

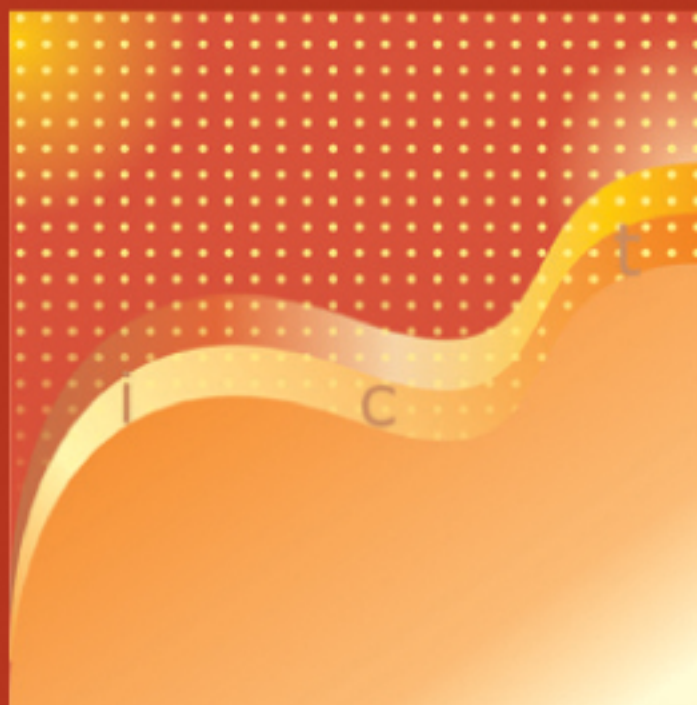
EMBARGO

The contents of this report must not be quoted or summarized in the press, on radio, or on television, before
6 February 2008, 19:00 hours GMT

United Nations Conference on Trade and Development

INFORMATION ECONOMY REPORT 2007-2008

Science and technology for development:
the new paradigm of ICT



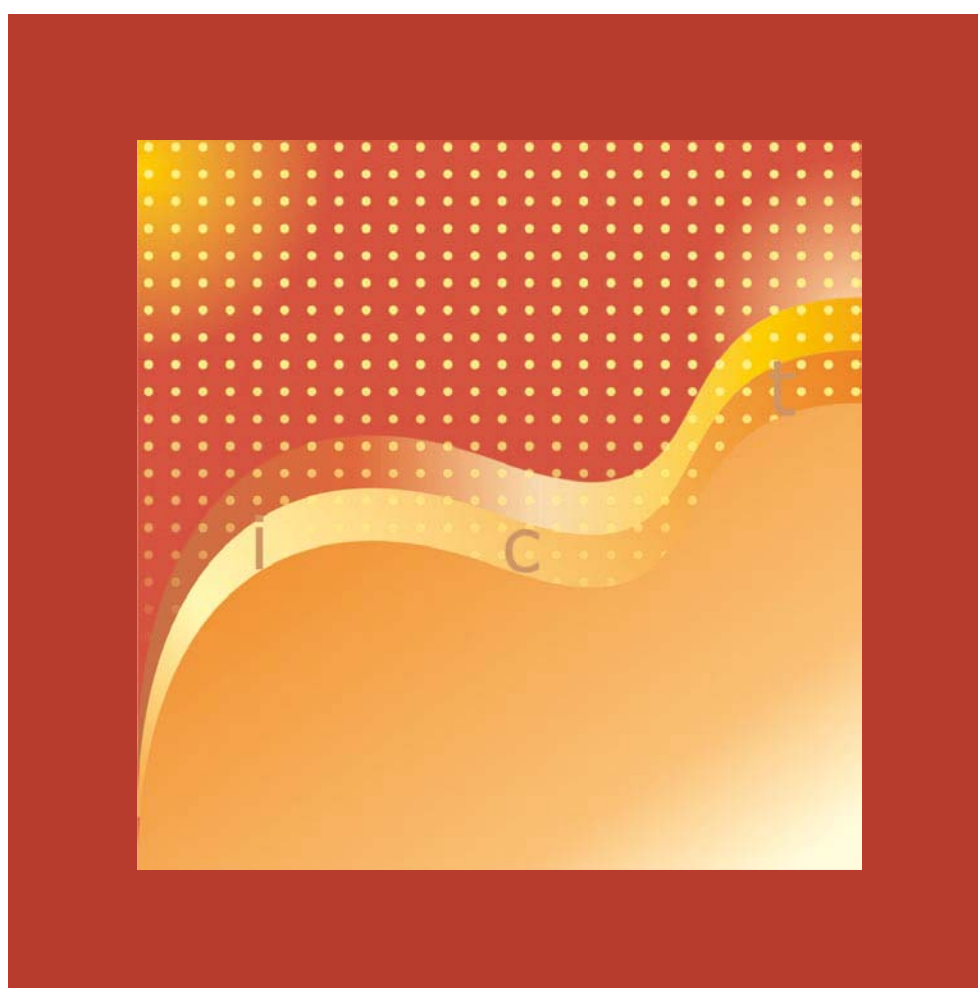
United Nations

United Nations Conference on Trade and Development

INFORMATION ECONOMY REPORT 2007-2008

Science and technology for development:
the new paradigm of ICT

Prepared by the UNCTAD secretariat



UNITED NATIONS
New York and Geneva, 2007

Note

Symbols of United Nations documents are composed of capital letters with figures. Mention of such a symbol indicates a reference to a United Nations document.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Material in this publication may be freely quoted or reprinted, but full acknowledgement is requested, together with a reference to the document number. A copy of the publication containing the quotation or reprint should be sent to the UNCTAD secretariat at: Palais des Nations, CH-1211, Geneva 10, Switzerland.

The English version of the full report and the English, French and Spanish versions of its Overview section are currently available on the Internet at the address indicated below. Versions in other languages will be posted as they become available.

www.unctad.org/ecommerce

UNCTAD/SDTE/ECB/2007/1

UNITED NATIONS PUBLICATION

Sales No. E.07.II.D.13

ISBN 978-92-1-112724-9

Copyright © United Nations, 2007

All rights reserved

Foreword

The world economy is increasingly driven by technological innovations. If developing countries are to seize the opportunities this implies, and also to address emerging global challenges, they will have to harness those innovations and the knowledge that comes with them.

UNCTAD's *Information Economy Report 2007-2008: Science and technology for development: the new paradigm of ICT* analyses the current – and potential – contribution of ICT to knowledge creation and diffusion. It looks at how developing countries use technology to generate innovations that improve the livelihoods of the poor and support enterprise competitiveness. And it examines the impact of ICTs on productivity and growth, international trade and employment in developing countries.

But mastering technology is not enough; it must, as the Report also stresses, be complemented by government policies to develop the ICT sector – by providing incentives, for example, and by building national institutional capacity for knowledge creation and diffusion. At the international level, more effective technology transfer and knowledge-sharing are needed, which can be achieved through more flexible intellectual property rights regimes, open access to knowledge and international partnerships. Development partners, in turn, can also help close the digital divide, including through technical assistance and funding of ICT infrastructure.

We are now at the midpoint in the timeline set by the international community for achieving the Millennium Development Goals. The eighth goal – developing a global partnership for development – included making available the benefits of new technologies, especially information and communication technologies, in cooperation with the private sector. This Report makes an important contribution to our understanding of how to achieve that.



Ban Ki-moon
Secretary-General of the United Nations

Acknowledgements

The *Information Economy Report 2007-2008* was prepared under the overall direction of Anh-Nga Tran-Nguyen, Director of UNCTAD's Division for Services Infrastructure for Development and Trade Efficiency (SITE). It was written by a team supervised by Geneviève Féraud, Chief of the ICT and E-Business Branch, until her change of functions on 1 October 2007, and consisting of the following UNCTAD staff members: Cécile Barayre, Dimo Calovski, Scarlett Fondeur Gil, Angel González Sanz, Muriel Guigue, Rouben Indjikian, Diana Korka, Marta Pérez Cusó and Susan Teltscher. The Introduction was drafted by Anh-Nga Tran-Nguyen.

The UNCTAD team acknowledges the contribution to chapter 8 by Chris Connolly of the consulting company Galexia, and by the ASEAN secretariat, whose material was based on a project funded by the ASEAN Australia Development Cooperation Program (AADCP) through the Australian Government (AusAID).

The team also wishes to thank the following individuals for their contributions to, and comments on, various parts of the Report: Carolin Averbeck, Claire Buré, Carlo Cattani, Florencio Ceballos, José Luis Cervera Ferri, Diane Coyle, Charles Geiger, Benedict Hugenschmidt, Martina Metzger and Ugo Panizza, as well as staff from telecentre.org. Participants in the expert meeting "In support of the implementation and follow-up of WSIS: using ICTs to achieve growth and development", which was held jointly by UNCTAD, OECD and ILO in Geneva on 4 and 5 December 2006, provided useful inputs that were considered in the preparation of this Report.

UNCTAD appreciates the sharing of statistical data by the National Statistical Office of Thailand, the Egyptian Information Technology Industry Development Agency (ITIDA), ITU, OECD and Eurostat, as well as the National Statistical Offices that responded to the UNCTAD 2007 questionnaire on ICT use by enterprises and on the ICT sector. The UNCTAD Central Statistics and Information Retrieval Branch provided valuable advice and support in the analysis of trade data.

Research assistance was provided by Bjorn Griesbach, Laura Harbidge, Jackie Lee, Giulia Quaia, Iulia Teodoru and Lidia Villalba during their internships with UNCTAD.

Administrative and secretarial support was provided at different times by Karima Aoukili, Elvira Chudzinski, Marie Kamara, Monica Morrica and Janaki Venkatchalam.

The Report was edited by Graham Grayston. The overall layout and desktop publishing were done by Christophe Manceau. Diego Oyarzún Reyes designed the cover and formatted the charts.

The financial support of the Governments of Finland and France is gratefully acknowledged.

Contents

<i>Foreword</i>	<i>iii</i>
<i>Acknowledgements</i>	<i>iv</i>
<i>List of boxes</i>	<i>xi</i>
<i>List of charts</i>	<i>xii</i>
<i>List of tables</i>	<i>xv</i>
<i>List of abbreviations</i>	<i>xvii</i>
<i>Explanatory notes</i>	<i>xxi</i>
<i>Overview</i>	<i>xxiii</i>
i. Introduction:	
Science and technology for development: the new paradigm of ICT	1
A. Science and technology in development	2
1. Role of technology in growth and development	2
2. Technology and institutions	4
3. Knowledge diffusion and technology transfer	5
B. ICT as a general-purpose technology	8
1. New paradigm	8
2. Some policy implications of ICT for development	11
C. Harnessing ICT for development	13
References and bibliography	16
Notes	18
1. Trends in ICT access and use	21
A. Introduction	21
B. ICT access and use by individuals	21
1. Mobile phones as the breakthrough ICT in developing countries	21
2. The Internet gap is closing slowly	25
C. ICT access and use by enterprises	29

1. Mobile phones are valuable business tools	30
2. Internet use by businesses is slowly growing	31
3. E-Business is facilitated by government.	33
4. E-Commerce remains limited in developing countries	35
D. Conclusions	42
Statistical Annex	43
References	96
Notes	98
2. The ICT producing sector and the emerging South	101
A. Introduction	101
B. ICT market, value added and employment	103
1. Overview of the ICT market	103
2. ICT sector value added	105
3. ICT sector employment	109
C. Trade and investment in ICT goods and services	114
1. Overview	114
2. ICT goods	115
3. ICT services	120
D. The role of the ICT sector in the growth of China and India	123
1. Overview	123
2. China's ICT manufacturing	123
3. India's ICT and ICT-related services	125
E. International and national environment and policymaking	129
1. Government policies on the ICT sector	129
2. Multilateral trade agreements relevant to the ICT sector: the ITA ten years later.	129
F. Conclusions and policy recommendations	133
Annex 2.1: Trade in ICT goods	135
Annex 2.2: ITA members as of September 2007	148
References	149

Notes	151
3. Measuring the impact of ICT on production efficiency	153
A. Introduction	153
B. Economic impact of ICT at the macroeconomic level	154
1. ICT capital, ICT use and growth	154
2. The ICT-producing sector and the ICT using sectors.	157
3. ICT impact on total factor productivity growth	159
C. Firm-level impact of ICTs	161
1. ICT use and firm labour productivity	162
2. Complementary factors explaining the ICT–productivity relationship	163
3. Impact of specific ICTs on productivity	164
4. ICT investment, soft technologies and total factor productivity gains.	165
D. Measuring ICT use and productivity in Thai manufacturing firms	166
1. Background and objectives of the project.	166
2. ICT use by manufacturing firms in Thailand.	167
3. The model and a few theoretical considerations	170
4. Results	171
E. Concluding remarks and policy issues	180
Annex 3.1: Summary of literature on ICTs and productivity at the firm level	183
References	185
Notes	188
4. ICT, e-business and innovation policies in developing countries	191
A. Introduction	191
B. Impact on innovation of the use of ICTs by enterprises	193
C. Maximizing synergies between e-business and innovation policies	201
D. Conclusions and policy recommendations	206
References and bibliography	208
Notes	210

5. E-banking and e-payments: implications for developing and transition economies	213
A. Introduction	213
B. ICTs and innovations in banking and payments	214
1. From brick to click: emerging e-banking, e-payments and e-money	215
2. ICTs and securitization of debt instruments	217
3. E-finance and security challenges of cyberspace.	218
C. Recent trends in e-banking and e-payments	219
1. The state of play in Internet banking.	219
2. Wholesale e-payments.	221
3. Retail e-payments.	222
D. E-banking and e-payments for development	223
1. E-banking and e-payments in developing and transition economies	223
2. ICTs and remittances	227
3. E-banking and e-payments for SMEs	228
4. Microfinance	230
E. Regulatory issues related to e-banking and e-payments	233
F. Conclusions	234
References and bibliography	236
Notes	240
6. Mobile telephony in Africa: cross-country comparison	243
A. Introduction	243
B. Mobile telephony: stylized facts	244
1. Origins and effects	244
2. Accessibility of mobile telephony	245
3. The economic context of mobile telephony	246
4. Use of mobiles	247
5. Mobile telephony and GATS	250
C. Country analysis	251

1. Mobile telephony in Africa	251
2. Nigeria	251
3. Kenya	255
4. South Africa	256
5. Uganda	258
D. Cross-country comparison	260
E. Conclusions	261
References and bibliography	263
Notes	267
7. Promoting livelihoods through telecentres	269
A. Introduction	269
B. The case of telecentres	269
1. How telecentres can promote livelihoods	269
2. Telecentres' impact on supporting economic opportunities for sustainable livelihoods	271
3. Best practices and opportunities	291
4. Major barriers and challenges	294
C. Recommendations to support livelihoods through telecentres	297
Annex 7.1: ICTs and poverty reduction. Case study: Chilean telecentre network	301
Annex 7.2: UNCTAD questionnaire	302
Annex 7.3: Telecentre networks that completed the questionnaire	315
References	316
Notes	319
8. Harmonizing cyber legislation at the regional level: the case of ASEAN	321
A. Introduction	321
1. Background	322
2. E-commerce project goals	323
3. Harmonization structure	323
B. Regional and domestic implementation	324

1. Regional implementation	324
2. Domestic implementation.	325
3. Domestic implementation challenges.	326
4. Cyberlaw coverage.	327
5. Jurisdiction.	330
C. Lessons learned.	331
1. Regional lessons.	331
2. Domestic lessons.	333
D. Concluding remarks and policy recommendations.	339
1. Focus on international interoperability	339
2. Focus on trade facilitation.	339
3. Implementation tools	339
4. Comprehensive legal infrastructure	339
5. Aligning domestic and international e-commerce laws	340
Annex 8.1 ASEAN's countries' legislation	341
Annex 8.2 Survey on e-commerce legislation in developing countries	342
References and bibliography	344
Notes	345

List of boxes

Box	Page
i.1	9
1.1	24
1.2	28
1.3	31
1.4	35
1.5	41
2.1	102
2.2	104
2.3	105
2.4	106
2.5	108
2.6	111
2.7	112
2.8	121
2.9	130
2.10	130
2.11	131
3.1	170
4.1	200
4.2	201
4.3	205
5.1	223
5.2	227
5.3	230
6.1	248
6.2	252
6.3	259
7.1	270
7.2	272
7.3	279
8.1	331
8.2	334

Box	Page
8.3 Singapore and the UN Convention	338

List of charts

i.1 Science and engineering in first university degrees by selected region, 2002 (or more recent year)	4
1.1 Mobile phone subscribers	23
1.2 Mobile phone penetration	23
1.3 Mobile phone penetration in China and India	24
1.4 Internet penetration	25
1.5 Broadband subscribers	27
1.6 Broadband penetration	27
1.7 Brazil: resources provided by enterprise websites	41
1.8 Brazil: activities of enterprises with Internet	41
2.1 Electronics industry output by location, 1995–2005	103
2.2 ICT goods exports in Costa Rica, 1997–2006	104
2.3 Share of Intel GDP in total industrial GDP, 2002–2005	104
2.4 Value added to sales ratio for US MNC computers and electronic products sector, 1999–2004	106
2.5 Share of ICT sector value added in total business-sector value added	107
2.6 Share of ICT sector workforce in total business-sector workforce	107
2.7 IT workforce in Sri Lanka, 2003–2008	108
2.8 Job categories as share of overall IT workforce and demand for IT professionals in Sri Lanka, 2007	108
2.9 Highly skilled graduates by sector, Sri Lanka, 2007	109
2.10 Female representation by sector, Sri Lanka, 2007	109
2.11 Global distribution of employment in electrical and electronic products manufacturing, 2004	110
2.12 Employment in electrical and electronic products manufacturing, 2002	110
2.13 Permanent and temporary workforce in a sample of ICT companies in Egypt	112
2.14 Male and female occupations in a sample of ICT companies in Egypt	113
2.15 Potentially offshorable occupations in total employment: EU 15, United States (estimate) Canada and Australia, 1995–2003	113
2.16 Growth of world merchandise exports and ICT goods exports, 1996–2005	114
2.17 ICT goods export by level of development, 1996 and 2005	115
2.18 ICT goods exports by level of development, 1996–2005	115
2.19 World exports of ICT goods, 1996–2005	116

Chart	Page
2.20 Mexican merchandise exports and ICT goods exports (1996 = 100 per cent)	116
2.21 Indonesia merchandise exports and ICT goods exports (1996 = 100 per cent)	116
2.22 Selected LDC exports and imports of ICT goods	118
2.23 Direction of ICT goods trade originating in developed and developing economies, 1996–2005	119
2.24 ICT-enabled services share in total worldwide services exports	120
2.25 ICT-enabled services exports, by broad development categories, 2000–2005.	120
2.26 Developing countries' exports of ICT-enabled services, 2000–2005	122
2.27 China's share of employment in world total employment in the electrical and electronic industry, 1997 and 2004.	124
2.28 China: merchandise exports and ICT goods exports (1996 = 100 per cent).	124
2.29 China: shares of ICT goods exports in all merchandise exports, 1996 and 2006	124
2.30 Potential market for ICT-related international sourcing.	127
2.31 India-based IT services providers, export revenue by corporate characteristic (2005), in billion \$	128
3.1 Channels through which ICT contributes to productivity growth.	155
3.2 Sources of GDP growth, 1990–2003	157
3.3 Impact of the IT sector on GDP growth and domestic demand, 1996–2000	158
3.4 Contribution of ICT capital to labour productivity, and of ICT production to total factor productivity	160
3.5 Average sales per employee in manufacturing Thailand (baht per employee).	169
3.6 Computer, Internet and website use by regions in manufacturing Thailand	176
3.7 Computer, Internet and website presence across manufacturing industries in Thailand	178
3.8 Computer use by manufacturing industries in Thailand	178
3.9 Share of manufacturing industry sectors in total sales and value added in Thailand	180
4.1 Innovation and productivity.	192
4.2 Innovation system diagram	194
5.1 Architecture of the CTMI-UEMOA.	226
5.2 Penetration of bank branches and mobile phones	226
5.3 Financial flows to developing countries (\$ billion)	227
5.4 Average annual interest rates	231
5.5 MFI penetration rates.	231
6.1 Mobile teledensity and GDP per capita.	246
6.2 Mobile telephone market share from 2001 to 2004	252
6.3 Fixed and mobile telephone lines and subscriptions in Nigeria, 2001–2004.	253
6.4 Teledensity and subscriber growth in Nigeria, 2001–2004.	253

Chart	Page
6.5 Fixed and mobile telephone connection charges in Nigeria.	254
6.6 Connection and airtime charges for mobile telephones in Nigeria	254
6.7 Mobile networks in Kenya	255
6.8 Urban and rural fixed connections in Kenya.	255
6.9 Comparison of growth of fixed and mobile networks in Kenya.	256
6.10 South African telecommunications providers' earnings growth.	257
6.11 Fixed and mobile telephone subscriber growth in South Africa	257
6.12 Comparison of cost of fixed and mobile networks, 2001-2006.	258
6.13 Fixed and mobile telephone subscriber growth in Uganda	258
6.14 Growth in number of mobile subscribers.	261
6.15 Call costs in 2003: mobile versus fixed lines	261
7.1 Main sources of finance	273
7.2 Composition of telecentre networks Rural vs. urban	274
7.3 Composition of telecentre networks Basic vs. multi-purpose	274
7.4 Percentage of female staff among telecentre network staff	275
7.5 Percentage of female users.	275
7.6 General services provided by the telecentre networks	276
7.7 Training services provided by the telecentre networks	277
7.8 Business-related services provided by the telecentre networks	278
7.9 Approaches used by telecentres to support business-related services	280
7.10 Extent to which supporting economic activities is an objective of the telecentre networks . . .	281
7.11 Economic sectors supported or serviced by telecentre networks, by level of support.	282
7.12 Social groups targeted by telecentres	283
7.13 Environment conditions: their importance and the extent to which they are being met	284
7.14 Key purposes of using a telecentre	286
7.15 Key purposes of using a telecentre, by user group.	286
7.16 To what extent the telecentre networks help users to...	287
7.17 Organizations telecentres work with	288
7.18 Analysis conducted by telecentre networks	289
7.19 Key areas in which network leaders would like to receive more support.	290
7.20 Which institutions should be further involved to improve livelihoods?	290
7.21 12 Cs pro-poor ICT framework.	297

List of Tables

i.1	Researchers worldwide, 2002	6
1.1	Mobile phone subscribers by level of development and region	22
1.2	Mobile phone penetration by level of development and region	22
1.3	Internet users by level of development and region	26
1.4	Internet penetration by level of development and region	26
1.5	Argentina: use of ICT in the manufacturing sector (%).	30
1.6	Enterprises with Internet and website	32
1.7	Enterprises with Internet by mode of access	34
1.8	Enterprises with intranet, extranet and LAN	36
1.9	Use of the Internet for e-business activities	38
1.10	Enterprises receiving and placing orders over the Internet	40
1.11	Mobile phone subscribers: economies by level of development and region	43
1.12	Mobile phone penetration: economies by level of development and region	49
1.13	Economies ranked by 2006 mobile phone penetration	55
1.14	Internet users: economies by level of development and by region	60
1.15	Internet penetration: economies by level of development and by region	65
1.16	Economies ranked by 2006 Internet penetration	70
1.17	Broadband subscribers: economies by level of development and by region	75
1.18	Broadband penetration: economies by level of development and by region	80
1.19	Economies ranked by 2006 broadband penetration	85
1.20	Core indicators on use of ICT by businesses and on the ICT sector	88
2.1	Global production of electronics, 2002–2005, \$ billion	103
2.2	The Philippines e-services industry	105
2.3	Employment trends in electrical and electronic products manufacturing, 1997–2004	111
2.4	Employment by gender in electrical and electronic products manufacturing	111
2.5	Exports of ICT goods in selected least developed countries (thousand \$)	118
2.6	Direction of ICT goods trade and growth, 2000–2005	119
2.7	Intraregional South–South telecommunications FDI, 1990–2003 (percentage of total South–South FDI)	121
2.8	Indian employment in the software and services sector	126
2.9	The Indian IT industry	126
2.10	Exports of ICT goods by level of development and by region, 1996–2005 (\$ million)	135
2.11	Exports of ICT goods, 1996–2005: economies ranked by 2005 export values (\$ million)	136
2.12	Imports of ICT goods by level of development and by region, 1996–2005 (\$ million)	140

Table	Page
2.13 Imports of ICT goods, 1996–2005: economies ranked by 2005 import values (\$ million)	141
2.14 Top 50 exporters of ICT-enabled services, 1996–2005: ranked by 2005 export values (\$ million)	146
3.1 Share of ICT investment in non-residential fixed capital formation in selected OECD countries (5-year averages), 1980–2004	156
3.2 Oliner and Sichel (2002) estimates for the IT contribution to labour productivity growth in the United States (per cent).	160
3.3 Key variables for measuring ICT impact on labour productivity.	162
3.4 Computer, Internet and website presence in Thai manufacturing businesses.	167
3.5 Intensity of computer use in Thai manufacturing businesses	167
3.6 Modality of Internet connection (in manufacturing businesses using the Internet).	168
3.7 Type of activity performed while using the Internet (in manufacturing businesses using the Internet)	168
3.8 Type of activity performed on the web (in manufacturing businesses with web presence)	168
3.9 Estimation results for computer, the Internet and website presence.	171
3.10 Estimation results for the share of employees using computers, the Internet and website presence	172
3.11 Estimation results for the share of computers per employee, the Internet and website presence	172
3.12 Estimation results by employment size groups.	174
3.13 Estimation results by firm age groups.	175
3.14 Estimation results by regional location	176
3.15 Estimation results by industry affiliation.	179
4.1 Geographical distribution of R&D facilities of the top ten R&D companies in 2004.	196
5.1 The cost of transferring \$50 and \$200 to Armenia in 2004.	228
6.1 Growth in the number of mobile telephone subscribers worldwide, 2001-2005	244
6.2 Mobile subscribers per 100 population worldwide in 2002 and 2006	245
6.3 Number of operators and service providers in Nigeria	253
6.4 Change in mobile teledensity, 2002-2006.	261
8.1 E-commerce legislation in ASEAN member countries	325
8.2 ASEAN cyberlaw coverage	328
8.3 Components of an e-commerce legal infrastructure	335
8.4 Sample generic implementation guide	337
8.5 Sample country implementation guide	337

List of abbreviations

ACH	automated clearing house
ALADI	Asociación Latinoamericana de Integración
ASEAN	Association of Southeast Asian Nations
ATM	automated teller machine
BDT	Bangladesh taka
BIS	Bank for International Settlements
BOP	balance of payments
BPO	business process outsourcing
B2B	business to business
B2C	business to consumer
CAGR	compound annual growth rate
CAP	community access programme
CB	Central Bank
CD	compact disc
CDI	Comité para la Democratización de la Informática
CIS	Commonwealth of Independent States
CISP	community Internet service provider
CLIC	community learning and information centres
CLMV	Cambodia, Lao People's Democratic Republic, Myanmar and Viet Nam
CONACYT	National Council for Science and Technology (Mexico)
CPC	Central Product Classification
CTIC	Centro Tecnológico de la Información y Comunicación
DFID	Department for International Development (United Kingdom)
DISK	Dairy Information Service Kiosk
DNS	deferred net settlements
DVD	digital versatile disc
EAC	East African Community
EBA	Euro Banking Association
ECA	Economic Commission for Africa
ECB	European Central Bank
ECDR	<i>E-commerce and Development Report</i>
ECLAC	Economic Commission for Latin America and the Caribbean
EDI	electronic data interchange
EISI	Egyptian information society initiative
ENRD	e-network research and development
EU	European Union
Eurostat	Statistical Office of the European Communities

EU15	The 15 countries members of the European Union until May 2004
FDI	foreign direct investment
FTTH	fibre (-optic cable) to the home
FX	foreign exchange
GDP	gross domestic product
GPCIC	Grameen Bank Community Information Centre
GPTK	gabungan pemuela terampil dan kreatif
G10	Group of 10
HFC	hybrid fibre-coax (cable)
HS	harmonized commodity description and coding system
IAI	initiative for ASEAN integration
ICTs	information and communication technologies
IER	<i>Information Economy Report</i>
ILO	International Labour Organization
IMF	International Monetary Fund
IPRs	intellectual property rights
IPO	initial public offering
ISIC	International Standard Industrial Classification
ISIC Rev.3	International Standard Industrial Classification of all economic activities, third revision
ISP	Internet service provider
IT	information technology
ITA	information technology agreement
ITCR	Instituto Tecnológico de Costa Rica
ITES	IT-enabled services
ITIDA	Information Technology Industry Development Agency
ITU	International Telecommunication Union
Kbps	kilo bytes per second
LAN	local area network
LDC	least developed country
MCIT	Ministry of Communication and Information Technology
MFN	most favoured nation
MFI	microfinance institution
MIS	management information system
MMS	multimedia message service
MNEs	multinational enterprises
MNO	mobile network operators

MOSTI	Ministry of Science, Technologies and Innovation (Malaysia)
M&As	mergers and acquisitions
M1	narrow money supply concept
NASDAQ	National Association of Securities Dealers Automated Quotations system
NASSCOM	National Association of Software and Service Companies
NGO	non-governmental organization
NSO	National Statistical Office
ODA	official development assistance
ODR	online dispute resolution
OECD	Organisation for Economic Co-operation and Development
OEM	original equipment manufacturer
PAA	Pan-Asian E-commerce Alliance
Pe-PP	partnership for e-prosperity for the poor
PIF	Pacific Islands Forum
PKI	public key infrastructure
PMC	Philippine multiDoor courthouse
POS	point of sale
P2P	peer to peer
R&D	research and development
ROE	return on equity
ROA	return on assets
RTGS	real-time gross settlement systems
SAARC	South Asian Association for Regional Cooperation
SADC	Southern African Development Community
SEPA	Single Euro Payments Area
SMEs	small and medium-sized enterprises
SPV	special purpose vehicle
SWIFT	Society for Worldwide Interbank Financial Telecommunication
STPI	software technology parks of India
S&D	special and differential treatment
TARGET	Trans-European Automated Real-time Gross-settlement Express Transfer system
TELMIN	telecommunications and ICT ministers (ASEAN)
TELSOM	telecommunications and ICT senior officials meeting (ASEAN)
TFP	total factor productivity
TNC	transnational corporation
UCR	University of Costa Rica
UK	United Kingdom

UN	United Nations
UNCITRAL	United Nation Commission on International Trade Law
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNSD	United Nations Statistics Division
US	United States
VoIP	Voice over Internet Protocol
WACB	West African Central Bank
WiBro	wireless broadband
WITSA	World Information Technology and Services Alliance
WTO	World Trade Organization
xDSL	any of several types of digital subscriber lines

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

Harnessing knowledge for development

It is now well established that technological progress and innovation are the long-term drivers of economic growth. In the context of a global knowledge economy fuelled by the fast pace of technological innovation, it is important for developing countries to lay good foundations for building their capacity to acquire and create knowledge and technology in order to take advantage of the opportunities offered by globalization and, at the same time, to address emerging global challenges. The challenge is therefore to harness knowledge for development – by providing an enabling environment for the production of ideas and innovations, as well as for their dissemination and use by different actors, directly or indirectly involved in the production process.

In this broader context of science and technology for development, the *Information Economy Report 2007/2008* is analysing the contribution of information and communication technology (ICT) to growth and development. As in the case of other technologies, the ICT contribution is determined by factors such as the role of human capital, externalities and spillovers (notably through learning and complementary innovation), and appropriate policies and institutions supporting innovations. The analysis highlights the importance of open access to knowledge and, hence, the importance of diffusion and sharing of knowledge and technology, especially in the case of developing countries.

The institutional framework should ensure a good flow of knowledge between scientific research and technological applications, as well as a good flow of information among researchers and users, at the national and the international level. Governments play a crucial role, because knowledge creation cannot rely on market mechanisms alone. Policies to support knowledge creation (such as government funding, government procurement, tax subsidies and

intellectual property protection) as well as knowledge diffusion (establishment of libraries, communication networks, access cost subsidies, etc.) are examples of government measures in this area. A clear legal and regulatory framework in many areas touching upon the interactions and transactions among different actors is also necessary.

The market for knowledge is often characterized by imperfections - that is to say, social and private returns derived from knowledge can widely differ. In the area of knowledge creation, this “market failure” may lead to private underinvestment in knowledge: that is why Governments have taken measures to provide incentives for individual agents to create knowledge, namely through intellectual property rights (IPRs), tax rebates and subsidies, and full or partial funding of research. In particular, intellectual property protection through patents, trademarks, copyrights or trade secrets confers the right to appropriate the income derived from the application of proprietary research in order to recover the high fixed cost of research. However, the approach to IPRs needs to strike a balance between incentives for creativity and society’s interest in maximizing the dissemination of knowledge and information.

Knowledge is increasingly being privatized and commercialized, and the use of IPRs to protect knowledge has restricted access to information and technologies. Furthermore, the international governance of knowledge has moved towards tighter and more harmonized IPRs at the international level, with a view to minimizing the free-rider problem. This has been achieved through the World Trade Organization’s Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), the “TRIPS-plus” provisions of regional and bilateral trade agreements negotiated by the European Union (EU) and the United States, and new treaties negotiated under the auspices of the World Intellectual Property Organization.

In the area of knowledge diffusion and technology transfer, externalities and spillovers can bring enormous benefits for the economy as a whole, and for the rest of world, derived from technology flows among countries. In some instances knowledge can be considered to be a public good (non-rivalrous and non-excludable). Many inventions were built on earlier inventions (“standing on shoulders of giants”) and the benefits of technological progress are not just limited to one firm or one sector, because of complementarities in the application and generation of knowledge, and are thus extended to the economy as a whole. The benefits of externalities and spillovers may not be fully reaped because of high access costs or other obstacles. In the case of cross-border flows of knowledge, high access costs and barriers resulting from a harmonization and tightening of IPR standards at the international level may be harmful for poorer countries with limited human and capital capacity. While market failures in the area of technology diffusion may be important, measures to address them have not been clearly identified, especially with regard to the transfer of technology from developed to less developed countries.

Many approaches to encourage more effective transfer of technology to developing countries have been suggested:

- Improving flexibilities in IPRs, in terms of calibration of standards and norms for countries with varying levels of development.

- Open access systems. The key feature of open access systems is that the knowledge is free for use by the general public domain. In some areas involving extensive cumulative innovation, such as computer software, biotechnology or other domains of common knowledge, these systems may be the most efficient to advance knowledge.
- International partnerships for generating and sharing information. Many global initiatives have been launched, with the financial support of public and private sectors, to enhance global research and information capabilities, so as to overcome crucial problems in the areas of rural development, environment and health in the poorest developing countries. International partnerships could be reinforced in those areas, as well as in other areas, in order to allow more effective participation by poor countries in sharing the benefits of common knowledge.
- Global support for building capacity in developing countries, especially the least developed countries, to enhance human capital, infrastructure and institutions in order to develop those countries' capacity to absorb and create scientific and technical knowledge. There is a strong case for donors to increase "knowledge aid" and aid for science and technology.

The new paradigm of ICT: implications for innovations and development policies

ICT is a general-purpose technology and as such has a pervasive impact on the economy. It introduces a new paradigm for the configuration of economic activities, radically changing the approach to technology for development. The main aspects of this new paradigm can be summarized as follows:

- First, the economic impact of ICT could be more important, in terms of externalities and spillovers through its use and applications in different sectors of the economy, than its direct contribution to gross domestic product as a production sector.
- Second, one of the most important externalities is a new mode of organization of production and consumption, which results in cost-saving transactions and faster and better communication between economic agents. With regard to the developing countries, those innovations have provided new opportunities for their insertion to the global value chains and for diversifying production activities and exports. At the same time, ICTs facilitate the creation of networks and increase the exchange of information locally and globally.

- Third, the rapid pace of innovation in the ICT sector itself has considerably reduced the costs of access to ICTs. This has allowed a democratization of ICT use, including use by poorer people to support their livelihoods, and it has also facilitated the adoption of ICT in poverty reduction programmes.
- Fourth, ICT has generated new services in the form of e-commerce, e-finance, e-government, and so forth. These new services can contribute to greater economic efficiency. However, other challenges may arise concerning questions of trust and security in the transactions that these new e-services generate.
- Fifth, ICT requires skills, and education and training are ever more important in building a knowledge economy in which ICT represents an indispensable tool.
- Lastly, ICT has given rise to new models of sharing knowledge and collective production of ideas and innovations, which often bypass the proprietary system provided by IPRs. These "open access" models, whether in activities such as open source software, open innovations or common knowledge associations, have become very widespread and are promising in terms of the rapid diffusion of knowledge to less advanced countries.

The ICT revolution is spreading to the developing world and brings with it the promise of major technology leapfrogging, which will contribute to rapid modernization of the economies of developing countries. In order to reap the opportunities offered by ICT, countries may find it necessary to identify a set of policies to encourage the creation, diffusion and use of knowledge, which should form the basis of a sustained growth strategy. The ICT contribution to building knowledge capital should be taken fully into account in designing innovation policies. Innovation patterns are country- and industry-specific, and countries with different level of development will have different approaches according to their capacities and priorities. Taking for granted a general enabling policy framework for investment and enterprise development, specific innovation policies should aim at promoting national knowledge systems to support the competitiveness of national economies.

Within this broad policy framework to encourage innovations, the particular role of ICT as an enabler of innovations should be recognized and encouraged. Given the strong links between ICT use by enterprises, competitiveness and innovation, there is a need for better integration of policies to promote ICT use by enterprises within general innovation policies. One way to achieve that integration is to systematically coordinate the policies of different ministries and to do so at different levels. Many of the developed countries have entrusted overall policymaking for innovation and e-business to the same organizations, which formulate ICT policy as an integral part of science, technology and innovation policies.

It should be stressed that ICTs enable faster dissemination and better coordination of knowledge, thus encouraging open access to sources of innovations. An innovation policy framework that takes fully into consideration the changes generated by ICT may give prominence to open approaches to innovation, which could present significant advantages for developing countries.

ICT policy should also address the digital divide between rich and poor countries, and the national digital divide between different income groups in the population. Technological progress in ICTs is moving fast, and at the same time, costs are declining and many kinds of software have become available through the free and open source software networks. Although some new ICT applications (Wi-Fi, Semantic Web, to name but a few) and the continuing fall in access costs will allow developing countries to leapfrog on the technology trail, a number of challenges remain to be tackled in order to close the digital divide. The first is to invest in the development of human capital capable of rapidly absorbing and effectively using those new technologies. The second is to regulate e-commerce and provide protection and security to users under cyber laws. The third is the financing of infrastructure, taking into account the costs of adjustment of displaced technologies. In all three areas, the international community of development partners can make a significant contribution.

The chapters of this Report illustrate the applications of the ICT new paradigm for the economic development of developing countries, in an international context characterized by a still substantial digital divide between developed and developing nations, and at the same time by the dynamism of some developing countries that are becoming competitive in a few ICT sectors.

1. Trends in ICT access and use

The diffusion of ICT in developing countries is growing steadily, but except for East Asian countries that straddle the line between developed and developing status (notably the Republic of Korea and Singapore), developing countries remain far behind developed ones in the adoption of ICTs and their use by enterprises.

Among ICTs, mobile phones are most widely spread in the developing world. The number of mobile phone subscribers in developing countries has almost tripled in the last five years, and they now account for 58 per cent of mobile phone subscribers worldwide. This marked increase suggests that mobile telephony serves as a “digital bridge”, which will help many developing countries reduce the connectivity divide. In Africa, where the increase in terms of the number of mobile phone subscribers and penetration has been greatest, this technology can improve the economic life of the population as a whole.

Mobile phones, being the main communication tool for many entrepreneurs (particularly small entrepreneurs) in developing countries, have great potential for small and medium-sized enterprises in those countries. For example, in Africa mobile phones were the most commonly used ICT for communicating with clients and for ordering supplies. Small and medium-sized enterprises (SMEs) that export agricultural products receive daily price quotes and are alerted to business opportunities through their mobile phones. M-commerce (the buying and selling of goods and services using wireless hand-held devices) of digital products such as mobile content is starting in most developing countries and is expected to grow. Payments and banking by means of mobile phones are likely to promote the growth of m-commerce, provided that there is an enabling regulatory environment.

The Internet has continued growing worldwide in terms of users and penetration. Although developed economies still account for the majority of Internet users and have the highest Internet penetration, developing economies are slowly catching up. While in 2002 Internet penetration in developed economies was ten times higher than in developing economies, in 2006 it was six times higher. Countries with economies in transition had the highest annual Internet penetration growth rates between 2002 and 2006. Several

developing country Governments are taking steps to improve Internet penetration, through a combination of ICT for development policies to improve ICT access and skills, regulatory reforms to increase the offer of services and competition, and fostering investments in infrastructure and in the ICT sector. Internet access by enterprises in developing countries continues to grow, as does the number of employees using the Internet in their daily work. The number of enterprises with websites is also slowly increasing. The adoption of ICT by enterprises goes hand in hand with the investments they make in ICT, and it is the larger enterprises that invest more often.

While available data show that the number of broadband subscribers has grown rapidly worldwide, developed countries still dominate subscriptions, and the gap between those countries and developing countries in terms of penetration has widened since 2002. Broadband access to the Internet can enable or enhance the adoption of certain applications that have an impact on enterprise productivity, and the technology is changing fast (ever-increasing access speeds). A more competitive environment brought about broadband growth in developed countries, while continuous improvements and diversification in infrastructure contributed to increasing the bandwidth. In developing countries, however, different infrastructure and market conditions resulted in price policies that still hindered the wider adoption of broadband. Although data on broadband adoption by enterprises in developing countries are still scarce, there is some indication that it is growing.

The use of ICT for business processes can also contribute to income generation and increased labour productivity. ICT can reduce the cost of transactions and increase market access. However, wider adoption of ICTs by developing country enterprises is still limited by a lack of awareness of the potential benefits of ICT use, and by investment and implementation costs. Few enterprises in developing countries have an intranet or extranet, which are often the first steps towards the automated integration of business processes – that is, automatic linking between computer systems to manage orders that have been placed or received and other internal systems (reordering of supplies, invoicing and payment, and management of production logistics

or service operations). On average, 34 per cent of European enterprises have automated integration of internal business processes. This figure cannot be determined at present for developing countries.

There are, however, encouraging signs that some enterprises in developing countries are realizing the benefits of ICT adoption. In some cases, Governments can help by encouraging enterprises' use

of e-government services to improve the efficiency of their operations. The Government of the Republic of Korea, for example, provides firms with information on export-import logistics and Customs, and offers an electronic documentation service for private companies that have a high level of document exchanges with the Government. In India, the government of West Bengal is launching an electronic trading programme for agricultural products.

2. The ICT-producing sector and the emerging South

The ICT sector is a dynamic and fast-changing market, with an important growth potential in developing countries. As a key technology producer, it contributes to total factor productivity and GDP growth and can play an important role in the development of a competitive information economy in developing countries. The strong growth in ICT production, trade and investment observed since the mid-1990s has continued over the past few years, in particular in developing countries and countries with economies in transition, where ICT sector supply and markets have grown much faster than in member countries of the Organisation for Economic Co-operation and Development (OECD). These shifts from developed to developing countries are likely to continue, and the ICT sector will, therefore, play an increasing role in the emerging South-South trade.

ICT sector value added as a share of total business sector value added continues to increase globally. ICT services account for more than two thirds of ICT sector value added in the OECD countries, with growth sectors being communications services and software services. Between 2003 and 2005, in the EU countries, high ICT-sector value-added shares were seen in Finland and the United Kingdom, whereas shares were falling in Ireland and Austria. On the other hand, new EU member countries such as Hungary, Slovakia, Romania and Estonia, have increasing shares of ICT sector value added. Among the developing countries, ICT sector value-added share is still small, with the exception of some Asian countries. Growing shares can be observed in some smaller economies, such as Mauritius and Cuba.

Employment in the ICT sector is also increasing. The share of the ICT sector workforce in total business

sector workforce is highest in the Republic of Korea, accounting for more than 10 per cent in 2003. As in the case of ICT sector value added, ICT workforce shares are increasing in EU countries such as Finland and the United Kingdom, but are decreasing in others, for example Ireland, Sweden and the Netherlands. Available figures from developing countries point to small but increasing shares in countries such as Egypt, India, the Philippines and Sri Lanka.

The past decade has witnessed strong growth in ICT-related trade flows and full recovery from the crisis in 2000, with growth rates for trade in ICT goods equal to those in overall manufacturing trade and above the average growth of trade in ICT services. In 2004, exports from developing to developing countries (i.e. South – South) exceeded those from developing to developed countries. The (\$ 410 billion) value of South – South trade in ICT goods almost equalled the (\$ 450 billion) value of North – North trade, and is likely to have exceeded it in 2006, given the strong growth of South – South ICT trade and the relatively weaker growth of North – North trade. This confirms the increasing importance of trade among developing countries, and the overall shift of ICT production and trade from developed to developing countries. It also demonstrates the growth of the ICT market in developing countries, where the potential for ICT uptake is considerable and hence the demand for ICT goods is high. Although the developing world ICT market is concentrated in a few Asian economies, a number of small economies (including some least developed countries) have succeeded in building some competitive advantage and increasing their shares of exports of ICT goods and services.

Exports of ICT-enabled services grew faster than total services exports during the period 2000–2005. In 2005, the \$ 1.1 trillion value of ICT-enabled services represented about 50 per cent of total services exports, compared with only 37 per cent in 1995. This has created new export opportunities for developing countries. Up until 2004 the top 10 exporters of ICT-enabled services were all from developed countries, but in 2005 India joined their ranks as the first developing economy. Computer and information services exports grew six times faster than total services exports between 1995 and 2004, and the share of developing countries in this export sector increased from 4 per cent in 1995 to 28 per cent in 2005.

Foreign direct investment (FDI) in the ICT sector is growing strongly, especially in ICT manufacturing and services, with developing countries increasingly becoming a destination for FDI flows. While most of those flows are directed towards Asian emerging economies, they represent larger shares of GDP in smaller developing countries. South Asia, East Asia and South-East Asia are the main magnet for FDI inflows into developing countries, which reached \$165 billion in 2005, representing 18 per cent of world inflows. Manufacturing FDI has been increasingly attracted to South, East and South-East Asia, although specific locations have changed as countries have moved up the value chain. It has included large inflows into the electronics industry. In particular, South – South investment inflows into the telecommunications sector are increasing, driven by large transnational corporations from such countries as South Africa, Malaysia and Mexico.

China and India are the world's largest players in the export of ICT goods and services, respectively. The strong growth of the ICT sector has played a critical role in the expansion of the two economies. China has overtaken the United States as the world's number one producer and exporter of ICT goods in 2004. India is the world's largest exporter of ICT services and ICT-enabled services and the main supplier for business process outsourcing (BPO). Foreign investment and international sourcing play an important role in the economic growth of China and India. In the next few years, not only will China and India continue to be major recipients of FDI and international sourcing,

but also international sourcing by those two countries to other locations in developing countries will increase. Both countries are in the process of shifting from labour-intensive to knowledge-intensive goods and services. It is to be expected that they will develop huge domestic markets, and as a result foreign trade is likely to become relatively less important than in smaller economies. The two countries will generate a large pool of knowledge, as well as developing new technologies, and will therefore further contribute to global shifts in ICT production, trade and employment.

The trend observed in the international spreading of production of ICT goods and services will most likely continue, with a huge potential for developing countries to host this production, while the impact on employment in ICT sector in developed countries is insignificant overall, although more pronounced in some lower-skilled sectors. At the same time, competition will increase and countries wishing to attract FDI and BPO contracts will need to invest more in their domestic labour skills and telecommunications infrastructure, and improve their investment climate.

Government policy can be instrumental in the development of the ICT sector. In particular, in the area of telecommunications infrastructure and services, government policy can contribute to creating a more competitive market with a view to lowering prices and improving the quality of services. Governments can also strengthen technical education and training in order to create a high-skilled workforce for the information technology (IT) industry, and provide a stable regulatory and enabling environment to attract BPO contracts and promote call centres. Creating an investment-friendly environment is also critical in this process.

At the international level, the WTO international technology agreement has contributed to facilitating trade in ICT goods, 93 per cent of which are now imported duty-free. A revision of the agreement to harmonize the product coverage on the basis of international classifications and to take into consideration the fast-changing nature of the ICT market should fully assess the implications for developing countries, and especially the least developed countries.

3. Measuring the impact of ICT on production efficiency

The positive macroeconomic impact of ICT on GDP growth in the case of developed countries has been well demonstrated and researched. There are, however, only a few studies for developing countries, but they confirm that in recent years those countries have benefited from a positive contribution by ICT investment to GDP growth. This positive contribution comes mostly from the ICT production sector, although the role of ICT use by enterprises in increasing labour productivity is also recognized. Gains for labour productivity from ICT derive from two principal sources: capital-deepening through investment in ICT, and technological progress in the ICT-producing industry. In countries with a low level of ICT use, the effect of ICT investment on GDP growth remained similarly low.

At the firm level, a number of studies using developed country statistical data measure the effect of specific ICTs on business productivity. The magnitude of this effect depends very much on the business environment. For example, a 10 per cent higher share of employees using computers was found to generate 1.8 and 2.8 per cent more labour productivity in Finnish manufacturing firms and services firms respectively, while in Sweden the estimated effect was 1.3 per cent for a mixed sample of businesses. Additionally, total factor productivity gains from computer capital become significant only after a series of organizational changes and restructuring of the business process. Estimates show that factors such as firm age, foreign ownership or industry affiliation have an influence on the relationship between ICT and labour productivity.

The Thai National Statistical Office and UNCTAD have conducted a joint research project to assess the link between ICT use and labour productivity in Thai manufacturing firms. The study is part of a broader global initiative to improve ICT measurement and the quality of data on ICT uptake, promoted by UNCTAD through the Partnership on Measuring ICT for Development,¹ and is the first developing country analysis undertaken in this context on the impact of ICT on labour productivity at the firm level.

The study confirms that the use of ICT by Thai enterprises is associated with significantly higher sales per employee. Unlike similar studies on developed country firms, this study reveals that in Thailand the use of basic ICTs such as computers still accounts for large differences in terms of productivity between enterprises. While in developed countries computer penetration rates are close to saturation levels, in some developing countries the share of firms using at least one computer remained considerably lower (60 per cent in manufacturing in Thailand in 2002).

Also, variations in the intensity of computer use in Thailand were reflected in larger productivity differentials between firms. A 10 per cent increase in the share of employees using computers was associated with 3.5 per cent higher labour productivity, compared with 1.8 per cent in the case of Finnish firms. On the other hand, Internet access and website presence were found to be correlated with higher sales per employee in Thailand, with a coefficient similar to that estimated by other studies in developed countries (between 4 and 6 per cent in Thailand from the Internet and 5 per cent in the United States from computer networks).

The Thai example confirms the hypothesis that developing countries can benefit as much as developed countries from the use of ICT. Moreover, results show that even the use of ICTs such as computers can make a substantial and positive difference to the economic performance of developing countries' firms.

Given the positive impact of ICT on productivity, developing countries should encourage the use of ICT on a wider scale. For that purpose, it is necessary to gather information and constantly monitor the evolution of ICT use in order to assess the impact of ICT on economic growth. Further analysis is needed to identify the complementary factors that lead to superior productivity gains from ICT in developing country firms. In addition, ICT policymakers should ensure that domestic businesses have access to information about the best practices whereby ICT use can enhance production efficiency.

¹ For more information see <http://measuring-ict.unctad.org>.

4. ICT, e-business and innovation policies

Technological progress generates productivity gains through product or business process innovation. Hence, it represents the main source of long-term improvement in per capita income. ICT is the technology that powered the strong wave of innovation that transformed the global economy during the last quarter of the 20th century. In particular, the application of ICT to financial, manufacturing and marketing and distribution activities has helped enterprises to become more efficient through process innovations, and it has resulted in the emergence of entirely new products or services.

Economic globalization has significantly increased the competitive pressure on enterprises in many sectors. This comes as a result of, among other factors, the emergence of new, lower-cost producers, fast-changing demand patterns, increased market fragmentation and shortened product life cycles. In such an environment, product and/or process innovation becomes crucial for the long-term competitiveness and survival of enterprises. Innovation also enables them to climb the value ladder, a particularly important consideration for the enterprises of many developing countries. At the same time, the enterprises of developing countries, particularly SMEs, face serious difficulties in benefiting from ICT-led innovation. For example, since research and development (R&D) involves high fixed costs, it is a high-risk activity and is subject to economies of scope that favour larger firms. Other general features of SMEs, such as greater vulnerability to the essentially unpredictable market responses to innovative activity, or the greater difficulties they face in accessing financial and human capital, put them at a disadvantage with regard to engaging in innovative activities. When it comes to ICT-based innovation, policymakers need to take into account the general difficulties encountered by enterprises in developing countries, particularly in connection with access to ICT and its use by enterprises.

ICT has profoundly changed the techno-economic paradigm within which innovation takes place today. Whereas in the past innovation revolved around concepts of mass production, economies of scale and corporate-dominated R&D, in the last three decades of the 20th century this was replaced to a large extent by an emphasis on economies of scope, exploiting

the benefits of interconnected, flexible production facilities, and greater flexibility and decentralization of R&D. Flexibility, interconnectedness and collaboration rely on ICT, which also plays a fundamental role in facilitating research diversification and collaborative, interdisciplinary approaches.

ICT also enables faster cross-border knowledge dissemination, particularly within transnational corporations, but also through networking and partnering among smaller players. By investing in ICTs enterprises improve their capacity to combine disparate technologies in new applications. This is important not only from the point of view of ensuring that firms achieve an adequate spread of internal technological undertakings but also from the point of view of the need to engage in R&D partnerships. In that regard, the major benefit of adopting ICTs may not necessarily derive from the technology per se but from its potential to facilitate technological recombination and change.

Government policies aimed at supporting long-term growth need to recognize and exploit the dynamic relationship between the use of ICT and innovation. A growing number of initiatives at all governmental levels now aim at supporting ICT-driven innovation. The links between innovation policies and policies to promote the use of ICT and e-business by enterprises are becoming stronger and in many countries they are now being placed within the same institutional framework and under the same overall political responsibility. However, even when innovation and policies related to the use of ICT by enterprises share the same institutional framework, they are not necessarily envisioned as a single set of policy objectives with a coherent arsenal of policy instruments to achieve them. The border lines are uncertain, and ministries and agencies dealing with matters such as industry, SMEs, education and scientific research may be involved at various levels. As developing countries adapt their national innovation systems to benefit from the dynamic interplay between ICT use in economic activities and innovation-led competitiveness they need to be aware of available experience in that regard and adapt the lessons from it to their specific needs and concerns. There are several institutional issues to be addressed, such as the establishment of a development-friendly intellectual property regime and competition

policies, the reinforcement of education and research systems, the creation of public knowledge structures, the development of IT infrastructures, the creation of a trust environment for ICT use, and well-functioning capital markets.

Beyond those general issues, developing countries need to reinforce the complementarity between ICT and innovation policies. An important consideration for them is to put in place instruments to support ICT-enabled innovation among SMEs. This involves identifying the specific contribution that e-business can make to their innovation and competitiveness strategies, which is not something that can be done quickly or at low cost. But it is essential, for ICT-enabled innovation policies to succeed among the SMEs, that the latter understand the long-term competitive implications of ICT adoption and what skills they need to equip themselves with if they wish to be able to engage in process innovation and – probably in a second stage – product innovation.

Policies should aim at helping SMEs integrate ICT and e-business considerations as a fundamental element of their enterprise development plans. To that end, it is necessary to speak to enterprises in a language they understand, namely the financial performance benchmarks that they are used to. When SMEs can make a clear connection between their performance benchmarks against those of their competitors and their relative position in terms of ICT, e-business use and innovation, the vital importance of ICT

integration in their business will become evident. This calls for adequate outreach strategies. It also means that policies should be implemented with sufficient continuity and be solidly integrated into sectoral approaches. Policies should facilitate the emergence of ICT-enabled alliances and networks for R&D. Equally important from the developing country perspective is the need to support open, user-centred innovation approaches: development-friendly intellectual property regimes are particularly useful in that regard, as it is often observed in markets where intellectual property regimes are weak, that open access models are more likely to expand.

An important lesson for countries that are considering putting in place support programmes in this field is that for initiatives to succeed they need to remain in place for a reasonable period of time. The value of any set of ICT innovation support measures can be judged on a rational basis only once an impact measurement has been undertaken, and this takes time. However, it is not uncommon to see programmes in that field terminated before their effects on enterprises can be assessed. This makes it difficult to replicate and scale up successful initiatives and to accumulate and disseminate best practice. At the same time, it is important that policies adapt and change in response to practical experience. Striking the right balance between the need for policy stability and the need for flexibility and evolution requires mechanisms that allow feedback from end-users to policymakers and frequent and meaningful interaction between all stakeholders.

5. E-banking and e-payments: implications for developing and transition economies

Being one of the most information-intensive services, finance is at the forefront in the use of modern ICTs as a means to achieve efficiency gains in every step of the financial supply chain. In the case of banking, Internet banking or e-banking and e-payments are becoming one of the main delivery channels as they make it possible to dramatically decrease the unit costs of financial operations, and to make the latter much faster and in many cases safer. Consequently, commercial banks and other financial service providers are increasing the share of Internet-based operations and services and

are establishing a constant and sustainable relationship with their clients through online communications.

ICTs have thus accommodated the explosion of large international financial transactions mainly between banks, thanks to the introduction of new online payments protocols and real-time gross settlement systems. In retail payments traffic, actively used electronic means of payments include payment cards, automated teller machines, telephone banking and mobile banking (m-banking) or m-payments. The latter can use the Internet Protocol and other communication

protocols and are relatively more important in the context of developing countries.

Banks and payment card providers remain at the core of e-banking and e-payments. At the same time, relatively new players such as non-bank money transfer operators, mobile phone operators and e-payment technology vendors are trying to develop niches or special value-added operations via the main players, or to make various cooperative arrangements with them.

Innovative e-banking and e-payments, both corporate and retail, proved to be less costly and more convenient for commercial banks and their clients, including businesses, Governments and households. They encouraged further use of bank money and reduced the role of cash (notes and coins). However, Internet banking created another set of security challenges, such as the need for protection from emerging cybercrime. Consequently, further innovations were introduced to allow more secure methods of e-finance. The intensive use of ICTs also facilitated the transformation of traditional bank-related loans into securities that are floated on capital markets. As a result, banks' activities in securities trading have increased, while their role as deposit-taking institutions has become less important in comparison.

Making e-banking and e-payments more affordable for banks and their clients in developing countries is still a major challenge. Furthermore, providing SMEs, microenterprises, and individuals (a proportion of whom are "unbanked", i.e. have no bank accounts) with better access to simple forms of e-banking and e-payments or m-payments is also an issue that is being addressed in many developing countries.

The financial flows between developed and developing countries take place mainly in the framework of major online inter-bank transfer systems. While

those systems facilitate the transmission of the main private and public financial flows such as bank credits, FDI, portfolio investments and official development assistance, ICTs are no less important for retail or small-volume financial transfers destined for households and small businesses. The most important of small-scale private financial transfers are migrant remittances; these are increasingly relying on online money transfer systems, which are cost-saving for both originators and end-users of those funds.

SMEs and microenterprises in developing countries are still largely excluded from formal financial intermediation. This long-standing issue could be addressed by introducing e-finance techniques. For example, one of the obstacles to lending to those small-scale enterprises is the lack of information about their credit risks and the high cost involved in keeping credit risks on record. Building up, at much lower unit costs, online databases and scoring systems concerning small clients' credit risks can provide solutions for overcoming traditional information asymmetry barriers to their access to finance. In that respect, the introduction of a business-friendly and streamlined regulatory and institutional environment will help those enterprises move out of the informal sector and start creating their credit histories. To provide credit to SMEs, banks will increasingly need either to rate borrowers' credit risks internally or to rely on external acceptable credit-rating institutions.

E-banking and e-payments have achieved quite a high level of penetration in developed economies and in a number of emerging ones. However, they are still at an early stage in the overwhelming majority of developing countries and countries with economies in transition. To exploit that potential, the financial sector of developing and transition economies will need the capacity to move rapidly towards modern ICT-based systems.

6. Mobile telephony for business connections for the poor

Mobile telephony has become the most important mode of telecommunications in developing countries. While Internet access has become a reality for many businesses and public institutions, and for individuals with higher levels of education and income, for the vast majority of low-income populations mobile telephony

is likely to be the sole tool connecting them to the information society in the short to medium term.

Mobile telephony has grown remarkably fast in developing countries and continues to be the only ICT-use sector where developing countries are catching up

quickly or have in some ways even overtaken developed countries. Mobile connectivity has a clear advantage over fixed-line infrastructure, which faces high costs and difficulties in connecting remote areas. As a result, mobile phone subscriptions since 2001 have doubled globally, and quadrupled in Africa. However, for many developing countries and regions, improving both rural penetration and access is a more daunting task because of the lack of commercial distribution channels, the low level of education and widespread poverty.

Mobile telephony can lead to economic growth in several ways. Investment in network infrastructure and related services creates direct and indirect employment opportunities. The use of mobile telephony in the conduct of business reduces the costs and increases the speed of transactions. Those effects will be more pronounced in economic activities that have a greater need for information or where added information enables increasing returns to scale. The growing availability of mobile services and their constantly decreasing cost further increase the use of mobile phones in the business communities in developing countries, even in the informal sector.

Mobile telephony services are often provided on a prepayment basis, which helps to avoid problems of non-payment. This is important in regions where large groups of the population are poor and are thus “unbankable”. Once the network is in place, there is no waiting time for new mobile subscriptions. In many countries prepaid services are used to provide mobile

public payphones, and this improves connectivity and accessibility in rural areas.

Examples of innovative and productive use of mobile telephony in small businesses among the poor in developing countries abound. Mobile telephony provides market information for, and improves the earnings of, various communities, such as the fishermen of Kerala, the farmers of Rajasthan, the rural communities in Uganda, and the small vendors in South Africa, Senegal and Kenya.

Mobile telephony is a dynamic technology growing in sophistication. Short message services have introduced simple wireless text and data transfers. Mobile handsets have new functionalities, such as digital photography, multimedia messaging and other programmes and utilities many of which were previously available only on personal computers with Internet connections. Mobile telephony provides a gateway to digital literacy. For many individuals and communities, once the initial hurdle of ICT acceptance has been overcome, the adoption of subsequent higher-level technologies may be less intimidating. In that sense, mobile telephony is the most useful ICT tool for low-income populations.

In addition to policies to encourage competition with a view to reducing costs and improving the servicing of mobile telephony, Governments may explore locally relevant policies to extend mobile services and networks to remote rural areas and to poor communities.

7. Promoting livelihoods through telecentres

Telecentres – that is, public facilities where people can access ICTs, communicate with others and develop digital skills – have become a key programme and policy instrument to extend the benefits of ICTs to poorer communities. They can support the livelihoods, or means of living, of people living in poverty by providing access to key information, supporting the development of technical and business skills, facilitating access to government services and financial resources, and supporting micro-entrepreneurs. For example, telecentres such as the rural information centres in Bangladesh and the Partnership for E-prosperity for the Poor in Indonesia are providing farmers with

access to valuable farming knowledge to combat crop insects and improve breeding techniques.

To understand how telecentres are currently supporting livelihoods, UNCTAD has surveyed a number of telecentre networks. The survey assesses what services telecentres are providing, who benefits from them, and what are the key environmental and institutional factors influencing the ability of telecentres to support livelihoods. The results show that most telecentres are concentrating their efforts on providing access to ICTs and developing basic ICT skills. In line with the type of services offered, telecentres are primarily used for

informational and educational purposes. However, wider access to ICTs and general training in ICT skills are not sufficient to support the livelihoods of people living in poverty. For instance, few telecentres provide specific training in how to use ICTs for the development of economic opportunities, such as e-business training, or training to support the development of business and/or occupational skills.

There are some good examples of how telecentres provide access to business-related services, most notably access to government services, employment-related information (in more developed economies), sector-specific information and business communications. However, there is limited support for crucial business-related services such as banking or access to finance.

Access to relevant information and knowledge is crucial for livelihoods, and telecentre network leaders believe that improvements would be most valuable in increasing the availability of relevant content. To facilitate access to content, some telecentres are repackaging information in formats accessible to their illiterate customers. Other telecentres are facilitating access to content through the development of local content and user-generated content or by supporting accessibility through help desks and infomediaries. The quality of the general infrastructure and the broader economic and business conditions are two other important external factors influencing telecentres capacity to support livelihoods.

Questionnaire responses show that, institutionally, the majority of telecentre networks support economic activities where possible, but this is not their main objective. Telecentre networks work with social and educational institutions and to a lesser extent with organizations that promote economic activities, such as professional associations or business supporting organizations. Therefore, there is scope for working with business-supporting organizations in order to, for instance, share/provide training programmes and business-related services.

One efficient approach to support economic opportunities is to embed the activities of telecentres in existing economic activities. For example, e-Choupal is a commodity services programme supporting farmers in India through information kiosks that provide real-time information on commodity prices, customized agricultural knowledge, a supply of farm inputs and a direct marketing channel for farm produce. Because the network is strongly embedded in a specific economic activity, it enables its participants to derive economic

opportunities. However, the downside is that those not part of such activities will be excluded.

Another approach that some telecentres are successfully using to support livelihoods is to develop niches of economic opportunities. For example, a telecentre in an impoverished community in Nunavut (Canada), as a result of increasing demand, is supporting two specific sectors, namely film production and scientific research. It acquired filming equipment through additional funding and is providing training in film production. As a result, film companies are interested in filming in this community because of the availability of trained personnel. The network has also developed a programme to support research work by offering services for visiting scientific researchers (i.e. renting of equipment) and by training community members in basic research methods.

Telecentres can better support economic activities when providing value-added services, and not only connectivity. For instance, the availability of training to develop skills important for undertaking economic activities (such as e-business skills) is still limited. Telecentres should provide a continuum of training, from basic ICT skills training to more specialized skills training, and support customers in putting those skills into practice. There is also scope for providing a wider range of services, such as access to finance or to expertise in specific sectors.

Special efforts are needed to support those in weaker positions. Such support may be provided by an intermediary who can offer adequate information, specific programmes targeted to disadvantaged groups and special services to support their economic activities. For example, in Indonesia, each telecentre of the Partnership for e-Prosperity for the Poor has an infomobilizer - that is, a person who supports the development of the community by using and promoting the use of relevant information. The infomobilizer helps the community/village identify its needs and opportunities for improving livelihoods (such as acquiring new agricultural skills or expanding the marketing of village products).

Policy-makers and telecentre managers may consider some useful measures to ensure that telecentres support the livelihoods of people living in poverty. In particular, recommendations are made to Governments for promoting relevant e-government content and services, supporting the development of e-business skills and providing strategic financial support for telecentre networks.

Similarly, recommendations are made to managers of telecentre networks for providing value-added services, offering e-business skills training programmes, supporting the economic activities of those in weaker

positions by employing community infomediaries, and collaborating with other organizations that support economic activities, such as business associations or microcredit institutions.

8. Harmonizing cyber legislation at the regional level: the case of ASEAN

The Association of Southeast Asian Nations (ASEAN) is the first regional organization in the developing world to have set in motion the harmonization of its members' e-commerce legal framework. By the end of 2008, all ASEAN member countries will have enacted consistent national e-commerce legislation. In that connection, ASEAN has commissioned a project, the ASEAN E-Commerce Project, to help its ten member countries develop and implement a harmonized e-commerce legal infrastructure.

An increasing number of developing countries are adapting their legislation to e-commerce in order to remove barriers to online services and provide legal certainty for business and citizens. The impact of the introduction of legislation on the expansion of e-commerce activities is reported by countries to be positive, leading to increased ICT-related business opportunities and FDI, according to an UNCTAD survey on e-commerce legislation in developing countries carried out in 2007.

Developing countries within their region and subregion are also considering the development of a harmonized legal framework for e-commerce to make their region competitive and help boost e-business and economic growth. The harmonization of e-commerce legal frameworks is expected to lead to larger internal or external consumer and business markets by facilitating cross-border e-commerce and the cross-border recognition of digital signatures.

Drawing on the ASEAN experience, the chapter presents the benefits of the implementation of law reform, as well as possible options and potential challenges awaiting countries in the development of a common regional and national e-commerce legal framework. Such challenges include different e-readiness levels and the development stage of e-commerce legislation, which can vary from one country to another.

The experience of the ASEAN member countries may be useful for other regional associations in the developing world that are currently considering the harmonization of e-commerce legal infrastructure. Harmonization projects are designed to align individual member country laws in order to remove unwanted gaps, overlaps and duplication, the aim being to increase legal certainty for parties engaged with more than one member country – for example, multinational businesses that are attempting to expand their business in a new region.

Harmonization projects usually fall into one of two categories – “soft harmonization” (based on training and capacity-building) or “hard harmonization” (based on model or uniform laws). Most e-commerce legal harmonization projects are “soft harmonization” projects, in that there is no intention or requirement that countries adopt the same (or even model) laws and regulatory systems. All that is undertaken is training and capacity development activities, so as to ensure a common (or harmonized) understanding of e-commerce legal requirements. However, the ASEAN E-commerce Project is an example of a “hard harmonization” project, based on implementation guidelines that build on the common objectives and principles for e-commerce legal infrastructure in ASEAN, rather than simple capacity-building. Although the ASEAN E-Commerce Project has enjoyed some success in generating rapid progress in the development of a harmonized e-commerce legal infrastructure in ASEAN, it also reinforces some of the significant challenges faced by organizations in implementing harmonization projects of this type, or in implementing domestic e-commerce legal infrastructure.

ASEAN member countries have identified a number of implementation challenges, and these are likely to be common to many other countries, especially developing countries. Key challenges include securing government policy support, identifying sufficient funding, and

obtaining relevant training and assistance. Furthermore, many developing nations may not be able to develop effective e-commerce legal infrastructure without some form of external assistance. Several ASEAN member countries have benefited from external assistance, including training programmes and advisory services concerning the legal aspects of e-commerce provided by United Nations organizations such as the United Nations Commission on International Trade Law and UNCTAD.

Part of the success of the ASEAN E-Commerce Project is due to the fact that it focused on global harmonization and international interoperability, rather than simply focusing on regional harmonization. This focus on international interoperability included the selection of international models and templates, especially the United Nations Convention on Electronic Contracting, for the implementation of domestic e-commerce law in ASEAN member countries. This ensured that ASEAN's e-commerce legal infrastructure would also be compatible with international developments, providing greater certainty for consumers and greater

consistency for businesses. Another important factor for success was the strong focus on trade facilitation in this project. This resulted in constant testing of the project outputs against trade facilitation objectives.

There is a need for detailed implementation tools to help developing countries implement e-commerce legal infrastructure, rather than just high-level recommendations or generic discussion papers. The implementation tools used in the ASEAN project included regional implementation guides, country-specific implementation guides, implementation progress checklists and implementation timelines.

The ASEAN project shows the importance of developing comprehensive legal infrastructure – not just written laws – and of aligning domestic and international e-commerce laws to avoid overlaps and inconsistencies. It is important for countries to minimize inconsistencies and duplications in order to create a smooth, consistent legal platform for businesses engaging in e-commerce in their region.