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COALITION OF RESOURCES
FOR INFORMATION AND COMMUNICATION TECHNOLOGIES

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EXECUTIVE SUMMARY

The United Nations Commission on Science and Technology for Development (CSTD), through Economic and Social Council resolution 1999/61, requested the secretariat of the United Nations Conference on Trade and Development (UNCTAD) to finalize and publish the findings and conclusions of several reports on the coalition of resources for the application of information and communications technologies (ICTs) in transmission infrastructure, education and health. The reports were prepared as part of the CSTD inter-sessional activities for the period 1995-1997 and were presented at the CSTD workshop held at the headquarters of the Economic Commission for Africa (ECA) in Addis Ababa on 17 and 18 November 1997.

This report was commissioned to further explore the issues raised during the workshop, in particular the concept of the coalition of resources in the current global environment. The objectives of this report are to synthesize the main working papers presented at the workshop and cover more recent developments relevant to ICTs in developing countries and for coalitions of resources.

The first part of the report focuses on the evolution of the concept of coalition of resources for science and technology, particularly ICTs. The second part provides a summary, analysis and a more detailed review of the working papers. The third part discusses market and technology developments since the workshop and provides conclusions in which recommendations and guidelines are spelt out. Selected cases discussed during the workshop are updated in the Appendix.

I. INTRODUCTION

Coalition of resources

The concept of a "coalition of resources," through which donor support to developing countries can be better coordinated, has received wide attention in recent years. These resources include finance and expertise, as well as support and logistical services, and involve a number of different stakeholders, including the public and private sectors and civil society.

Within the United Nations, the concept "coalitions of resources" seems to have originated, relatively recently, with the 1979 Vienna Programme of Action on Science and Technology for Development. Ten years later, in a resolution (A/RES/44/14) that seemed to imply the need for further action, the United Nations General Assembly requested "the Secretary-General to explore the possibility of organizing a more effective coalition of resources within the United Nations development system, multilateral financial institutions, regional development banks and bilateral funding agencies to strengthen the endogenous capacity-building of developing countries in science and technology". Two years later, the General Assembly requested in resolution, (A/RES/46/165) the Intergovernmental Committee on Science and Technology for Development (IGCSTD, the CSTD's predecessor) to submit concrete proposals for organizing a more effective coalition of resources to meet the scientific and technological needs of developing countries.

The resolution's objective was apparently to obtain means by which resources can help achieve together more than they could achieve separately. A similar "multiplier effect" is found in negotiations theory[1]: negotiating parties are advised to pursue "integrative bargaining," seeking solutions that would increase the benefit for both parties, rather than "distributive bargaining," where, in a zero-sum game, one party benefits at the expense of the other. In the former case, negotiations tend to be collaborative, whereas in the latter they tend to be confrontational. Proponents of integrative bargaining typically separate the people from the problem, focus on interests, invent options for mutual gain, and use objective criteria to decide. The difference between integrative bargaining and distributive bargaining is further described in table 1.

This has corresponded to a fundamental "paradigm shift" in development issues. In the early 1990s, Governments and organizations began to examine development strategies and programme in terms of sustainability (economic, social and environmental) so that immediate gains would not come at the expense of future generations. At the United Nations Conference on the Environment and Development (UNCED) at Rio de Janeiro in 1992, a Programme of Action entitled Agenda 21, designed to provide guidelines and goals for local, national, regional and global economic, social and environmental policies and programmes, was endorsed. The United Nations subsequently created the Commission on Sustainable Development to coordinate and monitor activities designed to achieve the goals set forth in Agenda 21. In the same spirit, the United Nations established the CSTD to give high-quality advice on science and technology to the General Assembly and the Economic and Social Council (ECOSOC) as well as to serve as a forum for the discussion of these issues.

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[1] Raiffa, Howard (1985) *The Art and Science of Negotiations*, Cambridge, Massachusetts, Belknap Press

Table 1: Difference between distributive and integrative bargaining

Dimension	Distributive bargaining	Integrative bargaining
Pay-off structure	Fixed, zero-sum	Variable-sum
Primary motivation	Win-lose	Win-win
Stance	Confrontational	Collaborative
Interests	Diametrically opposed	Convergent or congruent
Relationships	Short-term	Long-term

Source: Raiffa, Howard (1985) *The Art and Science of Negotiations*, Cambridge, Massachusetts, Belknap Press.

In December 1994 a consultative meeting was convened to discuss the concept of a coalition of resources for science and technology for development. This meeting was requested by both ECOSOC (in its resolution 1993/73) and the General Assembly (in its resolution 48/179). It explored ways and means of organizing such a coalition. It emphasized the need to ensure that a coalition of resources takes into account user/recipient needs and demands and donor mandates, and stressed that instead of a single global coalition of resources, such as the one envisaged in the Vienna Programme of Action on Science and Technology for Development, it would be more effective to develop mechanisms that focused on specific and well-defined themes.

More specifically, participants also noted that funding activities related to science and technology largely depend on spontaneous demand-driven responses, and that most of the existing donor coordination schemes in the areas of science and technology have been organized on supply-driven and ad hoc basis. A better understanding of the role of a coalition of resources as a funding mechanism and its application in the context of developing countries was found to be essential. The CSTD was therefore requested to provide a forum for the exchange of views and interaction among partners on the mechanisms and strategies needed to bring about a coalition of resources for the development of science and technology in developing countries.

This recommendation was later endorsed by ECOSOC in resolution 1997/62. This resolution recommended that the CSTD convene a workshop on a coalition of resources, particularly in relation to information and communications technologies (ICTs) and their applications. This was in line with ECOSOC's decision, in its resolution 1995/4, that the CSTD should focus on ICTs and their implications for development as the main substantive theme of its work during the inter-sessional period 1995-1997. The Addis Ababa workshop was therefore convened as a result of ECOSOC resolution 1997/62.

Partnerships vs. coalitions of resources

While the mandate of the workshop focused on "coalition of resources", many development agencies cite "partnership" as a framework for development initiatives. Interestingly, partnership precedes the development and mobilization of resources in the International Telecommunication Union's Strategic Plan for 1995-1999, although both are

part of the mission of its Development Sector.[2] The World Bank's Comprehensive Development Framework (CDF) emphasizes partnerships among Governments, donors, civil society, the private sector and other development actors. The CDF's main objective is to allow developing countries to take the lead for and acquire a sense of ownership of their development projects. The CDF emerged from a worldwide discussion initiated by World Bank on "Partnerships for Development". The World Bank has also provided seed funding for Business Partners for Development (BPD), a project-based initiative that supports and promotes strategic examples of "tri-sector partnerships" involving business, civil society and government working together.[3] Indeed, the CSTD's own agenda for the inter-sessional period 1997-1999 would focus on partnerships and national capacity-building in science and technology. In 1999, the UN Secretary-General challenged transnational corporations to join a "global compact" to ensure that the benefits of globalization extend to both developed and developing countries. Members of the compact are encouraged to enter into partnerships with UN agencies at both the policy and the operational level. Thus, the concept of a coalition now includes "partnerships" and members of a "compact" who are encouraged to form partnerships for development.

This distinction between "coalitions of resources" and "partnerships" is not merely semantic. Formulating a project in terms of resources focuses the discussion on the contributions that each and every stakeholder is expected to make. When resources are limited (or when the environment is competitive), such an outlook may cause distributive arguments between the various stakeholders. Formulating the project from the perspective of a partnership may, on the other hand, focus the discussion on the relationships between the various stakeholders and foster conditions more favourable to integrative negotiations between them. This may improve the outcome and lead, in turn, to a more efficient coalition of resources.

Promoting ICTs in developing countries

The ECOSOC decision to focus the CSTD's activity on ICTs and their applications for development should be reviewed in the light of the work of many other UN or other multilateral agencies which have also focused on IT. It is therefore instructive to briefly look at what some other agencies have done to promote ICTs in developing countries.

The International Telecommunication Union (ITU) is the UN specialized agency charged with telecommunications development, reform and standards. While originally a grouping of monopolistic telephone companies, it has now evolved into an organization within which 186 Governments and more than 600 private sector companies coordinate global telecommunications networks and services. One of ITU's main purposes is to promote the extension of information technology (IT) benefits to the world's inhabitants. It adopted the Valletta Action Plan in 1998 to address key elements in bridging the digital divide, such as sector reform, access to new technologies, gender issues, rural development and universal service/access, finance and economics, partnerships with the private sector and human resource development.[4]

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[2] International Telecommunications Union (ITU) website: (http://www.itu.org).
[3] World Bank website: (http://www.worldbank.org).
[4] International Telecommunications Union (ITU) website: (http://www.itu.org).

In implementing its mandates, ITU has fully embraced the Internet and is actively promoting it throughout the world. It undertakes country studies on the diffusion of the Internet and now considers the number of Internet protocol (IP) hosts (i.e. computers with a fixed address on the internet) to be an indicator as important as teledensity (the number of fixed telephone lines per capita). It has also established pilot projects in health-care delivery, transportation, tourism, agriculture, trade and education to demonstrate the application of new technologies. It cooperates in the management and implementation of these projects with private and public sector partners that have the necessary funds, skills and/or facilities. Thus, the ITU plays a catalytic role in bringing together many coalitions of resources.

It has started a special initiative—EC-DC— to bridge the digital divide and enable developing and least developed countries to be active participants in the networked economy. It is mobilizing support from public and private sector organizations to provide the beneficiaries with concrete deliverables in four areas:

- E-business infrastructure development;
- Human resource development to enable the transfer of e-business technologies;
- E-business policies and strategies;
- Partnerships with industry (for all of the above).

The initiative has now expanded to more than 110 countries, with the participation of a total of 225 organizations, including telecom operators, ministries, chambers of commerce, internet service providers, trade associations and federations, non-governmental organizations (NGOs) and financial institutions. In June 1999 EC-DC was given an innovative project award by the Global Bangemann Projects Challenge in Stockholm, Sweden.

The United Nations Development Programme (UNDP) has been actively promoting the use of ICTs in support of sustainable development. Its Sustainable Development Networking Programme (SDNP) has been particularly successful. Its main purpose is to assist developing countries in building the capacity to access and to contribute to solutions for sustainable development using the medium ICTs.[5]

Each country's SDNP proceeds in a multi-stage fashion. A pre-feasibility study is carried out to identify the most appropriate local partner, which will become the project's operator. This partner is then provided with seed funding, typically $150,000-$200,000 over a period of two to three years, during which time the partner is expected to get the basic operation running while at the same time sensitizing a wide audience of decision makers. Local operators are expected to build their own user communities and to have shifted from external to domestic financing before their seed funding runs out. By the end of the trial period the country should have acquired a national entity operating a commercially viable networking solution (hardware, software and connectivity), staffed by nationals with the requisite managerial and technical skills, and providing services to a wide range of actors in civil society.

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[5] United Nations Development Programme (UNDP) Sustainable Development Networking Programme (SDNP) website: (http://www.undp.sdnp.org).

This programme is noteworthy because it was one of the first for which voluntary contributions (hardware and software) were sought from the private sector and acknowledged by the United Nations. But, more importantly, it is noteworthy because of its repeated successes. Launched in 1992 as one outgrowth of UNCED, the SDNP started off with pilot projects in 12 countries. At the present time, the number has increased to 40 programmes in various developing countries. The following are among the successfully implemented country projects:

Take of year	Country	Programmes
1994	Angola	Capacity building: SDNP helped to develop Angola's first private Internet service provider (ISP). Other projects included the establishment of cyber-centres and e-mail for all.
1997	Bulgaria	Promoting networking and access to information among Bulgarian NGOs.
1996	Cameroon	Provision of services aimed at bridging the gaps in local infrastructure, such as training and development of e-mail facilities.
1997	Guyana	SDNP assisted in promoting public access to information and offered free Internet service to any government agencies on request.
1996	Mozambique	SDNP projects in Mozambique were focused on provision of connectivity, training and building the content of sustainable development information. As part of this initiative, Telecentres were provided for young people. Also, the VSAT (Very Small Aperture Terminals), established by SDNP, are used for transmission of data, video or voice through the satellite.

The World Bank's InfoDev shares several features with the SDNP. It is a global grant programme launched in 1995 to promote innovative projects in the use of ICTs for economic and social development. It brings together resources provided by corporations and bilateral donor agencies. Project proposals are required to show that the project would be sustainable beyond the grant period. InfoDev-funded activities fall into four categories: consensus building, information infrastructure strategies, telecommunications reform and demonstration projects. So far, over 100 projects have been funded, including 13 devoted to education and 9 devoted to health. [6]

The World Bank's World Links for Development relies on information technology to provide vital equipment, connectivity, training and access to information to countries where educational resources are minimal. Since 1997, World Links has been connecting students and teachers in secondary schools in developing countries with their counterparts in developed countries for collaborative research, teaching and learning programmes, using information and communication technologies. World Links is now operational in 18 developing countries, and involves approximately 100,000 students. These students are collaborating with teachers and students in over 25 industrialized countries on a range of topics, including environment, HIV/AIDS, gender equity, cultural heritage, biology and

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[6] InfoDevProgram website: (http://www.infodev.org).

literature. Over the next five years, the programme aims to expand its network to at least 3 million students in more than 40 developing countries.

In his Millennium Report in September 2000, the United Nations Secretary-General emphasized the importance for developing countries of keeping pace with information technology and proposed the creation of a global volunteer programme aimed at bridging the digital divide between developed and developing countries. The intention of the initiative— the United Nations Information Technology Service, or UNITeS—is to create a worldwide programme for information technology volunteers. The objective of this programme is to assist developing countries in strengthening capacities for applying information and communication technologies to human development, especially in areas such as health, education, environment and small and micro-enterprises. The programme is coordinated by the United Nations Volunteer (UNV) programme. It will function through an international coalition of institutions from both developed and developing countries, including Governments, civil society, the private sector, development agencies and academia.

The Economic and Social Council, in its resolution E/2000/L.27, decided to establish an ICT Task Force and a Trust Fund in order to provide overall leadership within the United Nations to formulate strategies for the development of information and communication technologies and putting those technologies at the service of development. To achieve this objective, the Economic and Social Council envisaged the forging of a strategic partnerships, i.e. a coalition of resources between the United Nations system, the private sector, financing trusts and foundations, donors, programme countries and other relevant stakeholders. A High-level Advisory Group on ICT was launched to help advance the process of consultations.

Other new initiatives, outside the United Nations, have also been launched to support the development of information and communications infrastructure in poorer countries. Chief among these is that of the Dot Force launched at the G8 Summit in Okinawa, Japan, in late July 2000. The Dot Force is made up of representatives of G8 and developing nation Governments, together with the representatives from the UN system, the private sector and NGOs. This Dot Force will submit concrete proposals on how to bridge the digital divide between rich and poor countries at the next G8 Summit meeting, scheduled to take place in Genoa, Italy, in July 2001.

These activities and programmes of the ITU, UNDP, the World Bank, the UNV and other United Nations agencies aimed at providing assistance to developing countries involve coalitions of resources and are carried out through different mechanisms, and following different guidelines. Yet all would stand to benefit from guidelines that would improve their collective efforts or coalitions of resources.

The Addis Ababa workshop

The workshop, held at the headquarters of the Economic Commission for Africa in Addis Ababa (17–18 November 1997) was attended by members of ECOSOC, representatives of UN agencies, financial institutions, donor organizations, and key decision makers from the private and public sector. The discussions at the workshop were based on four working papers and presentations by CSTD members and experts in ICTs, policy formulation, project management and financing.

The workshop's focus on ICTs provided an opportunity to build on earlier work of the CSTD that had highlighted the difficulties faced by developing countries in accessing ICTs and financing projects that contribute to the building of a national information infrastructure.

The objectives of the workshop were set out in an invitation letter from Professor George Waardenburg, then Chairman of the CSTD. The objectives of CSTD can be summarized as follows:

1. To engage in dialogue with invited experts on a coalition of resources;
2. To identify existing schemes for a coalition of resources in the area of ICTs;
3. To examine the various channels for networking between project managers, private sector financiers, and donors, including through the Internet;
4. To examine new approaches to forming broad-based coalitions of resources for the development of ICTs in developing countries;
5. To develop guidelines and policy recommendations on coalitions of resources for financing the application of ICTs in the areas of transmissions infrastructure, health and education.

The workshop covered the following main themes:

1. Coalition of resources for *building capabilities* in information and communication technologies in emerging economies, focused on:

   (i) Building capability in ICTs and developing a national information infrastructure (NII) in emerging economies;
   (ii) Guidelines for managing coalitions of resources.

2. Coalition of resources for the application of ICTs in *transmissions infrastructure*, focused on building and operating infrastructure, including:

   (i) Necessary adjustments to the regulatory framework;
   (ii) The financing of large-scale projects involving the private and public sectors, multilateral development banks and intergovernmental agencies;
   (iii) Innovative partnerships for the financing of small- to medium-size projects;
   (iv) New approaches to the financing of rural telecommunications infrastructure, including micro-lending schemes.

3. Coalition of resources in the *application of ICTs in education*, focused on education and learning in areas such as distance learning and teaching including:

   (i) The shaping of country-specific policy frameworks;
   (ii) The matching of domestic and external public and private resources for financing the provision of hardware, software and materials developments as well as human resources development;
   (iii) The prospects for and limitations of self-funding;
   (iv) The prospects for and limitations of universal service provision.

4. Coalition of resources in the *application of ICTs in health*, focused on telemedicine, long-distance consultations, diagnosis and treatment, including:
    (i)   The shaping of country-specific frameworks;
    (ii) The matching of domestic and external public and private resources for financing the provision of hardware and software, delivery systems and human resources development;
    (iii) The prospects for and limitations of self-funding;
    (iv) The prospects for and limitations of universal service provision.

The workshop's findings and recommendations are:

1. The changes in the global economic environment in recent years have had a major impact on both the way in which coalitions of resources for the application of ICTs are organized and the role of different stakeholders.
2. Increasingly, coalitions of resources are acquiring a global dimension, with the active participation of and contributions by the private sector, technology suppliers and global service providers.
3. To maximize opportunities for a coalition of resources in support of science and technology for development, there is a need to:

    (i)   Balance private and social profitability in project design;
    (ii) Design a clear and transparent national policy and regulatory framework;
    (iii) Develop the capacity to inform potential investors, lenders, donors, equipment suppliers and service providers about specific opportunities to create new coalitions of resources in a particular location or jurisdiction.

II.   SUMMARY AND ANALYSIS OF THE WORKING PAPERS

The following is a summary and analysis of the four working papers presented at the Addis Ababa workshop on "Coalition of Resources for Financing Science and Technology: the Case of Information and Communication Technologies".

In his paper entitled "Coalitions of Resources for Building Capabilities in Information and Communication Technologies in Emerging Economies," Dr. Wolfgang Hillebrand of the German Development Institute in Berlin highlights the elements required to both build a capability in ICTs and develop a national information infrastructure (NII). This requires the mobilization of large amounts of investment and considerable expertise. Emerging economies planning to achieve those ends need to create an enabling business environment, formulate explicit national ICT strategies that both address the question of financing ICTs and provide operational guidelines on how to raise and combine public and private funds from domestic, regional and international resources, and closely link the question of financing ICTs to the process of planning and implementing an NII. This theme is frequently echoed throughout all papers presented at the workshop.

In the case of education, examples show that private companies play a key role in the coalitions of resources when given favourable framework conditions that make it attractive

for them to participate in helping grow the educational system. A policy framework that supports ICTs for education almost always involves coalitions of resources identified in the examples.

In the case of health care, the examples clearly point to the critical need to develop integrated policy frameworks that bring together the various actors in order to create innovative systems which have the possibility for long-term support and growth.

Successful programmes for ICT use and development need to be financially sustainable and able to mobilize and attract domestic and external resources. To achieve these ends, they should focus on self-funding, target commercial users, accommodate commercial users in remote areas, accommodate non-commercial users, refocus existing expenditures, build ICTs into existing projects, and cope with both high front-end investments and foreign exchange constraints.

The majority of examples demonstrate that private capital is playing an increasing role in the financing of transmission infrastructure. Sources of funding are now more diverse but require new organizational and institutional forms that create both opportunities and barriers. In the case of infrastructure development, private capital and externally based finance are taking over as main sources of financing, with bank debt as the prominent funding mechanism. New forms of private sector involvement, such as build-operate-transfer (BOT) and build-own-operate-transfer (BOOT), involving private contractors supervised by government agencies, are becoming more frequent.

All examples reviewed show innovative financial solutions with large projects involving sophisticated funding structures and complex risk-sharing schemes, especially in the case of infrastructure. Raising funds for poorer markets, while difficult, remains feasible with the use of creative financing methods. Perceptions of political risk remain a key barrier to financing; therefore, addressing political risk through various means is a key requirement. Project financing loans from international commercial banks often involve contractual risk-mitigating measures.

In the case of infrastructure, the inability of developing countries to meet financial requirements for transmission infrastructure through internal funding or multi- or bilateral aid is evident. This highlights the need for private capital and underscores the worldwide move away from State control and towards greater private sector involvement, both in funding and in operations. In the past, rural needs for telephony were met through universal service requirements that funded rural use with revenues from profit centres. Today, stand-alone profitability of such services may be achieved with new technologies such as wireless (technological leapfrogging), and through pooling of resources. Privatization of State-owned ICT companies could provide the State with the resources it needs to invest in the expansion of ICTs.

Private funds to finance transmission infrastructure are available. The problem lies in a lack of high-quality projects satisfying profit requirements and limiting risk at the same time. This can be resolved through the establishment of the right institutional framework.

In the case of education, self-funding and sustainability may be achievable with student/user fees for the post-secondary and professional education levels, but require initial investments in the development of courses or infrastructure. As in the case of infrastructure, private sector involvement is increasing.

It appears that for the vast majority of the examples reviewed, project owners are responsible for financing operating costs, thus underlining the necessity for the projects to be able to rely on self-financing to ensure sustainability.

Dr. Hillebrand calls for the establishment of a body at the highest political level to oversee the development of a coherent ICT strategy as well as a select number of mission-oriented task forces focused on, among other things, telecommunications, transmission infrastructure, production, and development of ICTs.

In order to develop an NII and capability in ICTs, global and complex coalitions of resources need to be mobilized. These coalitions are increasingly global in terms of key stakeholders and require extensive cooperation and participation by public and private international institutions. The following coalitions of resources appear to be essential elements and constitute the foundation of the development of a capability in ICTs and an NII: the financial resources and expertise required to formulate a national ICT strategy and monitor its implementation, the resources necessary for building and operating the telecommunications transmission infrastructure, the resources that promote the production, maintenance and development of ICTs, computer literacy, and the application of ICTs in such fields as education, health, public sector management, agriculture, industry and the services sector.

The majority of cases show an increasing possibility of engaging coalitions drawing on international resources. The need for coalitions to include expertise found in global financial centres is becoming more apparent. A stable enabling business environment is a prerequisite for the formation of global coalitions of resources.

Cases in the education sector clearly demonstrate that coalitions of resources happen when real business incentives are offered to private companies and through the development of business feasibility studies that support investment against future earnings. Also highlighted is the essential role played by voluntary and not-for-profit organizations and their contributions to the promotion of ICTs. The cases also point to the existence of leverage points for bi- and multilateral agencies to support ICTs in education, for promoting resource investments from private companies, and for ensuring participation by telecommunications and Internet Service Providers (ISPs).

The case studies from all sectors clearly demonstrate that coalitions of resources are dynamic and evolve through the programme phases of planning, implementation and operations. Five types of coalitions of resources emerge from the working papers: materials/programme development, human resources development, hardware/software acquisition, communications infrastructure development, and operating costs/maintenance.

Dr. Hillebrand warns against favouring a purely market-driven approach to developing an NII and capability in ICTs, and calls for the design of an explicit national ICT

strategy that includes participatory planning procedures. Such a strategy must aim at integrating national development policies and building indigenous capabilities of ICTs. At the same time, it would be important to balance private and social profitability. Furthermore, economies of scale and cooperation need to be exploited, economies of harmonization emphasized, and economies of joint use, joint production, scope and coordination utilized.

A trend towards networked applications is clearly noticeable in the cases involving both the education and health sectors.

Several significant changes and improvements in technology have taken place in the last decade. Among those are:

1. Globalization of telecom networks, which has led national network providers to standardize their structures and improve their facilities.
2. Digital technologies have greatly increased the capabilities of telecommunications systems.
3. Digital technologies have decreased unit costs, particularly for transmission systems.
4. Telecommunications have been liberalized, leading to an increase in the number of competitive suppliers.
5. A large number of State-owned telecommunication companies have been privatized.

The impact of the Internet is not to be overlooked. The Internet substantially minimizes the need for individual institutions to develop proprietary information systems. The challenges remain in designing appropriate programmes, which can be sustained over time, content (i.e. local content), financing and administration.

Rapid development and standardization of the international telecommunications network, together with the international standards being imposed by the Internet, have allowed programme providers to focus primarily on what information they want to deliver rather than on how it should be delivered.

While the initial equipment and use costs associated with new satellite systems remain high, competition, technological development and the economies resulting from mass production will lower these costs, opening even the most remote areas to communications. Such openings will then permit the extension of health and education services to workers and users in remote areas.

Technology is only a minor problem relative to the efforts needed to organize, finance and sustain the various programmes.

III.   REVIEW OF WORKING PAPERS

WORKING PAPER 1: BUILDING CAPABILITIES

Title: Coalitions of Resources for Building Capabilities in Information and Communication Technologies in Emerging Economies.

Author: Wolfgang Hillebrand, German Development Institute, Berlin, Germany.

*Summary***:**

The paper consists of five sections. Section one provides the main messages of the paper and highlights the conditions required for building a capability in ICTs and developing an NII. Section two itemizes the areas for which coalitions of resources would need to be developed to build a capability in ICTs and develop an NII. Section three provides guidelines for securing efficient resource use. Section four provides guidelines for mobilizing and attracting resources. Finally, section five provides guidelines for managing a coalition of resources.

The author begins by identifying the conditions required for building a capability in ICTs and developing an NII in emerging economies, which requires the mobilization of large amounts of investment and considerable expertise. To that end, emerging economies need to create a market-friendly environment, formulate explicit national ICT strategies that both address the question of financing ICTs and provide operational guidelines on how to raise and combine public and private funds from domestic, regional and international resources, and closely link the question of financing ICTs to the process of planning and implementing the NII.

Next, coalitions of resources that need to be mobilized are identified. These include the financial resources and expertise required for formulating a national ICT strategy and monitoring its implementation, as well as building and operating the telecommunications transmission infrastructure and promoting the production, maintenance and development of ICTs, computer literacy, and the application of ICTs in such fields as education, health, public sector management, agriculture, industry and the services sector.

The author then proceeds to address guidelines that will secure efficient resource use and cautions against a purely market-driven approach. An explicit national ICT strategy, with participatory planning procedures, is necessary. Such a strategy must aim at integrating development policies, building indigenous capabilities of ICTs, balancing private and social profitability, exploiting economies of scale and cooperation, emphasizing economies of harmonization, and exploiting economies of joint use, of joint production/scope and of coordination.

The author stresses the need to explicitly address financing of national ICT strategies. Guidelines to be considered for the design and implementation of programmes/projects for ICT use and development that are financially sustainable, as well as for the mobilization and attraction of domestic and external resources, are identified. These aim at focusing on self-

funded programmes/projects, targeting commercial users, accommodating commercial users in remote areas, accommodating non-commercial users, refocusing existing expenditures, building ICTs into existing projects/programmes, and coping with both high front-end investments and the foreign exchange constraint.

Finally, the author offers guidelines for the management of coalitions of resources. These call for the establishment of both a body at the highest political level to oversee the development of a coherent ICT strategy and a select number of mission-oriented task forces, namely for such fields as telecommunications transmission infrastructure, production and development of ICTs, computer literacy/human resource development, and application of ICTs. The task forces should act as advocacy and advisory bodies and should involve government and public agencies, project operators, professional bodies, financial institutions and relevant user groups.

WORKING PAPER 2: TRANSMISSIONS INFRASTRUCTURE

Title: Coalition of Resources for the Application of ICTs in Transmissions Infrastructure.

Author: Dr. Andreas Crede, Science Policy Research Unit, University of Sussex, United Kingdom

Summary:

The paper consists of five sections and is based on eight examples of coalitions which provide transmission infrastructure. The first section provides an executive summary of the paper's findings. The second section describes the background against which the cases were chosen. Section three describes the lessons learned from the cases and the guidelines that follow. Section four discusses the requirements for a transmission infrastructure, rural telephony, the financing of the transmission infrastructure and the availability of funding. The fifth section examines the eight cases in some detail.

SECTION ONE: OVERVIEW

Building new transmission infrastructure increasingly requires the mobilization of complex and globally based coalitions. Coalitions consist of equipment suppliers, institutional investors, bank lenders and major international telecommunications operators, as well as host Governments, local telephone operators and service/equipment suppliers.

Given the increasing scale of projects and their associated funding requirements, private capital is playing an increasing role in the financing of transmission infrastructure. There is a growing global savings pool that is in principle available to fund these new investments. The coalitions of resources required to build new transmission infrastructure into the millennium depend on competitive market-based environments that provide the right mix of risk and benefits.

The paper highlights the increasingly complex and global nature of coalitions of resources seen in both large-scale and small-scale projects. It identifies access to international

markets for private capital as a key feature and addresses the need for new financial structures to accommodate investor risk. The author identifies perceptions of political risk as a principal obstacle to the formation of coalitions of resources and access to funding. Telephony in rural areas can be addressed commercially and does not need universal service requirements. The creation of competitive market environments both internationally and nationally is recognized as a feature of projects that have successfully expanded the transmission infrastructure resource base.

SECTION TWO: EIGHT CASE STUDIES

The author continues his discussion by contrasting technological developments with areas of great need: 50 to 75 per cent of the world's population have never made a phone call, while a highly urbanized class has access to the latest technology, calling for most of the world's expenditure on infrastructure. He seeks to understand key issues required for building capacity and infrastructure, and confirms an earlier conclusion of CSTD studies, namely that there is a need to create coalitions of resources that are increasingly global in scale.

The author considers eight examples of transmission infrastructure at various stages of completion and of varying scale and scope.

Large-scale projects

- The P.T. Mitra Global Telekomunikasi Indonesia (MGTI) joint venture project in Indonesia;
- The privatization of the principal public telephone operator in Peru, now Telefónica de Peru;
- The fibre optic line around the globe (FLAG) undersea cable project;
- The ICO mobile satellite service project

Small-scale projects

- The GrameenPhone venture in Bangladesh;
- The SUNSAT satellite project in South Africa;
- The CelTel mobile phone venture in Uganda;
- Telenor International/Norwegian Government Artelekom project.

These examples consist of a first group of four large projects, with expenditure of around $1 billion obtained from international banks and financing involving both private and public sectors, and a second group of smaller projects with budgets of less than $50 million.

The transferability of resource mobilization models found in each case is addressed, and the stakeholders and the context in which they form coalitions are identified. The globalization of financial markets has more than ever before made a variety of funding sources available. These developments, however, have led to new organizational and institutional forms with new opportunities for, as well as barriers to, the formation of the coalitions needed to reduce current imbalances in transmission infrastructure.

In addition to expenditure levels, the author uses four criteria to select the cases. These are stakeholders involved, geographical location, technology utilized and type of funding used. The cases are divided into two categories. The first is large-scale projects, which are similar in scale and involve complex financial and human resource schemes. They also reflect certain regional patterns and have all successfully raised funds. The second category is smaller projects noteworthy because of innovative elements in financing arrangements and coalitions of human resources.

Each project is analysed according to principal stakeholders, the nature of the coalition of resources, how the coalitions were mobilized, the level of success and the lessons that can be drawn.

After key lessons and guidelines have been drawn, the paper sets a broader context for discussion, covering the increase in demand for infrastructure, the changes in the way funding is obtained, funding sources utilized, and the changing role of multilateral banks.

SECTION THREE: LESSONS LEARNED

In this section, the author draws six different lessons from the case studies:

- Globalization: Coalitions of resources have an increasingly global dimension in terms of key stakeholders, particularly in large-scale projects. This is due to the internationalization of commercial, technological and financial markets. The role of strategic telecom companies in financing new investments is highlighted. The coalitions of resources that need to be mobilized involve extensive cooperation and participation by international private sector and relevant public sector institutions.

- Private capital: Externally based finance is taking over as the main source of financing. Most case examples required private capital for funding. Financing for the large projects came from private sources only. Bank debt is featured prominently as a funding mechanism in a number of cases.

- Financial innovation: All cases demonstrate innovative financial solutions for raising private funds, with the larger projects exhibiting sophisticated funding structures. Complex risk-sharing schemes have allowed substantial funds to be raised.

- Political risks: Perceptions of political risk are a key barrier to funding, more so than the availability of funds. This has led to an increasing concentration of funds in particular geographical areas and industrial sectors.

- Competitive markets: The existence of international and regional competitive market environments is an important characteristic of projects that are successful in expanding the transmission infrastructure. Because of the need to service their cross-border requirements, a small number of super carriers have effectively transformed the telecom business on a global scale. The contributions of these super carriers are not primarily in project funding, but in

their enabling and catalytic role in attracting the international banking community.

- Rural telephony: Innovative approaches have led to an increase in service provision to rural areas and made it profitable. Imbalances remain, however.

From the case studies no simple blueprint emerges. However, coalitions can be mobilized in a creative fashion and drawn across national boundaries. This allows the creation of innovative financing arrangements. However, political risks need to be overcome. This is a key issue for the future.

Requirements for transmission infrastructure

The author illustrates the contrasts in communications infrastructure between developed and developing countries, but he also notes the differences in infrastructure development among developing countries. In this section, the author sets the scene to describe the complexities involved in the construction of a telecommunications infrastructure. He notes that the issue cannot be simply reduced to a question of relative levels of economic wealth measured by gross domestic product (GDP). In that connection, he points out that while some of the poorer countries have made rapid advances in increasing teledensity, other relatively wealthier countries have been left far behind. The author mentions the huge amounts that developing countries are now spending on their telecommunications infrastructure, noting the increasing inability to meet these requirements through traditional combinations of host government revenues and bilateral or multilateral capital flows. Such requirements are particularly acute in East Asia. Globally, in the last decade teledensity in developing countries increased by more than 50 per cent. However, it remains orders of magnitude lower than in developed countries. This inequality is being exacerbated by the establishment of the Internet. However, technological leapfrogging, such as the use of mobile telephones may, to a large extent, replace fixed telephone lines and thus reduce the need for the large investments required in transmission infrastructure.

The author also discusses the evolution of the telecommunications market, which until the early 1980s was dominated by government-owned monopolies enjoying direct support from the State and able to exclude other companies from the market. Since then, there has been a move towards less public ownership and a more competitive market environment. By 1996 more than three quarters of the worldwide telecommunications markets were already deregulated or in the process of being so. This has led to the emergence of global alliances among the largest telecom companies. The author also notes the role of international traffic, which accounts for a disproportionate part of net income.

Of course, the author notes that the advances in technology have caused the cost of voice and data transmission to drop significantly, and that emergence of the Internet has accelerated the demand for new infrastructure. That presents a problem when internally generated cash flow is no longer sufficient to meet the demand for these new services.

Rural telephony

The author emphasizes the need to address rural telephony. In the past, telephone services in rural areas were simply subsidized by more profitable activity centres (urban local loops, international long-distance). Even though technological developments are beginning to reduce the cost of providing services, more innovative solutions are increasingly being sought in order to create the right investment climate for rural telephony projects to be undertaken on a stand-alone basis. New and innovative technologies, such as wireless and mobile means of communication, can offer alternatives to technological fixes or annual subsidies. Pooling of limited resources might be an alternative, as shown by one of the case studies.

Financing transmission infrastructure

The author notes a progressive shift over the past 15 years or so to private funding of infrastructure projects, telecommunications projects in particular. This requires a realignment of political goals to accept the principle of full-cost recovery of services in order to achieve acceptable payback times, and the development of regulatory frameworks to promote competition and ensure stakeholder support.

These requirements, in addition to the need to retain a certain measure of public control and concerns about foreign ownership, have led to the emergence of new forms of private sector involvement—BOT, BOOT and similar schemes. Performance criteria for such contracts need to be established by specific government departments that would also be responsible for supervising the contracts.

The advantages of these contracts are several. They make a private contractor responsible for both construction of new facilities and their operation, including their commercial viability, and increase the availability of existing government funds.

Funding for BOT schemes is provided as project financing loans from international commercial banks. BOT project financing is based on a contract providing the basis of the project's revenues, and reducing the risk for both lender and recipient. Particular emphasis needs to be given to political uncertainties. These need to be minimized through various mechanisms: co-financing, restrictions on expropriation and currency exchange, and a clear definition of the project's sources of revenue.

BOT projects financed by commercial banks are expected to play a major role in the development of telecommunications infrastructure. The coalitions of resources needed for such projects will be brought together by a consortium consisting of a local partner, an international operator, and other investors.

Funding availability

The author highlights the increasingly large pool of capital available for investment in emerging economies, as illustrated by United States pension funds. He also notes that multilateral bank lending has been overtaken by private capital inflows: United States-based fund managers tended to bypass World Bank bonds and invest directly in Latin American infrastructure bonds with better yields. Thus, the issue becomes the appropriateness of the

institutional framework to achieve savings intermediation, rather than the amount of capital available. However, these private inflows have been subject to sharp fluctuations based on how global investors assess political risk.

The issue therefore is not the lack of private capital, but rather the insufficient number of high-quality developing country projects that satisfy risk and reward requirements of investors in key investment markets. This explains why private capital flows to emerging economies have increased overall, yet are mostly invested in a select group of Asian and Latin American countries.

Therefore, perceptions of associated political and commercial risk must be addressed in order to improve investments in less favoured jurisdictions. Much can be accomplished in this regard with the establishment of the right institutional and legal framework.

The case studies, which are quite detailed, are reviewed in the Appendix.

WORKING PAPER 3: EDUCATION

Title: Coalitions of Resources for the Application of Information and Communication Technologies in Education.

Author: Anna Stahmer, *Training Technology Monitor*, Toronto, Canada.

Summary:

Section One sets out the findings drawn from the cases. section Two provides an in-depth analysis of the 12 cases. Section three provides detailed information gathered on the cases that form the basis for the analysis presented in section One. Section Four offers information on 25 additional projects with significant potential relevance to the report. The examples chosen illustrate innovative uses of ICT in education and some examples of coalition of resources that may not be highlighted in the case in the second section.

SECTION ONE: LESSONS LEARNED

The author starts by highlighting the role of private companies in the cases, as well as the framework conditions that make it attractive for them to participate in helping the growth of the educational system, which is governed by public sector mandates. Her cases that draw on private resources show that coalitions of resources appear to take place in two directions: offering real business incentives for private companies and developing business case studies to support the investment against future earnings. She notes that the role of voluntary not-for-profit organizations cannot be overlooked and that multilateral agencies as well as bilateral donor agencies are increasingly involved in ICT-education projects.

From the cases, the author draws a number of lessons, which she categorizes as follows:

1.   Lessons related to framework conditions

- In country policy frameworks, leadership or institutional re-engineering are important conditions for the coalition of resources.

2. Lessons related to trends, roles and leverage points of coalition partners

- Participating schools and institutions have to show commitment through resource reallocations.
- Voluntary or not-for-profit organizations can provide essential "fuel" to promote ICT.
- Leverage points exist for bi- and multilateral agencies to support ICT in education, for attracting investment from private companies, and for ensuring participation by telecommunications and Internet service provider (ISP) firms.

3. Lessons related to prospects for and limitations of self-funding

- Sustainable projects requiring significant organizational re-engineering by the project owners have a very long cycle from initial pilot projects to large-scale implementation.
- Use of ICT in education can be a cost-effective proposition, given that suitable organizational models are implemented.
- Self-funding and sustainability may be achievable with student fees for post-secondary and professional education after the initial investment in a course or infrastructure.
- Private sector solutions are becoming more common.
- At the post-secondary level, institution-to-institution partnerships between developed and developing countries or between advantaged and disadvantaged regions of a country can lead to the creation of innovative programmes of benefit to both parties.

SECTION TWO: FINDINGS FROM THE CASE STUDIES

The author then reviews her examples and offers observations on the use and financing of ICTs in education. A broad analysis of observations is derived from the examples detailed in Section Three as well as information from Section Four. The examples include:

- Western Cape Schools' Network (WCSN) – South Africa;
- Project Grass Roots & Computer for Schools Programme – Canada;
- Enlaces – Learning Network for Primary and Secondary Schools – Chile;
- Public-Private Partnership in School Design, Construction and Operation– Canada;
- Virtual Campus Open Learning University of Indonesia – Indonesia;
- Distance Education and Child Health for Health Professionals – South Africa/Canada;
- Distance teaching at the University of the West Indies – Caribbean;
- University of the Philippines Open University (UPOU) – Philippines;

- TeleCampus for Post-secondary Learning – Canada;
- Training and Development Communications Channel for Continuing and Professional Education (TDCC) – India;
- Information and Library Network (INFLIBNET) – India;
- Quipunet for Peruvian Education – Peru.

Findings are synthesized under issues that link to the potential impact and "replicability" of the projects. These issues are: framework conditions, technologies, education levels, disadvantaged areas, cost and effectiveness, ability and willingness to pay, and self-funding principles and limitations.

1.   Framework conditions

The cases indicate that in almost all examples a policy framework that supports ICT for education is involved in the coalition of resources. This framework can be at the national, regional or even institutional level.

2.   Technologies

The author notes that the use of ICTs for education in developing countries is still highly selective and virtually non-existent. However, private and public education providers in the United States and other developed countries are aggressively preparing for a future of virtual institutions through institutional reforms, technology adoption plans, staff training and the like. Students in developing countries who have access to the Internet and sufficient foreign exchange funds could therefore migrate to virtual institutions at potentially low fees. The cases indicate a trend towards networked ICT applications where the infrastructure allows. However, as noted by the author, these findings are influenced by the choice of cases. School computer laboratories equipped with educational materials are used for local exercises and study. This appears to be the direction in which schools and distance education institutions are going. These laboratories are equipped with some form of Internet access or e-mail or bulletin board services.

3.   Education levels

The case examples indicate that ICTs are being used at all levels of education with a concentration in the post-secondary and professional areas. At the post-secondary and professional levels, there is typically a need to expand access to a course or to learning materials. At the lower levels, access to ICT and networking appear to be the first aim of the project, and access, via the network, to resources, such as other students, fellow teachers or Internet searches, appears to be part of an evolving collaborative learning model.

4.   Disadvantaged areas

Most of the projects in the case examples address the issue of providing access to educational ICTs for disadvantaged regions. The solutions used in these projects are not necessarily applicable in the case of poorer countries. In all examples the cost of telecommunications services to reach distant regions is an expressed concern. Another key concern is access to funds with which to purchase, operate and maintain terminal equipment.

A number of projects cope with the lack of infrastructure in disadvantaged areas by developing learning materials that use multiple methods, including print and learning centres as well as ICT.

5.   Cost and effectiveness

Economic justifications underpin a number of the case examples. They show that the use of ICT can enable more efficient use of resources, e.g. by reducing travel costs or reaching more students, more quickly than traditional methods. A number of the examples take place in a policy framework that considers ICT and education an essential investment for future social returns and economic and industrial growth.

6.   Ability and willingness to pay

The author suggests that the ability and the willingness to pay for ICT education appear to be quite closely correlated to the level of education, the target group and the level of a country's development. For post-secondary or professional-level projects, member organizations may actually save funds over time by reallocating resources from traditional to ICT education methods. Some project owners apparently manage to carry ongoing costs. However, they do need external funds to underwrite or pay for the initial ICT investment costs. At the primary and secondary school levels, the ability to pay ICT-related costs is less evident, but might be possible when it comes to covering operating and ongoing support costs (this may not apply, however, to less developed countries).

7.   Self-funding principles and limitations

Self-funding for total project costs appears to be feasible in cases that operate at the post-secondary and professional levels, either through cost trade-off or through reaching large numbers of learners. However, limitations of self-financing are evident in circumstances without a broad supportive policy framework or where financial resources simply do not exist to expand services. Most case examples are simply too recent for it to be determined whether self-funding can sustain even these projects, which are typically in higher-income environments.

8.   Coalition of resources–the broad patterns

The author then summarizes the key features of the case examples in terms of the resources that different partners are contributing. She notes that the reliability of some of the lessons from these projects is also very much influenced by issues related to the coalition of resources regarding access to expertise, sources of contributions and the implementation process.

An analysis of the coalition of resources in key areas of project implementation, such as materials development, human resources development, end-user hardware, communications infrastructure, operating costs and hardware maintenance, is important for the development of broad guidelines.

9.   Access to expertise

The initiatives covered by the author appear to have strong in-country project leadership, drawing on resources as wanted/needed, or as available with external funding. At the post-secondary level, institution-to-institution cooperation and partnering arrangements are most prominent in the sharing of expertise.

10.   Financial and in-kind contributions

In-country project leadership parallels in-country financial contributions and in some cases completes in-country financing. The author details most significant inroads into the use of private funds for ICT in education. Technical assistance agreements also play important roles in four of the cases.

11.   Coalition of resources – over the project cycle

The case studies did not yield much direct information about the coalition of resources in the planning phase. However, the author notes that inter-institutional agreements and participation in international conferences, professional workshops and study tours may play a support role during the planning phase.

During the implementation process, pilot stages are identified as quite important steps in the implementation of ICTs. At the post-secondary level, they have helped define operational requirements in such areas as technology, operating costs and staffing. Some projects include technology and proof-of-concept trials, which in turn helped in moving them on to the implementation of operational systems, and very importantly, to the definition of organizational underpinning for operational services.

According to the author, four distinct types of coalitions of resources emerge during the implementation and operational phases. These are coalitions of resources for materials development, human resources development, hardware acquisition and infrastructure development. The development of materials remains the principal responsibility of the project owner, but with occasional financial contributions and technical assistance from other stakeholders. By and large, human resource development is channelled through technical assistance in the form of seminars, workshops and study tours. Hardware, such as computers, earth stations and satellite dishes for end users (students) at the post-secondary and professional levels are, for the most part, expected to be carried by the students or their employers. At the post-secondary levels, however, hardware investment is typically the responsibility of the owners, although several are looking at private companies to fill the gap. Most projects use the operational communication infrastructure and are thus bound by the infrastructure conditions.

12.   Financing of operations

In all cases but one, the project owners were responsible for financing operating costs. The cost of telecommunications services, staff and teacher salaries, and hardware maintenance and replacement costs are mentioned as concerns.

SECTION THREE: DETAILED CASE STUDIES

In this section, the author provides a description of each project/case, for which she reviews the following: framework conditions, project overview, technical information, coalition of resources, and assessment.

SECTION FOUR: ADDITIONAL CASES

Finally, the author introduces 25 additional projects with significant potential interest. The examples illustrate innovative uses of ICT in education and some examples of coalition of resources that may not be highlighted in the case examples in Section Two.

Sections Three and Four of this paper, which are devoted to the case examples, are reviewed in the Appendix.

WORKING PAPER 4: HEALTH

Title: Coalitions of Resources for the Application of Information and Communications Technologies in the Health Sector

Author: Douglas Goldschmidt, Consultant, United States

Summary:

The paper consists of three sections, and is based on a large number of cases which vary by regional focus, scale and scope, and funding. The first section provides an introduction and summary of the paper's findings, and includes a discussion of the impact of communications media, and in particular the Internet, on telemedicine. Also included is a detailed discussion of the issues that arise during the implementation and operation of telemedicine projects. Section two examines the case examples in varying degrees of detail, with a particular emphasis on SatelLife and Healthnet. The author's concluding remarks are in the third section

SECTION ONE: INTRODUCTION AND SUMMARY

The author highlights the limitations of the traditional model for the delivery of health care, which has tended to be less available to the poor and to rural dwellers. He then identifies the problems that arise from the fact that most health systems have been organized around archaic transportation modes, rather than the possibilities of newer communications modes. The inadequacy of communications in health care has led to the isolation of clients from the direct provision of health services, rural health providers from expert information, health providers from continuing education, and health professions from research, other medical information and colleagues. It also leads to the unavailability of surveillance, epidemiological information and management information.

A.   Communications media

The author provides a historical overview showing that medicine has been an early adopter of communications technologies, starting with the telephone and the radio. This trend continued through the satellite era, beginning in the 1960s, when the first telemedicine programmes using experimental communications satellites were initiated. Satellites offered the first opportunity to link many remote health centres with the knowledge and expertise of urban hospitals and medical schools.

Unfortunately, the idea and the reality of telemedicine were separated by the uneven development of the telecommunications infrastructure in developing countries, particularly in rural areas, as well as the high cost of telecommunications services. Poor infrastructure development resulted from the technologies' high cost, the low priority many countries attach to telecommunications investment, and the monopoly/government ownership of the infrastructures, among other problems.

However, changes in the international telecommunications infrastructure over the past ten years have significantly improved the technological environment for telemedicine. First, as telecommunications networks have become more global, national network providers have increasingly had to standardize their structures and improve their facilities. Second, digital technologies have dramatically increased the capabilities of telecommunications systems while decreasing their unit costs, particularly for transmission systems. Third, telecommunications has been liberalized, increasing the number of competitive suppliers.

Over the next few years, the author expects the prospects of telemedicine to improve even further, thanks to new satellite systems that are accessible from any part of the planet via very small, hand-held units. Competition, production economies and continued technical change are expected to lead to significant reductions in costs. Hence, one can expect that all rural areas will at least have the potential for telecommunications service, so long as some form of budgetary support is found.

B.   Telemedicine and the Internet

The author recognizes the Internet's transformative effect on the communication of health information through the proliferation of e-mail services, the development of remotely accessible databases, extended international networking among all professionals, the development of commercial information services on the Internet, and the improvement and extension of telecommunications infrastructure to provide Internet services.

As an information infrastructure, the Internet minimizes the need for individual institutions to develop proprietary information systems. The challenge lies in designing appropriate programmes, which can be sustained over time.

D.   Implementation issues

The author identifies eight distinct implementation issues, which he discusses in varying degrees of detail. These are:

1.   Factors affecting the cost-effectiveness of telemedicine – hardware and software

        A key area for review is whether the hardware and software used in making health services available is efficiently provided. Among the elements that affect the efficiency of health delivery are:

        -       infrastructure issues

        The case studies in this paper are of projects that heavily utilize the Internet and other digital media. While the basic Internet software infrastructure is now readily available, the hardware infrastructure is lacking in the developing world, particularly in rural areas. Ideally, the hardware infrastructure would be optimized over a large range of users, resulting in economies of scale. The reality is that such infrastructure is unavailable for use in rural areas. The author singles out SatelLife, which has attempted to address this problem by providing interim dedicated facilities that will phase out in favor of a common infrastructure. In the absence of a common infrastructure, or where requirements are more specialized than would be available through common infrastructure, shared facilities will generally offer savings over dedicated facilities.

        -       Standardization

        A major problem in developing extended communications systems and services has been the lack of hardware standardization, which liberalization and globalization have greatly reduced. The problems now are in software standardization, which raises the following concerns: vendor standards and compatibility, costs of creating and maintaining software, and costs of making software systems compatible.

        -       Technological trends

        Health informatics is undergoing significant changes as new technologies become available.

2.   Issues of scale and budget

        The author notes that more efficient technology does not always lead to decreases in programme costs. More efficient technology reduces the cost per unit (e.g. per patient) served. Aside from the costs of the hardware/software associated strictly with telecommunications, introducing telemedicine will often lead to higher budgetary requirements as programme scales grow. Failure to understand this can lead to poor service delivery and poor system maintenance.

3.   The central requirement for changing agency structure and management in assessing and ensuring cost-effectiveness

        Project histories clearly show that in the absence of strong and creative management, the hardware and software simply become additional expenses, without the commensurate benefits one would assume. This is a continuing problem, reflecting the naive belief that the

telemedicine system can be added to the existing medical system without changes in management and agency structure and procedures.

4.   Training as a prerequisite for success

User training remains perhaps the most critical issue for successful telemedicine projects.

5.   Marketing, health and telematics

The author emphasizes the need for service promotion and system marketing to educate end users.

6.   Financing requirements over the project cycle

Health systems incorporating advanced communications incur a series of budgetary costs that need to be addressed even if, in many cases, they are only indirectly acknowledged:

-       Planning – these are the costs for research and development of a new delivery system.
-       Implementation – implementation costs refer to the one-time resource requirements to actually put a system in place. These costs will include capital, software, administration and management of the implementation, training and promotion.
-       Operating – it is system operations that incur the greatest problems. The operating costs particular to the communications system will include staff, supplies, maintenance, administration, ongoing training, communications costs, licensing and access fees, and evaluation.

Note that these costs do not specifically address all of the incremental costs of implementing a telemedicine programme. Improving service access, expanding the coverage areas and adding new training programmes all incur incremental expenses that need to be studied.

-       Continuing system planning – the costs of system expansion and modernization need to be accounted for.

7.   Funding sources

The author identifies three broad categories of funding sources for health informatics programmes:

-       Coalitions of resources, volunteer and indirect subsidies, and user fees and other means of private support.

(a)   Coalitions of resources

The case studies in this report usually had several outside sources of funds. These included NGOs, government, bilateral and multilateral agencies, and pharmaceutical companies and other private concerns.

(b)   Volunteers and other indirect subsidies

Many of the programmes included in the case studies rely on volunteer work and benefit from indirect subsidies, e.g. reduced telecommunications charges.

(c)   Self-funding

One of the key issues in establishing new informatics-based services is whether the service can sustain itself in the future. Sources of self-funding found in the cases include user fees (patient, practitioner and agency) and third-party payments.

8.   The need for a policy framework for health telematics

The case studies indicate that policy frameworks are necessary for any health informatics system. The policy framework will need to address the financing and compensation issues discussed above. Ethical and legal questions, licensing, competing stakeholders and infrastructure development may require a larger framework than a single agency or provider can establish.

SECTION TWO: CASE STUDIES

In this section, the author presents a series of case studies using telecommunications/computer hardware and software to deliver health services to rural or otherwise isolated populations. The cases were initially selected through an intensive Internet search. Relevant cases were chosen with follow-up research via literature searches, e-mail and telephone conversations.

The cases are:

- SatelLife/HealthNet;
- Technology of information delivery;
- Health information;
- Country programmes;
- Library programmes on the Internet;
- MARA – using the Internet to map the spread of malaria and disseminate research;
- Inforoute Francophone;
- Latin American Public Health Network;
- Programmes in Costa Rica, South Africa, Australia, China, and Singapore.

SECTION THREE: CONCLUDING REMARKS

As already noted, the rapid development and standardization of the international telecommunications network, coupled with the international standards being imposed by the Internet, have permitted health providers to focus primarily on what information they want to deliver rather than on how it should be delivered. While Internet access remains problematic in rural areas starved of basic telephone service, it is increasingly available in the cities of the developing world, permitting significant expansion of the types of resources available to healthcare personnel, and in the types of health services that can be provided via the telecommunications network.

Outside those countries with national telecommunications coverage, rural communications, and hence telemedicine, will remain problematic. However, even here there is cause for some optimism. HealthLink and similar programmes' attempts to extend Internet or other digital networking capabilities via digital radio are the likely first-stage extensions of telemedicine into rural areas.

Of far greater importance is the projected launching of multiple low-earth orbiting satellite systems. These systems will permit the use of hand-held units anywhere on earth (including the poles) for real-time communications via the international telecommunications network. While the initial equipment and use costs associated with these systems remain high, competition, technological development and the economies resulting from mass production will lower these costs, opening even the most remote areas to communications. Such openings will then permit the extension of health services to health-care workers and users in remote areas.

In the end, however, we are brought back to the problem which has plagued telemedicine projects for the past 30 years: the technology is only a minor problem relative to the efforts needed to organize, finance and sustain the extended health system. Advanced technology and the Internet shift some of the variables in terms of what can be done, and at what cost, but they do not provide the answers to what should be provided, to whom and at what cost – those questions remain in the health and political sectors.

There remains a critical need to develop integrated policy frameworks which bring together the various actors – the health-care workers, health ministries, equipment and software vendors, educators, insurers and telecommunications carriers – to create innovative systems which hold the possibility of long-term support and growth.

IV. MARKET AND TECHNOLOGY DEVELOPMENTS

This section deals with the changes in market conditions that have taken place since the workshop, and which may have an impact on the coalition of resources required in order to foster and promote ICT capabilities in developing countries.

To begin with, the ICT infrastructure has been expanding all over the world: more people have access to ICT services than ever before. However, the expansion has not been

uniform. In many parts of the world, the digital divide, instead of shrinking, has been expanding. This, in great part, has been due to the emergence of mobile communications. The number of new mobile lines now exceeds the number of fixed lines. But new modes of securing private sector involvement have also contributed to this expansion.

What is more, the cost of using ICT services is decreasing worldwide, sometimes radically. There are two main factors regarding the decrease in price: technological developments and competition. Competition, when made possible by the regulatory environment, has been observed to lead to considerable reductions in the cost of services. Technology has made possible a range of new, bandwidth-heavy services that are now offered at competitive rates in developed countries and that may also become available (through satellites) to end-users in developing countries.

Developments in technology have occurred along two directions. The first is hardware, resulting in better, cheaper communications equipment (as illustrated by Moore's law, which states that computer processing capability is doubled every 18 months). The second is software, which has led to the emergence of common protocols that allow the use of a common hardware infrastructure more efficiently (e.g. compression algorithms) and for different services (as in Voice over IP).

The interplay of developments in technology and in market conditions has continued to affect market alliances and strategy among the major carriers. There seems to be a certain consolidation of global players along "verticals" (e.g. in satellite services). Competition among them will lead to the commoditization of bandwidth, resulting in greater access and a further reduction in communications costs. While not quite enough to offer services on a par with what is available in urban areas in the United States or Western Europe, it is sufficient to allow for order of magnitude improvements in ITC services. This will enable providers of health care and distance learning to, in turn, improve their offerings to end-users.

Expansion of infrastructure and services

Teledensity (number of fixed telephone lines per 100 inhabitants) is one useful indicator of the development of national ICT infrastructure. Table 2, drawn from data published by the ITU, shows teledensity in different world regions and their growth rates during 1998 and 1999. The table also shows the corresponding numbers for mobile phone subscribers. The growth of teledensity in less-served regions is evident, except in Africa, where it has been marginal. However, in those areas, the growth of mobile services stands out. For example, mobile users in Africa almost quadrupled between 1997 and 1999, such that mobile users there represented almost a third of all telephone subscribers, a figure that is close to the world average.[7]

The reasons for choosing wireless technologies are multiple. First, the cost per additional mobile subscriber is a fraction of what it would be for a new fixed-line subscriber. Second, the installation time is much less; indeed, delivery of a new mobile subscription could be immediate. Third, there is less reliance on existing infrastructure. Fourth, current

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[7] International Telecommunications Union (2000) *Yearbook of Statistics 2000: Chronological Times Series 1989-1998*, Geneva: ITU.

wireless protocols would allow additional services to be upgraded. The use of mobile telephones provides a typical case for technological leapfrogging.

Table 2: Teledensity and mobile users worldwide

Region	Teledensity, fixed lines/100 inhabitants			Mobile user/100 inhabitants		
	1998	1999	Growth	1998	1999	Growth
Africa	2.24	2.45	4.5 %	0.45	1.02	127 %
Americas	32.22	33.13	2.8 %	11.95	16.54	38.4 %
Asia	7.33	8.32	13.5 %	3.07	4.52	47.2 %
Europe	37.28	38.48	3.2 %	13.14	22.35	70.1 %
Oceania	41.31	40.29	-2.4 %	24.75	24.87	0.5 %
World	14.28	15.61	9.3 %	5.40	8.22	52 %

Source: International Telecommunications Union (2001) *World Telecommunications Indicators 2000/2001;* International Telecommunications Union *World Telecommunication Development Report,* various issues; and International Telecommunications Union (ITU) website: (http://www.itu.org).

Of course, one cannot discuss the development of ICTs in the last few years without discussing the Internet. The Internet has become so pervasive that Internet access and the number of IP hosts (i.e. computers with a fixed Internet address) per capita have become an important macroeconomic indicator. Table 3 shows these figures for different world regions. At the present time, the Internet is available in the overwhelming majority of countries. The increase in access in developing countries has been dramatic. However, it is still clustered in major cities. In 1997, for example, only four African countries had links to the Internet exceeding 64 kbps in capacity (roughly equivalent to a single modem); today, all but a small number have such links.

Table 3: Density of IP hosts and Internet users worldwide

Region	IP hosts/100,000			Internet users/10,000		
	1998	1999	Growth	1998	1999	Growth
Africa	2.09	2.41	15.3 %	21.45	34.63	61.4 %
Americas	399.05	684.56	71.5 %	913.96	1602.78	75.3 %
Asia	7.41	11.8	5.2 %	88.0	140.88	60.1 %
Europe	96.9	125.91	30 %	567.1	880.02	55.2 %
Oceania	315.0	455.12	44.5 %	1241.3	2241.7	80.6 %
World	73.7	120.05	62.8 %	266.36	439.8	65.1 %

Source: International Telecommunications Union (2001) *World Telecommunications Indicators 2000/2001;* International Telecommunications Union *World Telecommunication Development Report,* various issues; and International Telecommunications Union (ITU) website: (http://www.itu.org).

Even though the cost of a computer and of Internet access is high, large numbers of people are becoming familiar with the Internet, browsing the World Wide Web and using its

resources, including free personal e-mail services. As described by an Internet cafe owner in Nairobi, "The Somalis come in to browse for news of their country. Businessmen want to check prices in other countries for computers and old and new cars. But most people just want email".

This de facto democratization of the Internet has been made possible thanks to the mushrooming of Internet cafes in practically all developing countries. Indeed, the economics of Internet cafes has a parallel with that of GrameenPhone: thanks to a pooling of resources, a local community can have access to a communications infrastructure that otherwise would have been too costly. This, however, remains an urban phenomenon.

Change in regulatory environment

The change in regulatory environment has also contributed to the expansion of ICT infrastructure. The trends outlined in Working Paper 2 have, overall, continued. Now, a fairly large number of developing countries have licensed private operators that are competing with the national provider, which may or may not be in process of privatization. Here are a few examples. Local cellular service in Egypt is currently provided to over 1 million users by two private competitors.[8] In February 2000, a Deutsche Telekom subsidiary acquired a 51 per cent stake in Uganda Telecoms Ltd for $33.5 million and committed to investing $110 million to expand the network by an additional 100,000 lines within five years. Similarly, Camtel Mobile (in Cameroon) was sold to Mobile Telephone Network of South Africa for $61 million on condition that the South African operators invest an additional $225 million over the medium term. Since the partial privatization of Telkom (South Africa) in 1997, 1.6 million new lines have been added, mostly in poor areas, and overall the telecoms efficiency has improved.[9]

One example worth underlining is that of Morocco. In 2000, it claimed the world's fastest mobile growth rate, with the number of digital subscribers exceeding the number of landlines within a year. The mobile operator is a Spanish-led group that started providing services within 9 months of winning the tender, and later on acquired a second GSM licence for $1.1 billion. Last year, smaller operators were awarded VSAT (very small aperture satellite) licences at $4 million each. Vivendi Universal, a French group, acquired a 35 per cent share of Maroc Telecom, the national company, whose hold on landlines will be broken in 2002.

Morocco's experience has been well received and some have argued that it might serve as an example to others.[10] The coalition of resources that made this possible has been orchestrated by a State regulator (not the Ministry of Telecoms), who is in charge and acts as an independent arbiter. It is not surprising that bilateral cooperation programmes have been set up in which well-established regulatory agencies in developed countries will provide assistance and know-how to their more recent counterparts in developing countries. By

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[8] International Telecommunications Union (2000) *Trends in Telecommunication Reform: Country Profiles*, Geneva: ITU.
[9] Ahmed Rafiq (2000). "The pace hots up", *African Business*, pp. 20-23.
[10] "Morocco goes mobile", *The Economist*, 11 May 2000, London, United Kingdom.

December 2000, the United States Federal Communications Commission, for example, had signed its tenth such international development work programme.[11]

When available, competition has led to a significant drop in the cost of Internet access. Kenya, for example, now has 47 Internet service providers and, compared with last year, the cost of unlimited Internet access has dropped sevenfold, down to $15 a month, corresponding to 50 per cent of Kenya's GDP per capita.[12]

The role of technology

It is quite appropriate to talk of a change in paradigm when talking about the technological changes that came to the fore over the last four years. Because of developments in hardware, they have ushered in what is now called the Optical Internet. Relatively economic backbone solutions with capacities of up to 10 Gbps that break the 4000 km barrier are now commercially available. Optical fibers with up to 6.4 Tbps capacities have been demonstrated. What this means is that global carriers will be able to increase their transmission capability to match any requirement. In developed countries, this means increased capacity will translate into price reduction for broadband access. Indeed, the cost of a monthly digital subscriber line (DSL) in the United States is $40, twice the cost of standard modem access but at four times the bandwidth. Current projections anticipate that in 10 years' time, the "Tera Era" will see 1Gbps connections to the desktop or home, at a monthly cost of $100. The implication is that the cost of information transmission will drop even further.[13] [14] [15]

Meanwhile, information-processing capacity, as a result of Moore's law, has continued to double every 18 months. Information storage capacity has improved at even better rates: over the last decade, hard drive storage technology has improved 50 per cent faster than computing power. With the advent of optical storage, the cost of storing media for 10 Mb of data (about 3,000 pages of text) is less than $0.10.

The commoditization of bandwidth (i.e. of information transmission services) has led major players in the industry to maximize economies of scale and scope. As a result, the communications infrastructure has coalesced into a hub and spoke model, much like the airline industry, with major ISPs (so-called tier-1 providers) operating the backbones linking

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[11] United States Federal Communications Commission (2000) "Kennard Development Initiative: For Developing and Emerging Nations", http:///www.fcc.gov/ib/initiative/welcome.html, December, Washington, D.C.: USFCC.

[12] Africa Internet Connectivity website: http://www3.sn.apc.org, Eastern Cape: Africa Cooperation Action Trust.

[13] National Science Council (1998) *Harnessing light: Optical science and engineering for the 21st century*, National Academy Press, Washington, D.C.: USNC.

[14] Additional information on future expectations can be obtained from the websites and publications of national agencies promoting research and development in basic and applied sciences, including the National Science Foundation (http://wwnsf.gov) and the Defense Advanced Research Projects Agency (http://darpa.mil) which are both based in the United States. Longer-term figures may be inferred from the solicitations for research projects promoted by such agencies.

[15] Information on the current capabilities of commercially available communications hardware can be obtained from vendor websites including the following: Nortel Networks (http://www.nortelnetworks.com), Lucent Technologies (http://www.lucent.com), Cisco System (http://www.cisco.com), Alcatel (http://www.alcatel.com) and Ericsson (http://www.ericsson.com) among others.

the main hubs and a cascade of smaller companies providing local access to the nearest hub. The commoditization of storage and, increasingly, of processing power has led to the emergence of the data centres. Data centres are secure environments where ISPs lease out storage and processing power to end-users. In the digital economy, these data centres and ISPs are, respectively, the equivalent of major cargo transit centres and shipping agents in the "old" economy. By leasing out storage, bandwidth and information processing capacity to new entrants, these ISPs allow them to avoid high upfront costs. By decreasing these barriers to entry, the ISPs have contributed significantly to the spread of the digital economy in developed countries.

An interesting development is the emergence of the so-called application service provider (ASP). While ISPs are aggregators of bandwidth, storage and computing capacity, ASPs are aggregators of software and usually provide higher value-added services than ISPs. A typical example of the ASP are the Internet search engines, such as Altavista and Google, or webmail providers, such as hotmail. Note that a significant number of hotmail's registered users are based in developing countries.[16] [17]

The impact of these new technologies on developing countries can be significant, provided that they have access to the necessary transmission capability. A developing country with proximity to a node on the worldwide undersea network will benefit directly from the network. In turn, this country could become a local hub for its neighbours, as is the case with South Africa for Lesotho, Namibia and Swaziland. Remote regions would achieve access by connecting via satellite to an earth station located at this hub.

In industrialized markets, 70 per cent of satellite capacity is dedicated to broadcast video-related services, while 30 per cent is used for voice, data and the demand for specialized services on private networks. In the rest of the world, there is a far greater use of satellite technology for basic infrastructure. Broadcast video represents perhaps 40 per cent of the traffic, while telephony and data traffic account for 60 per cent.[18]

Satellite services have also improved. While still not capable of equalling the transmission rates of optical fibres, satellite technology has resolved a number of problems associated with geostationary satellites, latency in particular. Newer schemes of satellite deployment, known as low- and medium-earth orbit (LEO/MEO), are in the process of being implemented. The advantage of LEO/MEO satellites is that their launching costs, because of their much lower orbits (600-1000 km), are much lower than those of geostationary satellites, which are typically at 30,000 km. These orbits criss-cross the sky, such that there is always at least one satellite within a given user's line of sight.

The best-known example of such clusters is Iridium, which was designed to offer mobile satellite telephony anywhere in the world, and turned out to be a major commercial failure. Indeed, other satellite clusters have encountered almost similar fates: ICO, one of the

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[16] Gilber, Geroge (2000) *Telecosm: How Infinite Bandwidth will Revolutionalize our World*, New York: The Free Press, Inc.

[17] Shepard, Steven (2000) *Telecommunications Convergence: How to Profit from the Convergence of Technologies, Services and Companies*, New York: McGraw-Hill Inc.

[18] Brown, Peter J. (1998) "Phone for everyone: Satellite telephony", *Via Satellite*, 1 August, Northbrook, Illinois.

case studies in Working Paper 2, filed for bankruptcy in 1999 but was acquired by Teledesic – a further indication of consolidation of the industry.

However, other constellations have been successful. Globalstar's 48 array satellites offer voice, short messaging, global positioning, fax and data transfers at 9.6 kbps.

Teledesic is the most ambitious LEO satellite services company. It is expected to become operational in 2003-2004. It will have an array of 288 satellites capable of providing up to 64 Mbps of downstream and 2 Mbps of upstream bandwidth for voice, videoconferencing and data. The monthly cost of a T-1 connection with Teledesic is expected to be around $700.[19] Even though its services are not yet operational, Teledesic is expected to play a major role in providing transmission capacity to developing countries, as is borne out by the fact that it is the only observer listed amongst the World Bank's partners in the InfoDev programme.[20]

VSATs are being deployed by a large number of vendors throughout the developing world, Africa in particular. VSAT offers one of the cheapest methods of providing connectivity to nodes distributed over wide areas, e.g. a network of health clinics or schools. At the present time, VSAT links are being used by bandwidth consolidators, who are offering voice services at much lower end-user rates than national carriers.

Software developments

The most noteworthy development in software in recent years has been the emergence of the Internet Protocol (IP) and its dominance over all other networking protocols. At this point, IP (and in particular, its latest implementation, IP v.6.0) is the only universal addressing system that is available. Because of its universality, it can accommodate all devices on a local area network (computers, printers etc.), all cell phones and pagers, indeed, any networked device. It is acceptable worldwide and, thanks to the efforts of equipment vendors, it is interoperable with network operating and signalling systems and applications.

The main benefit is that IP allows convergence of services: telephone operators can now transmit data, data transmitters can now, with Voice over IP applications, transmit voice over any network. VSAT operators can now offer both voice and data services. It is thus not surprising that VOIP international traffic has been increasing: just under 2,000 million minutes in 1999, it is expected to exceed 6,500 million minutes in 2001. Moreover, its share of total international traffic has increased from 1.6 per cent in 1999 to 3.2 per cent in 2000, and is expected to reach 5.5 per cent in 2001, yet another reason why the ITU attaches so much importance to the Internet.

Another noteworthy development is that of the Open-Source Movement, composed of a worldwide network of thousands of devoted software developers who make their software freely available. These developers are eager to share their work and willing to have it

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[19] Private communication by an industry insider. The author was unable to confirm this figure from published sources.

[20] Additional information on the future offerings of these companies can be obtained from their corporate websites (i.e. http://www.teledisc.com). Note that many satellite companies have had to revise their schedules, delaying the offering of their services for years.

improved upon by others. The most notable outcome of this movement is Linux, a stable, scalable and robust operating system that is distributed free (except for the cost of the media). Linux has begun to acquire a significant share of the market, becoming an alternative, and increasingly attractive, standard. In many ways, it is a better standard as it is economically written. For a given level of performance, it requires less memory and disk space compared with its main competitors. It can therefore run on computers that are less expensive. This is all to the benefit of developing countries. The operating system of a client computer costs several tens of dollars, whereas server software costs upwards of several hundred dollars. The Free Software Movement therefore makes it possible to significantly reduce the set-up cost of a network. Indeed, Mexico has considered installing Linux as the default operating system on all government computers.

Further software developments that have a direct bearing on applications, and in particular applications in education and health care, have been the development of platform-independent programming languages and the improvement of compression algorithms. The most notable of platform-independent languages is Java, which is particularly well suited to the Internet and the World Wide Web. An application written in Java will run on a wide range of compatible platforms. This is particularly useful in client-server scenarios, typically encountered in distance learning. In such a scenario, a professor located at the server might be connected to a large number of students using different client machines. Compression algorithms, typically using wavelet image compression, have reduced the transmission requirements by an order of magnitude, enabling the transmission of byte-heavy X-rays or CAT-scans. Such algorithms are currently operational. One company offers second-opinion medical advice by doctors at leading United States medical centres to primary doctors and their patients based in 15 different countries in Latin America, Africa, Asia and Eastern Europe.

Thus, the technology and market trends noted by the authors of the working papers have continued: the cost of transmission is still going down, transmission infrastructure in developing countries is being expanded (mainly thanks to wireless technologies), deregulation is leading to new modes of project financing, and applications in health care and education are expanding. In some cases, there have been some qualitative changes: consolidation within certain industries, new financing models, convergence on IP, the emergence of new categories of players, etc. What does this mean for the coalition of resources?

Implications for coalition of resources

The implications for coalitions of resources are positive. They are as follows:

1.   The continued diffusion of ICTs implies a greater level of acceptance and a diminishing need to educate end-users and decision makers. Indeed, decision makers in developing countries are now among the established users of the Internet. For example, the secretariat of the United Nations Framework Convention on Climate Change (UNFCCC) reports that in May 1999 its website (which is its main channel for the distribution of official documents) was accessed from 112 different countries. In October 1999, the website was

  accessed from 147 different countries, representing 80 per cent of the countries having ratified the Convention.[21]

2. Hardware will become commoditized and the recycling of used (but still useful) hardware will grow. Continued progress in the development of hardware means that, for a given information processing, storage or transmission capacity, the costs have decreased and will continue to do so. Competition in the supply of new hardware will increase, pushing prices down further. Meanwhile, demand for information processing, storage and transmission capacity in developing countries is expected to continue to grow. The upgrading of equipment in developing countries (e.g. by data centres) will make large amounts of hardware available for recycling. Such data centres could become significant resources of used hardware.

3. The standardization around software platforms and protocols brings in new private sector players – with significant resources – with a stake in the promotion of their products. For example, fearful of Linux, Sun Microsystems now makes its Solaris operating system available free of charge under quite generous conditions. Microsoft, Cisco and Oracle (respectively, the world's leading developers of operating systems, Internet networking equipment and database software) have each developed off-the-shelf training programmes to certify technicians and engineers in the use of their respective products. They are willing to provide resources to academic institutions interested in providing this training. Bir Zeit University in the Palestinian territory is one institution that has made partnership with these private sector companies a basic component of its strategy to develop a national IT capacity within a short time frame.[22]

4. Because of the convergence around IP, the transmission of information on the network (whether physical or wireless) will become a commodity, just like water or gas in a network of pipelines or electricity on a grid. This will lead to a consolidation among providers of transmission capacity (phone companies, ISPs, satellite operators) and the resulting entities will operate as utilities. Indeed, many utilities worldwide have begun providing telecommunications services. A case in point is that of Vivendi, which is a partner in the consortium providing mobile phone services in Morocco, and which recently acquired a 35 per cent stake in Morocco's national telephone operator; it was originally known Lyonnaise des Eaux, a French utility provider.

5. The upfront costs required for access to information transmission capacity will decrease, but operating costs may remain high. In certain cases, upfront costs may be negligible. A large information transmission capacity (based on satellite arrays and/or fiber-optic networks) is being developed worldwide by global operators and will be leased to both resellers and end-users. The end-users are likely to be global corporations. The resellers are likely to include bandwidth consolidators, and may even include national telephone companies or ISPs. The upfront investments in this global transmission infrastructure have been provided by the global operators and their financial backers. This

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[21] The UNFCC was also a pioneer in "webcasting" of conferences and meetings, i.e. use of the internet for live broadcastng.

[22] Tarazi, Marwan (2000) "The Role of International Cooperation in Developing the Palestinian IT Industry", Middle East Conference on Information Technology in the Middle East, 1 February, Washington, D.C.

will, of course, be factored into the use charges, so that while resources for start-up costs might be less, operational costs might be higher. Hopefully, the economies of scale will be significant.

6. National policies might need to be realigned to allow for cost-effective access. Many countries might not be willing to lease transmission infrastructure from a foreign entity, even though this might be the most cost-effective solution. This might challenge strongly held national assumptions and policies. Many countries have successfully challenged similar assumptions, but others have not.

7. In applications of ICTs, the role of information owners and information users will predominate. As information transmission capacity becomes a commodity, the focus will shift to information owners, to the quality of their information, and to the information users and their ability to use this information. Typical examples of this include telemedicine, where information owners could include on-line medical databases, and information users could include medical professionals.

V. CONCLUSIONS

Even though the 29 case studies and the Addis Ababa workshop were undertaken four years ago, their main findings and recommendations still hold: trends in the global economic environment continue to impact on the coalitions of resources required for and the roles of the stakeholders involved in the promotion of ICTs in developing countries. There is still a need to evelop a clear and transparent national policy and regulatory framework to balance private and social profitability in project design, and to increase the capability to publicize new opportunities among the stakeholders concerned. CSTD's new information network for development could play a role in this regard by disseminating information on existing conditions and facilitating networking by those who wish to form new coalitions.

In the case of transmissions infrastructure, the main constraint is essentially capital cost; financial institutions will therefore continue to be major stakeholders. Political risk was and is a key barrier in putting together public and private resources. Here, the right institutional framework and political risk guarantees could play a role.

Even though recent (and future) developments will reduce the cost of expanding the ICT infrastructure (e.g. through mobile networks and satellite connections), the recommendations of the workshop are still valid. For example, leasing the services of a foreign international carrier rather than building a nationally owned infrastructure will require, even at substantial cost savings, the realignment of political priorities – a point argued in Working Paper 2. New forms of private sector involvement, a point also argued in Working Paper 2 (e.g. BOT, BOOT), involving private contractors supervised by government agencies, are becoming more frequent.

In the case of applications (assuming, of course, an existing infrastructure), the main constraints are human resource capabilities and access to information and know-how. Here, stakeholders include volunteers and not-for-profit organizations. In the case of health care

and education, the use of networked applications has continued to increase. In both cases, considerable resources are now available to users with access to the Internet: these include educational material and curricula, medical and epidemiological information, second opinions, information compiled by professional societies, etc. Because of the development of wireless communications, these resources can be made more readily available, and with improved access, to practitioners in developing countries. Indeed, pioneering examples (e.g. SatelLife) were discussed at some length at the workshop. The involvement of developing country education and health-care practitioners in international or bilateral knowledge networks providing access to high-quality information at acceptable costs becomes important.[23] Such networks (e.g. providing access to bibliographical information) were also discussed at the workshop.

With these developments, the setting up of an overall national strategy and action plan that encompass both the development of the infrastructure and the promotion of its use remains important. There is still a need in most developing countries to establish a body at the highest political level to design a national IT strategy. It is only through such a plan that resources can be used optimally and duplication and lock-in avoided. The guidelines proposed by Working Paper 1 address issues of equity (e.g. building indigenous capability, balancing private and social profitability) and sound economics (e.g. economies of scale and scope, and economies of coordination).

The first set of concerns (equity) translates into policies and regulations to be formulated by a national regulatory authority. Ideally, this national authority should be independent of all stakeholders in order to be able to set its guidelines and resolve disputes, keeping in mind the common good by applying principles of integrative bargaining. For example, such an authority could empower institutional users to access the services of international carriers if the services of the national carrier are too costly or are unavailable. By the same token, the regulatory authority could require institutional users to switch to the national carriers if they provide comparable services at reasonable cost.

The second set of concerns (sound economics) can be achieved through evolving partnerships between the stakeholders involved. These partnerships will offer the frameworks through which projects that use or develop ICTs (or, better still, portfolios of such projects) can be implemented. The optimal coalition of resources will require applying the operational guidelines discussed throughout the workshop. These include:

1. A clear and transparent national policy and regulatory framework for ICTs based on a national action plan that includes development of infrastructure and promotion of its use and a strategy for developing and running the telecommunication industry;
2. Involving financial institutions as well as new forms of private sector participation (e.g. BOT and BOOT) to invest in infrastructure;
3. Partnerships with private ICT companies, telecentres, academia, etc.

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[23] United Nations Conference on Trade and Development (1999) "Making north south research partnerships work", Economic and Social Council, *Commission on Science, Technology and Development in cooperation with the European Centre for Development Policy Management*, UNCTAD/ITE/EDS/7, Geneva: UNCTAD.

In order to maximize the chance for the success of a coalition of resources, there is also a need not only to balance private and social profitability as mentioned before but also to develop the capacity to inform potential investors, lenders, donors, equipment suppliers and service providers about specific opportunities for creating new coalitions of resources in a particular location or for a particular sector.

VI.   APPENDIX

SUMMARY OF CASE STUDIES

This section reviews in brief detail the majority of the case studies included in the working papers. A series of tables providing an overview of the most significant cases is then provided. Data included in the tables include both information gathered in 1997 and information gathered for the purposes of this report. The updates were completed through Internet searches and through e-mail contact with project owners. A short e-mail-based questionnaire was designed to collect information about the various cases included in the tables.

WORKING PAPER TWO : TRANSMISSION INFRASTRUCTURE

The paper considers eight cases of transmission infrastructure projects that are at various stages of completion. The first four projects have been selected for both their scale and scope. They each involve expenditures of around $1 billion and the mobilization of finance from the major international banking and capital markets. They reflect the complex nature of such coalitions, involving coordination between the private and public sectors as well as other multilateral institutions. The second group of projects are on a more modest scale, with an average size of less than $50 million. These cases were selected to compare and contrast the innovative solutions which these projects offer for mobilizing resources in an environment where larger-scale alternatives may be either inappropriate or not feasible.

The cases were selected on the basis of a series of criteria that sought to identify different forms of coalitions in terms of key stakeholders, regional location, technologies employed and type of funding. Data were obtained from a variety of published sources and direct contact with the project sponsors.

The case examples are as follows:

Large-scale projects

- The P.T. Mitra Global Telekomunikasi Indonesia (MGTI) joint venture project in Indonesia;
- The privatization of the principal public telephone operator in Peru, now Telefónica de Peru;
- The fibre optic line around the globe (FLAG) undersea cable project;
- The ICO mobile satellite service project.

Small-scale projects

- The GrameenPhone venture in Bangladesh;
- The SUNSAT satellite project in South Africa;
- The CelTel mobile phone venture in Uganda;
- Telenor International / Norwegian Government Artelekom project.

WORKING PAPER THREE: EDUCATION

The cases presented in this paper were selected by using criteria that focused their innovation in terms of ICT and innovation in terms of coalitions of resources involved.

The projects were principally identified through Internet searches and the author's personal knowledge. The cases are mostly computer and online-savvy projects. The projects are not necessarily the most prominent ones in the use of ICTs in education. They are very important, however, in their illustration of innovative coalitions of resources to implement ICTs for education. A total of 12 projects are reviewed in detail. Twenty-seven additional projects are also briefly reviewed because of their potential interest to the paper.

The cases are as follows:

- Western Cape Schools' Network (WCSN) – South Africa;
- Project Grass Roots & Computer for Schools Programme – Canada;
- Enlaces – Learning Network for Primary and Secondary Schools – Chile;
- Public-Private Partnership in School Design, Construction and Operation– Canada;
- Virtual Campus Open Learning University of Indonesia – Indonesia;
- Distance Education and Child Health for Health Professionals – South Africa/Canada;
- Distance teaching at the University of the West Indies – Caribbean;
- The University of the Philippines Open University (UPOU) – Philippines;
- TeleCampus for Post-secondary Learning – Canada;
- Training and Development Communications Channel for Continuing and Professional Education (TDCC) – India;
- Information and Library Network (INFLIBNET) – India;
- Quipunet for Peruvian Education – Peru.

WORKING PAPER FOUR: HEALTH

Case studies using telecommunications/computer hardware and software for delivering health services to rural or otherwise isolated populations were selected through an intensive Internet search. Relevant cases were chosen with follow-up research via literature searches, e-mail, and telephone conversations.

The case studies are as follows:

- SatelLife / HealthNet – United States;
- Library programmes on the Internet:
    - The Bach Internet National Library of Medicine Information System;
    - The Sister Library Programme;
    - University of Zimbabwe Medical Library;
- The Mapping Malaria Risk in Africa (MARA) Project;
- Inforoute Francophone;
- Latin America Public Health Network;
- Programmes in Costa Rica, China, South Africa, Australia and Singapore.

CASE EXAMPLES: INFRASTRUCTURE

Artelekom
Russian
Federation

ICO and FLAG
Global

Telefónica
Peru

Sunsat
South Africa

GrameenPhone
Bangladesh

CelTel
Uganda

P.T. Mitra
Indonesia
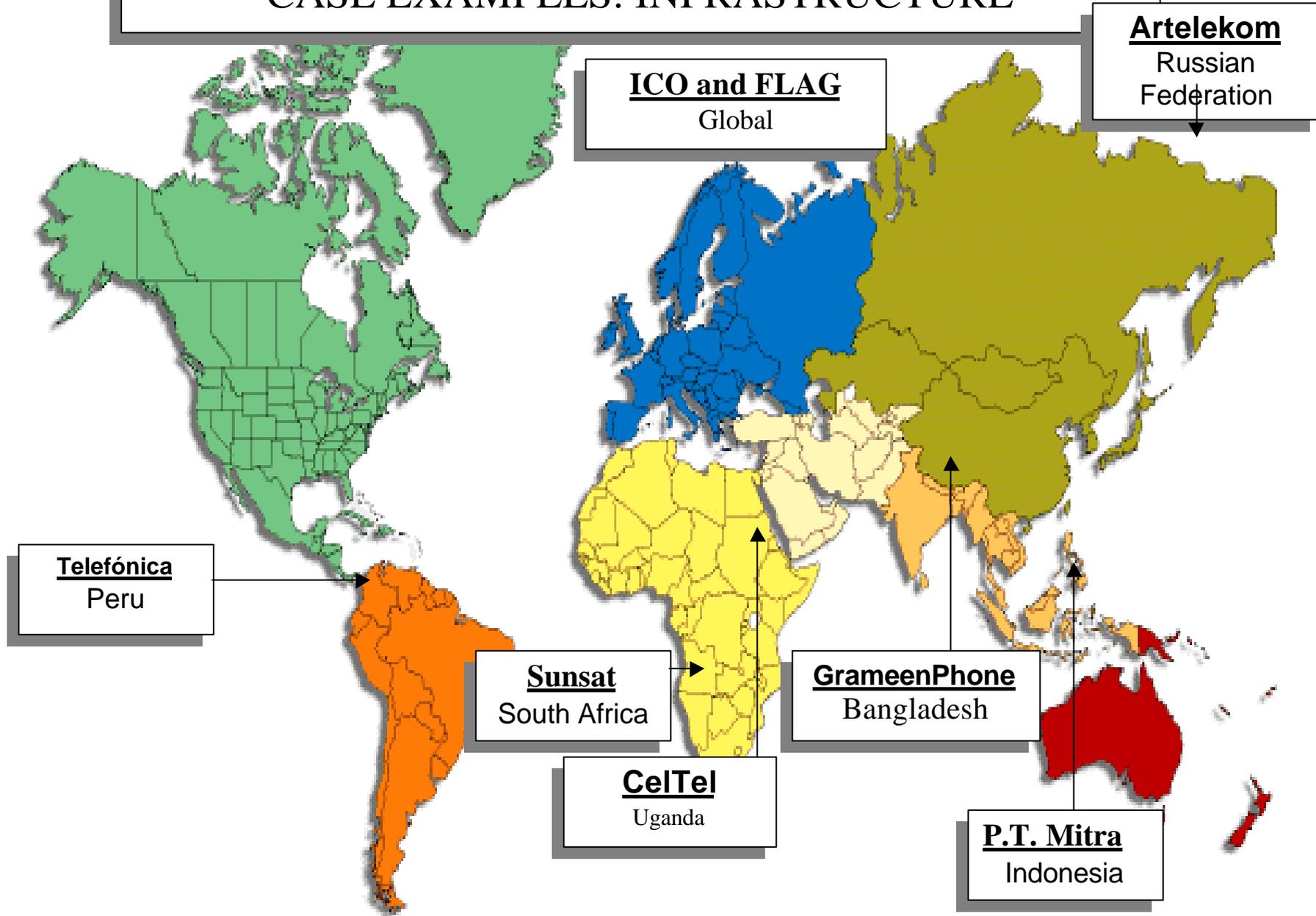
ARTELEKOM
Russian Federation – Europe
http://www.artelecom.ru

SYNOPSIS/OVERVIEW	A project being run by Telenor (Norway) involving the transfer of old analog switching equipment to remote locations in the former Soviet Union.	
TOPIC	**1997**	**2001**
FRAMEWORK	Privatization of telecommunication sector in the early 1990s.	Company is restructuring. Moving towards Western-style management.
TECHNOLOGY	Implementation of 35 used analog telephone switches. Installation of 12,000 new telephone numbers.	Completed transferring the switches at the end of 1999.
AUDIENCES/TARGET MARKETS	Individuals and businesses requiring access to telephony in remote urban communities in northern Russia.	Same as 1997.
COALITIONS/STAKEHOLDERS	Telenor, Norwegian Ministry of Foreign Affairs (Grant Aid) and the city of Arkhangelsk.	AIG-Brunswick Capital Management and government holding company Svyazinvest.
FUNDING	Project run by Telenor.	Artelekom posted a profit of $2.42 million in the first nine months of 2000 and has gained control of the Arkhangelsk city telephone system.
POLITICAL RISK MITIGATION	Grant Aid funding by the Norwegian Ministry of Foreign Affairs.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	A creative approach in which old equipment can be recycled into locations which would otherwise not be able to generate sufficient funds for new state-of-the-art equipment. Project provides a very specific solution that may have application elsewhere (countries in transition).	

CELTEL		
Uganda – Africa http://www.nic.ug/CelTel/ OR http://www.celtel.co.ug/		
SYNOPSIS/OVERVIEW	Cellular telephone joint venture in Uganda with a very low subscriber break-even point. The first private telecommunications project to be implemented in Uganda. Servicing the more densely populated areas of the country. Service launched in 1995.	
TOPIC	**1997**	**2001**
FRAMEWORK	Deregulation and liberalization of the telecommunication sector.	No data available.
TECHNOLOGY	Development of a cellular network based on the GSM cellular standard.	Voice mail, fax and data.
AUDIENCES/TARGET MARKETS	Commercial users of mobile telephony in Uganda.	Launched Commercial Services Department in January 2001.
COALITIONS/STAKEHOLDERS	Vodafone, Siemens, CDC, IFC	Vodafone (35 per cent shareholder), MSI Cellular
FUNDING – FINANCING	Equity raised from strategic investors, plus IFC and CDC are also providing long-term debt. First private financing for a small-scale telephone joint venture in Africa. Total financing: $16 million.	No data available.
POLITICAL RISK MITIGATION	Involvement of IFC and CDC as both debt and equity providers.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Reveals a similar global coalition of resources that have been mobilized for the four larger projects. Had 24,443 subscribers as of September 2000 compared with 9,000 in 1996. Currently extending coverage to other areas of the country. Company has 110 employees. Unable to access information through websites.	

FIBRE OPTIC LINK AROUND THE GLOBE (FLAG)
Asia and Europe
www.flagtelecom.com

SYNOPSIS/OVERVIEW	Fibre optic line around the globe. An undersea cable project linking Europe and Asia via Africa and the Middle East being developed by a consortium of companies led by Nynex (now Verizon).	
TOPIC	**1997**	**2001**
FRAMEWORK	Greater globalization with access to the United States capital markets by an increasing number of Asian and Latin American borrowers.	Same.
TECHNOLOGY	Laying of 28,000 kilometres of undersea fibre optic cable, 12 landing points and the capacity to handle 120,000 individual 64 Kbps circuits.	Became operational in November of 1997. First dual transoceanic terabit cable system (2001), longest transoceanic DWDM system (2002). 26 PoPs for 2001.
AUDIENCES/TARGET MARKETS	Existing telephone operators seeking increased bandwidth communications between the Far East and Europe. Access points to include underserved regions in Africa and Asia.	Value-added services targeted at worldwide web-centric companies. 50 total carrier/customers.
COALITIONS/STAKEHOLDERS	KDD, ATT, Nynex (Verizon), CIBC, Barclays, MITI, Ex-Imbank. Commercial bank lenders and project developers.	Same.
FUNDING	Project finance facility supported by political risk insurance coupled with substantial contingent equity. Commercial bank debt.	FLAG initial public offering of early 2000 to finance, a senior note and none recourse bank debt to finance United States-Japan undersea link.
POLITICAL RISK MITIGATION	Substantial political risk cover provided by United States Ex-Imbank and MITI Japan.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Demonstrates that given the right balance of risk and reward, large amounts of funding can be raised in the form of both debt and equity for such projects. Reveals that broad and complex coalitions can be mobilized. Does not offer simple blueprint for similar projects in other location.	

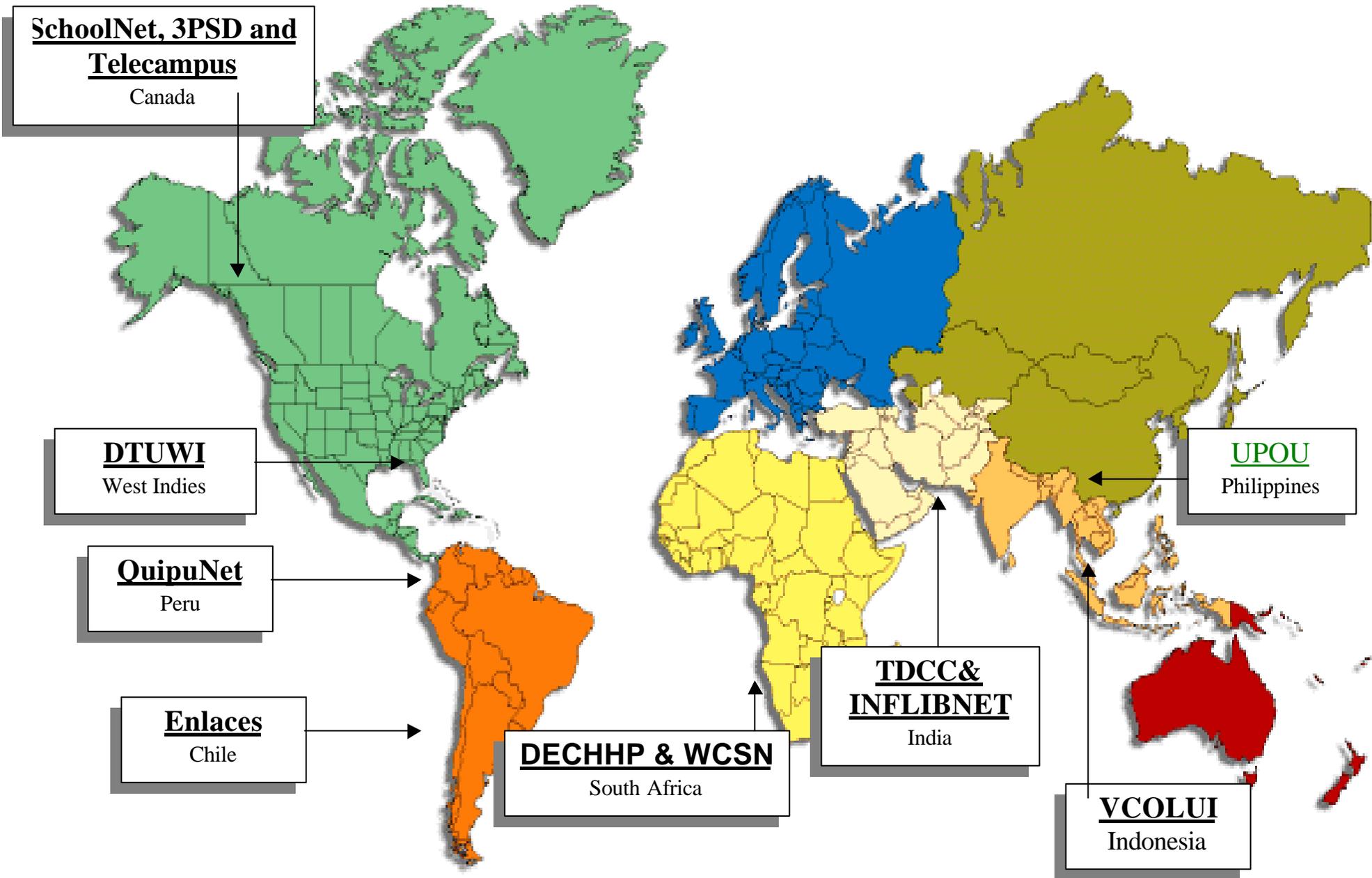| GRAMEENPHONE		
Bangladesh – Asia		
www.grameenphone.com		
SYNOPSIS/OVERVIEW	A cellular telephone joint venture involving Grameen Bank and Telenor (Norway) which aims to expand access to basic telephone service in the rural areas of Bangladesh. Launched 26 March 1997.	
TOPIC	**1997**	**2001**
FRAMEWORK	End of monopoly held by Bangladesh Pacific Telecom. Competitive cell phone market. International joint ventures allowed.	Same.
TECHNOLOGY	New mobile network based on the GSM cellular network (Ericsson main supplier).	Going to introduce the mobile Internet service Wireless Application Protocol (WAP).
AUDIENCES/TARGET MARKETS	68,0000 villages in Bangladesh currently without access. Businesses and women's groups.	65,000 subscribers. 3,000 are village phones, about 7.5 million users (01/2001). 50 per cent market share. Market leader.
COALITIONS/STAKEHOLDERS	Telenor, Ericsson, Grameen, IFC, ADB, Marubeni Corporation, Gonofone Development Corp. Banks, Trading Companies, Investment Company.	Same.
FUNDING	Equity finance by Telenor and Grameen Bank. Bank with debt to be subscribed by ADB and IFC.	Revenue-generating operation.
POLITICAL RISK MITIGATION	Involvement of International Finance Corporation, Asian Development Bank and Grameen Bank as local partner.	Same.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	GrameenPhone has won the prestigious GSM Association Award for its innovative Village Phone Programme and has received wide acclaim. Effective use of coalition of resources leading to enduring partnerships.	

ICO GLOBAL COMMUNICATIONS – NEW ICO Global www.ico.com		
SYNOPSIS/OVERVIEW	Inmarsat Mobile Satellite telephony project. One of several mobile satellite services projects being developed by ICO Global Communications, a private company which was originally set up under the auspices of Inmarsat.	
TOPIC	**1997**	**2001**
FRAMEWORK	Progressively emerging. Memorandum of Understanding (MOU) to facilitate the development of GMPCS.	No data available.
TECHNOLOGY	Satellite network to be operational in 2000. Mobile satellite telephony.	New ICO to launch satellite services in 2003. To provide global IP services, including Internet connectivity, data/voice/fax, and satellite-equivalent of 3G wireless, and wireless Internet.
AUDIENCES/TARGET MARKETS	Global. Individual and business users requiring access to mobile telephony in remote areas or where existing cellular networks are incompatible.	A range of markets, including oil and gas, maritime, aviation, transportation; governmental agencies; individual consumers; small and medium-sized businesses lacking adequate broadband or voice services.
COALITIONS/STAKEHOLDERS	Hughes Telecom, NEC, Mistsubishi Electric, Panasonic, Ericsson, Deutsche Telekom, Telstra, Beijing Marine Com., Merrill Lynch. Multilateral organizations and the private sector.	New group of international investors led by Craig McCaw. Telesdesic.
FUNDING	Substantial private equity placement. One of the largest private equity placement in the United Kingdom. 47 investors from 44 countries.	New ICO has backing of Craig McCaw who led a group of international investors to provide $1.2 billion to acquire the new ICO business in 2000.
POLITICAL RISK MITIGATION	Initial funding provided through equity private placement, including several major national telecom companies.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Illustrates how a variety of solutions can be made available for creating new transmission infrastructure on a global scale. This model is particularly difficult to duplicate, given specific history, scale and background.	

P. T. MITRA GLOBAL TELEKOMUNIKASI		
Indonesia – Asia http://www.telkom.co.id		
SYNOPSIS/OVERVIEW	A joint venture involving the expansion of telephone services on the island of Central Java using the build, operate and transfer model.	
TOPIC	**1997**	**2001**
FRAMEWORK	Removal of State-owned telecom monopolies. Changes in regulatory structure encouraging private sector participation. Private ownership of telecom assets allowed.	Ratified the WTO, APEC and AFTA agreements making the telecommunications service more competitive with the entry of regional and international competitors.
TECHNOLOGY	Installation of an additional 400,000 fixed telephone lines. Limited use of wireless telephony in remote rural areas. VSAT wireless telephony.	Cellular phone connections –over 2 million users by end of 1999. Fixed wire lines have increased 17 per cent/yr. Soon to offer IP Services, including voice.
AUDIENCES/TARGET MARKETS	Inhabitants of Central Java currently with minimal access to telephony services.	Inhabitants of Central Java.
COALITIONS/STAKEHOLDERS	NTT, Telstra, Deutsche Bank, Lucent, Widya Duta Infotel, P.T. Indosat, Sumitomo and Itochu Corporation. International banks, funding agencies and export credit agencies.	Current partners include: Alcatel, Ericsson, Gilat Satellite Networks LTD., NEC, Japan Radio Co.
FUNDING	BOT–style project financing arranged by a syndicate of more than 20 banks.	No data available.
POLITICAL RISK MITIGATION	Export credit cover from Japanese Export-Import Bank plus strong contingent equity support from two major telecom companies.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Impressive broadening of telecommunications services. Demonstrates that a highly complex coalition of resources can be mobilized to build, finance and operate a telecommunications project in one of the least developed (very low teledensity) part of the world. Aggressively pursuing global partnerships.	

SUNSAT South Africa – Africa http://sunsat.ee.sun.ac.za/		
SYNOPSIS/OVERVIEW	The first satellite to be developed and launched by an African State. It was developed at Stellenbosch University in South Africa. SUNSAT was launched on 23 February 1999.	
TOPIC	**1997**	**2001**
FRAMEWORK	No data available.	No data available.
TECHNOLOGY	Satellite. Scheduled for launch in early 1996, delayed until August 1997.	Launched in 1999 on a Delta II Launch Vehicle. Payloads include NASA experiments, Radio Amateur communications, a high-resolution imager, precision attitude control and school experiments.
AUDIENCES/TARGET MARKETS	Academic community in Southern Africa.	Academic community in Southern Africa.
COALITIONS/STAKEHOLDERS	Stellenbosch University, NASA, Surrey University. Cooperative venture, innovative partnerships with cross-geographical divides.	No data available.
FUNDING	Funding by Stellenbosch University with support from private industry in South Africa and indirectly from NASA.	No data available. Programme still has multiple donors.
POLITICAL RISK MITIGATION	Indirect South African and United States government involvement.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	SUNSAT is an innovative approach to providing new transmission infrastructure facilities. The coalition of resources involved includes public sector support, funding from the private sector in South Africa and direct support from NASA.	

TELEFONICA PERU Peru – Latin America www.telefonica.com.pe		
SYNOPSIS/OVERVIEW	Privatization of the principal public telephone operator in Peru, involving the sale of an initial strategic stake in Telefónica and the subsequent public flotation of the company.	
TOPIC	**1997**	**2001**
FRAMEWORK	Privatization of the State-owned telephone company. Significant private sector involvement in telecom.	Same.
TECHNOLOGY	Extensive modernization of existing network and increase in teledensity. Fixed wireless telephony. Additional services: cell and cable.	Started deploying ANTEC's RF amplifiers in an effort to bring advanced, two-way services to its more than 250,000 subscribers in 1999.
AUDIENCES/TARGET MARKETS	Population of Peru, which has one of the lowest teledensities in Latin America.	As of 1997, the teledensity in Peru was around 5.9 per cent per 100 or double that of 1994.
COALITIONS/STAKEHOLDERS	Telefonica, Goldman Sachs, JP Morgan, NM Rothschild. Complex forms of public/private sector partnerships on a transnational basis.	Minority share of State ownership of Telefónica is to be phased out over the next few years and to be sold to private investors.
FUNDING	Sale of 35 per cent interest for $2 billion, followed by public flotation with United States listing and bond placing in the United States and Peru.	No data available.
POLITICAL RISK MITIGATION	Public, flotation in Peru, strategic investment by Telefónica (Spain) and an international investor base.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT & CURRENT STATUS	One of the most successful privatizations of its kind. Telefónica Peru appears to be on course to achieve its target of 10 lines per 100 by the year 2000 (as of 1997). Demonstrates that successful privatization programmes depend on a broad coalition of resources that include active participation by international investors. Has exceeded performance standards to which it committed.	

CASE EXAMPLES: EDUCATION

SchoolNet, 3PSD and Telecampus
Canada

DTUWI
West Indies

QuipuNet
Peru

Enlaces
Chile

DECHHP & WCSN
South Africa

TDCC& INFLIBNET
India

UPOU
Philippines

VCOLUI
Indonesia

DISTANCE EDUCATION AND CHILD HEALTH FOR HEALTH PROFESSIONALS		
South Africa and Canada – Africa and North America		
http://www.healthlink.org.za		
SYNOPSIS/OVERVIEW	Doctors, nurses and other health professionals are provided access, via the Internet, to study materials and tutors in a child health degree programme. Programme with a global reach with implementation in several countries.	
TOPIC	**1997**	**2001**
FRAMEWORK	ICT emerged as a suitable delivery mechanism during the project development process. An existing NGO–SatelLife–targets expansion of access to online services for health organizations.	No data available.
TECHNOLOGY	Store and forward system for e-mail and web searches.	No data available.
AUDIENCES/TARGET MARKETS	Practising healthcare professionals.	Practising healthcare professionals.
COALITIONS/STAKEHOLDERS	University of British Columbia, BC Institute of Technology and University of Cape Town, Canadian Government, Healthnet (NGO).	Health trust systems.
FUNDING	Healthnet, schools involved, Bilateral assistance, Telcos, ISPs, students.	No data available.
OPERATING COSTS	Schools involved, Healthnet, student fees.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Highly expandable and replicable project.	

DISTANCE TEACHING AT THE UNIVERSITY OF THE WEST INDIES

West Indies – Caribbean

SYNOPSIS/OVERVIEW	Audioconferencing and other technologies to support distance learning. The programme equips 27 sites in 16 countries with conferencing facilities, print materials and computer software for credit and non-credit courses.	
TOPIC	**1997**	**2001**
FRAMEWORK	Distance education has been tested for more than two decades, and ICTs are an integral part of the university's strategic plan.	No data available.
TECHNOLOGY	Dedicated phone lines between distance educations centres that link PCs with telewriter software and voice. The centres also have computer laboratories that are to be connected via a WAN. Software development.	No data available.
AUDIENCES/TARGET MARKETS	Students enrolled in post-secondary credit and non-credit courses in a wide range of subject matters.	No data available.
COALITIONS/STAKEHOLDERS	Early support from USAID. Carribean Development Bank, University of the West Indies, Telcos.	No data available.
FUNDING	Schools involved, private sector, bilateral organizations, Telcos, ISPs, IFI, student fees and technical assistance.	No data available.
OPERATING COSTS	University operating budget and student fees.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	UWI has been able to access an impressive array of financial and in-kind resources for special projects from multiple donor agencies, foundations, IFIs, broadcasters and telecommunication carriers. A one-day seminar using the teleconference system cost just $1,000, compared with more than $11,000 for a face-to-face programme.	

ENLACES		
Chile – Latin America http://www.enlaces.cl/		
SYNOPSIS/OVERVIEW	Enlaces aims to establish Internet services for all secondary and 50 per cent of primary schools by the year 2000 as well as developing suitable learning resources.	
TOPIC	**1997**	**2001**
FRAMEWORK	School reform programme aims at improving primary and secondary levels. Telephone carrier and ISPs pay special attention to the sector.	Same.
TECHNOLOGY	Computer laboratories in all schools with 80 per cent PCs and 20 per cent Mac. E-mail, bulletin board and increased Web access, modems, printers. Software development.	Two years of technical support are provided to participating schools.
AUDIENCES/TARGET MARKETS	Primary and secondary schools.	Primary and secondary schools.
COALITIONS/STAKEHOLDERS	Government of Chile, municipalities, universities, World Bank, private sector, Apple Computer, participating schools.	No data available.
FUNDING	Government, participating schools, universities, private sector, Telcos and ISPs, IFI.	No data available.
OPERATING COSTS	Under discussion, schools and municipalities.	$ 5,880 for a small school (<100 students) to $20, 932 for a large school (100-300 students), with $78/student spent on small primary school level. Large schools cost $21/student. Hardware is 70 per cent of the budget.
ROLE OF END-USERS	No data available.	Evaluation studies. Evaluate the impact of ICTs on education by means of tests and surveys given to students and teachers.
ASSESSMENT	Begun in 1993, as an experimental pilot programme, it had as of 1996 managed to build a network among some 180 primary and 62 secondary schools. Highly successful use of coalitions of resources.	

GRASSROOTS & COMPUTERS FOR SCHOOLS PROGRAMMES (SchoolNet)
Canada – North America
http://xinfo.ic.gc.ca

SYNOPSIS/OVERVIEW	Promotes use of on-line services for schools and community facilities. Activities include education resources Web site and soliciting of business contributions. One of project's aims is to collect and distribute government and surplus computers. The GrassRoots Programme and its partners promote academic, employability and computer skills in youth by integrating ICT into learning.	
TOPIC	**1997**	**2001**
FRAMEWORK	The Canadian Government has identified ICT use and literacy as one of the major stepping-stones towards future economic well-being.	Same.
TECHNOLOGY	Internet access and software development.	Same.
AUDIENCES/TARGET MARKETS	Primary and secondary schools.	Primary and secondary schools. Project reached 750,00 students at the end of 1999.
COALITIONS/STAKEHOLDERS	Federal and provincial Governments, private sector, voluntary organizations, schools involved.	No data available.
FUNDING	NGOs, federal and provincial Governments, schools involved, private sector.	In 1998, Microsoft Canada became Founding Partner with $1 million worth of support. AOL Canada also founding partner.
OPERATING COSTS	Schools, provincial Government and corporate contributions.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	The coalition of resources involved has been successful. May not be replicable in a developing economy. Programme has received worldwide recognition. By 31 March 2001, SchoolNet will have helped encourage educators and their students to create 20,000 on-line projects.	

<table>
<tr><td colspan="3" align="center">INFLIBNET INFORMATION AND LIBRARY NETWORK
India – Asia
http://www.inflibnet.ac.in/</td></tr>
<tr><td>SYNOPSIS/OVERVIEW</td><td colspan="2">INFLIBNET offers Intranet capacity among university libraries to share holdings and resources, and promotes the digitization of new and existing holdings. Major activities include library automation, database creation, software development, human resources development, information services and networking.</td></tr>
<tr><td align="center">TOPIC</td><td align="center">1997</td><td align="center">2001</td></tr>
<tr><td>FRAMEWORK</td><td>High-level support at time of initiation has waned at times.</td><td>No data available.</td></tr>
<tr><td>TECHNOLOGY</td><td>Satellite-based Intranet-type service with satellite terminals on university campuses provides Internet access.</td><td>Same.</td></tr>
<tr><td>AUDIENCES/TARGET MARKETS</td><td>Academic libraries, R&D institutions and information resources.</td><td>Same.</td></tr>
<tr><td>COALITIONS/STAKEHOLDERS</td><td>University Grants Commission (UGC), academic libraries, R&D institutions and information resources.</td><td>Same.</td></tr>
<tr><td>FUNDING</td><td>Schools and universities involved</td><td>Same.</td></tr>
<tr><td>OPERATING COSTS</td><td>INFLIBNET.</td><td>Same.</td></tr>
<tr><td>ROLE OF END-USERS</td><td>No data available.</td><td>No data available.</td></tr>
<tr><td>ASSESSMENT</td><td colspan="2">Has increased awareness of electronic media and research information management in the academic community, as well as for librarians and R&D institutions.</td></tr>
</table>

PUBLIC-PRIVATE PARTNERSHIP IN SCHOOL DESIGN
Canada – North America

SYNOPSIS/OVERVIEW	Partnership of several private companies that design, construct and own technology-rich new schools. School boards lease the facilities and retain control of the curriculum.	
TOPIC	**1997**	**2001**
FRAMEWORK	Government interest to partner with private companies for the construction and operation of technology-rich schools.	Same.
TECHNOLOGY	Computers in all learning areas, full Internet access in all classrooms, and TV monitors in all hallways and classrooms.	Same.
AUDIENCES/TARGET MARKETS	Primary, secondary and technical schools.	Nova Scotia has built 55 schools using the public-private partnership (P3) model.
COALITIONS/STAKEHOLDERS	Consortium of companies, government and schools involved.	No data available.
FUNDING	NGOs, government, schools involved and private sector.	No data available.
OPERATING COSTS	Schools involved and private sector.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Programme has been successful, especially in Nova Scotia, and has attracted international attention. Public-private partnerships provide exciting prospects and potential pitfalls. Relations between partners are innovative, efficiencies can be realized, and mutual goals attained. These partnerships can also result in some loss of control of educational institutions.	

QUIPUNET		
Peru – Latin America		
http://tumi.cis.gsu.edu/quipunet/English/Welcome.html		
SYNOPSIS/OVERVIEW	QUIPUNET raises resources worldwide to support education in Latin America with emphasis on Peru, including donations of books and computers. A grassroots, "virtual" organization, made up of Peruvian volunteers all over the world whose goal is to support access to Spanish-language educational resources. Links its website pages to Spanish education sites. Started in 1995.	
TOPIC	**1997**	**2001**
FRAMEWORK	Official links to in-country policy are not apparent.	No data available.
TECHNOLOGY	A website with self-study courses, computers and modems.	No data available.
AUDIENCES/TARGET MARKETS	Students and learners at all education levels.	No data available.
COALITIONS/STAKEHOLDERS	Volunteers, private sector, American university (San Francisco State University?)	No data available.
FUNDING	NGO (QUIPUNET), private sector.	No data available
OPERATING COSTS	QUIPUNET.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Important role played by volunteers. Last website update seems to have taken place in 1997.	

TELECAMPUS FOR POST-SECONDARY LEARNING
Canada – North America
http://telecampus.edu/

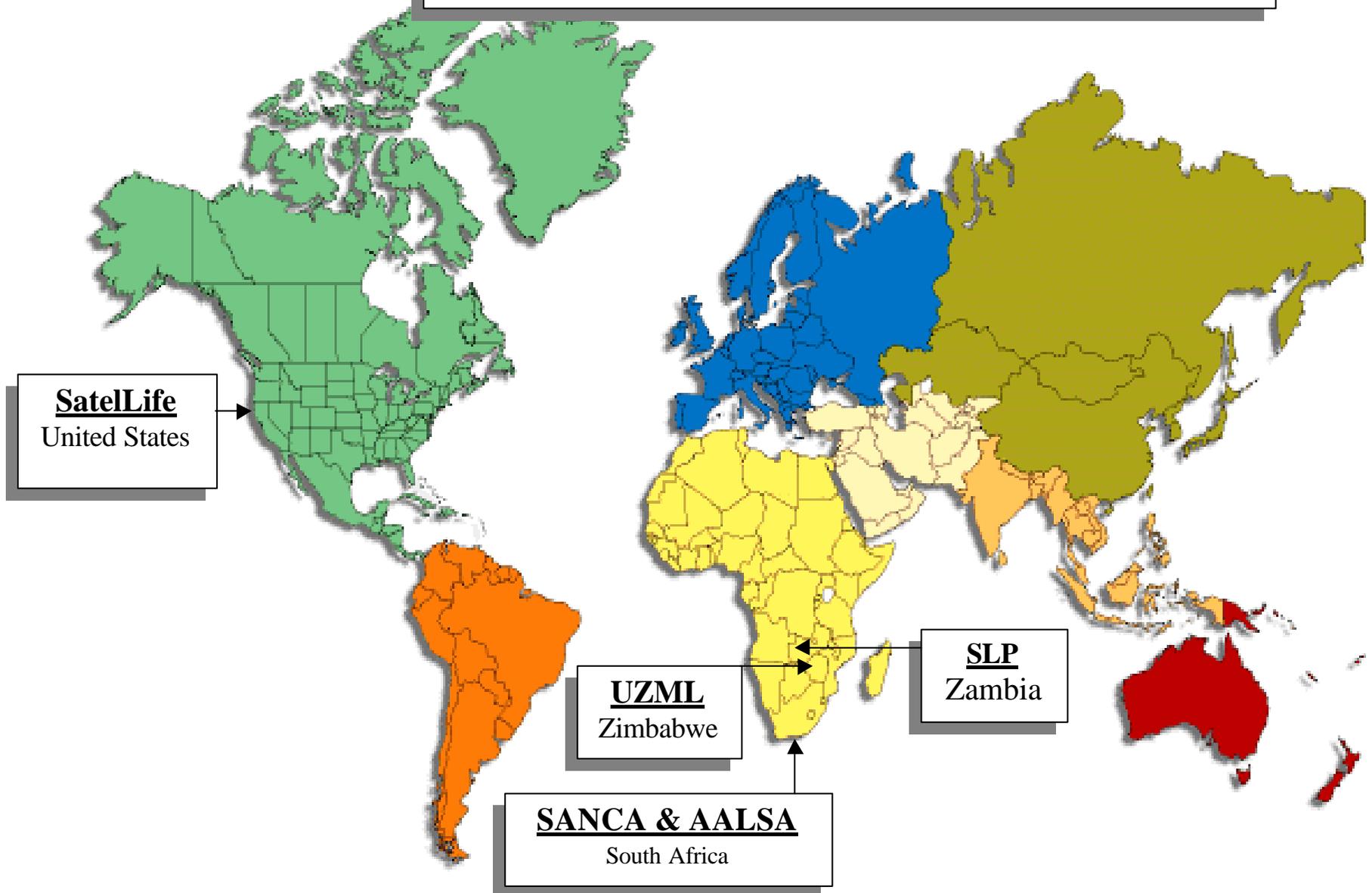| SYNOPSIS/OVERVIEW	TeleCampus is accessible from anywhere with an Internet connection, for students as well as for course originators, or for courseware developers. The development and marketing of the locally developed courses is an integral part of the project.	
TOPIC	**1997**	**2001**
FRAMEWORK	ICT is seen as essential to industrial growth as well as educational development in this area, which has traditionally relied on resource-based industries.	Same.
TECHNOLOGY	Web-based learning environment with systems including student records, student support and competency-based testing.	Same.
AUDIENCES/TARGET MARKETS	Post-secondary students taking credit and non-credit courses.	Same.
COALITIONS/STAKEHOLDERS	New Brunswick Government, private sector and schools involved.	Same.
FUNDING	New Brunswick Government, schools involved, private sector, and student fees.	No data available.
OPERATING COSTS	No data available.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Project has attracted worldwide attention. Dual mission of education and industrial development. Initiative is being used to seed the development of small private sector learning technology companies. Over 200 companies have grown out of the programme to date.	

TRAINING & DEVELOPMENT COMMUNICATIONS CHANNEL FOR CONTINUING & PROFESSIONAL EDUCATION (TDCC)

India – Asia

TOPIC	1997	2001
SYNOPSIS/OVERVIEW	TDCC offers a business television satellite infrastructure for organizations with dispersed training needs. The aim is to consolidate. Different education and training requirements onto one channel to achieve savings and share investments in the ground infrastructure. Launched in 1995.	
FRAMEWORK	Result of two decades of testing by Indian Space Research Organization (ISRO).	No data available.
TECHNOLOGY	Satellite-based one-way video, two-way audio network with two fixed uplinks and studios and with 225 receiving sites in 1997.	Plans to upgrade satellite to digital. Planning use of digital video. 250 sites as of 08/1998. Efforts also initiated to introduce new technologies in TDCC network by phases.
AUDIENCES/TARGET MARKETS	Professional and continuing education students, professional trainees for large and dispersed organizations.	Several Indian states are planning to use TDCC to reach women and masses in remote villages.
COALITIONS/STAKEHOLDERS	ISRO, India Open University, schools involved, private sector.	Same.
FUNDING	Schools involved, private sector.	No data available.
OPERATING COSTS	Customers' and users' fees.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	TDCC has seen extensive use. Satellite system can reach a large number of people spread over large distances. Such systems can become cost-effective if the infrastructure is used by a large number of users. Requires a great deal of systems management and coordination.	

UNIVERSITY OF THE PHILIPPINES OPEN UNIVERSITY (UPOU)
Philippines – Asia
http://www.upou.org/

SYNOPSIS/OVERVIEW	UPOU is developing two initiatives–computer science and Philippines culture that will use online delivery. In support of the initiative, UPOU has undertaken a series of staff training courses related to designing on-line courses and developing audio-visual materials. Launched in 1995.	
TOPIC	**1997**	**2001**
FRAMEWORK	UPOU mandate to democratize access to post-secondary education.	The Telecommunications, Information Technology and Telehealth Network (TITAN) project was initiated in 1998.
TECHNOLOGY	Computers and on-line services.	Same.
AUDIENCES/TARGET MARKETS	Post-secondary and professional education students.	Health-care sector.
COALITIONS/STAKEHOLDERS	University of the Philippines, Canadian and United Kingdom institutions (Simon Frazier University and UK Open University).	No data available.
FUNDING	University of the Philippines, bilateral organizations, student fees, technical assistance.	No data available.
OPERATING COSTS	University of the Philippines and student fees.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Not able to assess owing to lack of data.	

VIRTUAL CAMPUS OPEN LEARNING UNIVERSITY UNIVERSITAS TERBUKA (UT)		
Indonesia – Asia http://www.ut.ac.id		
SYNOPSIS/OVERVIEW	The virtual campus of UT is testing the use of real-time, on-demand ICT-based access to UT's educational resources supplementing text and tutor-based service for about 400,000 students.	
TOPIC	**1997**	**2001**
FRAMEWORK	Government policy is emphasizing educational applications of new infrastructure development.	Same.
TECHNOLOGY	E-mail for messages and conferences, summaries of course materials on the website, and radio and television broadcasts.	Mobile telephony.
AUDIENCES/TARGET MARKETS	Students enrolled in post-secondary and teacher upgrading programmes.	University students located in remote areas, private sector professionals, and government Employees.
COALITIONS/STAKEHOLDERS	Universitas Terbuka, telephone carrier, Indonesian, Canadian, Australian and United States Governments.	No data available.
FUNDING	Universitas Terbuka, private sector, bilateral assistance, telcos and students	Government of Indonesia, PT Telekom and PT Post Indonesia, contributions from students.
OPERATING COSTS	Universitas Terbuka, student fees.	Same.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Virtual campus project currently has three locations. Project has moved beyond pilot stage and has seen some improvements. A complex international coalition of resources has been used in the planning phase of the project. For both implementation and operation the coalition is made up of Indonesian institutions only.	

WESTERN CAPE SCHOOLS' NETWORK
South Africa – Africa
http://www.wcape.school.za

SYNOPSIS/OVERVIEW	A school association dedicated to networking 150 schools (out of 1,500 schools to be connected) to the Internet. Schools have focused on website development as a basis for becoming knowledgeable users and contributors to the Internet. Primary and secondary education.	
TOPIC	**1997**	**2001**
FRAMEWORK	Internet support strategy from the Department of Education and carrier involved. Post-apartheid government funding gives low priority to ICTs.	Produced complete system integrated Pegasus Mail, UUPC and Usenet newsreader.
TECHNOLOGY	Internet access, E-mail, and websites	Same.
AUDIENCES/TARGET MARKETS	Primary and secondary schools donors and collaborators are being approached.	Same.
COALITIONS/STAKEHOLDERS	Member schools and a foundation that supports part-time administrative and technical positions.	Same.
FUNDING	NGO, Government, schools involved. Schools finance materials and development as well as hardware.	Same.
OPERATING COSTS	Schools through membership fees.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	The organization is very cost-efficient. Self-funding may have reached its limits. Expanding network to disadvantaged schools not possible through this model.	

CASE EXAMPLES: HEALTHCARE

SatelLife
United States

SLP
Zambia

UZML
Zimbabwe

SANCA & AALSA
South Africa

ALLERGY SOCIETY OF SOUTH AFRICA (AALSA)
South Africa – Africa
http://allergysa.org/index.html

SYNOPSIS/OVERVIEW	Network that offers allergy information both to the general public and to health-care professionals. AALSA is planning to extend the programme to include more interactive information about specific allergy issues.	
TOPIC	**1997**	**2001**
FRAMEWORK	No data available.	No data available.
TECHNOLOGY	Web site	Web site
AUDIENCES/TARGET MARKETS	General public and health-care professionals.	General public and health-care professionals
COALITIONS/STAKEHOLDERS	Allergy Society of South Africa, pharmaceutical companies, general public and health professionals.	Allergy Society of South Africa, pharmaceutical companies, general public and health professionals.
FUNDING	Pharmaceutical firms.	Pharmaceutical firms.
OPERATING COSTS	website maintenance.	Website maintenance.
ROLE OF END-USERS	No data available.	Peer-reviewed website.
ASSESSMENT	Pharmaceutical funds have diminished, so that the site has not been active and maintained as it was in its early stages. AALSA has not employed a full-time person to continue managing the site. The site is not frequently updated. It still has around 12,000 visitors per month.	

SOUTH AFRICAN NATIONAL COUNCIL ON ALCOHOLISM AND DRUG DEPENDENCE		
South Africa – Africa		
http://wn.apc.org/sanca/		
SYNOPSIS/OVERVIEW	SANCA provides a series of programmes addressing the development, prevention and treatment of alcohol and other chemical addictions. It acts as a national umbrella organization consisting of 32 societies. Its Internet-based information programmes offer access to a library specializing in addiction treatment. Serves mostly South Africa. Provides services to countries as far as Liberia.	
TOPIC	**1997**	**2001**
FRAMEWORK	No data available.	National Drug Master Plan adopted in 1998. Makes provision for establishment of national database of substance abuse material.
TECHNOLOGY	Internet and databases.	Internet and databases. Pentium computers, software development, website (SANgonet is the ISP).
AUDIENCES/TARGET MARKETS	SANCA clinics and general public.	SANCA clinics, students, scholars, parents, community members, private sector, authors/ textbook developers, journalists, government, research organizations.
COALITIONS/STAKEHOLDERS	SANCA members and others.	National management board, Department of Welfare, SALIS Listserv (Substance Abuse Librarians organization), local library organizations.
FUNDING	Membership fees and other sources.	Membership fees, Department of Welfare subsidy, donations, UNDCP research projects.
OPERATING COSTS	No data available.	Salaries, computer licence fee (both for ISP & ILIS3 Software), journal subscriptions.
ROLE OF END-USERS	No data available.	No involvement.
ASSESSMENT	Large increases in user constituency. SANCA has submitted a project proposal on the establishment of the National Clearinghouse on Substance Abuse in South Africa.	

SATELLIFE – HEALTHNET United States – North America www.healthnet.org		
SYNOPSIS/OVERVIEW	SATELLIFE applies Internet, satellite, and phones to needs of developing countries through global computer-based communications network, HealthNet. Its mission is to improve health by enhancing exchanges of information in the areas of public health, medicine and the environment through better connectivity. Special emphasis on areas where access is limited. HealthNet programmes in 28 countries.	
TOPIC	**1997**	**2001**
FRAMEWORK	Various owing to the global nature of the programme.	Various owing to the global nature of the programme.
TECHNOLOGY	Satellite, telephone, Internet and radio. Store-and-forward link to the Internet. GetWeb Web to e-mail tool.	HealthNets have evolved from DOS to UNIX and from Fidonet protocol to UUCP and SMTP. HealthNet Nepal evolved into full-fledged ISP.
AUDIENCES/TARGET MARKETS	Public health, medicine and environment professionals worldwide.	Same. Actual size of audience to be determined by an independent evaluator in 2000-2001.
COALITIONS/STAKEHOLDERS	NGOs, Governments, bilateral and multilateral agencies, private sector, HealthNet partners in Asia, Africa and Latin America.	Same.
FUNDING	NEC, private donors, foundations, bilateral agencies and contractual projects, IDRC and WHO grants.	Collective technologies, Panamax.
OPERATING COSTS	SatelLife and HealthNet partners.	Some HealthNets have achieved or will soon achieve complete independence from SatelLife.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Efforts heavily concentrated on Africa. Over 2,700 health professionals receive e-mail information through local HealthNets. An additional 8,000 health professionals subscribe to the organization's information services.	

SISTER LIBRARY PROGRAMME		
Zambia – Africa		
Www.zamnet.zm/zamnet/health		
SYNOPSIS/OVERVIEW	Connects the U. of Florida Science Health Center with the University of Zambia (UNZA) Medical Library. Programme allows users to access medical information at major United States health library. Programme began in 1992. Through a SatelLife project, UNZA obtained access to store and forward e-mail service.	
TOPIC	**1997**	**2001**
FRAMEWORK	No data available.	No data available.
TECHNOLOGY	E-mail, database access, CD ROM, Internet, website.	Internet access and speed much increased with addition of radio dish to the ISP. Project to network the School of Medicine.
AUDIENCES/TARGET MARKETS	Zambia healthcare community. Website is also accessible to anyone with Internet access. Health-care personnel in developing countries.	Same.
COALITIONS/STAKEHOLDERS	University of Florida, University of Zambia, Dreyfus Health Foundation, USIS, Zamnet (ISP affiliated with the University).	Same.
FUNDING	Dreyfus Health Foundation Grant Fund, University of Florida, volunteers, USIS, USAID.	Hardware donations. Fogarty Institute grant for training in medical informatics at the University of Florida.
OPERATING COSTS	No data available.	Internet access and cost incurred by the University of Florida.
ROLE OF END-USERS	None.	In 2000 a "users' survey" of the website was conducted by The U of F to help with the redesign and emphasis of the website.
ASSESSMENT	Coalition of resources could be replicated in similar contexts. Sister library programmes well established. Lack of hardware at the UNZA medical library is obstacle to the project. ISP is affiliated with the university and Internet access is reliable and cost-effective. Growth in use of website.	

UNIVERSITY OF ZIMBABWE MEDICAL LIBRARY
Zimbabwe – Africa

SYNOPSIS/OVERVIEW	Addresses the difficulty the University of Zimbabwe has had in financing the procurement and maintenance of its journal and book collections. The project also aimed to capture unpublished locally-produced health literature in a database. It also fed into the African Index Medicus database of unpublished health literature, produced by WHO.	
TOPIC	**1997**	**2001**
FRAMEWORK	No data available.	No data available.
TECHNOLOGY	CD ROM, databases, e-mail.	CD ROM, databases, e-mail. Started having reliable access to the Internet in 1999 thanks to WHO network.
AUDIENCES/TARGET MARKETS	Health-care professionals in Zimbabwe.	Health-care professionals in Zimbabwe.
COALITIONS/STAKEHOLDERS	University of Zimbabwe and health-care professionals.	University of Zimbabwe, health-care professionals and WHO.
FUNDING	No data available.	No data available.
OPERATING COSTS	No data available.	No data available.
ROLE OF END-USERS	No data available.	No data available.
ASSESSMENT	Project is currently inactive, lacking staff time and funds. However, use of CD-ROM database has increased from 4,000 searches a month in 1997 to 10,000 searches a month today. Member of HealthNet.	

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