UNCTAD

Evolving Knowledge Societies:

A practical source book for ICT development policies

Third draft

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6 April 2004

Content

Page no

Executive summary of best practices in ICT policy making

- There are few precedents of ICT best practice in policy making as country circumstances vary and technology development is rapid.
- If used effectively ICT is a unique and powerful policy tool. Its applications in healthcare, education, agriculture and public information are manifold.
- ICT policy is most effective when it is integrated in other aspects of governance (eg health, education) and not a stand alone objective.
- Policy makers need to understand the mutual interdependencies between local ICT capacity building, ICT infrastructure, FDI in ICT industries and ICT trade.
- The promotion of bridging institutes to straddle academia, industry and public bodies are essential mechanisms for achieving sustainable ICT development.
- The best ICT policies are formulated by a wide range of public and private stakeholder interest groups inside and outside the country that should include leading TNCs in ICT.
- Policy makers can now use modern risk analysis software tools to manage the complex stakeholder negotiations in policy setting and depoliticize decision making.
- Flagship catalyst projects such as Dubai Internet City can be used to leapfrog the ICT development process, achieve quick wins and buy time to overcome infrastructure deficiencies.
- The most realistic ICT policies focus on broad policy goals such as poverty reduction, computers in every classroom, growth of ICT labour force rather than highly prescriptive initiatives. Such prescriptive initiatives risk obsoletion as technology marches

forward, which can be illustrated by the quickly increas ing use of open source software.

- Donor aid should be used creatively, not only to acquire equipment, but foremost to promote training and understanding of the tools and potential of ICT.

Introduction

The first phase of the World Summit on the Information Society held in Geneva in December 2003 emphasised the great potential of Information and Communication Technologies (ICTs) for sustainable development in developing countries. ICT potential for sustainable development has been further increased by major developments such as the internet and e-applications (e-government, e -health, e-education, e-commerce, etc).

To exploit ICT for sustainable development is a huge challenge. Many hurdles have to be taken before the full potential of ICT can be realised. To be effectively removed, these hurdles have to be addressed by dedicated national ICT policies. This publication, initiated by the Commission on Science and Technology for Development (CSTD), aims to be of assistance in developing such national ICT policies. It places the development of ICT policies in its context and attempts to clarify aspects of its complexity. This publication should be regarded as a supplement to the "Knowledge Societies: Information Technology f or Sustainable Development", published by the CSTD in 1998. The Knowledge Societies book contains comprehensive guidelines for national strategies on information and communication technologies.

Many countries have already developed national strategies that make innovative use of ICT for development1 . Patterns of successful ICT policies for sustainable development emerge. In this publication we discuss these patterns in the context of the Millennium Development Goals (MDGs), the common vision for sustainable development. However these patterns have to be treated with care as we are still in the early stages of learning how to use ICT to achieve the MDGs2 .

The World Summit on the Information Society in Geneva recognized that science has a central role in the development of the Information Society. The Declaration of Principles said “Many of the building blocks of the Information Society are the result of scientific and technical advances made possible by the sharing of research results”. Therefore we pay particular attention to the role which science and technology can play in ICT for sustainable growth.

Since 1998 common entry points for ICT policies have emerged, with a focus on education, health and governance sectors3 . Malaysia, for example, sees ICT as both an incentive and means of reforming its schooling system, while reaching the broader community through its youth. Mali has made use of ICT in several telemedicine projects that share advanced expertise and case studies across remote areas of the country and abroad with Swiss organisations. In education, healthcare and e-governance, Bolivia has emphasised the importance of public access and developing locally relevant content, driven by communities themselves.

This publication attempts to reveal what we can learn from these and other country cases on how to develop ICT policies. It provides concrete policy options, with a view to assist policy makers in formulating national ICT strategies and to restructure their science and technology institutions to meet the needs of "knowledge societies", including the setting up of new institutio ns.

The first chapter familiarises the reader with current ICT policies. It discusses the sophistication level of ICT policies, their social relevance and the main technical factors.

The second chapter emphasises the importance of the involvement of many relevant local stakeholders in the ICT policy making process. The need for innovative models for ICT policies is discussed, especially in the context of the technological base, quickly developing in favour of sustainable development. The need to develop such models in close co-operation between universities, research institutes and private industry is clarified.

The third chapter provides case studies from each continent, and draws ICT policy lessons to be learned. The case studies are followed by an overview in the fourth chapter of lessons to be learned from existing ICT policies and insights from innovation management. The fifth and last chapter contains main options for ICT policy development.

Recognising that ICT policy development is a very broad issue, this publication can not be all inclusive.

Understanding ICT policies

Understanding existing ICT policies is a prerequisite to understanding the elements which contribute to successful ICT development. Questions which immediately rise are: Can one distinguish levels of ICT policies? Do these policies follow the lines of level of income? And are there patterns of ICT policies to improve income? The answers to all these questions are positive.

Basically one can distinguish 5 levels of ICT policies and each level correlates with an income level of a country. At first sight, such a correlation suggests that each income level has its own ICT policy. But fortunately another pattern reveals that a high governmental involvement in ICT policy can make contributions to a country in its attempts to move from one in come level to the next4 . In this chapter, the 5 existing ICT policy sophistication levels and the characteristics of ICT policies which allow a country to make the transition from one level to the next are discussed. In these transition oriented ICT policies it becomes clear that ICT policies should not be viewed in isolation from other pressing issues.

The methods for measuring ICT development, introduced by UNCTAD in conjunction with the Commission on Science and Technology for Development (CSTD) are also discussed.

Existing policy levels

The five levels of ICT policy development considered here are based upon an interpretation of the work of the infoDev project of the World Bank in the Information Technology Report 2003-2004 of the World Economic Forum.
At the first level, ICT policies are largely based upon government control of telecommunication. In these countries, there is a strong state telecommunication monopoly. However, many governments have opened their telecoms monopolies to the private sector and have privatised their state-owned telecom companies. That brings governments to the second level of ICT policy s ophistication where they are concerned with creating an ICT enabling framework, a regulatory framework in which fair competition is the main driver. This is b ecause there is widespread evidence that fair competition policies improve the development of infrastructures and services and lowers consumer prices. The third level of ICT policy sophistication is a consequence of general shortage of ICT knowledge workers. A reactive ICT policy is needed to bring the amount of ICT workers up to the level perceived necessary and a more pro-active approach leads to a surplus of ICT workers which attracts foreign investors to invest in the country. The fourth level of ICT policy sophistication comes from the understanding that ICT is able to lead all other developments in a country and at the same time, most international developments are affected by ICT. At the fifth and highest level of ICT policy sophistication, the government sets up demonstration projects in education, health and public services to enable public participation in technology at an early stage.
The first level of sophistication: developing infrastructure
At the first level of ICT policy, countries are typically installing ICT infrastructure by state-owned telecom companies. These countries are characterized by their production of ICT equipment in state-owned companies and publicly finance R&D, with linked private R&D. They do not cope with the fast pace of ICT developments and do not take advantage of them. Many of these countries are preoccupied with urgent and basic needs for food, health and education. Some of these countries do not possess electricity networks, especially in remote areas.
Enabling regulatory framework
Evidence shows that countries that set-up a liberal, strong, but regulatory framework for telecoms competition have improved their level of income per capita to above $10,000 (at 2001 level). These countries like Slovenia, Greece and Portugal are building on a sustainable environment for ICT development. Turkey is working to join this group. These countries acknowledge that privatisation and market forces are necessary to reach a higher welfare level.
The regulatory framework in these countries deals with various areas which directly affect the way information and communication technologies can be used. The regulatory framework should enable competition in telecommunication in ord er to get consumer prices down and thereby accessibility of ICT data and information exchange up.
With the introduction of market forces, the markets should be regulated to guarantee a fair competition. Therefore, regulations are set up for electronic transactions, to enable commerce through ICT. For e-commerce, the pricing and taxation of electronic services are regulated. They and other ICT services are protected from hackers and other cyber threats like viruses and worms through network and computer security measures. To stimulate the development of ICT industries trade policies for ICT-related goods and services are introduced. And industry’s intellectual property is protected by copyright laws.
Laws are stipulated to protect ICT users against content which is indecent, obscene, false, menacing or offensive in character. Personal data of the users is also protected in data protection regulations.
The use of ICT is further stimulated by the adoption of standards in order to increase access to ICT and the inter-operability of ICT tools. Special measures are taken to protect cultural and linguistic diversity.

Table 1:

Area to be regulated	Relevance to ICT
Telecommunication	Enabling competition in telecommunication to get consumer prices down and thereby accessibility of ICT data and information exchange up
Electronic transaction	Enabling commerce through ICT, normally described as e-commerce by means of pricing and taxation of electronic services
Network and computer security	Protection from hackers and other cyberthreats
Content	Protection against content which is indecent, obscene, false, menacing or offensive in character
Intellectual Property Rights (IPR)	Protection of copyrights, including computer software
Data protection	Protection of privacy of personal data
Development of ICT industries	Trade policies for ICT-related goods and services
Cultural heritage	Protection of cultural and linguistic diversity
Standards	Adoption of standards in order to increase the access to ICT and the interoperability of ICT tools

Source: OCO Consulting

Education promotion

Governments which see education as an important ICT priority are preparing their country for the future, rather than focusing only on short term solutions and goals. They acknowledge that it is necessary to develop a computer literat e and ICT savvy workforce. These governments understand the challenge to educate students at all levels of education (primary, secondary and tertiary education) and to train experienced people in dealing with ICT. Common measures in ICT education promotion include installing computers, making Internet acces s available at schools, installing LAN linking classrooms at schools, implementing teacher trainings, and developing computer based learning for schools, etc.

Countries such as Estonia and India have educated far more people in ICT than what one would expect necessary for their own local economy. By educating a surplus, they have created a top ranking location for multinational companies to invest in their country. Other countries like Algeria and Lebanon also have a huge surplus in ICT workers, with at least 50% of ICT graduates leaving their country to work overseas, primarily in the huge ICT sector in the USA but also in countries like France and Canada. The challenge for countries like Algeria and Lebanon is to improve the attractiveness of their ICT environment, so that the multinationals invest in their country, instead of experiencing labour migration.

Making ICT high priority

When ICT becomes not just one of the many policy issues in a country but is brought higher on the national agenda, a country reaches the next level of policy-making. At that level ICT policy making between various ministries (telecommunication, industry, technology, media etc.) is coordinated to reach the highest impact possible. At this level ICT policies are designed at the highest political level. In addition, dedicated bodies, like councils and task forces, are formed to provide strategic advice to further develop the ICT policy, to monitor progress in implementation and to advice on specific measures to be taken. In several countries like Malaysia and the Philippines, dedicated Agencies have been formed to implement the ICT policies.

An important issue at this level of ICT policy making is compliance with international regulations set by the ITU (International Telecommunications Union), the ICANN (Internet Corporation for Assigned Names and Numbers, the W3C (World Wide Web Consortium), the WIPO (World Intellectual Property Organisatio n), the WTO (World Trade Organisation) and the ISO (International Organisation for Standardisation).

Leading through example

Still at a higher level of ICT policy making the government is taking the lead in ICT developments. By applying ICT to all aspects of government, countries develop an integrated and deep-rooted ICT environment. This is often called e-government. The types of transactions involved not only depend on governments making electronic transactions available, but also on their acceptance by the general public. In 2002[5] the most popular government transactions in Europe on the Internet were sequen tial. These include library book search, job search, change of address, car registration, personal documents, income tax declaration and declaration to the police. Making these kinds of services available, renders the government more credible in its own ICT policy, which in turn improves the effectiveness of its ICT policy.

Moving up the policy sophistication level

Contrary to what one might expect, government involvement in ICT grows with income[6] and this involvement comes from a social rather than from a technical point of view. In recent years common entry points for ICT policies emerge, with a focu s on the education, health and governance sectors[7] . Malaysia, for example, sees ICT as both an incentive and means of reforming its schooling system, while reaching the broader community through its youth. Mali has made use of ICT in several telemedicine projects that share advanced expertise and case studies across remote areas of the country and abroad with Swiss organisations. In both these sectors and e-governance, Bolivia has underlined the importance of public access and developing locally relevant content, driven by communities themselves.

Effective ICT policies are not an end in themselves and can be embraced to tackle wider social issues of poverty, health and education. To illustrate the potential of ICT in helping to address other social issues, we discuss circumstantial evidence of the role ICT can play in areas like education, health, commerce and entertainment, commonly described as e-education, e-health, e-commerce, and e-entertainment.

E-education

In the Turkey Basic Education Programme, some 6000 basic education schools have been equipped with ICT classrooms since 1998. The aim of the programme is to e nhance the quality of the country’s basic education system by providing computer literacy to all teachers and students. Since the start of the project, the basic education enrollment in the country has been increased by 900,000 st udents.

The Turkish Programme is a good example of how e-education can be part of the solution to remove constraints in delivering education to the right people at the right time. Access to education material can be improved by providing education material through the internet, or making it available on a CD-ROM. Typically a CD-ROM can contain the content of a school library and such a CD-ROM can be made available for only a few dollars per copy. Education material is made widely available, while the costs of distributing it have been immensely reduced. In this way distance learning becomes a reality and people can be reached who had hitherto limited access to education.

Distance learning is particularly well suited to the developing world, where specialist teaching resources are scarce and teaching facilities are limited. Distance learning brings specialist teaching and high-quality teaching aides available to any student with access to a network terminal. Networking can be a major multiplier of limited educational resources. Traditionally there appears to have been an emphasis in aid projects towards e-education at primary schools, but e-education at secondary and tertiary education is of at least the same importance for sustainable development. For example during secondary education the usage of the internet can be taught, while in tertiary education the systems on which ICT is based can be explained.

Singapore has been one of the countries investing heavily in all levels of education. Singapore chose to transform its education system towards high-tech industry. The investment in the education system has resulted in higher technical skills among graduates and investment in training gave existing employees the capabilities to work in ICT industries. Thailand has somewhat neglected the relevance of secondary and tertiary education, based on the assumption that it should first of all develop the capabilities and skills to master imported technologies. This approach has been successful in the industrialisation of the economy, but has it drawbacks in taking advantage of ICT. Nowadays Thailand has a lack of indigenous capability to develop and produce ICT equipment.

Information and Communication Technologies are still in development. Even in the developed world the full potential of applications has not been reached, and it's hard to predict when saturation levels of ICT will be reached. Due to ICT, an on-going process of social change is still affecting the developed countries. In the beginning of 2004, the advanced communication possibilities of text messaging, especially popular among youngsters, and the rise of distributed computer applications like KaZaa are two important examples of this changing social behaviour. The lesson to be drawn is that it is not enough to be able to use such novelties, but it is also necessary to possess the indigenous skills to be able to develop and introduce new innovative applications.

ICT have a profound influence on tertiary or higher education. Where universities previously depended on expensive scientific journals, they can now use online journals such as ie arXiv.org. Online journals and online universit y libraries have both an important influence on tertiary education, as well as on high-tech industry. Such improved access to the latest insights in science and technology enables faster scientific exploration and faster adoption of the state-of-the-art technology in products and services.

E-health

E-health is making use of ICT in many different forms by providing information through health information websites, exchange of data to keep track of patient’s development and remote medical advice. E-health has the potential to support long distance clinical health care, patient and professional health-related education, public health and health administration. There may be further potential in the battle against HIV/AIDS through information dissemina tion. The World Health Organisation has set up the Health InterNetwork, sponsored by the UN, to create websites for hospitals, clinics and public health facilities in developing countries, to make high-quality information available and to facilitate communication in the healthcare community.

In Russia, a low cost solution connected the department of oncology of the St. Petersburg hospital to other similar specialised hospitals. Desktop computers, a server, internet access and an electron microscope with digital imaging equipment enabled physicians to e-mail digitalised images to other hospitals for consultation. That has improved the quality of the care and the success has led to more connections in the Russian Federation and Europe. It is a successf ul example of remote medical advice.

ICT improved the collection of health data in the Czech Republic and in Peru. In the Czech Republic, these data are used to improve the budget allocations for health and to allocate resource where it is most needed. In Peru, the data collection on outbreaks of selected diseases (eg cholera, dengue, malaria and polio) is significantly improved. Health officials in Peru are now able to react within days to outbreaks, instead of weeks.

Disease prevention or epidemic control can use ICT to disseminate medical information. In Cape Town, South Africa, SMS on mobile telephones was used to remind patients to take medicines. Patients suffering tuberculoses have a tendency to forget to take the medicaments which causes the treatment to fail. The SMS messages resulted in a nearly 100 percent success rate in taking the medication.

Still the innovations should allow e-health to become a wide spread phenomenon for the general public. The main obstacles for e-health to be of direct relevance to patients are privacy of medical information, internet prescription and ensuring quality of information. Patients would rather keep their heath in formation private from, for example, their employer. Online medication and prescription can increase the risk of maltreatment. Some unorthodox pharmacists offer medication on the internet, without any proper quality checks.

E-commerce

With the birth of the World Wide Web, e-commerce was one of the first fast spreading applications. Sites such as Amazon.com and eBay have become icons for the new technological revolution. These and many other internet sites were ori ginal innovations as they took advantage of the possibility to conduct transactions online. Not only was the purchase of goods enabled online, but also the resulting financial transactions became electronic. A whole range of advantages emerged, such as the reduction in transactions costs, increased transparency in the market (price comparisons made a lot easier), elimination of intermediate sales and distribution agents, etc. Although these advantages seemed to appear out of the blue, in reality they were based upon an existing trade system in the developed world. The existing trade system already used credit cards extensively, which basically guarantee the accompanying financial transaction. It consisted also of a well-developed insurance and transport system. That leads to the conclusion

that e-commerce is not a solution for sustainable development in itself, but can be a powerful element in realizing a new trade policy. Remote regions can now use e-commerce to get connected to ma rkets, purchasers and suppliers that were never accessible.

Although the original e-commerce was focused on consumers (B2C Business to Consumer), the interest wave of growth has appeared more in the business between companies (B2B, business to business). For sustainable development, e-commerce could be very beneficial in integrating the local supply and value chain. Such attempts are made in the traditional agricultural sector, which is in turn called e-agriculture.

In the Philippines farmers took advantage of the B2Bpricenow.com internet site. They can obtain market price information they lacked before. At the end of 200 3, about 2000 SMEs, most of whom were farmers, used the site to obtain relevant daily trade information.

In textiles, e-commerce is being used by the large fashion houses, which introduced ICT to enlarge the control over their suppliers. In tourism, e-commerce is having big impacts. Booking flights and holidays through the internet is now widely accepted by consumers and is often cheaper. Travel agents are the main drivers, but so far the tourist destination countries have done little to take their advantage of these developments.

E-entertainment

Computer games, digital music files, video on demand and many other entertainment possibilities are quickly broadening their commercial scope through the networked world. For sustainable development, these trends create new opportunities, which are still being conceived. It is a common trend for MNCs to place software development labs in developing countries to access new skills and lower costs. But indigenous developments could also be realised as Bollywood has for India in entertainment.

The technical side of an ICT policy

Besides the sophistication levels of an ICT policy and the social perspective of ICT policy, there is an important technical aspect to ICT policies. This factor is particularly well acknowledged in the framework for measuring ICT development, which was developed by the UNCTAD in conjunction with CSTD 8 . This framework was applied to benchmark and analyze the diffusion of ICT capabilities across 160–200 countries for 1995–2001. The framework is a good starting point for any ICT policy development. The ICT benchmarking tool of the UNCTAD and UNCSTD9 is available online. Other online assessment tools have been developed by the Centre for International Development at Harvard University10 , based on earlier work by the Computer Systems Policy Project (CSPP) on Global Electronic Commerce Readiness, developed with the support of IBM.

The UNCSTD framework is constructed around four main sets of indicators: connectivity, access, usage and policy. Connectivity is defined as the physical infrastructure available to a country, as distinct from broader factors determ ining access (e.g. literacy, cost). It represents the basic “limiting factor” regarding access to and use of ICT . Without the essential physical hardware, ICT use is not possible. UNCTAD defined narrow “connectivity” as the minimum set of measures necessary for ICT access, comprising Internet hosts per capita, PCs per capita, telephone mainlines per capita, and mobile subscribers per cap ita.

Access defines the opportunity to take advantage of being connected. Access comprises number of internet users, literacy, cost of the local call and GDP per capita. The actual use of ICT is by all means a main denominator to assess ICT development. Unfortunately data to analyze “usage” is scarce due to commercial sensitivity. That is why usage is commonly discussed in terms of e-applications, such as e-commerce or e-health, in order to enable a qualitative discussion.

Any ICT policy should result in improved connectivity, access and usage in order to be effective. However, policy can at best only enable, facilitate, control and promote these important ICT factors. Intermediate indicators related to direct policy outcomes are defined by UNCTAD to assess policy. These indicators include the presence of internet exchanges, competition in the loca l loop/domestic long distance and competition in the ISP (Internet Service Provider) market.

Improving connectivity

Despite some progress in recent years, connectivity remains a key challenge for many countries. Countries with a low connectivity do not have a regulatory env ironment that promotes private investment in deploying information and communication networks. In these countries, governments remain sole owners of Public Switched Telephone Network (PSTN), creating a disincentive for competitors to enter the market. Deployment of backbone networks requires huge investments in equipment and construction. This is especially the case for rural and remote communities where connection points may be widely dispersed. Countries often lack skills (engineering, organisational, administrative and commercial) needed to launch and operate networks. Governments have therefore to ensure adequate education and training and to open their markets to private investment. But the needed liberalization of markets is no guarantee for success in itself. Liberalization seems to be most successful when it is introduced step by step and accompanied by a proper legal and regulatory framework.

Within the Plan of Action of the World Summit on the Information Society in Geneva in 2003 connectivity has become a major issue. Of the 10 targets in the Plan of Action, 6 are about getting organisations and establishments connected to the Internet, and the ICT infrastructure. Connectivity is essential for building the inclusive Information Society; to put the potential of knowledge and ICTs at the service of development; to promote the use of information and knowledge

for the achievement of internationally agreed development goals, including those contained in the Millennium Declaration; and to address new challenges of the Information Society, at the national, regional and international levels. The final target of the Plan of Action is to ensure that more than half the world's inhabitants have access to ICT within their reach. Where connectivity still can be discussed in the terms of the telecommunication industry, access is a factor which has been changed completely by the commercialisation of the internet. That is why the market of structure of the Internet needs to be first considered.

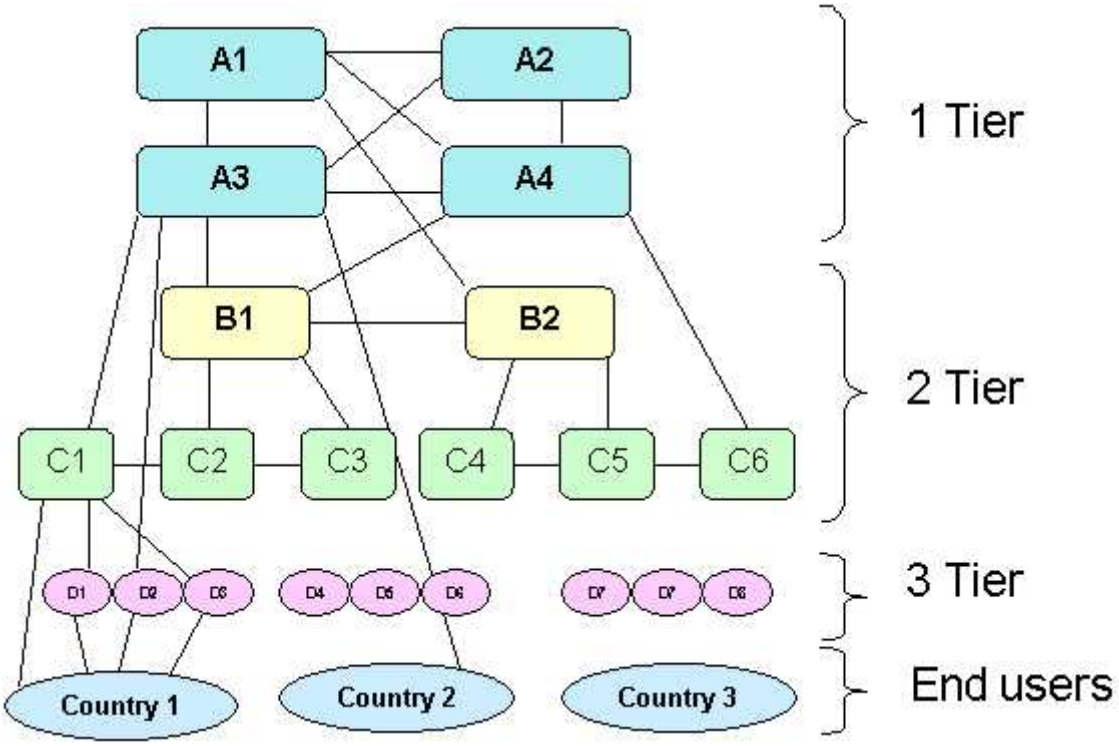
The market structure for the Internet

The market structure has undergone significant changes since the commercialization of the Internet in 1994. The period of sharp increase of Internet providers gave way to the consolidation process, with many small ISPs going out of the business or being acquired by the larger ones. As the process of consolidation reshaped the industry, the larger Internet providers began to sell upstream bandwidth connections to their smaller peers that service customers directly. Figure 1 demonstrates this basic structure consisting of three major tiers.

1. Tier (A1-A4) – Internet backbone providers with worldwide focus, which have direct links with one another. These are the dozen or so international companies that own or lease the international infrastructure that links different continents, particularly the USA and Europe and carry both voice and data traffic. The companies in this category include: AT&T, BT Ignite, Cable and Wireless, France Telecom and WorldCom.
2. Tier (B1- C6) – 50-60 providers with a regional and national focus. Inter-national providers (B1 and B2) with a regional focus are not only interconnected but also have a link to one or more international backbone provides with worldwide focus (A1-A4). Intra-national providers (C1-C6) also have a direct link with one another and are usually connected with international providers with a regional focus. Moreover, at least some intra-national providers are connected to a worldwide international backbone provider (A1-A4).
3. Tier (D1-D8) – local Internet providers that offer direct services to customers. They are usually connected to one or more intra-national backbone providers. However, sometimes they could also have a connection to a regional-focused provider.

The majority of end-users are connected to local ISPs. In case of high flow traffic, end-users might be directly linked to an intra-national or even an international provider.

Figure 1. Three-tier market structure



Source: adopted from WIK-Consult, 2003

Tier 1 companies, being at the top of Internet market structure and pricing policies, determine the framework for what other ISPs can charge. There are both regulation and competition mechanisms at the national level in Europe, North America, Australia and New Zealand to leverage the market (Chris Nicol, ICT Policy: A Beginners' Handbook, 2003). The regulatory climate in many emerging economies has only recently welcomed private sector ISP, and a key challenge lies in creating a level playing field between government-owned and private sector ISP (in terms of operating licences, tariffs, cross-subsidies, and setting up international gateways).

Extending access

Models to improve internet access have emerged by lowering costs. Two established models (Free ISP and international peering) are based on agreements between tiers in the market. One model (Voice Over Internet Protocol) is based on new technologies which have become available recently.

The Free ISPs option is based on an agreement concluded between an ISP and an incumbent telecommunication company on splitting the revenue from the call made to access the internet. The agreement allows the ISP to provide free or nearly free services and the company profits from extra traffic generated.

In Kenya, Internet service provider Swift Global, fixed-line operator Telkom and Interactive Media Services have initiated such a revenue-sharing agreement. 'Internet Direct' service allows users to access the Internet without having t o subscribe to an ISP. In Uganda MTN, the biggest telecommunication company in Uganda, has set up a 'per minute' dial-up rate together with ISPs. 'Internet Easy' service allows fixed line customers to dial up to any of the ISPs without paying initial connection fees or any other additional costs 11.

International peering is the arrangement of traffic exchange between Internet Service Providers. Larger ISPs with their own backbone networks agree to allow traffic from other large ISPs in exchange for traffic on their backbones. They also exchange traffic with smaller ISPs so that they can reach regional end points. Peering agreements for formal national (regional) Internet exchanges allows a country to avoid international connectivity charges and therefore reduce costs. In 2002 national internet exchange points (IXPs) went online in Kenya with initially four ISPs and now used by ten ISPs. After a short period of time it became possible to decrease international call rates by 50 percent.

Voice Over Internet Protocol (VOIP) technology refers to internet telephony or, in other words, calls made over the Internet. If national telecoms use the ser vices of international VOIP operators, the settlement rate balancing tariffs are eliminated and the savings of the cost of terminating international calls could be 50 percent. Telecoms in Venezuela, South Africa, Egypt, Chad and Nigeria have adopted VOIP to build more efficient, low-cost networks. Countries can take further steps by allowing the licensing of IP telephony providers.

Conclusion

To understand current ICT policies, a good understanding of its sophistication level, its social relevance and the relevant technical factors of ICT are essential.

At least five levels of ICT policy sophistication can be determined. To move up the sophistication level, a strong socially relevant driver such as education is essential to be effective. Due to the fast pace of technological developments the choice of technical infrastructure is crucial too, in order to provide connectivity and access for sustainable development.

Essentials of ICT policy making

ICT may one day be regarded as the technology with the widest influence on human society. Therefore the involvement of stakeholders is essential in ICT policy making. However for sustainable development, the stakeholders have very different characteristics compared to the stakeholders in developed countries. Developing country stakeholders typically have low income, follow an informal business approach and the majority live in rural areas. To reach these groups conventional ICT policy has to adapt.

ICT policies for sustainable development have to be built upon innovative models in which shared infrastructure, public access facilities and the use of intermediaries to interact with the public12 are essential. Such innovations are only feasible if the local scientific and technical knowledge is fully incorporated. A proven approach to ensure the involvement of local academia, research institutes and industry in innovation is called the "system of Innovation", in which these stakeholders in innovation co-operate to improve the usage of scientific and technical knowledge. In this section we consider the concept and its implications for ICT policy making.

To make ICT policy sustainable, significant efforts have to be devoted towards human capacity building. Without the right skills there is little rationale in obtaining ICT equipment. This is an important lesson which needs to be understood by donor countries, which are the main financial source for ICT for sustainable development. If the proper capacity has been created, foreign direct investment becomes another important source for finance. Currently India and China are the main beneficiaries of capacity building in ICT in the past.

Importance of stakeholder's involvement

ICT influences human communications and behavior. The current impact of ICT can be compared with the impact of new transport technologies had on humanity in t he last 100 years. The train made the difference between inaccessibility and accessibility of entire regions; the car gave individuals the freedom to travel and in the last century the airplane facilitated travel across and between con tinents in hours. Today, ICT touches upon everyone's lives, even upon those who have never used or touched it.

When designing an ICT policy, it is quite likely that groups of people will positively or negatively be affected by the outcomes. If these groups are consulted during the ICT policy design process, it is more likely that they will positively endorse the new ICT policy. In most cases such interest groups are not well organized. Therefore the design of an ICT policy involves the creation of such interest groups, such as the formation of the Nepal Participatory Action Network (NEPAN) in 1995. Generally speaking, ICT policies need involvement of interest groups representing societal, cultural and economic effects.

Effects on the society

The effects of ICT on society are manifold. ICT may touch upon privacy and civil liberties rights. It may interfere with political activities, and enable the creation of anti-democratic activities. Societal stakeholders are usually less well organized than other interest groups. That could lead to a misjudgment to marginalize or ignore them, which in turn could result in serious problems in ICT policy implementations. A good starting point to address the societal issues is the APC (the Association for Progressive Communications), which is active in supporting ICT policy making. The APC provides training for ICT policy design for Civil Society. Another rich source on involving society in ICT policy making is BRIDGES.ORG, an international non-profit organisation providing advice to ICT policy makers and publications on successful ICT projects (www.bridges.org)

Effects on the culture

ICT has already had a considerable effect on the culture of the developed world. Recently new cultural changes are going with the transition of letters to e-mail, the change of vinyl to CDs to MP3s and from videos to DVDs. These technologies have a profound influence on people's behaviour and cultural experiences. In sustainable development, it is important that ICT policies contain measures to address and accommodate cultural diversity and cultural heritage (a good case example of the last is the DigiCULT initiative of the European Commission).

Effects on the economy

One of the strongest cases for the effect of ICT on sustainable economic development comes from India. India's software and services sector has generated 92,000 new jobs and reached $7.5 billion in exports in 2003. Many more examples are emerging in which local traditional craftsmen and peasants have successfully connected by the internet to intermediates that are able to sell their goods directly in the market. As a result the income of craftsmen connected to the Novica web has considerably increased, as have the incomes of the peasant using the B2Bpricenow.com website. Still, relatively little is known about the effects of ICT on the economy. In 2003 the Information Work Productivity Council was created to promote understanding of the relation between ICT and productivity.

Importance of innovation

Current thinking is that new ICT concepts are needed in which shared infrastructure, public access facilities and the use of intermediaries to interact with the public13 are essential. However, the pool of information and communication technologies which can be applied is enlarging quickly. For example, entrepreneurs in Peru have taken an early lead in innovating wireless Internet applications--like Quimica Suiza, a leading pharmaceutical wholesaler, which is using a Java program on a Palm Pilot to empower their sales force to view client accounts, check inventories, and place orders in real time. With similar technology, customers of Peru's Banco Wiese can use a cell phone or PDA to wirelessly check their balances or open a new account in Lima before that capability was availa ble in New York or Los Angeles.

In ICT, it is of utmost importance to keep a close watch of the on-going technology trends. Most of the technology trends are relevant towards sustainable development as they enable a lower cost base, self-regulation and accessibility.

On-going technology trends

At the heart of the ICT revolution is the miniaturisation of electronics, resulting in lower hardware costs and integration of ICT in all kinds of products and services. This trend enabled the development of the Simputer in India, a computer with price below $ 250

Two of the visionaries foreseeing the miniaturization of electronics long ago were Vannevar Bush ("As We May Think") and Richard Feynmann ("There's Plenty of Room at the Bottom"). Their inspiring visions can be accessed for free on the internet.

The second technology trend is the enormous growth in data transport capacity of the world's communication networks. It is estimated that less than 3% of the US communication networks' capacity is actually used today. This growth in dat a transport capacity is enabled by Dense Wavelength Division Modulation (DWDM) technology and the development of Optical Amplifiers that amplify the communication signals in an optical fibre to cover larger distances without converting them into electrical signals. DWDM dramatically increases the traffic carrying capacity of existing optical communication fibres. Commercially available systems today can carry 256 channels of 10Gbits/s each over a single fibre, a fibre that may have been designed and installed originally for a single 10Gbits/s channel 8 or 10 years ago. This trend will inevitably bring the costs of world wide telecommunication down more rapidly than could be foreseen some years ago.

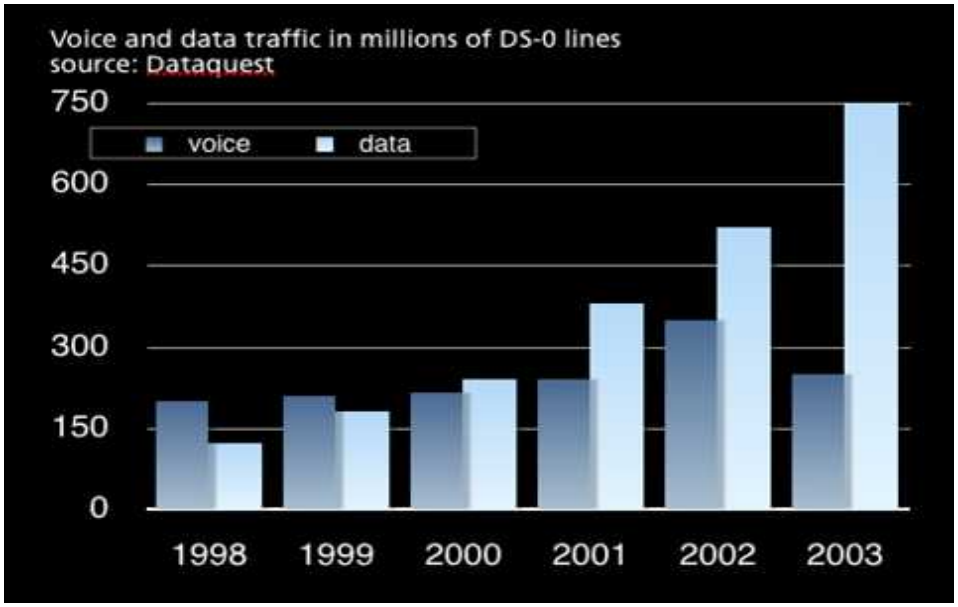
The third emerging trend is the wider application of the Internet Protocol (IP). The full potential of cost savings of internet protocol have still to be explored. IP switching technology, based on information packets, is much cheaper than traditional switching technology based on circuits. Because information packets in an IP network are not processed in the network, but only transported from source to destination, an IP network is not limited towards a particular type of

service. Processing of the information takes place only in the endpoints of the network. Therefore the network is open to any service or application, including services and applications that have yet to be developed.

The fourth trend is the concept of Tim Berners-Lee to program a computer to create a space in which everything could be linked, which led to the World Wide Web14 , but which only has been realised to a limited extent. His vision to connect computers and information further is published on the website www.w3.org. "W3C in seven points".

A fifth, rapidly developing trend is the emergence of VOIP. This technology, already developed in the late eighties, allows telephone calls to travel over IP networks.

Figure 2: Voice and data traffic in millions of DS-O lines

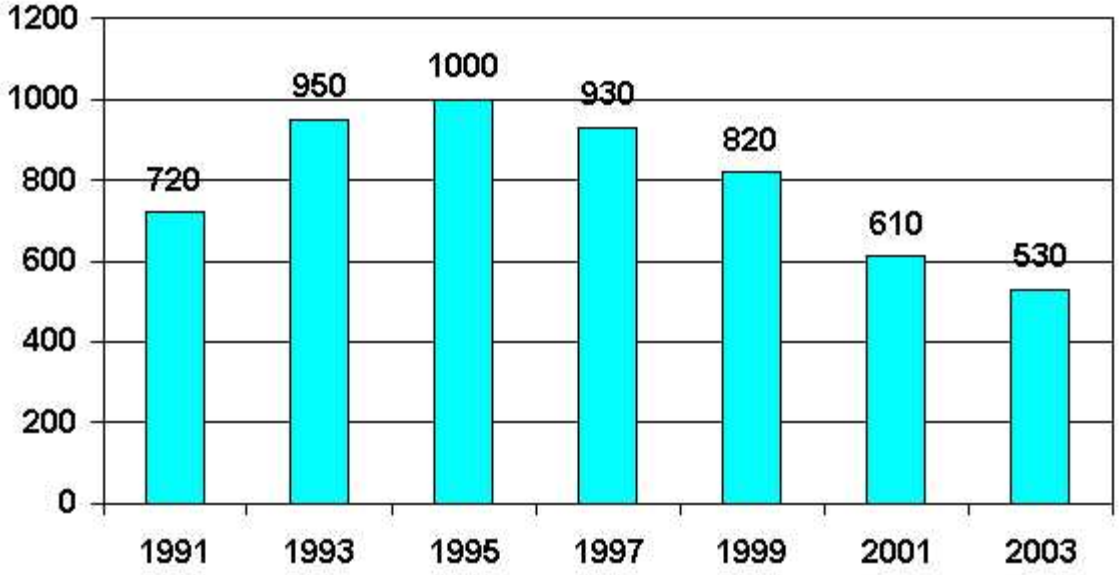


Source: Dataquest

As the volume of data traffic surpassed the volume of voice traffic by 2000. and is now at least 5 times larger than the voice volume, it starts to make sense to debate the necessity of a separate voice network. As already discussed, IP (data) networks do not favour any particular type of service, so a voice service over IP is entirely feasible. As discussed below this trend forces telecom operators to lower their call charges for long distance and international traffic, which decreases their revenue stream.

Figure 3: Service revenue per subscriber ($)

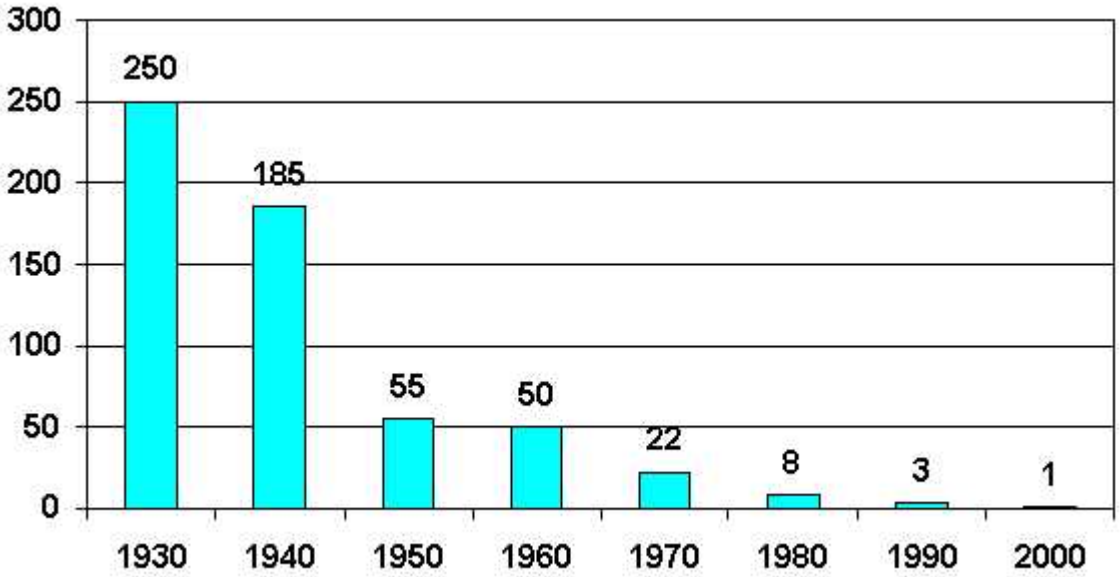
Source: ITU, 2003



A sixth trend is the reduction of long distance and international toll charges, due to the availability of large amounts of capacity, especially on popular ro utes (transatlantic, for instance) on one hand, and telecoms liberalization, leading to increased competition from service providers. Charges have already come down considerably, but they are still very high compared to the real cost of transmission.

The end result of this development will most likely be a flat fee telephony charge, no longer dependent on time and distance. This development will be sped up by the increasing use of data networks for telephony purposes (VOIP), as da ta networks tend to be paid for on a flat fee basis already. Decrease of toll charges leads of course to a decreasing revenue stream for telecom operators. This is visible in the figures of the International Telecommunications Union (ITU), which show an all time high for 1995 and a rapid decrease since then. These figures include the revenues from cellular operations, an area that has grown tremendously since 1995.

Figure 4: Price of a 3 minute London-New York call in 1990 ($)
Source: ITU, 2003



A seventh development, which has been slowly but steadily gaining ground over the past years is the rise of open source software. The most visible open source software is the Linux operating system. According to IDC (2001, 2004) the current installed base of Linux as an operating system for servers (computers that do tasks like file serving, email serving , web serving, etc) is around 30%, while Microsoft's Windows operating systems cover around 40% of the installed base. Linux has been by far the fastest grower in this area for years, so we can expect it to take the lead position somewhere in the coming 3 to 4 years. The same development has taken place in the market for embedded operating systems

(computers used in a device, like a printer, copier, cellular telephone, etc), Linux is expected to move to the number one position in this market in 2004, replacing VxWorks and DOS. (IDC 2004)

Desktop (or client) systems are still dominated by Microsoft's Windows, with an installed base of over 90%. This is largely due to the fact that desktop appli cations for open source operating systems like Linux do require a new training effort for end users, which is a time consuming and expensive affair, as well as the lack of availability of software for specific desktop applications that is not (yet) available for Linux.

However, cost savings of applying open source software and operating systems are considerable, so we can expect open source to penetrate into the desktop market as well over the coming decade. As open source software is indeed 'open', there are no barriers for new entrants with innovative ideas and concepts to put them to work, as opposed to proprietary software from the well known software houses. It is exactly this innovative character that has allowed open source software to establish its current growth and position against the large commercial players in this field. A good indication of the growing importance of open source Linux is the fact that China has created its own packaged distribution of Linux, called 'Red Flag Linux'.(www.redflag-linux.com), which is deployed in education, government and service industry.

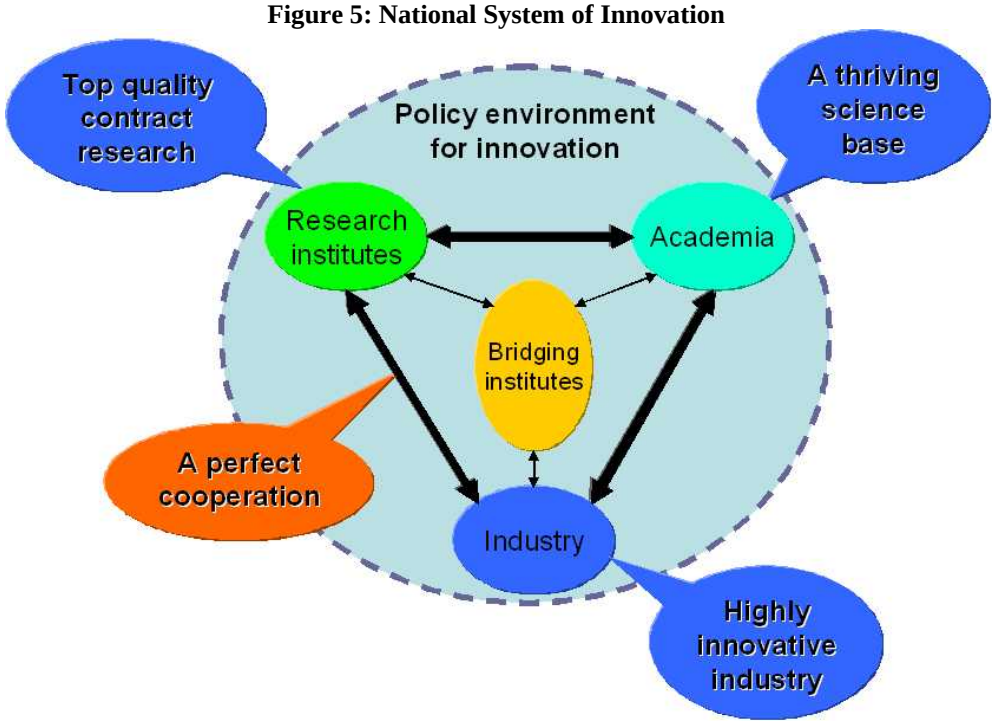
Importance of co-operation in innovation

Where individual industries, clusters of industries and industry sectors are competing, 'the industries capacity to innovate and adjust' (OECD) is being viewed as the key factor to successful business and consequently to successful national economic growth and growth of employment.

Industries throughout the world see innovation, flexibility and technology as the assets with which they can obtain a better competitive position in a globalising market. National governments are increasingly trying to create the fruitful environment for their industrial sectors, eg, by providing a national technological knowledge base, stimulating the uptake of technological knowledge by industry, limiting factor costs (energy, labour) and being flexible to or e ven initiating change. Benchmarking on the international playground of industries and governments will therefore be 'identifying best practice in the national synergy between the strategy of an industry sector and the national framework conditions'.

Several authors describe the national systems of innovation (Lundvall 15, Nelson16, Edquist 17) in which R&D and innovation function. The main actors in the national system of innovation are research institutes, academia and industry, accomplished by bridging institutes. In this system, the academia are responsible for a thriving science base with a focus on (fundamental) research and education, which leads to educated human recourses and knowledge. Research Institutes deliver top quality contract research. Industry is highly innovative and focuses on product development. Bridging Institutes operate as successful mediators. Furthermore, in the perfect innovation system, the national science and technology policies form a favourable environment. All actors have a perfect co-operation.

Figure 5: National System of Innovation



Source: OCO Consulting

The favourable policy environment is one in which the co-operation between the actors is optimised to make industry as innovative as possible. For the relation between industry and academia to work means that curricula are developed in

consultation with industry. Academia and research institutes often exchange educational staff and students. Research institutes are engaged in co ntracted research for industry.

Policy makers can make a big difference in the system of innovation as they promote the creation of bridging institutes. Such institutes can be technology transfer organisations, research foundations, business incubators, licence and IPR brokers, science parks and the like. The bridging institutes exist to bridge the gaps between the actors in the system of innovation.

In general there is a lack of capability in academia and research institutes in ICT. ICT policy development should address this issue accordingly, but also en sure that with capability building the co-operation with industry is a necessary condition. In many countries, the academia and research institutes still operate at great distance from industry. Together with ICT development this would result in engaging many experts from abroad. Such an engagement is not only be expensive, but also leads to a lack of long term internal expertise. Engagement of external experts is in the short term unavoidable in many situations, but policy making should resolve the internal expertise issue in time. Creating a good functioning national system of innovation can resolve this issue.

Importance of capacity building

To make ICT developments sustainable, an indigenous human capacity has to be built to ensure that at the end of individual development projects, there is a base for continuity. The implication is that any ICT policy should include a learning programme. Such a learning programme should consist of two components, a training programme and an education programme. Training involves imparting k nowledge and the effects can be permanent and enduring. Education can take the form of e-learning, which is a delivery of learning and training using new multimedia technologies and the Internet. For many organisations in developed countries, e-Learning is a means of saving time and travel expenses through providing Internet courses to employees. At the same time, e-Learning has also become a serious policy issue of governments that want to improve quality and access to education and training. The Programme for the Effective Integration of Information and Communication Technologies (ICT) in Education and Training Systems in Europe (2004 – 2006) launched by the European Commission is an example of governmental initiative involving e-Learning.

Case study: e-Learning Programme of the European Commission

In January 2004 the e-Learning programme of the EU was launched as a catalyst programme to (1) help the individual to realise his or her full potential; (2) reduce the disparities and inequalities between individuals and groups; and, finally (3) ensure that skills available meet the requirements of business and employers. Some 44 million euros will be invested in providing incentives for the following projects

- **School twinning** targets at fostering European dimension to education with high technologies pl aying an essential role
- Development of **Virtual Universities Campuses** to encourage European students to attend virtual classes all over Europe

- **Digital literacy** programme aim is to encourage the acquisition of new skills and knowledge that is needed for personal and professional development and for active participati on in an information-driven society.

In addition, transversal actions for the promotion of e-learning in Europe aim to promote best practice, products and services stemming from the many projects and programmes that have been funded at European or Member State level and str engthen co-operation between all those involved.
Source: e-Learning Europe, http://www.elearningeuropa.info

Importance of finance

Besides the involvement of indigenous financial resources, the appropriation of external financial resources is essential in sustainable development. These ex ternal financial resources originate from donor countries and also from foreign direct investments by transnational corporations(TNCs). Both sources have diff erent sets of ICT strategies, with an emerging overlap of common goals, such as the e-inclusion18 project of Hewlett Packard.

Donor countries as a financial source

Although most donor countries recognise the potential of ICT for sustainable development and have supported such strategies, there is a wide variety of approaches towards the deployment of ICT for meeting the Millennium Development Goals. Most of the donor countries have organised their ICT for development ac tivities (ICT4D) around partnerships between multilateral agencies, bilateral agencies, relevant ministries (such as ministries of communication and education) civil society interest groups, the private sector and universities and research institutions in both the receiving and donor countries. In addressing the multilateral and bilateral agencies, it is essential to acknowledge the lessons they have learned resulting from their broad experience base19:

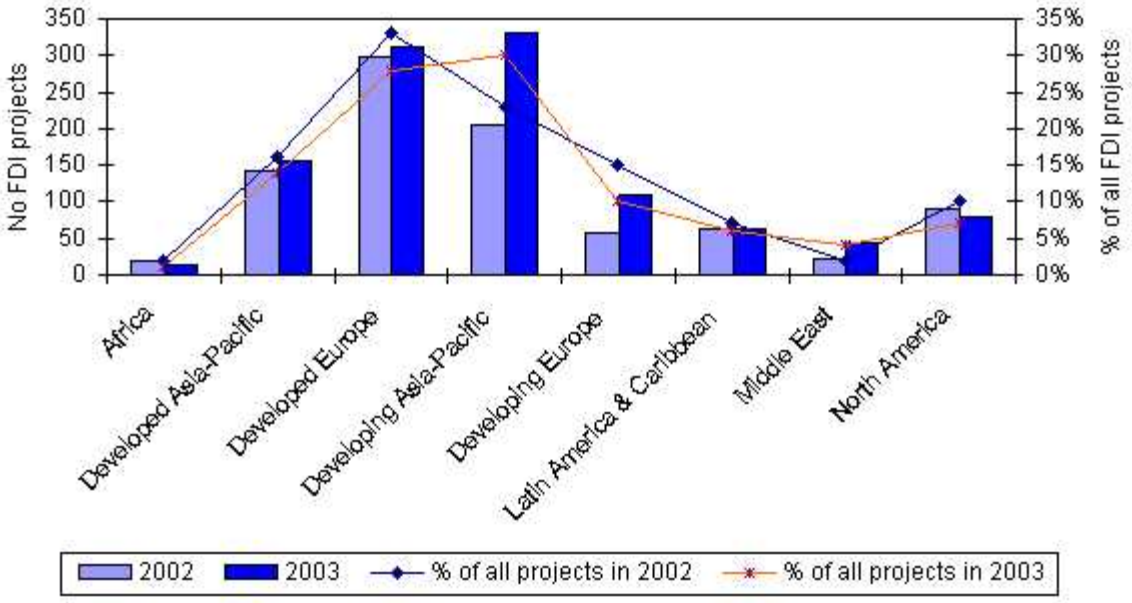
- Sustainable ICT projects need to be locally owned and accompanied by human capacity development.
- Capacity in effectively using ICT for development is often the main constraint, not equipment.
- The private sector is instrumental in expanding ICT for development access and applications.
- Governments play a key role in establishing a well-regulated, competitive enabling environment for ICT to flourish.
- For ICT to have a positive development impact, the various social groups must have equal access to them, particularly disadvantaged groups such as the poor, children, and indigenous people.
- Many important aspects of information and communication infrastructure are cross-border in nature, and therefore require international/regional co-operation.

Foreign Direct Investments as a financial source

Transnational companies are motivated to invest overseas primarily by the search for skilled ICT workers. Foreign direct investment became the most important determinant in the globalisation process and has been changing the economies of many countries in the world. For a country to become and stay competitive FDI is a pre-condition since it brings at least four enablers for value: financial capital, management skills, access to export markets and technology – and therefore leads to a sustainable growth (Lall, 2000).

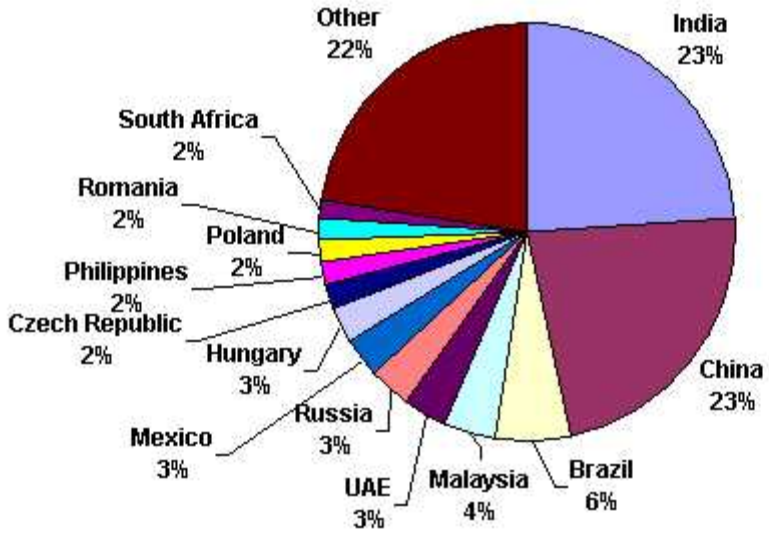
Considered to be the main source of innovation and technology, transnational corporations (TNCs) play a particularly important role in high technology activities where they possess the strongest advantages (UNCTAD). Developing countries are increasingly becoming an attractive location option for TNCs due to cost and efficiency factors. In 2002 and 2003 developing countries accounted for almost a half of new or Greenfield global foreign direct investment projec ts made by ICT multinationals. In this period the share of developing countries in global FDI projects in ICT increased by 10 percent: from 41 percent in 2002 to 51 percent in 2003 (www.locomonitor.com)). This growth was mainly associated with a spectacular 60 percent increase in ICT FDI projects in Asia-Pacific region and almost doubling of projects in Cen tral and Eastern Europe.

Figure 6: FDI projects* in ICT in world regions in 2002 and 2003



* FDI

Source: LOCOmonitor™, OCO Consulting (www.locomonitor.com)
FDI projects in ICT in developing countries are highly concentrated. In 2002 and 2003 India and China hosted almost half of all ICT projects in developing world.
Figure 7: FDI projects in ICT by developing country, 2002-2003

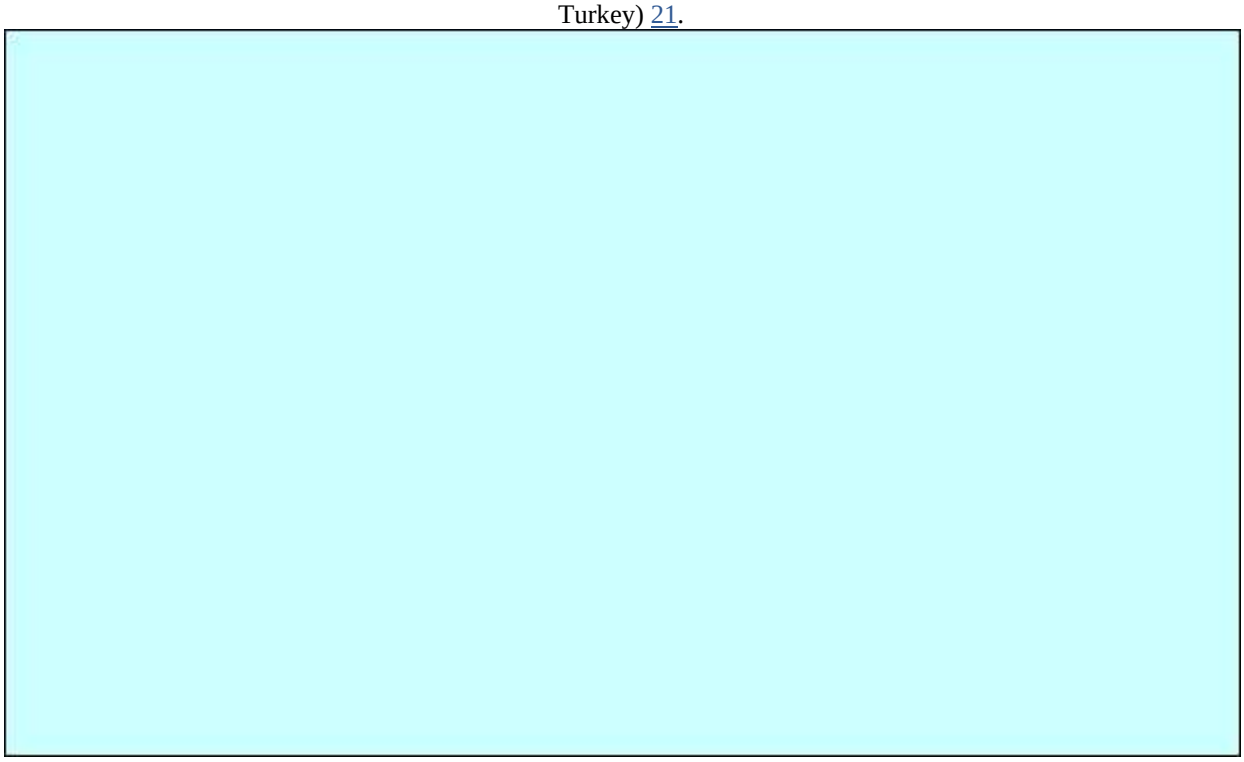


Source: LOCOmonitor™, OCO Consulting (www.locomonitor.com)
In countries that have attracted ICT projects, FDI has not only facilitated economic growth , but opened up new job opportunities and increased exports. However, the distribution of these FDI benefits is uneven. The reason is that not many developing countries can match increasingly demanding location requirements of knowledge-driven TNCs. Nowadays, besides cheap labour, developing countries have to ensure other pre-conditions such as adequate physical and social infrastructure and an adequate policy and regulatory framework for TNCs to seriously embed in their local economy. A liberal privatised and competitive telecommunications infrastructure is at most a prerequisite to attracting ICT FDI and countries are more and more competing amongst each other to attract FDI. Decisive factors for TNCs to invest are the investment climate and incentives available. The comprehensive reform programme recently launched in Turkey demonstrates the array of issues that have to be addressed in order to streamline the investment climate in a

country. The case of Singapore demonstrates how countries that have engaged in massive programmes of development of indigenous skills and industries, have managed to leapfrog in their economic development and become a significant player in the global market.

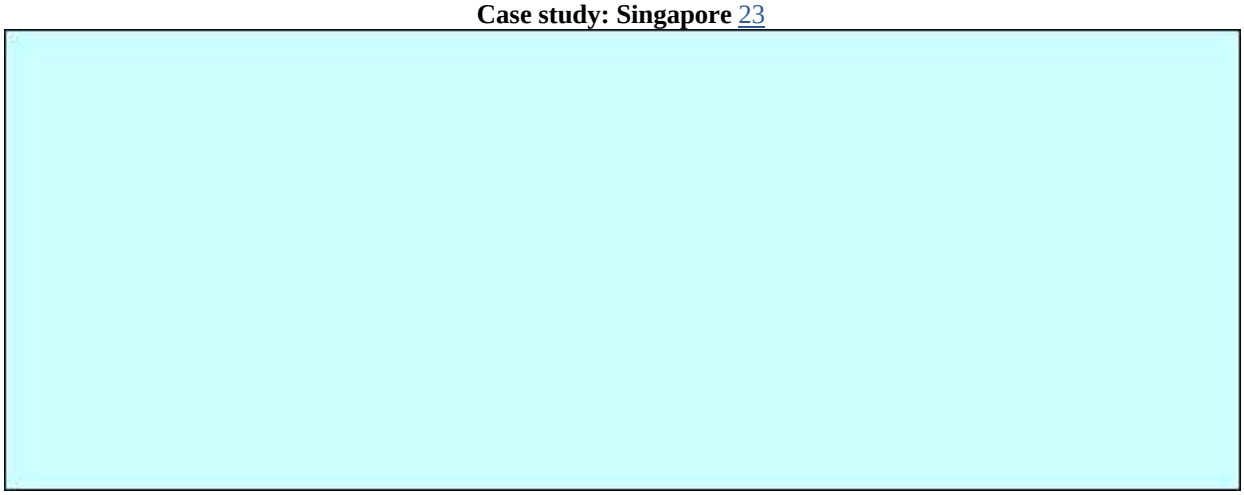
Case study: Reform Programme for the Improvement of the Investment Climate in Turkey

Turkey's size, location and dynamic population should make it an ideal destination for foreign investment. However, Turkey's share of foreign investment has been very low by international and even regional standards. To tackle this problem, in 2001 the Government approved the framework of the "Reform Programme for the Improvement of the Investment Climate in Turkey". The work of identifying the measures to be taken in order to increase FDI in the c ountry was conducted with the participation of representatives of private and public sectors20 . The Programme for the Improvement of Investment Climate in Turkey is being implemented with the activities carried out by mixed committees formed in the fields of business start-ups, employment, sectoral licences, investment locations, taxes and financial incentives, customs and standards, intellectual property rights, investment promotion and legislation (Invest in Turkey) 21.



National governments should bear in mind that attracting FDI does not replace the need for indigenous capacity-building for technology absorption. On the contrary, to become strong and fruit-bearing trees the seeds of new technologies brought by TNCs have to be put into fertile soil. The policies on technology transfer applied by developing and developed countries concern strengthening legal framework, especially intellectual property rights, stimulating R&D activities, enhancing skills, raising the capabilities of local enterprises22.

Case study: Singapore 23



Singapore, one of the smallest Asian economies, has made a spectacular transition from a struggling colony to a modern high tech country. Singapore's development model is one of strong leadership, pro-active industrial strategy, a consistent FDI-policy and continued industrial upgrading. There was a great effort to directing investments into higher-

value-added activities and inducing existing affiliates to upgrade their technologies and functions. This strategy involved extensive interventions in factor markets (skill creation, institutio n building, infrastructure development and supplier support), encouraging R&D and technology institutions, and in attracting, targeting and guiding investments. The success of Singapore's strategy is reflected in the fact that it evolved from a level of using new technologies transferred by TNCs to the one of creating indigenous intellectual property and commercialising it in the market place.

Conclusion

Because ICT has social, cultural as well as economic effects, ICT policy making is a task that requires the involvement of many relevant local stakeholders. T hese stakeholders' interests and requirements are significantly different from those in the developed countries, which leads to significantly different ICT policies for sustainable development. To build such policies the creation of innovative models is required, but the resulting ICT policy models are far from easy to predict, because the technological base on which these innovations are built evolves rapidly. Fortunately the technological base is quickly developin g in favour of sustainable development as they enable a lower cost base, self-regulation and accessibility from every place on the planet. To take full advantage of these technological developments and to take local circumstances into account innovative models for ICT are required. These models can be best created in co-operation between universities, research institutes and private industry. Thereby these parties create a capacity to make ICT developments sustainable.

Effective ICT policy in developing countries can only be sustained through a combination of indigenous capacity building, targeting donor aid at training and ICT equipment acquisition and creative use of FDI to fast-track local ICT clusters and specialisations.

Case studies from each continent

This chapter illustrates ICT policy making with best practice cases of ICT development from each continent. Due to limited resources, these case studies are based upon information publicly available. s

Europe: Estonia eVikings – Idealism, Aspiration, Dedication

Estonia, the smallest state in Central and Eastern Europe (CEE) in terms of population (1.37 million), is a regional forerunner[24] in ICT connectivity and access. It has the highest use of Internet and mobile communication per head in CEE, world-class telecommunication network and low connectivity costs. After the collapse of the Soviet bloc, increasing FDI [25] has been one of the engines of Estonia's successful transformation to market e conomy. Estonia took full advantage of its geographical and cultural proximity to the Nordic neighbours including IT leaders Finland and Sweden and through partnership integrated itself into the supply chains of knowledge-led Scandinavian companies[26].

In 1998 the principles of the Estonian Information Policy were approved by the Parliament of Estonia[27] , as was an accompanying plan for its implementation[28] , which is the basis for all government organisations involved and their ICT projects and programmes. Every year the Government of Estonia discusses the plan. The Estonian Informatics Centre, a state agency, fulfils a coordinating role in implementing the Information Policy. Through the backbone network PeaTee, all government institutions are connected and a government programme of rural data communications KülaTee is now under implementation.

Based on its success in building up an information infrastructure, Estonia launched the Eesti eViikingid (Estonian eVikings) project with the support of the European Union in 2000. The goal of the project was to contribute to Estonia's competitiveness and market power through strengthening the links between the Estonian and the European (mainly Scandinavian) academia and industry and national innovation networks[29] . The project envisaged three stages:

1. Assessment of the Estonian IT cluster and ICT Sector Innovation System, including a wide-scale survey of Estonian IT companies and to compile technology forecast review to develop long-term ICT strategy.
2. Elaboration of IT R&D policy recommendations, aiming to support broad IT strategy with a concrete action plan.
3. Establishment of Virtual Centre of Excellence that capitalises on main IT strongholds of Estonia identified on the stage 1.

The findings of stage 1 provided a basis for the elaboration of policy recommendations concerning the need for activity-specific industrial policy, reevaluation of the R&D funding schemes, a cluster-based strategic planning approach and urgently required skills development. The special emphasis of the recommendation has been put on the importance of a strong, well functioning and integral National Innovation System for innovation policy to be responsive to technology developments and conductive to industrial development of Estonia [30].

With a recent launch of eViking II project, the Virtual Centre of Excellence was established by the Institute of Cybernetics of Tallinn Technical University, Tartu University and companies such as Ericsson Eesti AS, EMT AS, Cybernetica AS. The centre encourages international partnership in the fields of Estonia's IT competency which are:

- Dependable computing, trust and security

- Human language technologies
- Microelectronics design
- Mobile and wireless systems

The founders believe that with a uniform high quality R&D, this well-designed Virtual Centre brings together excellence in above-mentioned fields creating a truly synergistic effect. In addition, the centre wishes to enhance the ability of Estonia's innovative system to anticipate future developments and manage th e related innovation process31.

Lessons to be learned from the Estonian case

Despite the low income level of Estonia, the country has been able to reach the latest level of sophistication of ICT policy. It has also built information ca pacity as well as building the human capabilities to make the ICT policy results sustainable. Stakeholders' involvement is ensured through the activities of the Estonian Informatics Centre and together with the business community, eVikings is the tool to create the necessary pool of human capacity. FDI and the assistance of the European Commission have been essential to guara ntee the necessary financial funding.

Asia: Malaysia National IT Council's Strategy and National IT Agenda (NITA) – "Turning Ripples into Tidal Waves"

Malaysia's economic performance is very much export driven and it has a fine track record in attracting foreign direct investment as a result of years of economic planning policy. Its attractiveness to high tech industry has not been recognized by the government initially, but once identified the government gav e substantial support in its policies to sustain that attractiveness.

The Malaysian government commitment to ICT development was formalized in 1994 with the establishment of the National IT Council (NITC), an advisory and consultative body to the government that comprises members from the public, private and community-interest sectors (Knowledge Societies: Information Technology for Sustainable Development, 1998). NITC envisages a knowledge society aligned with the policies adopted by the Government in Vision 2020 development plan, which emphasizes that the principle purpose of development should be for comprehensive human development. The National IT Agenda launched in 1996 by NITC provides the framework for the utilization of ICT to transform Malaysia to a values-based knowledge society. NITA puts strong focus on skill development, info structure, content and applications to create value, to provide equity and access to all Malaysian people.

"Ripples" of ICT strategy in Malaysia represent focused initiatives by the government to create the necessary environment and empower people so they can bring about the tidal wave of change. These initiatives include:

1. Multimedia Super Corridor (MSC) – a Malaysian version of Silicon Valley to attract foreign and local investors to establish their operation in a dedicated location incorporating a new airport and 'intelligent' multimedia cities. This US$40 billion initiative aims to develop a powerful information network system connecting ASEAN, Japan, Europe and USA. Since 1996 the MSC has grown into a v ibrant ICT hub that in 2003 hosted 759 companies (66 percent Malaysian-owned), out of which 24 are higher education institution and four incubator companies (http://www.elcot.com/mait-reports.htm , Country Intelligence Report Malaysia, MAIT, 2002). Besides world-standard network and supporting infrastructure, MSC attracts major technology-led companies through special privileges and tax relief. To accelerate the growth of the MSC and to support the transformation of the major sectors through the utilization of ICT, seven 'Multimedia Multimedia Flagship Application' projects have been launched in education, healthcare, manufacturing and government sect ors.

2. Demonstrator Application Grant Scheme (DAGS) – to motivate the usage of ICT by the Malaysians through demonstration of benefits. The scheme provides funds for citizens to access the opportunities associated with the MSC and to be involve d in multimedia development (http://www.opt-init.org/framework/pages/appendix3Case3.html , Final Report on The Digital Opportunity Initiative, 2001). Currently there are more than 50 DAGS projects
3. Mobile Internet Unit (MIU) – to conduct basic computer literacy programme for teachers and students in the schools with limited or no access to information that are not included in the government Smart School or other ICT initiatives

4. SJ2005 Smart Community Program – to transform Subang Jaya community into an information-based community using three-sided co-operation between government, private entities and communities. The main objectives of the project are to (1) to build knowledge-based society, (2) to evolve effective and transparent gove rnance framework, (3) to improve Internet access and connectivity, (4) to promote e-commerce and e-trade for new wealth creation, (5) to encourage relevant education and skills development (http://www.elcot.com/mait-reports.htm , Country Intelligence Report Malaysia, MAIT, 2002).
5. The Governance Agenda – Migration Plan - to facilitate the migration of Malaysian and the institutional structures to the E-World where migration is seen as a qualitative people-driven transformation. Five Strategic Agenda Thrust Areas identified in the plan include E-Economy, E-Public Services, E-Community, E-Learning, E-Sovereignty.

At the end of the 1980s, there were clear shortfalls in the availability of knowledge workers in Malaysia. To address the issue, a double deduction from tax was introduced in 1988 to encourage in-house training in firms. In 1993, this scheme was replaced by the Human Resource Development Fund, but the main problem remained the absence of proximity training institutes. In 2000, Universiti Malaysia Sarawak (UNIMAS) and the Multimedia University launched knowledge and innovation management centres to coordinate the stimulation and appropriation of knowledge across the country.

Lessons to be learned from the Malaysian case

Thanks to the establishment of the National IT Council, in which many different stakeholders are represented, Malaysia is able to coordinate and successfully implement its ICT policy, and to boost a large number of successful initiatives. Despite several attempts to address the shortage of human skills and capacities for ICT, the shortage of knowledge workers remains a major issue for further economic development. In retrospect, it is the lack of institution al building in universities and research institutes, in combination with the provision of training facilities that represents the major obstacle to further capacity building and in fostering links between industry, agencies and academia.

Middle East: UAE – Dubai Internet City

Dubai Internet City case is an instructive example of a country's ICT readiness defined as "facilitating the change in the transformation process" into an inf ormation/knowledge society.

Dubai Internet City (DIC) was designed with an objective to support the growth of the new economy and ICT industry, by providing a cutting edge infrastructur e, real estate, company registration and facilitation services. It fulfils the vision of the government of the UAE to provide IT companies with a world-class dedicated compound and to enhance the competitive advantage of the country. The ICT strategy of Dubai formulated four major targets – (1) creating a world-cla ss infrastructure, (2) ensuring the right conditions for ICT businesses, (3) putting in place a business-friendly attitude and (4) providing a clear business advantage for operating from Dubai (Information/Knowledge Society: The case of the UAE, Z. Karake-Shalhoub, L. Al Qazimi).

The initial DIC complex was established at an estimated cost of $272 million, provided by the Dubai Government. In addition, the Dubai government performs as a guarantor of a $500 million loans brought together by a consortium of banks for the purpose of completing the infrastructural support for the project; this will ultimately act as an "incubator" for e-commerce in the region. Within a s hort span of time, a dynamic international community of ICT companies has established itself in Dubai Internet City. At the moment there are more than 450 tenants in DIC, mostly international companies operating in various IT industry sectors. All the global ICT giants have settled in Dubai: Microsoft, Oracle, HP, IBM, Compaq, Dell, Siemens, Canon, Logica, Sony Ericsson and Cisco. These companies represent a formidable community of over 5,500 knowledge worke rs.

DIC provides a high bandwidth technology platform which allows companies looking to provide cost effective business process outsourcing (BPO) services such as call center operations. Major services offered by DIC include

- In-campus access
- Web hosting
- E-mail
- Www-bundled services
- Telephony
- Data centre
- Content and security network

The city became a strategic location for supporting and promoting IT related activities within a vast geographical area extending from the Middle East to the Indian subcontinent, and Africa to the CIS countries, covering 1.6 billion people with GDP $ 1.1trillion[32].

Dubai Internet City provides an environment that attracts each and every element of the value chain for an ICT business into the community. The City also creates an ideal environment for growth and flourishing of IT projects. In addition, it has developed programs that can be leveraged by the ICT community to explore and expand 'Channel Development' opportunities such as expansion of operations, setting up new business, etc.

In line with Dubai's liberal economic policies and regulations, Dubai Internet City offers foreign companies 100% tax-free ownership, 100% repatriation of capital and profits, no currency restrictions, easy registration and licensing, stringent cyber regulations, 50 years land lease contracts, cost effective sit es, protection of intellectual property in addition to facilities for financing, training, education and research. Over the years, the Dubai Government with the assistance of the legal department of DIC has been working extensively to create a legal environment that will provide security for the companies' investments and a means for effectively resolving conflicts [33].

Dubai Internet City works closely with the region's ICT community to identify the areas of technology expertise and infrastructure for which there is an urgent need in the region. The DIC is also committed to international co-operation with other ICT players. ‘Strategic partnership’ has been forged with ICT organisations and trade bodies of developed and developing economies as well as with international organisations such as the World Summit Awards, an initiative of UN member states aimed at showcasing and recognizing high qualit y digital content and innovative new media applications from around the world [34].

The DIC generates many spillover effects for both sides of the project. For business community, it enhances their competitive edge, raises credibility, helps improve skills, and creates synergy among client-firms. In addition, DIC offers businesses opportunities to acquire innovations and interact with other businesses that might support, complement, or even compete with them in the same geographical area. From the Government perspective, DIC helps promote regional development, generate jobs[35] and incomes, and becomes a demonstration of the political commitment to SMEs. As for the local community, in addition to job creation, DIC has created an entrepreneurial culture, especially among young university graduates [36].

Lessons to be learned from the Dubai case

The case of Dubai Internet City illustrates that for information and communication technology quick results can be obtained through an approach of a concentrated and well-located catalyst investment. Such an approach shortens t he timeframe to roll out a whole infrastructure in a country, while at the same time the benefits of the new approach can be enjoyed. On the basis of such a c oncentrated success the indigenous development capability can also be built.

Africa: Uganda – ICT policy and ICT master plan of Makerere University

With a student population of over 20,000, the Makerere University in Uganda ranks as one of the largest in East and Central Africa. It has twenty faculties/institutes/schools offering Day, Evening and External Study programmes and is actively involved in research activities.

The University has identified Information and Communication Technology (ICT services and systems) as critical and top priority enablers in achieving its Vision and Mission and initiated the implementation of these services with the support of various external partners[37] . A group of external donor organisations that express their intention to support the University in building up IT services and facilities includes:

- Sida/SAREC, Sweden - developing the framework for the establishment of ICT infrastructure.
- NORAD, Norway – supporting the strengthening of Administrative Computing.
- Government of Uganda/African Development Bank - supporting the strengthening of Scientific and Technical Teacher Education.
- USAID (Leland initiative) – establishment of Internet connectivity for all faculties and centres .

To assist the University in elaborating of a distinctive ICT policy and IT master plan, a consortium comprising Delft University of Technology (the Netherlands), Uppasala University (Sweden) and University of Dar Es Salaam (Tanzania) has been set up. Preceding the actual formulation of the policy and plan, a Quick Scan Survey has been conducted with the support of the Delft University of Technology by Makerere University to inventory the present situation for ICT at Makerere in terms of ICT services, infrastructure, technical support and human resource development capacities available [38].

In 2001, the work on the formulating of an Information and Communications Technology (ICT) Policy was completed highlighting the major actions to be taken by the University to integrate ICT services in its educational, research, administrative, and managerial processes. These actions include:

- To provide Common Network Services (Network Infrastructure), mainly comprising physical network infrastructure (wiring, switches, routers, servers, etc) and communication protocols (TCP/IP)
- To provide User-level Data Communication Services such as Email, Access-to-Internet, Internet/Intranet Services, which actually are major “users” of the low-level network services
- To promote office computing applications such as word processing, electronic mail, spreadsheet processing, document storage and retrieval, desktop publishing, access-to-internet and intranets
- To implement an integrated online Library Information System (LIBIS).
- To enhance and streamline student education related administrative and managerial processes through the implementation of an integrated Academic Records Information System (ARIS)
- To enhance and streamline the human resource management and administrative processes through the implementation of a Human Resource Information System (HURIS)

With a master plan, the University intends to provide a highly visible and open strategic planning process outlining the order in which the planned ICT servic es and systems will be implemented39.

Under the coordination of a representative of the Nakaseke MCT Pilot Project stake holders in ICT in Uganda are in the process of developing a National ICT Policy. In 2003 it started to develop a conceptual framework on which the policy consultation and development process can be based. Focus areas in the framework are: universal access for all sectors of society, human resource development, support for good governance, promotion of cultural heritage, appropriate infrastructure development and support for business development.

Lessons to be learned from the Uganda case

The case of Uganda proves that to a certain extent the classical approach for ICT development can be followed elsewhere. The classical approach is the introduction of advanced technologies in the tertiary education level first, before a national ICT policy is even put in place.

Latin America: Chile – Access Nova: DCC-UChile Technology Cluster

In terms of telecommunications and IT infrastructure, Chile is widely recognized as one of Latin America’s most advanced countries. Chile owes its status as a regional leader to its conscious decision taken in the 90s, to exploit the full social and economic potential of the ICT progress and to engage in strategic international co-operation.

In 1994 the project called AccessNova was inaugurated by the Japanese Nippon Telegraph Telephone (NTT) company, the University of Chile (UChile) and a mechanism existing between the Chilean National Council for Science and Technology (CONICYT)40 and the Japan Society for the Promotion of Science. According to the agreement , NTT supports UChile through the Science and Technology Information Centre in formulating a strategy for the introduction and development of B-ISDN 41 in Chile, by means of experimentation in ATM 42 networks platforms and broadband applications. The project consists of two par ts:

1. Optimisation of worldwide use of Internet through the development of an instantaneous transmission system, supported by broadband telephone connections.

2. Creation of a virtual laboratory between Tokyo and Santiago, which leads to fast transmission of larger volumes of information in the form of images, voices or text per time unit. The virtual laboratory involves the establishment of a dedicated circuit, through Abilene (USA), AMPATH (Trans Americas), Reuna2 (Chile) and GEMnet (Trans Pacific) network systems.

As an interdisciplinary project, AccessNova has become a research base of the University of Chile for advanced communications and information technologies such as electronic commerce, remote interacting education, remote monitoring and control, digital TV over IP, wireless IP and astronomy. It has also become an incubator offering low-cost infrastructure and 2 years start-up period for young businesses operating in IT sector. AccessNova programme enhances and facilitates intergovernmental co-operation through the organisation teleconferences and virtual meetings with participation of governmental officials and academics. Chile’s international partners on AccessNova programme besides Japan include USA (UTC, Sun Microsystems, etc), Malaysia (Multimedia U niversity) and Europe (European Southern Observatory).

In Chile the regulatory framework is still lacking to take the full economical benefit of ICT. The government mainly acts as an endorser of technical advanced equipment and infrastructure and of international co-operation. However it

has so far not grabbed the opportunities to introduce measures to further promote high-tech business growth by means of supporting venture capital or applied ICT in its own processes

Lessons to be learned from the Chile case

The case of Chile shows that innovation supporting action, like business incubation, can be taken, even if the regulatory framework is missing. However to be effective for sustainable development these measures have to be followed up by an appropriate regulatory framework and specific measures to bring start-up companies to full blossom.

Policy lessons to be learned

Get the stakeholders involved

What do we mean by stakeholders? With stakeholders we pinpoint all those organisations that may have a stake or an interest in the ICT policy we design. It is of vital importance to give them a say in the design of the ICT policy. As an ally to the ICT policy they may be essential to make it a success, as an opponent they may hinder the policy to be implemented.

Who may we identify as stakeholders for the design of an ICT policy? They can be classified in three main groups: governmental, societal and economical stakeholders. It will get easier if we think about their activities relevant to ICT. Do these stakeholders have a role in ICT as regulators, stimulators, inve stors, suppliers, resellers, users, service providers or enablers? And we should not forget to realise how influential various stakeholders may be. To turn it around: how influential we would like them to be in supporting the ICT policy. The stakeholders may be local organisations, but we should not rule out international organisations, which provide knowledge and guidance.

In any ICT policy, there are stakeholders who should always be consulted or involved. Telecom providers are of vital importance as we have seen, as well as Internet service providers (ISPs). We should not forget that nearly all Intell ectual Property Rights on ICT are in private hands and that large multinational companies dominate the ICT market. Companies like IBM, HP, Microsoft, Oracle, Cisco, Peoplesoft, SAP, etc, have a major influence on the computer and software platforms we use. Local companies will depend on them in developing their business.

Awareness, Interest, Desire and Action

Having made an inventory of stakeholders, the question arise how to address them and how to involve them. For stakeholders who have a clear interest in the ICT policy it is easy to consult them one by one or organise a workshop in whi ch they are brought together. For stakeholders who are not aware of their need to be involved in the ICT policy, the approach should be an information and awareness campaign. In the initial orientation phase international organisations are the ones who can provide information and guidance. In the table we provide an indicative list of international organisations with high ICT policy relevance.

Table 2:

International organisation	ICT relevance	website
International Telecommunications Union - ITU	Agency within the UN coordinating global telecom networks and services.	www.itu.org
World Intellectual Property Organisation - WIPO	Agency within the UN promoting the protection of intellectual property.	www.wipo.org
World Trade Organisation - WTO	Agency directly governed by its member countries, setting the global trade rules.	www.wto.org
World Bank	Bank with a global reach for development through financing and technical assistance. Runs the global donor-funded program infoDev.	www.worldbank.org www.infodev.org
World Economic Forum -WEF	Private organisation by world leaders in business to address global issues and promote entrepreneurship. Publishes the Global Information Technologies Report on e-readiness.	www.wef.org
Association for Progressive Communication - APC	Non-profit organisation to give civil society a voice in ICT. It hosts bridges.org to provide advice to ICT policy makers.	www.apc.org www.bridges.org
Internet Engineering Task	Open international community of	www.ietf.org

Force - IETF	network designers, operators, vendors, and researchers concerned with the evolution of the Internet architecture and the smooth operation of the Internet.	
Internet Society - ISOC	Professional membership organisation addresses issues on the future of the internet.	www.isoc.org
Internet Corporation for Assigned Names and Numbers - ICANN	Non-profit private sector organisation to assign domain names worldwide, as well as Internet Protocol addresses, protocol parameters and port numbers.	http://icann.org
World Wide Web Consortium	The consciousness of the world wide web created by its inventor and other who contributed significantly to the World Wide Web.	www.w3c.org
DigitalGovernance.org Initiative	Digital Governance aims to study, design and propagate e-governance models. The focus of is on developing countries.	www.digitalgovernance.org

Source:

To get local organisations involved is a matter of contacting them, interesting them and encouraging them to participate in the ICT policy. Local organisation s are typically NGOs (Non-Governmental Organisations), which co-operate with local entities such as schools, companies and hospitals to carry out projects which directly impact on the local population.

It is of vital importance to keep discussions among stakeholders interesting by discussing practical objectives such as providing all schools with access to I nternet, or reducing the price for computer usage. The involvement of the local stakeholders is essential in setting realistic policy objectives. Many nationa l ICT policies fail as a result of adopting unrealistic objectives which do not correspond with international or local realities and did not attract stakehold er 'buy in'.

Follow-up is needed to progress

To get stakeholders committed to ICT policy is a matter of keeping them involved during the design process. It is not only about organising huge gatherings in conferences, but there should be follow-up actions to keep their attention. That can be achieved by sending them newsletters or having smaller gatherings in workshops and seminars. Stakeholders' opinions should be listened to, but it is not always necessary to follow them. ICT policy design is a trad e-off between many interests and opinions. Very often financing mechanisms can be used to keep the local stakeholders involved by carrying out development projects.

Assign resources

Getting an ICT policy implemented is a task which goes beyond the definition of shared visions, objectives and regulations. Financial resources should be allo cated to projects which promote new ideas, build new concepts, design project plans and implement the ICT policy plans locally. Pilot projects should be promoted and may become case studies for further implementation.

Know their values and how to respond to them

Involving many stakeholders internationally as well as locally is a balancing act. Every stakeholder has their own interests and these interests do not necessarily correspond to each other. But often they share values, like fighting poverty or promoting equal rights. Values are very good denominators to reach agreement between stakeholders with different interests.

Values, attributes and competences

Responding to values is a matter of agreeing which kind of attributes can support various common values. Attributes can be, for example, access to a computer and training on which personal competences can be built to apply for a job. Below is a fictional example of stakeholder analysis43 to illustrate the combination between values, attributes and competences. In t his example a primary school is taken as the stakeholder and as the starting point for our inventory of values, attributes and competences. In this illustration, the values for the school on ICT are to have access to information, to be able to provide individual education and to communicate with parents. The ICT attributes which can contribute to the values are PCs, Intern et access, educational software, local area network, website/e-mail, the school administration (on a PC) and games. The competences to install, update and to maintain the attributes could be software

engineering, system engineering, administrative skills, educational skills, information analysis and website design. In policy development the discussion must address the level of importance of the relationships between values, attributes and competences. In this example the relationships are validated on a scale from 1 (for minor importance) to 5 (for major importance).

Figure 8: Stakeholder value mapping
Source: Inpaqt B.V.

Prioritisation

Any good policy design reaches the stage of priority setting. No country has an unlimited pool of resources to draw from. It is essential to prioritise. The a nalysis of values, attributes and competences is a valuable way of creating objectivity. This is illustrated in the analysis of the fictional example. In the matrix below each of the relations is weighted and normalised to a value from 1 (low priority) to 5 (high priority). It concludes that the website and e-mail will be most essential in contributing to the values of the primary school, directly followed by PCs and Internet Access. It also shows that competences in the field of information analysis are most needed, followed by software engineering and to a lesser degree system engineering and educational skills to install, update and to maintain the attributes to the values of the primary school.

Table 3:

	Attribute priority			**Competence priority**
Website/e-mail	5		Information analysis	5
PC	4		Software engineering	4
Internet Access	4		System engineering	3
School administration	2		Educational skills	3
Educational software	1		Administrative skills	2
Local Area Network	1		Website design	1
Games	1			

Source:

In reality we have to analyse each of the stakeholders accordingly and combine all their outcomes to find the trade-off between all the values, attributes and competences.

Planning and financial valuation

Priority setting makes it easier to minimise the resources required to implement the ICT policy. But the resources have to be allocated and made available. As well as proper project planning, a financial forecast is needed to predict the financial consequences of the ICT policy. Most countries or regions never make such a forecast and are not aware of the consequences of the measures they propose and implement. Thereby they run unforeseen risks, which can be avoided using modern software tools44.

Build policies together

ICT Policy building should be an exercise of listening to relevant opinions. Only then can ICT policies have the chance to be successful in the long run. The preferable policy design approach is building them in a team of people with various disciplinary backgrounds. There can also be a team of representatives of sub-teams, which prepare policy visions in relevant areas.

Technology foresight

Because innovation in ICT is an ongoing process, reactive measures of today may not be enough or relevant tomorrow. Therefore it is necessary to have a vision of how ICT will develop in the medium term, to give measures validity for a lo nger time. That requires coming up with more pro-active measures that anticipate coming developments. A helpful tool in this respect is technology foresighting. It determines which technologies are of strategic importance to a country and which innovation system is needed to support the development and a pplication of these technologies45 .

Technology fore sighting may can be executed in 6 steps:

1. Create list of international strategic technologies
2. Create list of technologies important to national business
3. Identify technologies of strategic importance to the nation

4. Identify availability of knowledge related to strategic technologies
5. Determine problems between the supply and demand for knowledge
6. Document results and methodology

Technology foresighting was successfully applied in South Africa after 1994. At that time the Reconstruction and Development Programme (RDP) set the vision fo r the country and created an agreed basis to measure many policies, programmes and projects. Between 1996 and 2001 South Africa took major ICT initiatives, such as the National Research and Technology Foresight, the Information Technology National Qualifications Framework, the Electronic Commerce Policy Process and the SA Information Technology Industry Strategy. The ICT Technology Foresight identified four main priority areas: future web applications, e-tagg ing, including all kinds of aspects of electronic security, tracking and auditing, knowledge management and ICT supported new learning methods.

Give all ideas a chance

The uncertainty of future technological developments in ICT makes it risky to simply copy successful ICT policies. What worked before does not necessarily work in the future. Consequently ICT policy makers should be open to new ideas, even when there is only a limited track record of application available. ICT p olicy makers can assess these ideas easily if they discuss them with the idea owner. After all, the values that the ICT policy tries to fulfil should be supportive of new ideas and open to change.

Delegate tasks between all

Being aware of the number of stakeholders, their values and the relationships between them leads to the conclusion that ICT policy making can only be efficient and effective once tasks in policy making are delegated and the leading ICT policy makers takes a visionary and coordinating role.

Show leadership in complex decisions

In some cases priority setting may prove difficult and sub-teams may not be able to reach a mutually agreed conclusion between them. In such a case it is crucial to demonstrate leadership and take a decision.

Policy options

There is an obvious relationship between ICT policy options, the level of Government ambition and the current economic context in a country. Because most of the benefits of ICT only arise on the medium term, it is important to ident ify opportunities for quick wins. Only in this way can the ICT policy agenda remain credible to both stakeholders in the country and potential donors and investors from overseas. This chapter provides policy options to consider in building the ICT policy for sustainable development:

- Establish policy advisory bodies to the Government, such as an ICT Task Force and a national science and technology advisory body.
- Take measures to raise public awareness of the importance of ICT for sustainable development.
- Make academia and research institutes relevant to development needs.
- Promote and increase investment in ICT education.
- Use special measures to retain and attract young talent; maintain close ties with expatriates.
- Promote the setting up of bridging institutes, like technology transfer organisations, research foundations, business incubators, licence and IPR brokers and science parks to stimulate innovation.
- Increase government usage, to make government application a good case for society.

Establish policy advisory bodies

Building ICT policies requires a high level of political leadership. All key barriers to implement ICT policies need to be properly addressed. A good approach for any government is to establish policy advisory bodies for ICT and for science and technology. Together these bodies should address bottlenecks such as a limited scope for ICT, existing societal hierarchies and the dependency on large scale investments.

ICT policy is often taken by policy makers to be connected to a specific sector or target. However, ICT is generic and it is important not to exclude sectors and targets, as ICT supports the whole economy and society. Existing social hierarchies may limit access to ICT for the most powerful economic and political actors only. However, ICT should create new opportunities for the whole of economy and society, rather than be used as a control mechanism. Internet access in cyber cafés or Internet access in schools are good examples of initiatives to give the poorest access to ICT.

Dependency on large scale investments in telecommunication, electricity and computer infrastructure can be a significant bottleneck. This barrier can only be overcome by national governments or technological innovations, such as the mobile telephone, which allows developing countries to leap-frog richer countries as massive investment in infrastructure, is not required.

Policy advisory bodies can take the idea of using ICT as a catalyst for sustainable development as their starting point. They are also able to suggest the framework for a nation’s needs to adopt the proper and legal and regulatory

framework. To be able to operate successfully, these bodies need a certain lev el of independence from the government, in order to propose measures which are based upon the latest insights and technological developments.

Raise public awareness of the importance of ICT

Proper ICT policy design depends on awareness of the implications the policy will have on the society, economy and culture of a country. Because of the wide-ranging consequences of ICT policy, it should be supported by a public awareness campaign. It may be necessary to publish the policy, preferably on a medium which is widely accessible by a local audience. Popular TV or radio pro grams can help to address the issues necessary to raise the awareness of ICT.

Schools should get quick access to ICT. Not only will students get more acquainted with ICT, but also so will their parents. In Senegal, the government and Sonatel came to an agreement to lower the price of Internet access for sch ools and universities. Schools should not only have access to the Internet but also teachers should become computer literate to provide computer trainings to their pupils.

Make academia and research institutes relevant to development needs

Universities are often the first institutions who 'get connected' because they have a high concentration of students, are heavy users of ICT in all its aspects and get involved in developing new ICT innovations and applications. In any ICT development the local involvement of academia and research institutes is of main importance to keep in touch with the innovative character of ICT.

The development of a local ICT industry that competes and at the same time supports each other in market developments is fundamental to successfully developing ICT. The end game is to form a cluster where companies, education establishments, research institutes, science parks and infrastructure providers are part of an interactive network sharing knowledge and capability and compet ing in international markets. Even the most developed countries are still aiming to develop such clusters and are still struggling to get their academia and research institutes to collaborate.

Promote and increase investment in ICT education

To close the digital skills gap, emerging economies need to improve the capacity of their workforces for Internet Age roles. This includes improving Internet access and educational programmes in schools and colleges, creating digital libraries for universities, and encouraging professional training. The Internet should also be strongly promoted among sectors that would have the most prospects to harness it. Key priority areas for such Internet growth include the software and Web solutions/services sectors.

Training and education is a large part of many technical assistance projects. While basic training is generally done in the country, advanced training and education programs are generally done abroad. Students sent abroad for such training and education not only learn specific subject matter, but also begin to create their own personal network of technical and professional contacts that characterizes most effective professionals in developed countries.

Use special measures to retain and attract young talents; maintain close ties with expatriates

Every country that has a long term vision for ICT has to create a knowledge pool in ICT to sustain its own ICT systems. This brain pool can only be sustained if there is a local industry that absorbs part of these knowledge workers. Without such a local industry these knowledge workers will themselves be the main source of brain drain. If the ICT policy is effective, as in India's case, many talented expatriates can be persuaded to return and participate in or finance ICT initiatives at home.

Promote the setting up of bridging institutes

Government should concentrate on promoting innovations that result from local demand, through the creation of bridging institutes for innovation. Each country has its own unique industrial mix, country characteristics and habits that can result in new ways of using ICT. On the conditions of uniqueness, some of these local applications could have a far wider application and become impo rtant export products for a developing country. For example, Lebanon's strong profile in the Arab media has allowed it to take a leading role in ICT initiatives aimed at this sector.

Bridging institutes will be searching for new ways of financing ICT policies. Models that are self-sustaining after an initial period are preferable, but private funding can also be sought. The e-inclusion46 project of Hewlett Packard provides, for example, support which may not always be expected from a multinational company.

Increase government usage

In the ICT policy design process governments can show leadership by using state-of-the-art ICT tools to make their operations more efficient and transparent. So far e-government has mainly been a supply-driven activity.

Level of basic usage

A RAND study47 reveals that citizens in Europe and the US make more use of e–government servi ces that do not require much personal information, except for tax declaration. They seem to be most driven towards e-government services because of convenience. The business community is driven to e-government for convenience reasons too, and there is room for more e-government services, especially in the government to business domain.

Level of transaction activity

Governments have not been the forerunner in ICT usage. As organisations they lack the motivation to save costs as much in the private sector. To make e-government worthwhile, a threshold of a number of transactions needs to be reached. Very little is known about the threshold at which various government transactions online become viable.

Classically government's main interest is in automation of its own administration, to improve control and credibility. As l ong as clerks fill these administrative systems, governments observe clear opportunities to get citizens to fill out their own forms directly. An obvious example for such a procedure is the filling of tax forms. In this example the benefits to the government are high in case of good access to ICT, because after a certain number of years governments are able to mandate every transaction to be made electronically.

Impact on commerce/spending

Businesses may benefit from governments going online. In an ICT project in the Philippines, the customs transferred from a paper based procedure to an electronic procedure, thereby an electronic payment system became feasible, reducing opportunities for corrupt payments significantly. The reliability of the customs towards business improved and the clearance time decreased from previously a week to a maximum of two days.

Impact on service offerings

Governments typically go online to improve dissemination of information. Instead of printing government publications such as taxation rates, application procedures and policies, publishing them on the internet improves access to th is information. The second step is to interact with citizens by delivering data to them and receiving data from them. An example is an ID number with which ci tizens can check the status of a government application. The third step is when applications can be directly made online. Online transaction costs are greatly reduced.

A. For further reading

In the field of ICT policy development literature is scarce and fragmented. Rather than providing a list of many references, we recommend the following list of books for further reading.

- Mansell, Robin and Uta Wehn, Knowledge Societies: Information Technology for Sustainable Development, United Nations Commission on Science and Technology for Development, Oxford: Oxford University Press, 1998, see http://www.susx.ac.uk/spru/ink/knowledge.html
- Digital Opportunities for Development: A Sourcebook for Access and Applications, Learnlink, 2003, see http://learnlink.aed.org/Publications/Sourcebook/home.htm
- The E-Government Handbook for Developing Countries, November 2002, A Project of InfoDev and The Center for Democracy & Technology, see http://www.cdt.org/egov/handbook/
- Creating a Development Dynamic, Final Report of the Digital Opportunity Initiative, July 2001, see http://www.opt-init.org/framework/pages/contents.html
- World Economic Forum, Global Information Technology Report 2003-2004, http://www.weforum.org/site/homepublic.nsf/Content/Global+Competitiveness+Programme%5CGlobal+Information+Technology+Report%5CGlobal+Information+Technology+Rep ort+2002-2003+-+Readiness+for+the+Networked+World
- "ICT Policy: A Beginners' Handbook", Association for Progressive Communications, 2003, see: http://www.apc.org/english/capacity/policy/
- index.shtml
- At http://www.undp.org.my/factsheet/docs/ICTmAnnotatedBibliography_14Jul03.pdf a very comprehensive annotated bibliography on ICT for development can be obt ained. This bibliography leads to many more relevant detailed publications.
- A very much related subject to ICT policy development is the strengthening of developing country participation in International ICT decision making, identified by the G8 DOT Force and the United Nations ICT Task Force, to strengthen the participation of developing countries in international ICT decision-making. This programme has resulted in the ICT Development Digital Library (ICT DevLibrary) accessible through: http://www.ictdevagenda.org/devlibrary/
- Detailed descriptions of national ICT development policies are becoming step by step available online. Here we provide some main references to each continent:

Asia

Regional road map towards an information society in Asia and the Pacific, UN Economic and Social Commission for Asia and the Pacific, ST/ESCAP/2283, 2004;
http://www.unescap.org/icstd/pubs/roadmap/Roadmap(Fullreport).pdf

Africa

A very rich source of data on the connectivity of Africa and many more ICT subjects can be found on Mike Jensen's webpage: http://www3.wn.apc.org/ . And the Africa ICT Policy monitor can be reached through http://africa.rights.apc.org/

Europe

European Civil Society Internet Rights Project: http://europe.rights.apc.org/

Latin America

Latin America and Caribbean ICT Policy Monitor (in Spanish): http://lac.rights.apc.org/

Middle East

A comprehensive overview of the current status of the Internet in the Arab world:

http://www.library.cornell.edu/colldev/mideast/nusacci.htm