INFORMATION ECONOMY REPORT 2012

The Software Industry and Developing Countries

OVERVIEW

UNITED NATIONS

INFORMATION ECONOMY REPORT 2012

The Software Industry and Developing Countries

OVERVIEW

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.

In this Report, the terms country/economy refer, as appropriate, to territories or areas. The designations employed and the presentation of the material 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. In addition, the designations of country groups are intended solely for statistical or analytical convenience and do not necessarily express a judgement about the stage of development reached by a particular country or area in the development process. The major country groupings used in this Report follow the classification of the United Nations Statistical Office. These are:

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.

Reference to companies and their activities should not be construed as an endorsement by UNCTAD of those companies or their activities.

The following symbols have been used in the tables:

Two dots (..) indicate that data are not available or are not separately reported. Rows in tables have been omitted in those cases where no data are available for any of the elements in the row;

A dash (–) indicates that the item is equal to zero or its value is negligible;

A blank in a table indicates that the item is not applicable, unless otherwise indicated;

A slash (/) between dates representing years, for example, 1994/95, indicates a financial year;

Use of an en dash (–) between dates representing years, for example, 1994–1995, signifies the full period involved, including the beginning and end years;

Reference to "dollars" ($) means United States dollars, unless otherwise indicated;

Annual rates of growth or change, unless otherwise stated, refer to annual compound rates;

Details and percentages in tables do not necessarily add up to the totals because of rounding.

The material contained in this study may be freely quoted with appropriate acknowledgement.

UNCTAD/IER/2012 (Overview)

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

ACKNOWLEDGEMENTS

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.
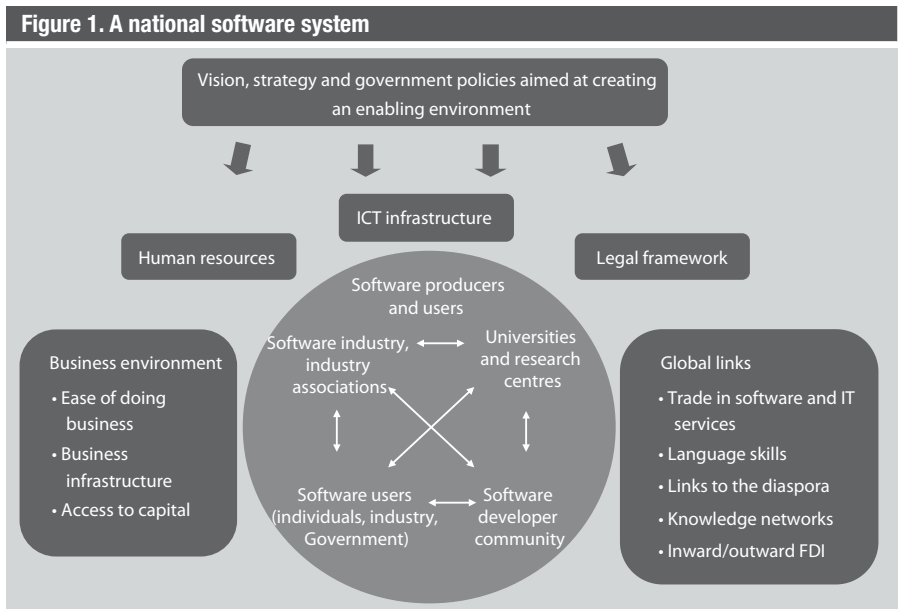
Consequently, countries increasingly need a certain capacity to understand, manipulate and adapt software. Other things being equal, locally based software expertise is better positioned to understand domestic needs and therefore to develop relevant and innovative applications and content. Countries 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 (figure 1). 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.

Figure 1. A national software system

Vision, strategy and government policies aimed at creating an enabling environment

ICT infrastructure

Human resources

Legal framework

Software producers and users

Software industry, industry associations

Universities and research centres

Business environment
• Ease of doing business
• Business infrastructure
• Access to capital

Software users (individuals, industry, Government)

Software developer community

Global links
• Trade in software and IT services
• Language skills
• Links to the diaspora
• Knowledge networks
• Inward/outward FDI

Source: UNCTAD.

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 software

and services made up 43 per cent of ICT spending compared with only 11 per cent in Latin America. Low ratios in developing regions can be seen as a sign of limited software use, hindering the passage to the information society. At the same time, a low level of income does not in itself have to be a barrier to the development of software capabilities and use.

Expanding the availability of local software capabilities can help to generate employment in the software industry as well as in industries for which embedded software development is important. Such jobs can help absorb the growing number of tertiary students 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 (figure 2). 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 exports and the domestic computer software industry have reached relatively high levels. In many other developing countries, software is important in the domestic economy but exports are low. Such a pattern applies, for example, to Brazil, the Republic of Korea and South Africa, suggesting that there is significant scope for an expansion of exports.

Figure 2. Computer software and services export intensity and computer software and services spending as a share of GDP, 2010, selected low and middle income economies (per cent)
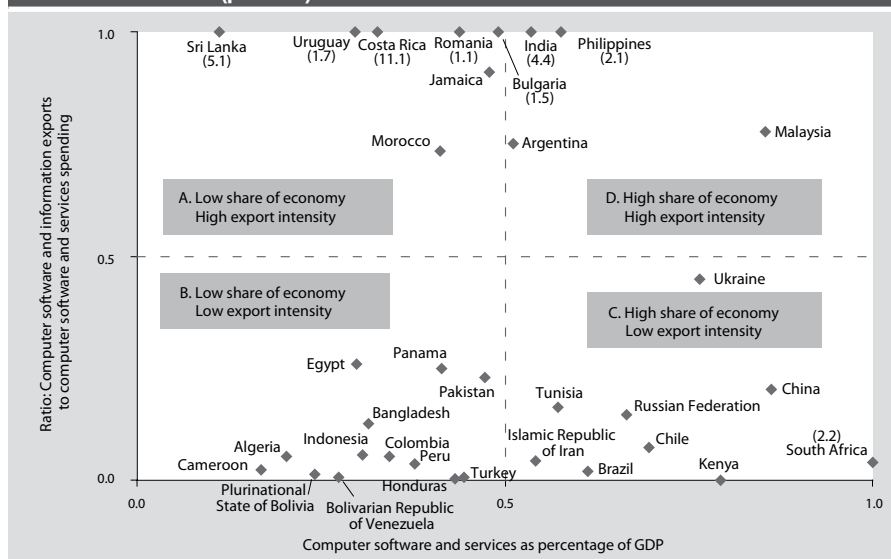
Source: UNCTAD, adapted from WITSA/IHS Global Insight, Inc and WTO Statistics database.

The mix of local sales and export sales has implications for the development impact of software production. Many Governments see exports of software and IT services as a way to generate foreign exchange, reduce trade deficits, induce job creation 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 (table 1).

Table 1. Main barriers to the growth and development of the software and IT services industry (Share of respondents mentioning factor)						
Barrier	*Developed Economies %*	*Asia-Pacific* %*	*LAC** %*	*Middle East and Africa %*	*Transition economies %*	*All regions %*
Limited capabilities in domestic software/ IT services companies	13	38	45	43	50	34
Lack of qualified human resources	63	63	55	43	75	56
Limited access to venture capital	63	50	73	86	75	66
Weak demand among private enterprises for software and IT services	25	25	18	57	50	29
Lack of government procurement of software and IT services	13	50	45	71	50	44
Limited demand from export markets	13	25	18	29	25	22
Inadequate protection of intellectual property rights	25	25	27	14	—	22
High rates of software piracy	—	13	45	29	25	24
Unfavourable general business climate	13	13	27	14	50	20

Source: UNCTAD–WITSA Survey of IT/Software Associations, 2012.
Note: * Excluding West Asia; ** Latin America and the Caribbean. Based on 38 responses.

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. As technologies and markets are in constant flux, software enterprises tend to look for employees with the ability to learn new things on the job as projects evolve.

Many countries have set up technology parks, innovation hubs and incubators with the aim of making it easier for enterprises to get started, interact, innovate and expand. Such facilities are of particular value when weak basic infrastructure represents a barrier. Co-location of software skills and enterprises can spur innovation and cross-fertilization between enterprises and the developer community. By facilitating the creation of informal networks such structures can facilitate transfers of tacit knowledge among different stakeholders, including the local developer community. Relevant initiatives may include meetings that bring developers together to develop solutions around specific software platforms or for certain development concerns (clean water, disaster risk reduction, open government) as well as various technology conferences and workshops.

Governments should also build on the rising demand for mobile applications (apps). This domain is particularly relevant in low-income countries in which the current use of computers remains limited while mobile phone use is booming. Ensuring that there is a market place for local developers to sell their output is essential if such development work is to be sustainable. Governments can help catalyse activities by incentivizing mobile operators to develop mobile apps markets and create new demand by identifying their own needs for new mobile apps. Mobile app stores

should facilitate the participation of developers in developing countries. Governments should ease the remaining restrictions on on-line payments, as these can represent a barrier for local developers to participate in software-development activities.

Governments should consider public procurement related to their e-government needs as tools to spur demand for software development. In this context, adequate attention should be given to the role of open standards, open innovation and free and open source software (FOSS) whenever it offers a competitive solution. Strategic advantages of FOSS include the empowerment of micro- and small software enterprises to innovate freely, the lowering of the cost of ownership for new software development, a reduction of errors and greater security. The way in which FOSS promotes grassroots creativity, innovation, leadership and teamwork is a key value added. The process of learning about and adapting software enables users to become creators of knowledge rather than mere passive consumers of proprietary technologies. Technological trends, especially with regard to cloud computing, mobile applications and big data, are further accentuating the reliance on FOSS. There is still large regional variation in the intensity of FOSS policy activity. Europe is the most active region, accounting for close to half of all known related policy initiatives. Among developing regions, Asia is the front-runner, followed by Latin America and Africa.

In the spirit of the World Summit on the Information Society, development partners should consider expanding their assistance to developing countries in the software area. Examples cited in this report offer a base of support activities on which to build in the areas of training, application development, strengthening of legal and regulatory frameworks, supporting IT/software associations and clusters, meetings of developers, development of small and medium-sized software enterprises, and more. Development partners can also contribute by using software enterprises and developers in developing countries for the development of software services and applications needed in their projects.

Some of the world's leading producers of software products and services are based in the South, and there is considerable experience in developing countries with public procurement and use of software, skills development and promotion of new business models. In other locations, the software industry is still nascent. This combination of diversity and excellence makes the software area attractive for South–South cooperation. Through its three pillars, UNCTAD could offer a platform

for developing countries to discuss how to use South–South cooperation with a view to bridging the digital divide, developing software capabilities and harnessing the software and ICT sector for development. Such discussions may help to avoid a lopsided approach by which many developing countries become mere passive adopters of software technology.

Supachai Panitchpakdi
Secretary-General, UNCTAD