projects'.[24] These and other initiatives emphasise the importance of strong public and business sector partnerships that provide a basis for sharing the challenges and costs of developing the domestic information infrastructure to support development goals. The transfer of ICTs to developing countries and the effective development and use of localised applications will continue to require innovative strategies to harness existing strengths and to combine them in new ways with investment in technological and human capabilities.[25]

Experience indicates that new ICT strategies must establish a framework for policies and regulations which strike a balance between commercial applications and those applications where market forces are unlikely to work effectively. National or regional ICT strategies also must be implemented in the light of developments in the global economy. In the course of its work, some of the members of the UNCSTD Working Group devised scenarios which helped to illustrate the interactions between global and domestic issues facing developing countries.[26] In some of these scenarios, the global environment was regarded as being enabling and inclusive, leading to open communication technology standards and universal

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[24] UN Economic Commission for Africa (UNECA) (1996) 'Exploiting Information Technology to Accelerate Socio-Economic Development in Africa: An Action Plan', 31st session of the Commission/22nd meeting of the Conference of Ministers, Addis Ababa, Ethiopia, 6-8 May; UNECA (1996) 'The African Information Society Initiative (AISI)', Addis Ababa.

[25] Gu, S. and Steinmueller, W. E. (1998 forthcoming) 'China's national innovation system approach to participating in information technology: The innovative recombination of technological capability', in C. Cooper (Ed) *Information Technology Policy and National Economic Development*. London and Tokyo: Routledge and UNU Press.

[26] Howkins, J. and Valantin, R. (1997) *Development and the Information Age: Four Global Scenarios for the Future of Information and Communication Technology*. Ottawa: International Development Research Centre.

access to communication networks. In other scenarios, the vision was of a global marketplace dominated by a few powerful companies resulting in increased concentration of technology, capital, wealth and power within the industrialised countries.

In both instances, however, there were two options for national governments and regional coalitions of actors. In one case, they were expected to adopt a passive stance, failing to introduce policy initiatives that would promote the use of ICTs to support development goals. In another, they were assumed to stimulate the accumulation of new technological and organisational capabilities and to have some successes in harnessing ICT applications to development goals. The most likely scenario was one in which ICT producers in the industrialised countries and a few developing countries succeeded in expanding and deepening their markets. At the same time, national governments, regional groupings and various local actors were expected to seek opportunities to create ICT-related businesses especially in the service sector and to encourage some public-sector applications. In this scenario, many developing countries would continue to be largely excluded from the global ICT system and many of the new products and services would be unresponsive to their development needs. Despite the instability of this scenario, it was suggested that there are opportunities for governments to minimise the risks and maximise the benefits of new ICT applications by implementing strategies that encourage compensatory or corrective policies in key areas, especially for the most disadvantaged communities.

Towards ICT strategies and international co-operation

Coherent national (or regional) ICT strategies can provide much needed support for introducing new regulatory frameworks, promoting the selective production and use of ICTs, and harnessing their diffusion especially for marginalised people. The resulting benefits in terms of contributions to education and the improved management of organisational change can assist in contributing to development goals. Such strategies can also be helpful in securing new means of financing ICT investment, strengthening indigenous scientific and technological research capabilities, and helping to improve the capacity to formulate and assess the impact of the new international governance regimes for ICT services and technologies. The most effective strategies are likely to encompass initiatives at the local community, municipal, sub-national, and regional levels and to actively encourage a ‘development dialogue’ within and between developing countries

The UNCSTD Working Group on ICTs and Development outlined the set of guidelines listed in Appendix I which illustrate some of the measures that need to be in place to harness ICTs to sustainable development goals. The guidelines cover major issue areas which confront most countries as they seek new ways to ensure that the risks of introducing ICT applications are outweighed by the benefits. The success with which these and other issues are addressed depends upon the way they are implemented, upon the conditions that prevail in each country, and on the interactions of local stakeholders with others in the global political and economic environment.

Conclusion

The UNCSTD suggested that developing countries would be in a stronger position to maximise the potential benefits of the new applications if they establish national or regional ICT strategies. They pointed out that such strategies must be underpinned by a commitment to action if they are to be effective. This paper has highlighted key factors contributing to the Commission's assessment of the potential of ICTs for development. Many of these issues are being addressed by policy makers and other stakeholders in developing countries, but some profound problems remain for the implementation of effective ICT strategies. Far too often very real damage to human welfare continues to occur when ICTs are introduced. This is often attributable to the fact that these technologies are promoted as a panacea for social and economic disadvantage. Even more often, it is attributable to haphazard implementation which does not take into account realistic factors of local conditions and use.

ICT strategies are often developed and publicised mainly to attract external investment to construct new infrastructure or to deliver hardware and software without giving sufficient attention to local concerns and requirements. Applications developed and designed for markets in the industrialised countries are transferred to the developing world with little concern about the need for technical modification or the importance of content, skills and training. Such strategies are often tailored to strengthening domestic ICT production aimed at export markets rather than at building up the capabilities of the majority of citizens, businesses and industrial sectors for using ICTs. Such strategies represent a 'Trojan Horse' of technologically driven social and economic transformation which heighten the risks that

people will be disadvantaged. They take too little account of the plight of the marginalised people and they fail to build upon existing strengths in the local environment.

The political and economic priorities of key decision makers often dictate these outcomes. There are substantial pressures to introduce ICT applications that are responsive to the most organised and vocal stakeholders within developing countries such as the representatives of multinational firms and the requirements of the larger firms located in urban areas. Action stemming from strategies oriented primarily to responding to the needs of these users is likely to exacerbate the existing ways in which substantial segments of the population are marginalised.

There is an urgent need to develop ICT strategies and actions which bring marginalised social and economic groups into reach. This requires greater clarity with respect to which users are targeted as a priority. It is not sufficient simply to ensure that strategies are oriented towards the 'user' of information and communication technology networks and services. The user's context (social, cultural, economic and political) is crucial to whether he or she has the capacity to shape the 'virtual' environment. Those people who do not have opportunities to acquire the skills necessary to conduct their lives in this kind of environment will be disadvantaged or excluded as ICTs become more pervasive regardless of how much investment occurs in the network infrastructure, computers and software. Strategies must take into account the fact that the 'user' may be someone in a village, an employee controlling a robotic system on an assembly line, or an official in government. Different users will have various skills and capabilities, cultural understandings of the roles for ICT applications, economic resources and political power. Strategies must take these differences into account.

Ideally, ICT strategies should be designed to permit 'users' to shape the design of ICT systems; in practice, especially in developing countries, this is rarely a realistic option. If policy makers can be persuaded to give much greater priority to investing in opportunities for building the required capabilities for reconfiguring and maintaining hardware and software and for local content production, even as they invest in hardware and in advanced network infrastructures, there is a greater chance that 'users' will be able to accommodate the new technologies into their lives in productive ways. This requires substantially greater attention

to education and training, knowledge transfer and sharing, policy co-ordination, and enabling local groups to determine the nature of their own communicative environments.

To accomplish this, major efforts are needed to devise innovative ways of tailoring ICT systems to the various needs of a broad cross-section of the population in developing countries. This requires attention to the assessment and selection of innovative ICT applications. It also entails increasing the priority given to social applications and those oriented toward strengthening the provision of public services and environmental protection. These application areas can make early and substantial contributions to the improvement of the social conditions of marginalised people and they can provide an improved infrastructure for stimulating economic activity. Financing of such initiatives is likely to be more difficult to justify than it is for ICT production oriented activities or for ICT applications that respond to the business needs of urban users. This is because the benefits are more difficult to demonstrate in the short term. Nonetheless, the potential benefits are substantial as the review carried out by the UNCSTD Working Group has shown.

Research can play a vital role in critically assessing the factors that support innovative applications of ICTs that are responsive to the local needs of citizens and smaller businesses as well as to the skill requirements of industrial users of advanced ICTs systems. Comparative research continues to be needed on innovative financing arrangements and on measures that can be taken within the framework of ICT strategies that are sensitive to the needs of those who are excluded. Such research needs to be undertaken systematically and continuously so that a broader base of experience can be accumulated and exchanged among those who are in a position to develop innovative applications oriented toward social, as well as economic, development goals. If the outcomes of investment in the 'juggernaut' called ICTs for businesses and citizens in developing countries are to bring positive benefits for those who live in poverty it is essential that ICT strategies give much higher priority to social issues, to training, and to financing initiatives for those who are otherwise likely to be excluded.[27]

[27] In Freeman, C. and Soete, L. (1994) *Work for All or Mass Unemployment? Computerised Technical Change Into the Twenty-First Century*. London: Pinter, the authors use this analogy in their title to chapter 3, 'the biggest technological juggernaut that ever rolled': information and communication technology (ICT) and its employment effects', p.39. The analogy as they point out was used by G. Gilder (1993) 'The death of telephony' in 'The Future Surveyed', *Economist*, 11 September, p. 93.

Appendix I

United Nations Commission on Science and Technology for Development (UNCSTD) Working Group on ICTs and Development (1997)

Summary of Guidelines

(for consideration and action by government and non-government actors) [28]

The principal questions for developing countries are: what economic, political and social resources can be used, even by the poorest countries, to develop distinctive information infrastructures that maximise the social and economic benefits of ICT applications? How can resources be extended through new partnerships between the public and business sectors? And, what are the most effective roles for national governments and regional coalitions?

I. *Producing and using ICTs to social and economic advantage.* It is important to ensure that:

- ICTs are used to satisfy the basic needs of all the population and that their production and use contributes to economic and social objectives;
- technology assessment procedures and methodologies are introduced to help identify and select key ICT production sectors and to promote key user initiatives. Feasibility, cost-effectiveness and the expected contribution to development priorities should be included as explicit selection criteria and evaluation methods should be strengthened;
- particular attention is given to promoting innovations in ICTs, especially in hardware, which can be implemented in ICT systems that are used in areas without, or with unreliable sources of, electricity and under difficult climatic or geographical conditions;
- measures to promote and strengthen the social and cultural diversity of content accessed via networks and to stimulate the production of indigenous content in selected areas are included;
- measures are taken to provide access to public information of relevance to citizens and community groups including those promoting public awareness of ICT applications, the potential of databases, and demonstration projects;

- ICT applications are used to encourage interactive relationships between governments, local authorities and citizens, and within citizen groups.

II. *Encouraging Learning Opportunities.* It is important to ensure that:

- the use of ICTs is encouraged at all levels of the formal education sector and that special attention is given to literacy, training, language skills and primary education;
- education and training programmes include scientific and technical skills, policy analysis skills and innovation management skills relevant to the effective production and use of ICTs, and incorporate specific plans for curriculum revision to introduce professional knowledge that is relevant to the production and the use of ICTs in support of development goals;
- curriculum revisions include training in methods of technology assessment, in creative approaches to ICT development, and in maintenance and adaptation to local conditions, as well as in evaluating the viability and sustainability of export-oriented strategies and complementary measures;
- curriculum revisions take into account the need for gender-specific training and education regarding the design and application of ICTs;
- measures are introduced to address job creation and working conditions that will contribute to sustainable livelihoods and the promotion of new skills acquisition through new forms of ICT-based interactive learning;
- the job creation (and destruction) potential of ICTs is explicitly addressed through employment measures linked closely with education and training policies.

III. *Managing ICTs for development.* It is important to ensure that:

- measures are taken to improve the 'management of change' in all organisational settings;
- mechanisms are introduced to compare the management processes adopted in different countries and to assess their strengths and weaknesses;
- the process of customising ICTs for more effective use, especially by the least developed countries, marginalised groups in rural areas, and women, is given special attention;

[28] See United Nations Commission on Science and Technology for Development (1997), op. cit.

- measures that encourage continuous organisational learning are included.

IV. *Accessing ICT networks*. It is important to ensure that:

- clear plans are devised for regulatory frameworks for telecommunication, broadcasting and cable television and that minimum standards are in place to achieve network interoperability within and between countries;
- regulatory measures address bottlenecks impeding effective competition which may be the result of unfavourable market structures;
- regulatory measures take account of national social and cultural priorities as well as economic efficiency considerations in licensing domestic and foreign operators;
- universal service measures and related policies are developed, and that suppliers take account of a wide range of user needs;
- special attention is given to street-side 'kiosks' in rural and some urban areas to provide access to networks and services that are responsive to people's needs;
- measures to explore innovative financing arrangements involving public and business partnerships are introduced.

V. *Promoting and financing investment in ICTs.* It is important to ensure that:

- plans are introduced that encourage coalitions of resources to initiate ICT production in key areas and to provide a basis for both experimental and commercial ICT applications, including measures that combine financial and human resources as well as technical contributions 'in kind' to provide seed capital for innovative projects;
- priority is given to measures to attract foreign investors to ensure the development of network infrastructure and ICT applications involving software including new forms of revenue generation to strengthen national capabilities in manufacturing and in the adaptation and customisation of ICTs;
- the implementation of innovative pricing schemes is encouraged, leading to stimulation of demand for commercial services and exploration of means whereby the most marginalised groups in society can access and use ICT applications;

VI. Creating and accessing scientific and technical knowledge. It is important to ensure that:

- science, technology and innovation policies are formulated in the light of the new opportunities generated by ICTs;
- measures encourage and facilitate the establishment of R&D networks linking ICT production and use to priority development issues;
- collaboration among science and technology research groups involved in the development and application of ICTs in developed and developing countries is encouraged;
- plans are implemented for the dissemination of information on R&D networks, including promotion of the use of ICTs to support these networks;
- special attention is given to ensuring close interaction with end-users and particularly with marginalised and special interest groups in rural areas;
- explicit measures are taken to encourage 'knowledge broker' organisations that facilitate the generation and application of scientific and technical knowledge by combining locally relevant expert advice with information acquired through using ICT applications.

VII. Monitoring and influencing the 'rules of the game'. It is important to ensure that:

- mechanisms are put in place to strengthen participation in multilateral and regional forums involving the public and business sectors;
- measures are taken to support monitoring and analysis of developments in these forums that affect the potential for the production of ICTs in the national context;
- special attention is given to monitoring and analysing the impact of developments in international or regional forums that affect the transfer, customisation and use of ICTs in domestic markets;
- the emerging governance regimes are assessed for new competitive and co-operation opportunities where initiatives can be taken to benefit from them.

The Commission's Working Group also noted that the agencies and organs of the United Nations system should play an important role in demonstrating the effective use of ICT applications and in supporting new initiatives in developing countries.