



## NOTE

Within the UNCTAD Division on Technology and Logistics, the ICT Analysis Section carries out policy-oriented analytical work on the development implications of information and communication technologies (ICTs). It is responsible for the preparation of the *Information Economy Report*. The ICT Analysis Section promotes international dialogue on issues related to ICTs for development, and contributes to building developing countries' capacities to measure the information economy and to design and implement relevant policies and legal frameworks.

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Developed countries: the member countries of the Organization for Economic Cooperation and Development (OECD) (other than Mexico, the Republic of Korea and Turkey), plus the new European Union member countries that are not OECD members (Bulgaria, Cyprus, Latvia, Lithuania, Malta and Romania), plus Andorra, Israel, Liechtenstein, Monaco and San Marino. Countries with economies in transition: South-East Europe and the Commonwealth of Independent States. Developing economies: in general, all the economies that are not specified above. For statistical purposes, the data for China do not include those for Hong Kong Special Administrative Region (Hong Kong, China), Macao Special Administrative Region (Macao, China), or Taiwan Province of China.

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## PREFACE

Information and communications technologies continue to transform our society. In recent years we have seen dramatically improved access to mobile telephones, the Internet and broadband connectivity throughout the developing world. These trends are gradually helping to dismantle barriers towards the goal of an “information society for all” agreed by world leaders at the World Summit on the Information Society.

Such a society depends on software. The growing emphasis on ICTs in the delivery of government, healthcare, education and other goods and services demands customized applications. Countries therefore need the capacity to adopt, adapt and develop relevant software. Such capacity is also important to facilitate successful technology transfer.

The *Information Economy Report 2012* provides an in-depth analysis of software industry developments in developing countries. It underlines the importance of focusing not only on the export opportunities offered by the sector, but also on domestic needs. Using new data, it makes a fresh assessment of the software performance of different countries, highlights key drivers in the evolving software landscape, reviews selected country cases and proposes concrete recommendations to policy makers in developing countries. I commend the report to Governments and development partners working to create an information society for all.



BAN Ki-moon  
Secretary-General  
United Nations

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## LIST OF ABBREVIATIONS

3G	third generation (refers to mobile phones)
A4D	Android for Development
ACE	Africa Coast to Europe
AFRICOMM	International Conference on e-Infrastructure and e-Services for Developing Countries
AGEXPORT	Guatemalan Exporters Association
AGPL	Affero General Public License
AHTI	Asociación Hondureña de Tecnologías de Información
AICOS	Assistive Information and Communication Solutions
APIs	application program interfaces
APKIT	Association of Computer and Information Technology Producers (Russia)
app	application software
ASEAN	Association of Southeast Asian Nations
ASSESPRO	Association of Brazilian Information Technology Companies
AVOIR	African Virtual Open Initiatives and Resources
B2B	business-to-business
BASIS	Bangladeshi Software and Information Services Association
BASSCOM	Bulgarian Association of Software Companies
BIND	Berkeley Internet Name Domain
BNDES	Brazilian Development Bank
BPO	business process outsourcing
BRIC	Brazil, Russia, India and China
BSA	Business Software Association
BSD	Berkeley Software Distribution
BMZ	German Federal Ministry for Economic Cooperation and Development
CAD/CAM	computer-aided design and computer-aided manufacturing
CMM	Capability Maturity Model
CMMI	Capability Maturity Model Integration
COBIT	Control Objectives for Information and Related Technologies
COMESA	Common Market for Eastern and Southern Africa
CRM	client relationship management
CSC	Common Services Centres
CSIS	Center for Strategic and International Studies
DNS	Domain Name System
DVD	Digital Versatile Disc
EASSy	Eastern Africa Submarine Cable System
EFTA	European Free Trade Association
EITO	European Information Technology Observatory
EMPEA	Emerging Market Private Equity Association
ESI	European Software Institute
ETS	Educational Testing Service
FDI	foreign direct investment
FENAINFO	National Federation of Information Technology Companies (Brazil)
FINEP	Financiadora de Estudos e Projetos (Brazil)
FONSOFT	Trust Fund for the Promotion of the Software Industry (Argentina)
FOSS	free and open source software

FOSSFA	Free Software and Open Source Foundation for Africa
FSF	Free Software Foundation
GB	gigabyte
GDP	gross domestic product
GIZ	Gesellschaft für Internationale Zusammenarbeit (Germany)
GLO-1	Globacom Limited submarine communications cable
GNU	GNU is not Unix
GPL	General Public License
HSPA	High Speed Packet Access
HTML	HyperText Markup Language
HTML5	Fifth revision of the HTML standard
ICT	information and communication technology
ICTA	Information and Communication Technology Agency (Sri Lanka)
IDC	International Data Corporation
IEC	International Electrotechnical Commission
IFI	international financial institutions
IMAP	International Network of Mergers and Acquisition Partners
IMF	International Monetary Fund
IPR	intellectual property rights
ISIC	International Standard Industrial Classification of All Economic Activities
ISO	International Organization for Standardization
ISPON	Institute of Software Practitioners of Nigeria
ISTQB	International Software Testing Qualifications Board
IT	information technology
ITES	information technology enabled services
ITIL	Information Technology Infrastructure Library
ITU	International Telecommunication Union
LAMP	Linux, Apache, MySQL, PHP
LPI	Linux Professional Institute
LDC	least developed country
LGPL	Lesser General Public License
MASIT	Macedonian Chamber of Information and Communication Technology
MERCOSUR	Southern Common Market
MIIT	Ministry of Industry and Information Technology (China)
MIT	Massachusetts Institute of Technology
mLab	mobile applications laboratory
MPL	Mozilla Public License
MPS.br	Brazilian Software Process Improvement Program
MySQL	My Structured Query Language
NACE	General Industrial Classification of Economic Activities within the European Communities
NAICS	North American Industry Classification System
NASSCOM	National Association of Software and Services Companies (India)
NGO	non-governmental organization
NIS	national innovation system
NITDA	National Information Technology Development Agency (Nigeria)
OECD	Organization for Economic Cooperation and Development
PC	personal computer
PHP	Hypertext Pre-processor

PRAM	Poverty Reduction and Agriculture Management
R&D	research and development
RUP	Rational Unified Process
RUSSOFT	Russian Software Developers Association
SaaS	software as a service
SEBRAE	Brazilian Service of Support for Micro and Small Enterprises
SECC	Software Engineering Competence Center (Egypt)
SEI	Software Engineering Institute
SEO	search engine optimization
SLASSCOM	Sri Lanka Association for Software and Service Companies
SME	small and medium-sized enterprise
SMS	short message service
SOFEX	Comisión de Software de Exportación (Guatemala)
SOFTEX	Association for the Promotion of Brazilian Software Excellence
SRDI	Soil Resource Development Institute (of Bangladesh)
SUSE	Software und System Entwicklung
TCP	Transmission Control Protocol
TEAMS	The East African Marine System
TNC	transnational corporation
UNCITRAL	United Nations Commission on International Trade Law
UNCTAD	United Nations Conference on Trade and Development
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNU-IIST	United Nations University International Institute for Software Technology
UNU-MERIT	United Nations University Maastricht Economic and Social Research Institute on Innovation and Technology
WACS	West Africa Cable System
WITSA	World Information Technology and Services Alliance
WSIS	World Summit on the Information Society
WTO	World Trade Organization

## OVERVIEW

The spread of information and communication technologies (ICTs) continues to facilitate technological change in the globalizing economy. Recent editions of the *Information Economy Report* have documented how the rapid diffusion of mobile telephony and improved international broadband connectivity, including in the least developed countries (LDCs), as well as the introduction of new services and applications, are facilitating more inclusive development. This not only has implications for enterprise development but it also expands the scope for leveraging ICTs in such development areas as health, education, governance, the private sector and more.

In order, however, to ensure that this improved access to ICTs brings about the desired benefits, the devices and services provided have to respond effectively to the needs and capabilities of users. In many instances, this in turn necessitates access to relevant technological capabilities within the domestic economy. This applies in particular to the area of software, which critically influences the functionality of goods and services offered by both the private and public sectors. Against this background, the *Information Economy Report 2012* puts the focus on the role of software in developing countries.

To facilitate structural transformation and technological advancement, it is necessary for countries to build domestic capabilities to allow individuals, firms and organizations to engage in learning processes. In this context, Governments should seek to adopt policies that help expand the opportunities for such learning, especially in new industries that offer wide learning opportunities. The software industry is such an industry. As a general-purpose technology, software has wide application throughout the economy and society. It is also characterized by relatively low capital barriers to entry and its relevance is likely to remain high in the future.

Developing software capabilities is important for several reasons. Software consists of a set of instructions that enable different hardware (computers, mobile phones, smart phones and tablets, and the like) to perform the operations required. In this sense, it can be seen as the “brain” of ICT devices. Software can help firms to manage their resources better, access relevant information, lower the costs of doing business

and reduce time to market. Greater emphasis on ICTs in the delivery of government, health care, education and other services is also raising the need for capabilities to develop customized software applications. Different ICTs are increasingly permeating societies in countries of all levels of development. In this context, developing the technological capabilities to adopt and adapt existing software solutions, and eventually to innovate, becomes more relevant.

Consequently, countries increasingly need a certain capacity to understand, manipulate and adapt software. Other things being equal, locally based software expertise is better positioned to understand domestic needs and therefore to develop relevant and innovative applications and content. Countries with well-developed software industries are better placed to implement their own tailored solutions. Furthermore, close interaction between domestic producers and users generates learning opportunities and gains in terms of productivity and operational efficiency, and thereby contributes to market expansion and diversification. Software industries also tend to generate high-end, direct and indirect employment, especially for skilled youth.

The opportunities of software and service activities for developing countries – thanks to the low capital entry requirements as well as the sector’s high-value, high-growth nature and high-technology, knowledge-rich profile – are well recognized. However, in many developing countries, it is only recently that sufficient demand for ICT applications and software has emerged to warrant a more systematic treatment of the software area. Thanks to changes in the ICT landscape, there is today more scope even for small-scale developers in developing countries to participate in software development and production.

The expanding use of mobile phones is creating new domestic demand for mobile applications and services geared towards improving access to domestic news and entertainment, government services, patient care, market information services and mobile money transfers. Having the software developed locally enhances the chances of it being adapted to the specific needs of the domestic users (for example, taking cultural and language considerations into account). Improved broadband Internet access allows developers

in developing countries to engage in software projects and export their services. Meanwhile, novel software production modes – such as distributed peer-production over the Internet – are leading to the creation of new business models based on local software service provision and adaptation.

As a framework for its analysis, the *Information Economy Report 2012* introduces the concept of the national software system. It emphasizes that actions and interactions of domestic software producers and users are greatly influenced by the quality and affordability of ICT infrastructure, access to relevant human resources and capital, the legal framework, and enabling business infrastructure, as well as by the links with software networks in the rest of the world. Overall, the competitiveness of the system is affected by the national vision, strategy and government policies which should nurture software capabilities and the software system as a whole. Governments play a central role in the system. They are important users of software (notably through e-government and public procurement activities) and they strongly influence the enabling factors of the system.

Available data suggest that there is considerable room for developing countries to make better use of the software potential. According to estimates from the World Information Technology and Service Alliance (WITSA)/IHS Global Insight, spending on computer software and services (excluding software embedded in devices) amounted to an estimated \$1.2 trillion in 2011. Most of this (four fifths) is accounted for by developed countries. The remaining share is mainly accounted for by developing countries in East, South and South-East Asia, while the combined spending in the rest of the developing world corresponded to only 4 per cent. Developed regions also spend relatively more on software and services as a share of their overall ICT spending. For example, in North America, computer

graduating each year in developing countries. New areas of software development may also help create a critical mass of local capabilities to develop software solutions in traditional application fields for the business and government sectors, which in many countries are still underserved.

Capability needs vary. For developing countries with nascent software sectors, catching up on the advances of other countries by technological learning will initially involve a considerable adoption of software techniques developed abroad. A common starting point in low-income countries is to focus on services such as reselling, installation, customization and training linked to imported, foreign packaged software. This can help local enterprises to obtain knowledge about that particular software before seeking to move up to the next level by becoming a producer of their own software. Producing software and IT services for export requires greater capabilities. Building capabilities requires a continuous learning process during which new competencies and skills are acquired by interacting with clients, peers and through various networks.

There are significant differences between developing countries in terms of the market orientation of software production. In a number of low and middle-income countries, computer software and IT service exports exceed the value of spending on domestic computer software and services (for example, Costa Rica, India, Jamaica, the Philippines, Sri Lanka and Uruguay). In some of these (for example, Sri Lanka and Uruguay), software spending is very small relative to the size of the economy, suggesting that domestic software needs might be crowded out by demand from foreign markets. In India and the Philippines, computer software has become an important part of the local economy and they have joined Argentina and Malaysia as countries where both ex-

and transfer technology. They can also accelerate the integration into global value chains and contribute to economic diversification. Moreover, globalization of the software industry and greater reliance on peer-to-peer production imply greater scope for developers and software enterprises in developing countries to engage in exporting activities linked to outsourcing and crowdsourcing of software services.

From the perspective of harnessing the value of software in local economic development, however, it is important that software services and capabilities are available to support the needs that exist locally in the public and private sectors. As noted above, domestic use of software can be instrumental in improving the competitiveness of enterprises and the welfare of society. The domestic market is potentially an important base for enterprises to develop relevant skills and innovative products. Indirect effects on society may be expected to be larger when software is locally developed for domestic enterprises and institutions.

The performance of China is striking in this respect. According to Chinese official statistics, software production rose from \$7 billion in 2000 to \$285 billion in 2011. As much as 90 per cent of this is produced for the domestic market. Much of the local production is either embedded in the manufacturing of ICT and other goods (which are often subsequently exported from China to the world market), or developed to meet rapidly growing ICT use in the domestic economy. The development of indigenous e-commerce platforms (Alibaba and Taobao), web platforms for social networking (Renren) and local search engines (Baidu) has contributed to the demand for locally adapted software applications. The building of software capabilities, goods and services has been supported by government policies and institutions, including publicly financed research into Chinese language software, translation engines and security systems.

Governments should take an active part in fostering software capabilities, taking all relevant aspects of the national software system into account. Intentionally or unintentionally, they influence the evolution of the system. Governments are important buyers of software. They determine the educational curricula for the production of software engineers as well as the availability of affordable ICT infrastructure. They shape legal and regulatory frameworks that influence the extent to which ICTs are taken up and used productively in the economy and society. The *Information*

*Economy Report 2012* offers several policy recommendations.

The experience of countries that have managed successfully to strengthen their software capabilities and industries suggests that the development of a national strategy, based on consultations with all relevant stakeholders, is a useful starting point. It should be well integrated in the overall national ICT strategy and adapted to the specific situation of each country. For most developing countries, focus should be on nurturing capabilities that are required to meet domestic software needs. For countries that have reached a certain level of maturity in the software field, it becomes more relevant to explore software also as a source of export revenues.

For governments to be able to design and implement relevant measures to strengthen the sector, a careful assessment of the system should be undertaken at an early stage of the process. Such an analysis helps to identify critical underlying challenges, such as capacity and skill gaps, regulatory shortcomings and other barriers to the sector's evolution. The UNCTAD-WITSA Survey of National IT/Software Associations found that the most frequently mentioned barriers for the growth and development of the software and IT services industry were lack of venture capital, shortages of qualified human resources and too little government procurement.

In terms of policy areas to consider, attention should be given to developing adequate ICT infrastructure, generating relevant skills from universities and specialized training institutes, making the business and legal frameworks conducive to the strengthening of software capabilities and production, and facilitating interaction among domestic producers and users as well as with international networks.

The availability of an educated workforce and students enrolled in computer-related education fundamentally affects the potential of the system. With a view to making available a pool of skilled manpower, curricula of regular education systems and professional training facilities need to be adapted to the skill requirements of software producers and users. This necessitates close dialogue with private-sector stakeholders, universities and key software users. Particular focus should be given to skill development around new models of networking, community building and international knowledge-sharing. At the same time, it needs to be generic, flexible and adaptable, rather than targeted at certain programmes or tools.

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