United Nations Conference on Trade and Development

INFORMATION ECONOMY
REPORT 2006

The Development Perspective

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United Nations

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INFORMATION ECONOMY REPORT 2006

The development perspective

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Foreword

At last year's concluding phase of the World Summit on the Information Society, the international community set itself an ambitious but achievable agenda. The Summit made a commitment to ensuring that information and communication technologies (ICTs) are employed to support a truly global, open and inclusive information society that benefits people everywhere.

Much work lies ahead to better understand the dimensions of the digital divide and its effects on development. However, the basic diagnosis is well established. People in developing countries need easier and cheaper access to ICTs. They need enhanced ICT skills to better employ these technologies in their homes, schools and jobs. And they need the freedom to create, share and exchange information and knowledge of all kinds.

UNCTAD's *Information Economy Report 2006: The Development Perspective* analyses the specific requirements of ICT and e-business strategy-setting in a developing-country context. It also considers the design and assessment of pro-poor e-strategies as well as the usefulness of national ICT policy reviews. Finally, it evaluates the development implications of crucial technology and business trends such as web services and service-oriented architectures – trends that first emerged in the developed world but that, in an increasingly networked economy, need to be considered by developing countries.

This Report was prepared as Governments, non-governmental organizations and the UN system continue to implement the World Summit's outcome. It is designed to help policymakers in developing countries make informed choices in the field of ICT and e-business. I am therefore pleased to recommend it to the growing ICT-for-Development community and, more generally, to anyone interested in promoting sustainable development for all.

Kofi A. Annan
Secretary-General of the United Nations

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ADNOC	Abu Dhabi National Oil Company
APC	Association for Progressive Communications
APDIP	Asia Pacific Development Information Programme
API	American Petroleum Institute, USA
API	application program interface
Aramco	Arabian American Oil Company, Saudi Arabia
ASEAN	Association of Southeast Asian Nations
B2B	business-to-business
B2C	business-to-consumer
BOP	balance of payments
BPEL	Business Process Execution Language
BPEL4WS	Business Process Execution Language for Web Services
CAGR	compound annual growth rate
CBO	community-based organization
CCA	common country assessment
CERA	Cambridge Energy Associates Inc., USA
CIS	Commonwealth of Independent States
CPC	Central Product Classification
DNS	domain name server/system
DESA	Department for Economic and Social Affairs
DSL	digital subscriber line
ebXML	Electronic Business using eXtensible Markup Language
ECA	Economic Commission for Africa
ECDR	E-Commerce and Development Report
ECLAC	Economic Commission for Latin America and the Caribbean
EDI	electronic data interchange
EIA	Energy Information Administration, USA
EIA	Enterprise Integration Application
ERP	enterprise resource planning
ESCAP	Economic and Social Commission for Asia and the Pacific
ESCWA	Economic and Social Commission for Western Asia
EU	European Union
EU15	The 15 countries members of the European Union until May 2004

EU25	The current member countries of the European Union
Eurostat	Statistical Office of the European Communities
FATS	Foreign Affiliates Trade Statistics
FCC	Federal communications Commission
FDI	foreign direct investment
FLOSSPOLS	Free/Libre/Open Source Software Policy Support
FOC	Forum of Conscience
FOSS	free and open source software
FTTP	fibre-to-the-premises
FTP	file transfer protocol
GAPTEL	Grupo de Análisis y Prospectiva del sector de las Telecomunicaciones (Spain)
GATS	General Agreement on Trade in Services
GEM	Gender and Evaluation Methodology
GDP	gross domestic product
HTML	hypertext transfer markup language
HTTP	HyperText Transfer Protocol
HTTPS	HTTP over SSL
ICANN	Internet Corporation for Assigned Names and Numbers
ICE	International Commodity Exchange
ICTs	information and communication technologies
ICT4D	ICT for Development
ICT4P	ICT for Poverty Reduction
IDRC	International Development Research Centre
IEA	International Energy Agency
IER	Information Economy Report
IFP	Institut français du pétrole
IFPI	International Federation of Phonogram and Videogram Producers
IGF	Internet governance forum
IICD	International Institute for Communication and Development
IMF	International Monetary Fund
IOC	international oil company
IOS	inter-organizational system
IP	Internet protocol
ISIC	International Standard Industrial Classification
ITC	Indian Tobacco Company
ITU	International Telecommunication Union

KOC	Kuwait Oil Company
LAN	local area network
LDC	least developed country
mb/d	million barrels per day
MOWS	Management of Web Services
MUWS	Management Using Web Services
NGO	non-governmental organization
NIOC	National Iranian Oil Company
NOC	national oil company
OASIS	Organization for the Advancement of Structured Information Standards
ODI	Overseas Development Institute
OECD	Organization for Economic Co-operation and Development
OIES	Oxford Institute of Energy Studies, UK
OIL	Oil India Ltd
ONGC	Oil and Natural Gas Corporation Ltd, India
OPEC	Organization of the Petroleum Exporting Countries
OPIS	Operational Program for the Information Society (Greece)
Orbicom	International Network of UNESCO Chairs in Communications
OSI	open systems interconnection model
OSS	open source software
OU	Open University
PC	personal computer
PPP	purchasing power parity
PRSP	Poverty Reduction Strategy Paper
RIPE NCC	Réseaux IP européens network coordination centre
Rosneft	Russian oil company, Russian Federation
SAR	Special Administrative Region
SIDA	Swedish International Development Agency
Sinopec	China Petroleum & Chemical Corporation
SGML	Standard Generalized Markup Language
SMEs	small and medium-sized enterprises
SMS	short message service
SMTP	Simple Mail Transfer Protocol
SOA	Service-oriented architecture

SOAP	Simple Object Access Protocol
Sonatrach	Société nationale de transport et commercialisation des hydrocarbures, Algeria
SPE	Society of Petroleum Engineers, USA
SSL	secure socket layer
Surgutneftegas	Surgut oil and gas company, Russian Federation

TCP	Transmission control protocol
TCP/IP	Transmission Control Protocol on top of the Internet Protocol
TNK	Tuimenskaya Neftyanaya Compania (Tiumen Oil Company), Russian Federation

UDDI	Universal Description Discovery and Integration
UK	United Kingdom
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UN	United Nations
UNCPC	United Nations Central Product Classification
UNCTAD	United Nations Conference on Trade and Development
UNDAF	United Nations Development Assistance Framework
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNDP	United Nations Development Programme
UPS	uninterruptible power supply
US	United States

VAN	Value Added Network
VoIP	Voice over Internet protocol
VSAT	very small aperture terminal

W3C	World Wide Web Consortium
WGIG	Working Group on Internet Governance
WS	Web services
WSDL	Web Services Description Language
WSFL	Web Services Flow Language
WSIS	World Summit on the Information Society
WSRM	Web Services Reliable Messaging
WSS	Web Services Security
WS-SX	Web Services Secure Exchange
WSTF	Web Services Transaction Framework

XLANG	XML LANguage (an XML-based language for defining business processes from Microsoft)

XML	Extensible Markup Language

EXPLANATORY NOTES

The term "dollars" ($) refers to United States dollars unless otherwise stated. The term "billion" means 1,000 million.

Two dots (..) indicate that the data are not available or are not separately reported.

A hyphen (-) indicates that the amount is nil or negligible.

Because of rounding, details and percentages do not necessarily add up to totals.

OVERVIEW

Global economic processes, including international trade, are increasingly influenced by the creation, dissemination, accumulation and application of information and knowledge. Development can no longer be understood without full consideration of the widespread effects of information and communication technologies (ICTs) and their applications to enterprise activities. UNCTAD's *Information Economy Report 2006* has been produced, like its predecessors in the E-commerce and Development Report series, with the intention of helping bring to the forefront of the international agenda the implications for developing countries of the changes that ICT and e-business are bringing about in the productive, commercial and financial spheres. The Report is also intended to support the efforts of developing countries to overcome the challenges they face as they strive to narrow the digital divide and to enable their enterprises to become more competitive through the adoption of ICTs and e-business. To do so, the Report analyses the specific policy challenges facing developing countries, proposes possible means to address them and identifies and disseminates existing international best practice.

The first question to be considered is the extent to which developing countries are active participants in today's global information economy. This problem presents several dimensions. The most obvious one has to do with the differences in the level of access to ICTs between developed and developing countries. From a development point of view, one must also investigate how and to what extent the enterprises of developing countries are adopting ICTs and e-business, and whether their patterns of adoption and use are (or should be) different from those of their counterparts in developed countries. It is then necessary to examine the internal divides in developing countries that limit the chances that groups such as the poor, rural communities and women will be able to benefit from ICTs in terms of better economic opportunities. The participation of developing countries in international trade in ICT goods and services is another fundamental aspect of their involvement in the global information economy. Lastly, one should try to quantify the impact of ICTs at the micro and macro levels, particularly with regard to their effects on growth and economic development. All these questions are treated in chapter 1 of this Report, which presents the only internationally comparable statistical information available about e-business in developing countries, as well as in chapter 5, which examines in more detail the impact of ICTs on employment in developed and developing countries. Chapter 5, which has been produced by the International Labour Organization in close collaboration with UNCTAD, also demonstrates the usefulness of addressing related development issues through inter-agency cooperation.

Notwithstanding the magnitude of the issues involved, one has to acknowledge the efforts made by Governments in developing countries in recent years to bring the benefits of ICTs to their people. Today, many developing countries have formulated and implemented national ICT plans and policies setting out a road map for a national information society and for integration into the global knowledge-based economy. But how can countries determine whether they are still following the pre-defined strategy, and what needs to be done to revise and adapt existing policies to meet their goals? There are no international guidelines for developing countries to assess their national ICT strategies and plans. Chapter 2 proposes a model ICT policy review framework for developing countries and encourages Governments to carry out such reviews. In this regard, it is particularly important that the effects of ICT policies on the poor be fully taken into account before they are implemented. That is the reason why chapter 3 presents a framework that policymakers can use to design pro-poor ICT interventions in developing countries, or to assess their value in terms of their impact on poverty.

The impact of ICTs and e-business on the economic prospects of developing countries extends well beyond the more obvious examples of e-commerce or e-government applications. As general-purpose technologies, ICTs have the potential to enhance efficiency in most areas of economic activity. For example, chapter 4 of the Report looks into the effects of ICTs on the production and distribution of oil from two standpoints: first, how ICTs are making the exploitation of oil resources more effective (with a possible positive effect on supply); and second, how ICT applications in oil distribution can help alleviate the effects on oil-importing developing countries of rises in oil prices.

Effective decision-making in the field of ICT and e-business, with regard to either public policies or business competitive strategies, requires a sound understanding of the principles and dynamics that govern the interaction between technologies and the economic, legal and social environments of the developing countries in which those technologies are implemented. These interactions provide the focus of the last three chapters of the *Information Economy Report 2006*. Chapter 6 shows how, for technological as well as business strategy reasons, service-oriented architecture technologies and particularly Web services are likely to represent a major milestone in the evolution of e-business. Enterprises in developing countries should be aware of the latest trends in these technologies and consider the most appropriate strategies for their gradual adoption. Chapter 7 explains how the layered structure of the Internet is one of the main reasons for the success of this technology and how it is in the interest of developing countries that the potential of the Internet as an equalizer in international competition is not eroded by suboptimal governance. In particular, the chapter makes it clear that optimal governance measures are those that respect the principle of minimal Internet layer crossing — that is, that policy should be implemented at the Internet layer that is closest to the problem that is intended to be dealt with. Chapter 8 closes the Report with an examination of the recently adopted United Nations Convention on the Use of Electronic Communications in International Contracts, which will help developing countries establish a legal framework for e-business that follows international best practice and enables and facilitates e-business transactions at the national and international levels.

A Call for Action

A long and intense period of international dialogue on the issues of ICT for development came to a fruitful conclusion with the closing of the second phase of the World Summit on the Information Society (WSIS) in Tunis in November 2005. Stakeholders are now engaged in the translation into practical actions of the programme and principles that were adopted in the two phases of the Summit. The amount of work that needs to be done is formidable, the time available is short, and the challenges of a multistakeholder decision-making process are complex.

UNCTAD is fully committed to contributing to this endeavour within the scope of its mandate and expertise. In addition to its participation in several WSIS lines of action, UNCTAD has entered into a partnership with the International Labour Organization and the International Trade Centre, with the objective of addressing key issues of e-business and e-employment. The first activity of the partnership was the joint organization of the first facilitation meeting on "E-business and e-employment", which took place in May 2006. The meeting recognized the key role of stakeholders from Governments, civil society, academia and the private sector in shaping, promoting and implementing related projects and programmes. Another example of inter-agency cooperation to support ICTs for development is the joint organization of an UNCTAD–UNITAR seminar on free and open source software (FOSS). The event, held on 29 August 2006 at the UN in New York, examined the role of FOSS in economic and social development as well as its use in the UN system. Ensuring the full participation of all developing countries in the global information economy will require the active involvement and support of the whole international community, including bilateral and multilateral donors.

The great potential of ICTs as catalysts of social and economic development is clearly recognized. ICT dissemination and adoption in developing countries are supported by many donors as a powerful means to facilitate the achievement of major development goals in the areas of health, education, governance and others. A comprehensive approach to supporting ICT-for-development actions should pay adequate attention to the adoption of ICTs and e-business by the enterprises of developing countries. There is a growing amount of evidence from developed and developing countries that the adoption of ICTs by enterprises helps accelerate productivity growth, which is essential for supporting income and employment generation. More widespread adoption of ICTs in the productive sectors of developing countries should also accelerate innovation and thus enhance the competitive position of developing countries.

In addition to the support of national and international development cooperation organizations, ICT and e-business for development initiatives have much to gain from South–South cooperation. This gives developing countries the possibility to share knowledge and capacity-building resources in an area in which a growing number of developing countries have achieved world-class expertise. UNCTAD actively supports South–South initiatives in the field of ICTs. An example of this was the signing of a Memorandum of Understanding with the Government of Brazil for capacity-building work in the field of FOSS in Africa.

In the final analysis, global knowledge sharing is also the fundamental purpose of this Report, whose chapters are summarized in the next few pages.

1. ICT Indicators for Development: Trends and impact

In 2005, the Internet and its applications continued to spread through societies and economies around the globe. Mobile communications are growing rapidly in developing countries, which are now far ahead of developed countries in terms of absolute number of subscribers. This makes mobile phones the only ICT in which developing countries have surpassed developed countries in terms of users. But penetration rates in developing economies continue to be well below those of developed countries. In some developed countries, the penetration rate is over 100 per cent, while in several dozen developing countries it is under 10 per cent. Schemes to make mobile telephony more affordable account for much of the growth in developing countries. For example, in 2004 almost 88 per cent of mobile subscribers in Africa used prepaid services that were tailored to low-income markets.

Although developed economies have lost some of their share of total Internet users to developing countries, they still account for more than half of Internet users worldwide. The digital divide between developed and developing economies is maintained in terms of Internet penetration. The average penetration for developing economies is boosted by the case of selected countries with exceptionally high penetration, such as the Republic of Korea. Approximately one third of developing economies have a penetration rate of less than 5 per cent. Africa has the highest growth rates in terms of Internet users, since many countries start from very low levels, but it has the lowest penetration rates.

Internet access by enterprises is nearly universal in most developed countries, with penetration rates reaching almost 100 per cent among large enterprises. Internet access by enterprises in the developing world is less uniform, reflecting a very broad range of penetration rates. There is, however, a positive correlation coefficient of 0.54 between Internet penetration and ownership of websites by enterprises with Internet access. This suggests that the level of ICT knowledge in the economy might also be an important determinant of Internet use by enterprises, since setting up a website demands more than basic computer literacy.

With regard to the type (or mode) of Internet access, there are large differences between developed countries, where broadband is growing rapidly, and developing countries, where dial-up is still prevalent. This changing nature of Internet modes of access is a new dimension of the international digital divide. In rich countries, broadband subscribers increased by almost 15 per cent in the last half of 2005, reaching 158 million. In particular, enterprise broadband connectivity grew significantly in the EU, from 53 per cent in 2004 to 63 per cent in 2005. Broadband increases the capacity of enterprises to engage in more sophisticated e-business processes and deliver through the Internet, thus maximizing the benefits of ICTs. It is estimated that broadband could contribute hundreds of billions of dollars a year to the GDP of developed countries in the next few years, and has been compared to utilities such as water and electricity.

The growth of broadband is largely due to competition and declining prices, but it also depends on the available infrastructure. In many developing countries, because of the lack of economies of scale, the incentive to expand broadband infrastructure outside urban areas is low. Wireless technology and satellites can help circumvent the cost of infrastructure for sparsely populated, remote or rural areas. Governments have an important role to play in improving access to broadband through infrastructure and policy. Government policy can either encourage or be a disincentive to competition, and thus have an impact on availability and prices. For example, while the Government of the Republic of Korea

enforces competition and encourages new entrants in the telecommunications market, the United States has allowed growing consolidation of the industry. The result is that there is a wider choice and better offers for customers in the Republic of Korea than there are for customers in the United States.

Online sales and purchases are now commonplace in all developed economies, but vary across industries and countries. In the OECD countries, the share of enterprises purchasing online ranged between 20 and 60 per cent in 2004. Enterprises in developing countries are increasingly conducting e-commerce, but available data do not confirm the developed country trend that online purchases are more frequent than online sales. This can be partly explained by an overrepresentation of certain sectors in surveys, as is the case for the manufacturing sector in Argentina and Kazakhstan, or other business activities in the real estate sector in the case of Romania. As regards the manufacturing sector, the reason for the lower incidence of online purchases could be that in some emerging markets intermediate goods B2B is less developed than final products B2B. Information from developing countries on the use of e-business for internal business processes is very limited, but data on the use of the Internet for business applications seem to confirm the trend from developed countries in terms of the gap between SMEs and large enterprises, with some exceptions.

Data on the ICT sector show that, generally speaking, following the contraction in the early 2000s, developed countries experienced an increase in both value added and employment in the ICT sector in 2003. This increase in demand and supply in the developed countries' ICT sector opened up new prospects for developing country business partners. In 2003, the ICT sector represented 5.5 per cent of total business employment in developed countries and was a source of employment growth. ICT sector employment grew by over 8 per cent annually between 1995 and 2003, which represented an additional 1 million people employed. The majority (66 per cent) of those working in the ICT sector were employed in the services sectors, a figure that corresponds to the high share of services in a typical developed economy. Among the developing countries for which data are available, the Republic of Korea, Malaysia and the Philippines show a very large share of ICT employment in their business sector (above the OECD average). One explanation could be that in some developing countries the size of the business sector is still small and most developments in the private market are based on new technologies.

Exports of ICT-enabled services grew faster than total services exports during 2000–2003, thus creating new export opportunities for developing countries. In 2003, this was mainly due to the above-average 20 per cent growth rate of developing countries' exports, surpassing developed countries' performance. Developed countries' contribution to world ICT-enabled service exports remained high in 2003, at around 83 per cent. During 2000–2003, developing countries lagged behind the world compound annual growth rate, but some had exceptionally high growth rates. Developing and transition countries' exports of ICT-enabled services originated mostly in Asia (77 per cent), followed by America (10 per cent), Africa (7 per cent) and South-East Europe and the Commonwealth of Independent States (6 per cent). While currently the top 10 exporters of ICT-enabled services are all from developed countries, China and India will soon make their way into the top 10 rankings. In 2003, the $836 billion value of the ICT-enabled sectors represented about 45 per cent of total services exports, compared with only 37 per cent in 1995.

An analysis based on foreign affiliates' flows demonstrates that trade in the ICT-enabled services carried out through the foreign affiliates of multinational companies largely exceeds conventional export and import flows as measured by the IMF Balance of Payments statistics. Furthermore, developing and transition economies have increased their commercial presence abroad. An analysis in relative terms shows that in most cases ICTs boost service exports more than sales through foreign affiliates. However, large exports of ICT-enabled services are also likely to be sold more through foreign affiliates. Developing countries' exports would benefit from improved access to foreign markets under all WTO GATS modes of delivery.

Computer and information exports are the most dynamic ICT-enabled service sector, particularly in the developing economies. Between 1995 and 2004, computer and information services exports grew six times faster than total services exports. The share of developing countries in this export sector increased from 4 per cent in 1995 to 20 per cent in 2003, with the highest growth since 2000. This is partly explained by the corresponding low-level regulatory environment in the WTO. Continued trade liberalization in this sector would need to take into account developing countries' concerns about the movement of natural persons (Mode 4). Additionally, developing countries should seek improved market access commitments under the other modes of delivery in order to boost the potential for South–South trade in services.

Calls for the measuring of ICT impact on development have been an essential and persistent feature in the discussion on ICT measurement and the collection of statistical indicators. The chapter shows that most research on the impact of ICTs at the firm level revealed a positive impact on firm performance and increased market share, if complemented by organizational changes, the upgrading of skills and innovation. Age and size of the companies, as well as quality and speed of the Internet connection, also play a role. Other critical factors concern the regulatory environment in which the firm operates, the structure of the industry sector and the degree of competition in the market. Hence, to optimize impact, firm-level ICT strategies need to be introduced in conjunction with other changes in the management of firms.

ICT access and use can contribute to productivity growth in both developed and developing countries. UNCTAD research on measuring the impact of ICTs on GDP in developing countries has revealed a positive contribution even in poorer countries. But countries that already have a certain level of ICT uptake and education seem to benefit most from the new technologies. Therefore, Governments need to create an enabling environment, through their national ICT plans and policies, to promote ICT diffusion among economic and social actors.

2. Reviewing National ICT Policies for the Information Economy

During the past decade, ICTs have become part of many developing countries' development plans and poverty reduction strategies. Governments have formulated ICT strategies or "master plans" and set objectives to ensure the effective deployment and use of ICTs in their country, for the benefit of their citizens and enterprises. As of June 2006, out of 181 developing and transition countries and territories, almost a half (44 per cent) had already adopted a national ICT plan and a fifth were in the process of preparing one.

But so far, only a few developing country policymakers have carried out a comprehensive assessment of their national ICT plans. Reviewing the status of their ICT policies would help them better understand the policy challenges and opportunities presented by ICTs for the information economy and quantify the main achievements regarding the implementation of their ICT policy measures as foreseen in the national ICT plan. It would also allow them to identify critical success factors and best practices as well as reasons for failure, which is important for adjusting and reforming the ICT policies.

However, there are no international guidelines for developing countries to define and implement an ICT policy review (such as, for example, what the OECD offers to its member countries through the ICT peer review process). Therefore, as part of its ongoing work on ICT policies and on ICT measurement for economic development and trade, UNCTAD has developed a model framework for carrying out national ICT policy reviews.

This chapter presents the **UNCTAD model ICT policy review framework** for developing countries. It outlines the three major components of the framework, using selected best practice country examples and successful ICT policies from developing countries. The first component is the review of the global ICT environment, which provides an overview of a country's ICT uptake, focusing on the status of ICT penetration and use for different economic actors. Its second component is the assessment of the main components of the ICT policy framework, which examines in depth the national ICT policies that have been put in place by the Government, including the components of a national ICT plan, priority actions, concerned sectors, targets and relevant projects. The last component consists of the assessment of the institutional framework and the implementation mechanisms, which considers the adequacy of the established implementation mechanisms and institutional framework and the extent to which changes have to be made to implement the policies contained in the ICT master plan.

The proposed framework is a generic model that could be used as a basis by developing countries. It will have to be adapted to the needs of each country, and could include additional elements to reflect specific national aspects not covered by the model. As part of its technical cooperation activities, UNCTAD carries out complete national ICT policy reviews at the request of member States and subject to the availability of funds.

3. Pro-Poor ICT Policies and Practices

ICTs are supporting poverty alleviation efforts across the world. Radio allows women in post-war Sierra Leone to express their concerns and advocate regarding their needs. Information kiosks in Bolivia are enhancing the negotiation position of agricultural producers because they can now access market price information.

In 2000, Governments committed themselves to halving poverty. Misconceptions about ICT and poverty should not cut short the much-needed contribution that ICTs can make to that end. This chapter provides policymakers, practitioners and the donor community with an understanding of how ICTs can contribute to poverty reduction and an overview of recommended pro-poor ICT policies and programmes.

Poverty alleviation means taking development efforts a step further to specifically enhance the capabilities of the poor. In a similar fashion, ICTs contribute to poverty reduction by complementing specific pro-poor activities (for example, by supporting women's advocacy efforts in Sierra Leone), directly enhancing poor livelihoods (for example, by providing access to market information in Bolivia) or reducing barriers to poverty reduction (including disinformation or corruption). ICTs for poverty reduction mean taking ICTs for development efforts one step further to enhance the capabilities of the poor using ICTs as an instrument.

Today, there is a common understanding that ICTs are a necessary but insufficient tool for poverty alleviation. Basic infrastructure, skills and political will, for example, are also needed. Reality shows that different technologies have different contributions to make to poverty reduction and that, in order to be effective, pro-poor ICT efforts must be embedded in poverty reduction initiatives (including national development strategies) and best practices (such as multistakeholder and participatory approaches). Support is needed at all levels, and sustainability concerns, although necessary, should not crowd out financial resources. Efforts should be made to scale up and replicate best practices, while policies and programmes must be context-specific. Finally, only through a focused dialogue and research on pro-poor ICTs will technologies bring poverty alleviation.

Having identified how ICT policies and programmes can contribute to poverty alleviation, one may ask what barriers policymakers and practitioners face in effectively pursuing pro-poor ICT endeavours. Recommended ICT policies and practices often do not materialize for various reasons. International debates and commitments (including the World Summit on the Information Society) are not focused on ICT for poverty reduction. And any broad commitments have yet to be translated into policy and practice. Contested discourses continue to influence policies and practices – failure to alleviate poverty is in the detail, not in the broad commitments. Experience shows that implementation of ICT programmes is the most challenging part. For instance, while multistakeholder approaches have many virtues, their practical implementation is not one of them – working with other organizations is not easy. Moreover, scaling up successful best practices involves more than replicating good projects: it requires another level of commitment. The cross-cutting nature of ICTs, as well as the limited availability of quantitative measurement and qualitative assessments of ICT for poverty alleviation, renders these efforts invisible. Institutionally, there is little accountability or incentive to coordinate ICT strategies and poverty reduction policies. More fundamentally, the question of how power imbalances are dealt with remains unsatisfactorily unanswered.

UNCTAD offers a **Pro-poor ICTs Framework** to examine to what extent an ICT policy or programme is pro-poor. The framework (expanded from Rao's 8 Cs Framework for Analysis and Planning ICT interventions) helps policymakers understand, question and propose pro-poor ICT interventions. It questions key areas for meeting the needs of the poor, such as connectivity (is the technology accessible and affordable?), community (who benefits from the intervention?), capital (are there sufficient financial resources?) and coherence (is the ICT strategy/programme coherent with the development strategies?).

On the basis of these reflections, ICT policymakers and practitioners are encouraged to focus on ICTs for poverty reduction by promoting a better understanding of pro-poor ICTs (including the follow-up to the World Summit on the Information Society) and to make ICTs work for the poor by adopting best practices in ICT

policies and interventions. They may also consider supporting approaches, including participation and decentralization, that enable the poor to be heard and to participate.

Other recommendations are to mainstream ICTs effectively into national and sectoral poverty reduction policies and into development assistance programmes, with an awareness of the cross-cutting nature of pro-poor ICTs; and also to promote the scaling up of successful programmes by providing an enabling environment as well as encouraging the development of pro-poor ICT networks and organizational capacities.

Finally, UNCTAD can support developing countries in carrying out poverty and gender analysis of ICT policies, and undertaking country reviews of policies and programmes across sectors and issues areas, and also support the collection of data disaggregated by sex, age, education and geography to help identify who is not benefiting from ICTs.

4. ICTs in the Oil Sector: Implications for Developing Economies

Oil is playing a major role in the world energy balance and the demand for it will continue to increase in the foreseeable future. Ensuring that the supply of oil from existing and new oilfields and other fossil energy sources is forthcoming will be the main challenge for the petroleum industry and one of the means of avoiding future energy crises. Meanwhile, tight market conditions, including a lack of enough spare productive capacities in oil production and refining, are keeping prices high and making upgrading and improving of the oil supply chain an urgent task. Given the capital-intensive and skill-based nature of the oil industry, a key instrument for facilitating its modernization is ICTs. More intensive and efficient use of the latter is increasingly mainstreamed into the industry practices in both developed and developing economies. Moreover, computing, measuring and communicating devices embedded in modern oil technologies are making them more information-intensive. Consequently, the oil sector could be considered an integral part of the information economy.

As the production of oil is mainly concentrated in developing and transition economies where the oil industry technology standards are similar to those in developed countries, the impact of ICTs on improving the economic performance of the oil sector is affecting the production of crude oil in all those countries. ICT and related key technology-driven efficiency gains happen in both the upstream stages (exploration and production of crude oil) and the downstream stages (transportation, refining of crude oil and distribution of oil products) of the global petroleum industry. ICTs impact the effectiveness of the petroleum industry and offer opportunities for its further diversification, especially in the oil-exporting developing and transition economies. They also offer possibilities for improving the production and distribution of oil products in oil-importing countries as part of sustainable development models.

Avoiding potential deterioration and oil supply shocks can be achieved only within a framework of well-defined and coordinated policies and practices that include the use of ICTs as a tool for integrating and optimizing business processes in both upstream and downstream operations. To improve the use of ICTs and new technologies the national oil-exporting companies of the oil-exporting developing countries should continue investing in ICT-related know-how and business processes. In addition to undertaking their own R&D, they should establish close relations with oil service companies and oil technology and ICT-related vendors, as well as oil industry consultants and experts. Stipulating technology transfer clauses in the production sharing or other arrangements with international oil companies could also be a part of their strategies. Governments, for their part, should encourage both national and foreign operators to use state-of-the-art technologies. As a result, oil companies will make the necessary investments in new ICTs and other oil-related technologies while extracting crude oil or producing oil products in those countries.

The benefits of using ICTs to reduce the unit costs of distribution of oil products are especially important for oil-importing developing countries that have no means of compensating for the increases in the cost of oil by increasing their exports or switching to alternative energy sources, or by introducing effective conservation measures. It is equally apparent that well-designed international energy cooperation efforts should include financial and technological support measures for those countries.

5. ICTs, Enterprises and Jobs: What Policies?

Jobs are an essential poverty eradication tool because they are the source of income both for the population through wages and for Governments through taxation. ICTs are important contributors to business performance. Since enterprises are the source of jobs, policymakers must develop strategies to promote ICT-using competitive enterprises (particularly small and medium-sized ones) that generate decent work.

The "digital divide" is the result of social and economic inequalities within and between countries. A major concern is to adopt corrective policies so that this divide does not prolong and deepen existing socio-economic inequalities. Chapter 5 reviews some of the factors that explain why ICTs have considerable effects on labour markets, how technology brings about changes in the structure of the economy and how the introduction of automation at the "factory" (or production) level has shifted employment away from production to managerial and other non-production employment and to the services sector. In addition, the chapter argues that there is scant evidence to prove that a significant amount of work previously done in high-cost areas is being displaced to low-labour-cost economies. On the other hand, employment levels of skilled workers in many developing countries tend to show a trend towards labour market segmentation similar to that in the developed economies. In all these countries there is evidence of a rise in either the employment or the wage levels of skilled workers and a fall in these same factors for others: there is considerable empirical evidence that skill-biased employment is related to technological change.

Those enterprises that fail to adapt to the structural changes associated with globalization and ICTs may be marginalized if they fail to recognize the competitive advantage offered by technology and the economies of scale that are associated with larger markets. Moreover, it is increasingly clear that economic activity will increasingly be network-driven. Several paths can be taken to achieve social and economic progress through ICTs. With regard to the first, enterprises must be able to fully exploit the benefits of ICTs. This implies ensuring that firms achieve productivity increases through their investments in these technologies: managers and entrepreneurs must be able to develop the processes and create the organizations that will make efficient use of investments in ICTs.

Unless the workforce has the necessary skills to adapt and be creative, enterprises will not be able to enhance their productivity and innovation. Throughout chapter 5 it is noted that ICTs are changing the nature of many tasks that have little to do directly with computers. Thus, the emphasis should not be placed exclusively on elusive "computer literacy". New production processes and enterprises require five fundamental skills: literacy, numeracy, the capacity to learn, the capacity to communicate clearly and the capacity to work in teams.

Taking the time and making the effort to explain to the labour force the work-related implication of investments in technology help to enlist their assistance and allay their fears. This can be achieved through dialogue, through social security and through training. Freedom of association and the possibility of initiating dialogue between employers and workers are central to this aim.

6. Service-Oriented Architecture and Web Services Technologies: Trends and Implications for E-Business in Developing Countries

The growing adoption of e-business practices reinforces global production and distribution models that emphasize cooperation and rapid information exchange among business partners. This means that competitiveness, including for enterprises in developing countries, is becoming more and more dependent on their ability to use ICTs to integrate themselves into value networks at regional and global levels.

In this business environment, web services (WS) technologies, which enable automated interaction over the Internet between computers that handle a business process, become particularly relevant. A very simple example of how web services can be used for e-business could be a service in an SME's website that automatically updates a catalogue's prices in several currencies by checking periodically the latest exchange rates from a financial news service. Of course, the same logic can be applied to a much more complex scenario involving any combination of business processes.

Systems operating in this way depend on the functionalities that other systems make available to them. Ideally, the level of dependence should be kept as low as possible in order to maximize the chances that different systems can interact with each other. Achieving such low levels of dependence is called "loose coupling", which is the goal pursued by Service-Oriented Architectures (SOA). SOA can be defined as a distributed software model in which modular, loosely coupled applications can be found, used and combined over a network.

SOA are built on open standards such as the eXensible Markup Language (XML) and Simple Object Access Protocol (SOAP), thus providing broad interoperability among different vendors' solutions. This means that an enterprise can implement WS without having any knowledge of the consumers of those services. Open standards ensure that the criteria and decisions are truly service-oriented and are not biased towards one platform or another. Without open standards the possibilities that SOA give enterprises to combine, replace and mix the components of their IT systems without the need to create specific code to interconnect them would not materialize.

Standard setting is therefore of the utmost importance for the development of SOA and WS technologies. These processes currently take place essentially outside the public sphere, through entities such as the Organization for the Advancement of Structured Information Standards (OASIS), the World Wide Web Consortium (W3C) and the Web Services Interoperability Organization (WS-I). The operations of these organizations have not always been controversy-free, as the competitive strategies of some of the major technology companies have affected their attitudes to and involvement in the standard-setting bodies. This is particularly true with regard to the intellectual property rights policies of the various actors involved. However, as the technological and market situation has evolved, a reasonable division of labour seems to have been achieved among the standard-setting organizations.

The adoption of WS technologies will be increasingly necessary in order to maintain competitiveness in several sectors and industries, some of which are important for the economies of developing countries. For example, the ICT-producing sector, in which developing countries have a significant and growing share of world trade, is rapidly adopting WS technologies. It can be expected that this trend will be replicated in a wide range of manufacturing activities of considerable importance in the developing world, including areas such as textile and apparel. Other sectors where SOA and WS could have a positive impact include retail banking, insurance, distribution services, transport and logistics operations, business process outsourcing and tourism. Developing countries should also consider the vast potential that WS and SOA technologies offer for the implementation of e-government services.

SOA and WS will facilitate deeper levels of inter-business collaboration. This could open up opportunities for developing country enterprises, for example by facilitating their participation in global supply chains or by making business process outsourcing more attractive. Enterprises in developing countries should also take advantage of the scalability of these technologies, which enables enterprises facing constraints in their IT budgets or in their human resources to gradually implement them. In any case, it is important to bear in mind that the pertinence of a change towards SOA and WS approaches is not a matter of mere IT policies, but of overall business strategy

From the practical point of view, an enterprise considering whether to invest in a WS implementation should address several issues. One of them is the kind of relationship it has with the business partners that are most likely to use the proposed WS. This refers to the content of the business relationship and to its time horizon. Another question to ask is how data are going to be shared and who is going to handle a given segment of a business process, and how. There are also decisions to be made about the way in which the WS are going to be implemented: what processes are to be automated and whether/how WS are to be extended to other business processes. Finally, there is the fundamental question of how the WS implementation is to be managed so that in the end the enterprise has made its knowledge base larger and enhanced its competitiveness.

In designing their strategy to implement SOA and WS technologies, enterprises in developing countries would be well advised to give full consideration to FOSS solutions. The value of implementing an SOA increases

more than proportionally to the number of WS that are available in it. Commercial solutions require the payment of fees that are proportional to the computing resources that run them. All this means that going for a truly comprehensive SOA implementation that connects all the enterprise's services and applications can be rather expensive. If one or several of the

many FOSS solutions that are available is chosen, this restriction is lifted and as many services and applications can be added to the SOA infrastructure as makes business sense. Furthermore, the use of FOSS generates significant positive externalities that help advance the information economy in developing countries.

7. The Layered Internet Architecture: Governance Principles And Policies

A vast array of human activities, many of them of a commercial nature, are increasingly moving to the Internet. This move is accompanied by associated politics and, consequently, by the need to govern. Even our governing organizations have moved online. With the Internet's outstanding growth, organized society cannot ignore it or leave it ungoverned. The issue is no longer whether to govern, but how and on the basis of what principles.

In asking this question it is useful to review what it is that has made the Internet become the preferred data network and network applications platform. The answer has more to do with enabling and empowering than a set of technical features or the way in which a thing is used. What is opaque is that the empowering principles of the Internet are embedded in the technical specification of the TCP/IP suite – the Internet protocol – and to the majority of lay users they seem to represent just that: a set of features. However, the contributions of Lawrence Lessig, Yochai Benkler, Kevin Werbach, and Lawrence Solum and Minn Chung and others have provided an improved transparency by translating the technical principles of the Internet into conceptual notions such as the *code thesis*, the *end-to-end principle*, the concept of *network neutrality* and the *layers principle*.

These principles describe the Internet as a layered, open and accessible network that focuses on efficiently transferring data as its sole functionality. Any functionality beyond getting data from the sender to the recipient is built into an application that runs on top of the network. Below the applications, various layers of applications and protocols ensure that the data travel correctly within their primary network and to recipients on other networks. Four layers are commonly identified, from a non-technical point of view:

- The physical layer – wire, optic fibre;

- The logical layer – where the TP/IP suite is lodged;

- The application layer – where the functionalities that we as users see are implemented; and

- The content layer – text, graphics, audio, video, etc.

In this sense, the Internet is a "stupid network" that does not care what the data are or where they are going. Also, it does not discriminate as to what applications use it – web browser, e-mail clients or voice-over-Internet applications – nor does a developer need permission from the network, or its owners or managers, to develop an application to give away or sell. Finally, the Internet does not discriminate as to what content these applications create and move between users. This has made the Internet into one of the most powerful, yet democratic, technologies in human history.

Indeed, many of the showpiece Internet success stories, such as the World Wide Web, Yahoo, Google, Skype, Amazon and eBay, were developed by ambitious entrepreneurs or scientists, and not by mainstream industry corporations. In this sense, it is entirely conceivable that the next Internet "killer application" may come from a developing or transition economy. Beyond its role as a communications network of networks, the Internet has established itself as an innovation platform, precisely because of its open and accessible nature. While deliberating on the future of Internet governance, Governments should consider whether any proposed policy enhances these fundamental characteristics or contributes to their deterioration.

The best way to handle this task is to establish one or several referential principles that would serve as

a qualifying test for policy proposals, in particular whether there is any intent to codify policy into regulation. This chapter proposes the so-called layers principle as a policy reference. The layers principle requires that Internet governance policy and regulation avoid interfering with and changing the layered nature of the Internet architecture. This principle can be decomposed into two arguments: the principle of layer separation and the principle of minimization of layer crossing.

The principle of layer separation states that the separation between Internet layers as designed in the Internet's basic technological architecture must be maintained. This means that policy or regulation that would require a particular layer of the Internet to differentiate the handling of data on the basis of information available only at another layer should be disallowed. The principle of minimizing layer crossing states that governing authorities primarily develop policy for a particular layer to be implemented precisely at that same layer. However, as this may not always be feasible, policymakers should minimize the distance between the layer at which policy aims to produce an effect and the layer directly targeted by the policy. While the layers principle may be sufficient to provide a policy check in most cases, Internet governance authorities should consider policy proposals by referencing them to the other complementary Internet principles listed above.

The WSIS debate on Internet governance was assigned to the Working Group on Internet Governance (WGIG) and continues, after the WSIS, with the work of the Internet Governance Forum (IGF). The WGIG succeeded in mainstreaming the Internet governance debate and established solid guidelines for the continuation of this process by the IGF. While much has been accomplished, it is yet to be seen whether the process will succeed in establishing convergence between the technological and political communities in order to establish a common set of principles for governance that takes into account political and social needs while at the same time preserving the technological advantages of the Internet as both an open data network and an innovation platform.

8. Laws and Contracts in an E-Commerce Environment

Most legal systems have developed over many years and comprise a myriad of laws and regulations as well as judicial decision-making. While laws and regulations rarely expressly require the use of paper, they often use terminology that seems to presume the use of paper and other physical acts. Concerns had been expressed that existing paper-based legal systems might be unable to accommodate e-commerce and could lead to uncertainty which would hamper global electronic trade. As a consequence, when organizations shift from paper-based communication techniques to electronic methods, there is often uncertainty about how existing laws will treat data messages in terms of validity, enforceability and admissibility. Although there is a general consensus that e-commerce is not taking place within a legal vacuum for which a totally new legal framework needs to be created, it is also acknowledged that there is a need to adapt the existing laws and regulations to accommodate electronic commerce. Many Governments have amended or supplemented existing laws in order to increase legal certainty and boost the trust of both business and consumers in e-commerce.

This chapter examines the legal nature of communications and data messages in electronic commerce. Considerable international harmonization has been achieved in this field, based on a series of initiatives by the United Nations Commission on International Trade Law (UNCITRAL). The most significant of these was the adoption of the United Nations Convention on the Use of Electronic Communications in International Contracts, which was formally adopted by the General Assembly in November 2005 and opened for signature in January 2006.

The provisions of that Convention address three main topics, which comprise the focus of the chapter: legal validity, form requirements and regulating the contract creation process.

A fundamental legal concern that a person will have when communicating electronically is, will such communications be considered valid? Legal validity concerns arise from a number of different sources. First, it may simply be an issue in terms of the trading

partner to whom a message is being sent: will the party accept my electronic message and act on it? Second, there will be concerns as to whether communications that pass between trading partners, but which are also required to be made by law, such as tax invoices, will be an acceptable record for the public authority with responsibility for regulatory supervision. Third, communications that are made directly with public authorities, namely e-government applications, raise issues concerning the possibility and validity of sending such communications electronically. Fourth, there is the need for electronic communications to be acceptable in a court of law in the event of a dispute arising between trading partners or a claim being made by a third party affected by the electronic communication. The Convention is designed to contribute to the resolution of all of these different validity concerns.

Legal systems abound with terms and phrases that, while not expressly excluding the use of electronic communications, were clearly used in reference to physical documents and processes, such that legal uncertainties exist as to whether electronic alternatives are acceptable. The UNCITRAL Model Law on Electronic Commerce in 1996 and the subsequent Model Law on Electronic Signatures address such form requirements in considerable detail. These are replicated, in whole or part, in the Convention.

Generally, most electronic commerce legislation leaves in place underlying contract law on such issues as contract formation, enforceability, terms and remedies. There are a few instances, however, where there has been supplementation of that law, specifically in areas where there is a perceived need to deal with the unique aspects of electronic commerce, specifically the process of communicating: sending and receiving messages. The Convention sets out rules for this communication process, thus providing some certainty for trading partners.

Finally, some policy recommendations are made, which constitute a checklist of issues for developing countries to consider when embarking on law reform designed to facilitate electronic commerce.