

Producing ICT indicators in developing countries: challenges and initiatives

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Keywords: ICT indicators, developing countries, statistical capacity building

The follow-up to the World Summit on the Information Society (WSIS) requires, as any other international agreement, a monitoring and evaluation system consisting of a set of agreed indicators. A core list of ICT indicators was proposed by the international community and endorsed by the UN Statistical Commission, including 48 indicators on ICT infrastructure, ICT access and use by households and businesses, the ICT producing sector, international trade in ICT goods and use of ICT in education. For National Statistical Systems, the production of statistics for the calculation of these indicators represents a challenge, with organisational, technical and resource implications. OECD member economies have produced survey-based ICT indicators since the late 1990s, but the availability of ICT data is still low in developing countries. Global initiatives have been put in place for building capacity for the production and dissemination of ICT statistics, such as the activities of the *Partnership on Measuring ICT for Development*. This paper discusses first the main institutional and technical challenges that developing economies face in relation to the production of ICT indicators. In the second part, the paper makes suggestions on how these challenges could be addressed presenting relevant national and international activities undertaken to enhance the availability of comparable ICT statistics.

1. Introduction

There is no doubt that the fast emerging information society calls for statistics and indicators to monitor and track access and use of information and communication technologies (ICTs). While the regular collection of ICT data has been common practice for over a decade in many OECD countries, the demand for ICT statistics has only recently emerged in the developing world, spearheaded by those countries that have identified the ICT sector as one of their priorities to lead economic and social developments.

Indeed, indicators on some basic ICTs, such as radio, television and telephony have been collected by most countries for a long time. Such data can fairly easily be produced based on *administrative sources*, such as telecom and broadcasting operators. Recently, Internet subscriber data have been added to the data production, based on information collected from Internet service providers.

While such data provide important information about the number of fixed telephone lines, mobile and Internet subscriptions, or availability of radios, they do not provide information about the number of individuals, households or businesses that have access to, and make use of, ICTs, nor the activities that are carried out by individuals using, for example, the Internet. This has important policy implications. For example, in order to design effective ICT policies and take strategic investment decisions, governments need to know how many Internet users there are in the country, where they are located, and what they do on the Internet. Similarly, in order to develop, promote and target development-oriented mobile applications, public and private players they need to know how many people use a mobile phone, who they are and where they live.

This is why OECD countries are collecting *survey-based* data, which provide more policy-relevant information concerning the development of the information societies in these countries, in particular about the use of ICTs. In addition, the resulting micro-level data allow countries and researchers to carry out in-depth analyses on the social and economic impacts of ICTs.

In the developing world, however, the awareness of the benefits of survey-based ICT statistics is not yet very widespread, or relevant surveys cannot be implemented due to a number of institutional and technical difficulties, as well as a lack of financial resources to carry out regular surveys.

At the same time, there is wide agreement that ICTs are an important development enabler and specific ICT-related goals and targets have been identified through the World Summit on the Information Society (WSIS), which took place in Geneva (2003) and Tunis (2005), as well as in the United Nations Millennium Development Goals (MDGs) defined in 2000. The target year when these goals should be reached is 2015. Therefore, it is critical that countries produce the necessary indicators to monitor information society developments and track progress towards the achievement of the agreed goals.

In this context, and considering the speed of ICT developments, the international community, under the leadership of the global Partnership on Measuring ICT for Development – an initiative that is presented in Section 3-, has now worked for five years to enhance the availability of internationally comparable ICT statistics. Since 2004, the year when the Partnership was launched, many achievements have been made, most notably to raise the awareness of the need to produce ICT indicators in the developing world; to develop international standards and guidelines on ICT statistics; and to provide technical assistance on ICT measurement. Nevertheless, important gaps still remain when it comes to available data on ICT, in particular ICT use by individuals and businesses.

This paper takes a closer look at the difficulties faced by countries when it comes to producing survey-based ICT statistics. It first highlights institutional and technical challenges related to the production of ICT household and business statistics (Section 2). This is followed by a discussion of efforts that are under way to address these challenges, both at the national and international levels (Section 3). The paper concludes with a number of suggestions on how to further advance information society measurements in developing countries (Section 4).

2. Challenges in the production of ICT indicators in developing countries

The capacity for producing indicators related to access to and use of ICT by businesses, households and individuals, is influenced by the organisation of, and resources and methods available to, national statistical systems. Developing countries, as well as some transition economies, face serious constraints in their efforts to establish quality statistical systems, such as the lack of financial, technical and human resources. In addition, the subject of the information society and economy is rather new for statistical measurement, and may appear as a non-priority sector for national statistical systems, where other, more basic statistics (on living standards and general economic aspects) may not be well developed.

This section will discuss a number of general institutional and technical challenges that the national statistical systems of developing and transition economies face. It is understood that different levels of statistical capacity exist in the developing world and therefore not all of these challenges apply to all countries.

2.1. Institutional challenges

Institutional coordination mechanisms

Among the institutional challenges to produce ICT statistics and indicators, the most relevant is the set up of coordination mechanisms between relevant institutions, including NSOs and Ministries responsible for ICT policies. Since survey-based ICT statistics is a rather new field in most developing countries, the initiative to produce ICT data often originates from a demand by policy makers. Traditionally, telecommunication data and statistics have been collected by national

telecommunication regulators or ministries, based on administrative sources. Therefore, it is rather new for them to turn to the NSO for the collection of survey data on ICT access and use.

National Statistical systems (NSS) include all the administrative bodies producing statistics which are considered official, either from administrative registers or from specific surveys and censuses. Usually, a central or national statistical office (NSO) is entitled by law to coordinate the NSS through a set of institutional instruments including a Statistical Law, overarching Statistical Committees, bilateral and multilateral working groups including different ministries and agencies, and in most cases, a Statistical Master plan or workprogramme.

In the field of ICT statistics, competencies and activities are very often decentralised:

National Statistical Offices usually have the competence for coordinating the production of official statistics. However, there have been cases where surveys on ICT have been produced by public institutions without the involvement of the NSO. NSOs carry out general business and household surveys, under a legal mandate, which may include sets of questions on ICT access and use, or stand-alone ICT surveys, as it is the case in most OECD countries and some developing economies (see section 3).

- *Ministries responsible for Telecommunications, Science and Technology* and related matters collect administrative data (such as operating licenses, telephone and Internet subscriptions) from provider companies, which can be used to produce certain ICT infrastructure indicators. In some countries where the demand for ICT indicators is high, they have carried out ad-hoc surveys on the use of ICT by businesses and households, not always under the supervision, or in coordination with, the NSO. Often the reason for this is that the Ministry has information needs for ICT policy-making which are not satisfied and at the same, better access to funds (including funds from international donors), skilled human resources in the domain of ICT or even the legal mandate to establish an ICT observatory. Sometimes, there is also a perception in the Ministry (or one of its subordinated institutions) that it is better qualified than the NSO to implement a survey on such a technical issue, ignoring the fact that the questionnaire design and the data analysis – which are specific to the subject matter- have to be complemented with a set of generic technical statistical infrastructure and skills such as sample frames, sample design methods, data collection, estimation procedures, etc., which are fundamental steps of the statistical process.
- *Private institutions*, such as industry associations or national observatories which are interested in the development of the Information Society may also have an interest in implementing surveys, which are not necessarily coherent with official data, and do not necessarily follow international standards. As a result, the data may not be representative for the country or internationally comparable.

To summarize, ICT surveys in developing countries are sometimes implemented outside the frame of the National Statistical System. Professional staff which have been responsible for such surveys are not always familiar with international statistical standards (including those on ICT), and may lack key statistical skills available at NSOs such as sample design and estimation.

Existing coordination mechanisms in National Statistical Systems (such as inter-institutional coordination committees) do not always accommodate ICT statistics mainly due to the relative novelty of the subject.

In many countries, the national legal framework for statistics is outdated and does not include the Ministries or administrative bodies in charge of ICTs. The relevant Ministry may not have a centralised statistical unit which responds to data needs, but these are assigned to different units. The composition of inter-institutional coordination committees, which is usually defined by the Statistical Law, may not include a representative of such Ministry. Unfortunately, it is also the case that in some countries the coordinating role of the NSO is not very effective and other Ministries plan and implement their own statistical operations without the involvement of the NSO.

In consequence, many developing countries have not included the implementation of ICT surveys in their national statistical work programmes, thus being unable to secure financing for stand-alone surveys on the topic.

Planning the production and dissemination of ICT statistics

In most countries, the production of official statistics is governed by a statistical law that sets up a planning system which usually consists of annual and multiannual planning and which is endorsed by relevant institutional bodies that represent users and producers of statistical information. The planning procedure depends very much on the administrative set up of the country, but in general, the national statistical programme includes a list of statistical operations and other activities to be carried out by the NSO and other public bodies in a given time frame.

The recommendations of the United Nations Statistical Commission (UNSC) and other international bodies, as well as good practices identified in the domain of official statistics, include the preparation of a national strategy for the development of statistics (NSDS) or a statistical masterplan, as well as multiannual programmes. Both have to be linked to national policies, international initiatives (such as the preparation of the 2010 Round of Population Censuses) and other users' demands for information, and should have the Government's support for funding such operations.

In the case of ICT statistics produced by developing countries, the following challenges related to statistical planning have been identified.

First, the process of drafting NSDS has started quite recently, mainly fostered by the initiative of the PARIS21 consortium¹. Most NSDS are linked to Poverty Reduction strategies and therefore include almost always the need for household surveys on living conditions as well as business surveys, but do not explicitly cover the topic of ICT access and use, which has not been identified as a statistical priority.

Second, some governments in developing countries cannot commit the funding of statistical operations on a multiannual basis and still depend on donor funding, which is less predictable and sustainable. Therefore, multiannual planning is not as frequent as desirable. Where mid-term statistical plans exist, they do not always include household or business ICT use surveys. Even where modules on ICT are embedded in other household or business surveys, their regularity is not always granted. It has to be noted that a specific feature of ICT-related information is the rapidity of changes in the adoption and use of technologies. As a consequence, carrying out ICT surveys with low periodicity is not satisfactory for policy demands. OECD and EU countries, however, as well as some other economies with strong weight of the ICT industry, carry out regularly ICT surveys on an annual basis (see section 3). It has to be recalled that carrying out ICT surveys as one-off exercises which external donor funding is not a sustainable solution for developing countries and therefore should be considered carefully.

¹ PARIS21 is a consortium of international organisations for the development of statistics. See www.paris21.org.

2.2. Technical challenges for the production of ICT indicators

This section describes a number of technical challenges faced by the statistical offices of developing countries when preparing the implementation of ICT surveys (or ICT modules embedded in household or business surveys). Some of them are general to any household or business survey, but need special consideration when measuring ICT access and use.

Conceptual difficulties related to ICT indicators

ICT statistics are new to many statistical offices. In order to collect harmonized indicators, the international community has defined ICT standards (see section 3) that can help countries implement ICT surveys or add modules on ICT issues in regular surveys.

Particular difficulties related to ICT definitions and concepts include:

- Acquiring some technological background on ICTs: the rapid pace of development in areas such as connectivity and access to networks, mobile devices and applications for e-business processes require statisticians to get familiar with the technologies and their definitions. The process of technological convergence makes it even more complex, since devices (such as mobile phones) increasingly allow access and use of new types of services.
- For respondents and interviewers, concepts such as type of ICT access and use, may be difficult to understand. This requires preparing training manuals and respondents' instructions specific to ICT-related questions, which cover a large variety of readers, from the most ICT-literate to the less familiar.
- Some economic issues related to ICTs, such as e-commerce value or impact of ICT on economic performance, are not readily obtainable from accounting systems of businesses, and therefore difficult to collect in questionnaires. Alternatives have been studied, such as devising easy-to-answer questions (for example, on placing or receiving purchase orders by Internet) or producing estimates from the analysis of micro-data (for productivity measurement).

Specific issues related to the measurement of ICT access and use by households and individuals

The internationally agreed core list of ICT indicators, developed by the Partnership on Measuring ICT for Development and endorsed by the UNSC, includes a number of indicators on access to ICT by households and use of ICT by individuals (see Annex). The basic source of primary data for the calculation of these indicators are household surveys; for some indicators, population and housing censuses can also provide the required information.

Household surveys are frequent in developed statistical systems, but due to financial and technical constraints, not always available with the desired periodicity in developing countries. One of the strategic points of the Marrakech Action Plan for Statistics² is indeed the improvement of the availability and use of household surveys, putting in place such tools as the Accelerated Data Programme and the International Household Survey Network (IHSN).

Statistical systems in developing countries face a number of technical constraints that make the production and analysis of data from household surveys scarce. These include: lack of reliable and updated household sample frames, lack of sample design skills, restricted coverage of surveys due to administrative, political or geographical conditions, difficulties in collecting information on ICT issues, insufficient technical skills for household data analysis, and poor dissemination of results. A more complete description of relevant issues for developing countries in relation with the implementation of

² The Marrakech Action Plan for Statistics is a statistical capacity building plan launched in 2004 and endorsed by international agencies for the strengthening of statistical systems as necessary tools for the measurement of development outcomes.

household surveys can be found in the UN 2005 [Household Sample Surveys in Developing and Transition Countries](#).

- *Lack of reliable and updated household sample frames.* Household samples should be drawn from updated and representative sample frames. Usually, household samples are designed on a multi-step approach, by randomly selecting geographical units (primary sampling units, PSUs) from the pre-defined strata, and in a further step, by randomly selecting households and individuals in the selected PSUs. Therefore, the preparation of a quality sample frame requires an updated listed of geographical units which usually comes from the last population census³ and a continuous maintenance system to cover new built areas or areas that have undergone important transformations (as a result, for instance, of natural disasters). Secondly, for each selected PSU a complete list of households should be established, which requires fieldwork to identify all households living in that area. Moreover, samples should be designed to interview the households over a 12-months period to avoid seasonality effects in data collection. All these maintenance tasks require trained staff working continuously, which requires financial resources to cover the running costs.
- *Restricted coverage of surveys.* Some countries, especially those with scarcely populated areas (such as rainforest or desert regions), or with poor road and communication infrastructure in some regions, may choose to restrict the coverage of household surveys to urban areas. ICT data are therefore biased, since usually urban households have easier access to technologies. On the other side, providing data on ICT access in scarcely populated areas may be of primary importance in understanding and measuring the digital divide between rural and urban areas.
- *Difficulties in collecting information on ICT issues from individuals and households.* All household surveys require training materials for the data collection and entry staff, but ICT concepts may present additional difficulties both for interviewers and respondents such as the correct identification of the type of access to the Internet or the purposes of Internet use. While the ITU *Manual for Measuring ICT Access and Use by Households and Individuals* provides model questions as well as explanations of concepts related to technologies, statistical offices implementing these surveys will still need to write training manuals and other reference material for interviewers – which in some cases are non-specialised persons that may only be part-time staff at the NSO - to enhance their skills for assisting the respondents without introducing any biases. Training manuals should of course also describe the objectives of surveys (or embedded ICT modules).
- *Insufficient technical skills for ICT household data analysis.* The analysis of household data is usually based on statistical techniques of complex sample estimation. While tabulation of aggregates is a rather basic task once the final sampling weights are calculated, more sophisticated analysis (such as sample error calculation, regression and other multivariate analysis) are not straightforward and require specialised software or highly technical skills which may not be available in poor-funded statistical offices. In the case of ICT indicators for the household sector, the statisticians should be able to estimate a set of proportions and ratios from complex samples, for which the formulas of sampling error can be somewhat complicated. Other statistical analysis relevant for ICT policy-making, such as modelling the probability of access to specific households through, say, logistic regression based on socio-economic covariates, may be even impracticable without specialised software and technical skills.
- *Poor data dissemination.* Household surveys which include an ICT module would provide a rich source of information for policy-making and socio-economic analysis, provided that sufficient dissemination of results is done, in the form of aggregate tables or microdata, as well as metadata required for interpretation of the data. As the IHSN objectives state, access to microdata is often insufficient due to technical, financial, legal, psychological and sometimes political obstacles. Statistical offices of developing countries may have difficulties in using Internet-based dissemination for their surveys, as well as insufficient knowledge of ICT policy-

³ As of July 2009, 71 countries have carried out the census corresponding to the 2010 Round and another 153 have scheduled, so that the existing frames may be already outdated of about 9-10 years

making data needs which should be addressed in the dissemination of results. ITU has proposed a list of aggregate tables for dissemination for international purposes, which should be complemented by other tables relevant for national users (probably more detailed).

Specific issues related to the measurement of ICT access and use by businesses

The measurement of access to and use of ICT by the business sector in developing countries suffers also from technical weak points that affect business surveys, such as the lack of quality business registers (necessary for selecting random samples), the important share of the informal economy, the use of industry classifications not adapted to international standards, the lack of trained staff for designing questionnaires and collecting information, low response rates, as well as insufficient data analysis and dissemination.

- *Lack of quality business registers.* Many developing and transition countries lack a reliable business register, which are often based on a combination of economic censuses, administrative registers as well as updated information from the business surveys themselves. One particular problem is the coverage of microenterprises, whose demography is generally very dynamic so that the creation and closing of micro-firms is not well captured by the registers. The exclusion of micro-businesses from ICT use surveys (or business surveys with an ICT module) in developing economies should be carefully considered when micro-businesses can account for a very high proportion of the total number of businesses (as high as 90 per cent or more) or a significant share of total employment (see below on informal economy).
- Another general issue regarding the quality of business registers is the high number of dormant firms present in registers, identified by investigating administrative files that record compulsory activities such as paying taxes, social security or pension contributions. The rate of inactive firms has been estimated as high as about 40% in Western Balkan countries. Samples selected from such registers will therefore be non-representative and surveys may require oversampling and replacement of units, thus increasing their costs. In Africa, few countries maintain business registers, and estimates are sometimes based on economic censuses, which are very costly and with low frequency.
- *Important share of informal economy.* Probably, the weakest point in economic statistics in developing countries is the large share of the informal economy. Several methodologies have been developed (for example, OECD) to measure the informal economy in developing and transition countries, but very few of them have produced estimates with periodicity. The use of ICTs by informal businesses, which seems to be common in many cases (such as the use of mobile phones by small farmers), is therefore not well covered by business surveys and alternative ways have to be used (for instance, a combination of household surveys, surveys of microenterprises and self-employed persons). This has also implications for the estimation of indicators on the use of ICT by employed persons in the business sector, since a significant part of the workforce may be operating under informal agreements.
- *Statistical classifications not adapted to international standards.* The adoption of international standard classifications such as those for economic activities (ISIC) or products (CPC) improves the harmonisation and international comparability of data, which is essential for the definition and evaluation of policies. Not all countries have national industry classifications fully compatible with ISIC Rev.3.1 and few have started the implementation of the new Rev. 4. The adaptation to a new classification system requires specialised personnel, with knowledge of classifications methodology and the possibility of follow-up to the work of the international working groups dealing with these issues. It also requires updating the information in business registers, questionnaires, stored information, etc. A particular problem in relation with ICT indicators is the definition of the ICT sector, which, according to international standards, is based on the 4-digit level of ISIC. Unless national classifications can establish correspondences at this detailed level, data on the ICT sector may be not comparable at the international level.

- *Low response rates from businesses.* As a result of the response burden and of inefficient data collection systems (for instance, due to poor mail services), businesses may provide low response rates even for official surveys. It is a general procedure that large firms are exhaustively surveyed in statistical operations, increasing their response burden. The alternative use of administrative data (such as those from balance sheets, tax forms, social security reports) is not well developed in many developing and transition countries, due to the lack of collaboration between institutions, the lack of a clear legal framework, or the lack of IT solutions to merge statistical and administrative information for the production of estimates.
- The *definition of statistical units* may also be problematic in some developing countries. As the Partnership report (Partnership on Measuring ICT for Development, 2005) identified, countries are using different statistical units in their business surveys, such as enterprises (the recommended unit by the UNCTAD Manual), establishments, legal units. In many cases, ICTs can be used only with some intensity in the central headquarter of a multi-located firm, a fact that would bias the answer if the establishment is chosen as statistical unit.
- As already mentioned, *some ICT-related concepts are particularly difficult* to measure quantitatively, such as the value of e-commerce, the e-business processes used by the firm or the ICT skills of employees in businesses. Pilot exercises, mainly in OECD countries, have tested model questions on these and other topics. Developing countries with less experience in ICT surveys may use the model questions proposed in the UNCTAD manual, or adapt the questionnaires used in more experienced countries.
- Other problems such as *insufficient analytical skills* and *poor dissemination* of aggregate data, microdata and metadata, already mentioned for household surveys, also apply for business surveys, with the additional concern of data confidentiality, which affects generally in a harder way the dissemination of business statistics, in particular, in economies where the number of firms in some economic activities can be small.

Collecting survey-based ICT statistics, as a response to policy needs and users' requests, may thus represent a challenge for national statistical systems in developing and transition countries due to institutional and technical difficulties. However, important progress has been witnessed in the last years in the production of such indicators, thanks to the efforts, at the national and international level, of both statistical and ICT policy-related stakeholders.

3. National and international efforts to enhance the production of ICT statistics

National efforts

Among OECD countries, the large majority of countries regularly carry out stand-alone ICT household and business surveys and there is a wealth of methodological information and resources available for data producers in those countries. Much of this is a result of the work of the OECD Working Party on Indicators on the Information Society (WPIIS), which has been meeting for over a decade to advance information society measurements by defining standards, developing model questionnaires and discussing methodologies (see next section).

In particular, member countries of the European Union have been the most active when it comes to the collection of ICT statistics. This has been greatly facilitated by a clearly defined political and legal framework for ICT measurement. The EU i2010 Strategy and benchmarking framework requires the preparation of annual progress reports on the European Information Society. In this context, a legal basis for information society statistics has been in place since 2004, requiring the implementation of annual surveys on ICT usage in households and by individuals, as well as enterprises. The statistical work has been driven and coordinated by Eurostat, mainly through its community surveys on ICT use by households/individuals and businesses. The surveys have been running since the early 2000s and use harmonized questionnaires provided to member states to use in their national surveys. As a result, EU countries now have the most comprehensive, regular and updated data collection on ICT statistics.

Prompted by the successful work of the OECD and Eurostat, other OECD countries have followed suit, such as Canada, the Republic of Korea, Australia or Norway, all of which carry out stand-alone ICT surveys on an annual basis. The United States, by contrast, does not conduct similar ICT surveys on a regular basis. As a result, relatively little nationwide information is available in the country on ICT use by households and individuals, as well as businesses. However, they do collect data on non-capitalized and capitalized business spending for ICT equipment and computer software through an annual ICT survey (ICTS) and have added ICT supplements to their monthly Current Population Survey (CPS).

In the *developing and transition countries*, there is much less knowledge, experiences and resources available to facilitate the production of ICT statistics. As the previous chapter has shown, major challenges include institutional difficulties, technical and resource constraints.

Some countries have identified ICT as a major development enabler, and have consequently linked their national strategies for statistical development to ICT policy needs. Others have included ICT statistics in the overall national development strategies. A good example for the latter is Albania (see Box 1)

Box 1: ICT statistics in the National Development Strategy of Albania

The Albanian National Strategy for Development and Integration 2007-2013 endorsed by the government in March 2008 sets out the national policies in the view of integration in the EU and NATO, as well as the achievement of the Millennium Development Goals. In particular, the Strategy identifies and inks the priorities and policies in the field of telecommunications infrastructure (covered by the Ministry of Public Works, Transport and Telecommunications) and telecommunication regulation and services (covered by the Regulatory Authority of Telecommunications). One of the issues included explicitly in the National Strategy is the adaptation of the EUROSTAT methodology for producing statistics on information and communication technologies.

Source: Paris 21 Knowledge Database (National Strategy for Development and Integration 2007-2013, <http://www.paris21.org/documents/3164.pdf>)

Currently, only few developing countries carry out stand-alone ICT surveys on an annual basis. Often, the demand for more comprehensive ICT data comes from the ICT policy making organizations. If NSOs do not have the resources or capacity to carry out a stand-alone ICT survey, other institutions may take the initiative to launch the data collection. This has been the case in some countries, such as Egypt, Thailand, or Brazil (see Box 2). In each of these countries, the production of ICT statistics has been driven by policy needs and was launched by ICT-related institutions rather than the NSO. Only at a later stage was the responsibility handed over to the statistical office, which usually has the instruments and know-how necessary to do the work in the medium- to long-run. These are therefore good examples of inter-institutional collaboration and represent a good initial approach towards an ICT data collection in the country, but it requires the readiness of various stakeholders to cooperate in the process through the establishment of sustainable cooperation mechanisms such as those mentioned earlier (participation of ICT policy making institutions in the statistical coordination committee, inclusion of ICT-related surveys in the national statistical programme, etc.).

Box 2: Inter-institutional collaboration for the implementation of ICT surveys in Thailand, Egypt and Brazil – Three examples of a policy-driven ICT data collection

Before NSOs decide to collect ICT statistics, often there has to be a clear demand for such data in the country from the policy side, in particular for implementing a stand-alone ICT household and/or business survey. The following provides three examples of countries in different regions (Asia, Africa, Latin America) where the ICT data collection was initiated by ICT policy makers and then handed over to the NSOs. This works well if all parties are willing to cooperate in the process.

The Government of **Thailand** has been focusing on the development of ICTs for more than a decade. Several national ICT masterplans have been developed and implemented, which included elements of monitoring and assessment. In 2002, Thailand chaired (together with Singapore) the ASEAN working group on e-measurement,

and the first data collections were launched by NECTEC⁴. Cooperation with the NSO was envisaged from the beginning, and the first stand-alone ICT surveys were carried out by the NSO in 2004. Since then, ICT indicators are produced based on annual household and business ICT surveys. The support for ICT statistics is greatly facilitated by the fact that the NSO is under the responsibility of the Thai Ministry of ICT.

Egypt is another example of a country where the development of the ICT sector has been identified as a priority in the country's national development strategy. In 2006, the Ministry of Communication and Information Technology (MCIT) launched the national ICT indicators project, in cooperation with the Central Agency for Public Mobilization and Statistics (CAPMAS). The aim of the project is to build information society indicators in Egypt, through providing relevant and accurate data about ICT infrastructure and usage within households, businesses, government and public sector enterprises, in addition to public Internet access points and educational institutions.

The two agencies work closely together in the design and implementation of ICT household and business surveys, and follow the international guidelines and indicators developed by the Partnership (see next section). While the data collection is done by CAPMAS, data analysis and dissemination is handled by the MCIT team. A joint high-level committee from MCIT and CAPMAS meets monthly to follow up the progress of the project, which has been formalized through an agreement signed between the two parties.

In **Brazil**, the collection of ICT statistics was initiated by the Brazilian Internet Steering Committee (CGI), which is a private institution that regulates Internet names and IP addresses in the country. CGI has conducted annual stand-alone national ICT household and business surveys since 2005. The surveys include a large number of questions on ICT access, usage, barriers (among others) and go far beyond the core list of indicators developed by the Partnership, following model questionnaires developed by OECD and Eurostat. CGI works closely with the Brazilian Institute of Geography and Statistics (IBGE), which in 2005 has conducted the first household survey that included some of the internationally agreed core ICT use questions; it is planning to repeat the survey in 2009.

Sources: NECTEC (2003a and 2003b) and ITU (2009),

While few developing countries carry out stand-alone ICT surveys, an increasing number of NSOs are including ICT indicators in their existing data collections. According to the ITU, which collects ICT household data at the global level, in 2000, only a handful of developing countries collected data on for example, Internet access in households (via existing household surveys). The number had increased to around 30% of developing countries⁵ in 2005, and to around 42 in 2008.

There are several approaches taken to the data collection in developing countries. With respect to ICT household indicators, in most cases, ICT-related questions are included in existing surveys, such as multipurpose household surveys, living conditions surveys, labour force surveys, and - in some cases - population censuses. The latter has been reinforced by the United Nations Principles and Recommendations on Population and Housing Censuses Revision 2 (UNSD, 2008), which recommends the collection of statistics on household access to ICT as a 'core topic'.

In terms of ICT business indicators, relevant questions have been included in industry surveys, for example manufacturing or services sectors surveys, or in some cases – mainly in Latin America - innovation surveys. The inclusion of ICT modules in other surveys allows reducing costs and linking ICT-related variables to general business variables at the micro-data level for analytical purposes (for example, the measurement of productivity gains due to ICT use in firms).

International initiatives – Five years of cooperation under the Partnership on Measuring ICT for Development

Several of the challenges outlined in section 2 cannot be addressed only at the national level, in particular if the produced data are to be globally comparable. Countries need to agree on common standards and methodologies at the international level.

During the past five years, much progress has been made at the international level to advance information society measurements. The Partnership on Measuring ICT for Development, with ten

⁴ NECTEC (National Electronics and Computer Technology Center) was also involved in the early stages of developing a national ICT master plan for Thailand. See NECTEC (2003a and 2003b).

⁵ Excluding the least developed countries, where the figure is much lower.

international organizations as members, has taken the lead in terms of raising awareness, developing standards and assisting countries in their ICT statistics production.⁶

The idea of creating a global Partnership on information society measurements originated in close relation to the work achieved by the OECD WPIIS⁷ and Eurostat, which has resulted in a rich source of comparable data in their member countries. On the other hand, hardly any survey-based data was available at that time in the developing countries. Even worse, some countries that started to produce data used their own definitions and standards, not conform with those promoted by OECD and therefore not allowing benchmarking with developed economies.

Therefore, it was opportune to start work on developing standards and methodologies on ICT statistics for *all* countries, both in the developing and developed world and taking as a basis the experience and work accomplished in OECD countries. Driven by the three lead agencies (UNCTAD⁸, ITU⁹ and OECD), the Partnership on Measuring ICT for Development was formally launched at the occasion of UNCTAD XI in Brazil in June 2004.

During the first five years of existence, the Partnership has made some remarkable achievements. The topic of ICT measurement is now well known in the large majority of countries; statistical indicators, standards and methods have been developed and are available for countries to produce internationally comparable data; the international community has recognized the work of the Partnership in many instances (e.g. outcome documents produced by the WSIS, the UN Statistical Commission, and the UN Economic and Social Council); and, most importantly, an increasing number of countries are producing indicators to measure their ICT developments, based on the core list proposed by the Partnership. The following reviews in further detail the core activities and achievements of the Partnership.

Standards and methods on ICT statistics

One of the most important achievements made by the Partnership to date concerns the development of a core list of ICT indicators and the related definitions, classifications, model questions and other relevant methods.

The first version of the core list of ICT indicators was developed by the Partnership during 2004-2005, through an extensive consultation process with statistical offices, ICT policy makers and national and international experts. During this time, the Partnership consolidated a global core list and circulated it to national statistical offices in all countries for further comment. A final list was discussed, and agreed

⁶ Members of the Partnership are Eurostat, the International Telecommunication Union (ITU), the Organisation for Economic Co-operation and Development (OECD), the United Nations Conference on Trade and Development UNCTAD, the United Nations Department of Economic and Social Affairs (UNDESA), the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS), the World Bank and four United Nations Regional Commissions (the UN Economic Commission for Africa, the UN Economic Commission for Latin America and the Caribbean, the UN Economic and Social Commission for Asia and the Pacific, and the UN Economic and Social Commission for Western Asia). For a detailed list of Partnership activities, see <http://measuring-ict.unctad.org>

⁷ The OECD started developing statistical standards for information society measurement about 10 years ago, through its Working Party on Indicators for the Information Society (WPIIS). The WPIIS provides a forum for national statistical experts to share experiences and collaborate on the development of information society statistical standards. Its main achievements to date are: (i) industry-based definitions of the ICT sector and content and media sector (the most recent versions are based on ISIC Rev. 4); (ii) an ICT goods and an ICT services classification (based on the Harmonized System and CPC Ver. 2 respectively); (iii) narrow and broad definitions of electronic commerce transactions; and (iv) model surveys of ICT use by businesses and households/individuals.

⁸ As a development agency, UNCTAD started to promote the work on ICT statistics among developing countries in 2003. The UNCTAD Expert Meeting on Measuring E-commerce, which was held in Geneva in September 2003, was the first international meeting bringing together key stakeholders from developed and developing countries to discuss ICT measurements.

⁹ The International Telecommunication Union has been actively developing standards for measuring ICT infrastructure and access indicators for a number of years. ITU's reference for this work is Definitions of World Telecommunication/ICT Indicators, which includes definitions for all their telecommunication/ICT indicators (ITU, 2007a).

on, at the WSIS Thematic Meeting on Measuring the Information Society, held in Geneva in February 2005. The list covered indicators on ICT infrastructure and access, access to and use of ICT by households and individuals, ICT use by businesses, the ICT sector, and trade in ICT goods.

The list was endorsed in 2007 by the United Nations Statistical Commission (UNSC) at its 38th session. The UNSC encouraged countries to use the core list in their data collection programmes. It further recognized that ICT is a rapidly evolving area, and encouraged the Partnership to continue work to improve and update the list of indicators (UNSC, 2007).

From the beginning, the core list was considered as a reference point that would be subject to periodic review. As countries gain experience with the collection of ICT statistics and as technologies and policy needs evolve, indicators may be modified, removed or added. In 2008, the core list was revised, following feedback received from users in statistical meetings, seminars and training workshops; revisions made in the ITU Telecommunication Indicators Handbook and the Eurostat ICT model questionnaires; and changes to other international standards (particularly those of UNSD and the ILO). In addition, the core list was expanded to include eight new indicators on measuring ICT in education (Partnership, 2009). These indicators were developed by the UNESCO Institute for Statistics (UIS) over several years and were subject to extensive testing and consultation processes. The revised and extended core list (see Annex) was presented again to the UNSC at its 40th session in 2009 and noted by member countries (UNSC, 2009).

The updated core list comprises 48 ICT indicators covering five areas as follows:

- ICT infrastructure and access (10 indicators)
- Access to, and use of, ICT by households and individuals (13 indicators)
- Use of ICT by businesses (12 indicators)
- The ICT sector and trade in ICT goods (4 indicators)
- ICT in education (9 indicators)

The main purpose of the core list is to help countries produce high quality and internationally comparable ICT data. In order to achieve this objective, the indicators have associated standards and metadata including (Partnership, 2009):

- Definitions of terms (e.g. computer, the Internet)
- Model questions
- Calculation of indicators (e.g. use of appropriate denominators for calculating proportions)
- Classificatory variables (e.g. business size for business ICT use indicators; gender for individual ICT use indicators)
- Advice on particular statistical issues (such as the measurement of e-commerce)
- Collection scope (e.g. by business size or industry; or age of individuals)

The Partnership core list of ICT indicators reflects a minimum realistic list of policy-relevant and cross-nationally comparable indicators that a majority of countries could easily produce without confronting a significant data collection burden.

Capacity building

Given that ICT statistics emerged as a new topic in many developing countries, when the Partnership was created little was known about the types of indicators to collect, how to define them to assure international comparability, how to design national ICT surveys, and what the best ways for ICT data dissemination are. Therefore, a key objective of the Partnership is to assist statistical agencies of developing countries to produce and disseminate ICT data. As part of their work on ICT measurement, various Partnership members have also developed specific technical assistance programmes and capacity building tools to assist countries in need.

The Partnership's Task Group on Capacity Building, led by UNCTAD, has conducted a stocktaking exercise on the capacity building requirements of developing countries (in 2005-06) and maintains a register of ICT statistics experts who are able to provide assistance to developing countries.

The Partnership work on capacity building is largely based on the agreed core list of ICT indicators and their associated statistical standards and definitions. The type of assistance offered varies and includes, responding to specific technical questions from data producers in developing countries; country advisory missions; national and regional workshops; as well as technical group training courses on ICT statistics. As a basis, several methodological documents have been prepared that serve as practical guidelines for practitioners in countries.

During the five-year period, a large number of regional capacity building workshops have been held, usually hosted or (co-) organized by one of the UN Regional Commissions. Apart from raising awareness (see also next section), the workshops discussed the core list of indicators, presented best practice examples and identified capacity building needs in regions and countries.

Recently, the focus has shifted towards more targeted, technical, hands-on training on ICT statistics. Since the work on methodologies, indicators and standards had advanced significantly at the global level, it was possible to produce and deliver such trainings. First, two technical Manuals were produced, by UNCTAD (2007 and 2009) on the “Production of Statistics on the Information Economy” (mainly focusing on ICT business surveys) and by ITU (2009) on “Measuring ICT Access and Use by Households and Individuals” (mainly focusing on ICT households surveys) (2009). Based on the Manuals, training courses were developed and have thus far been delivered in several regions (see Table 1)

So far, the experience in delivering these tools has been very positive. The Manuals and training courses have been appreciated greatly by developing countries and will continue to play an important role in the building of capacities on ICT statistics.

Table 1. Training courses on ICT statistics, 2008-2009

Date and location	Type of training	Main audience	Co-organizers
Bogota, Colombia December 2007	UNCTAD training course	NSOs from selected Latin American countries (mainly from Andean community)	UNCTAD, CANDANE, ECLAC
Incheon, Republic of Korea February 2009	UNCTAD training course	NSOs from Asian countries	UNCTAD, APCICT, UNSIAP
Port-of-Spain, Trinidad and Tobago January 2009	ITU training course UNCTAD training course	NSOs from Caribbean countries	ITU, ECLAC, UNCTAD
Addis Ababa July 2009	ITU training course UNCTAD training course	NSOs from Anglophone African countries	ITU, UNCTAD, ECA
Bangkok, Thailand October 2009	ITU training course	NSOs from Asia and the Pacific countries	ITU, LIRNEasia, MCIT Thailand

Awareness raising

Last but not least, perhaps one of the most important achievements of the Partnership has been to raise the awareness globally, and particularly among ICT policy makers, about the importance of producing measurable indicators and benchmarks to track progress in the development of the global information society and, in particular, to monitor the digital divide between the ICT have and have-nots. As noted above, this is critical given that the production of ICT statistics often originates from a demand by ICT policy makers.

Five years after the conclusion of the WSIS Tunis, and with an increasing number of calls for an assessment of the achievements made thus far in the development of the information society, it is widely recognized at the national and international levels that without comparable data it will be difficult to measure and track progress towards the agreed goals. Thanks to the work of the Partnership, the link between ICT policy and ICT measurement has been established and is part of the international agreements and recommendations that resulted from the two World Summits on the Information Society.

At the very beginning, the work of the Partnership was closely linked to the WSIS process. Written inputs on the subject of information society measurements were submitted throughout the second phase of the WSIS preparations; parallel events were held during the two summits; and at a WSIS Thematic Meeting in February 2005, the core list of ICT indicators was finalized. As a result, the WSIS outcome documents make clear reference to the topic of ICT measurement (Geneva Plan of Action), and specifically to the work of the Partnership (Tunis Agenda) (ITU, 2005). The Partnership is expected to play a critical role in the WSIS follow-up process and in monitoring and measuring the WSIS implementation and goals.

Another key forum to present, and inform about, ICT statistics, is the UN Statistical Commission (UNSC), which annually brings together the chief statisticians of all countries to discuss latest developments on statistics at the global level with the objective of harmonizing statistical standards and methodologies. The Partnership has brought to the attention of the UNSC various documents on ICT statistics (Partnership, 2007 and 2009). In 2007, the UNSC endorsed the Partnership core list of ICT indicators, encouraged countries to use them, and called upon the Partnership to provide capacity building on ICT statistics. The Partnership regularly reports on progress made in the area of ICT statistics to the UNSC (see UNSC, 2007, 2009).

Apart from the global ICT and statistics forums and bodies, the work of the Partnership has also been recognized by the UN Economic and Social Council (ECOSOC). In resolution 2008/3, ECOSOC recommends that the Partnership consider the creation of benchmarks and indicators to be presented to the UNSC, in order to track progress towards the attainment of the specific goals and targets set out in the outcome documents of the WSIS (ECOSOC, 2008).

The efforts done by the Partnership to enhance the awareness about ICT measurement is reflected in a large number of global, regional and national events being organized by different members of the Partnership.¹⁰ These events bring together policy makers and statisticians to discuss ways and means to improve information society measurements. This is critical, since as we have seen, the production of ICT statistics is often triggered by an ICT policy framework or plan requiring measurable benchmarks and indicators.

¹⁰ For a detailed list of Partnership activities and events, see <http://measuring-ict.unctad.org>.

4. Conclusions and recommendations

Taking into account the experiences of countries that have produced ICT indicators for a number of years, and the work accomplished by the Partnership, the following recommendations are provided to stakeholders at both national and international levels, in order to increase the availability of survey-based ICT statistics.

At the national level:

- Medium-term national statistical plans should take into account the needs of ICT policy makers and other relevant users (such as ICT service providers) to ensure the production of ICT indicators within the national statistical system
- ICT policy makers should include monitoring and measurement in their national ICT master plans and strategies
- NSOs in developing countries should include questions on ICT access and use in existing household and business surveys as a first approach to produce ICT indicators, if resources are not available for stand-alone ICT surveys
- ICT policy makers and statisticians should cooperate closely in the preparation and design of ICT-related surveys, taking into account the need for using adequate statistical infrastructure (business registers, household sample frames, classifications) and statistical skills (in the preparation of questionnaires, sample design, estimation procedures, data validation and analysis, dissemination)
- NSOs should train their staff on ICT indicators and methods with a view of using international standards.

At the international level:

- The international ICT community should include ICT measurement in the policy debates; ICT measurement should continue to receive major attention in the post-WSIS process in view of the 2015 target date
- UNSC members should give the appropriate attention to ICT statistics, in view of the emerging information society and the role of ICTs as key development enablers
- The international donor community should consider funding the production of measurable indicators on information society progress in developing countries, in coordination with national statistical strategies
- OECD members and other countries experienced in ICT measurement should share their expertise and provide assistance to countries/NSOs in need of training and capacity building on ICT statistics
- The Partnership on Measuring ICT for Development and its members should continue the work on coordinating and promoting ICT measurement at the global and regional levels through awareness creation, capacity building, and developing standards and methods.

Annex. Partnership on Measuring ICT for Development, Core List of ICT indicators (households/individuals, businesses, ICT sector and trade in ICT goods), 2008

Core indicators on ICT infrastructure and access	
A1	Fixed telephone lines per 100 inhabitants
A2	Mobile cellular telephone subscribers per 100 inhabitants
A3	Fixed Internet subscribers per 100 inhabitants
A4	Fixed broadband Internet subscribers per 100 inhabitants
A5	Mobile broadband subscribers per 100 inhabitants
A6	International Internet bandwidth per inhabitant (bits/second/inhabitant)
A7	Percentage of population covered by a mobile cellular telephone network
A8	Fixed broadband Internet access tariffs (per month), in US\$, and as a percentage of monthly <i>per capita</i> income
A9	Mobile cellular prepaid tariffs, in US\$, and as a percentage of monthly <i>per capita</i> income
A10	Percentage of localities with public Internet access centres (PIACs) by number of

Core indicators on access to, and use of, ICT by households and individuals	
HH1	Proportion of households with a radio
HH2	Proportion of households with a TV
HH3	Proportion of households with telephone
	Proportion of households with fixed telephone only
	Proportion of households with mobile cellular telephone only
	Proportion of households with both fixed and mobile cellular telephone
HH4	Proportion of households with a computer
HH5	Proportion of individuals who used a computer (from any location) in the last 12 months
HH6	Proportion of households with Internet access at home
HH7	Proportion of individuals who used the Internet (from any location) in the last 12 months
HH8	Location of individual use of the Internet in the last 12 months:
	Home
	Work
	Place of education
	Another person's home
	Community Internet access facility
	Commercial Internet access facility
	Any place via a mobile cellular telephone
Any place via <i>other</i> mobile access devices	
HH9	Internet activities undertaken by individuals in the last 12 months (from any location):
	Getting information about goods or services
	Getting information related to health or health services
	Getting information from general government organizations
	Interacting with general government organizations
	Sending or receiving e-mail
	Telephoning over the Internet/VoIP
	Posting information or instant messaging
	Purchasing or ordering goods or services
	Internet banking
Education or learning activities	

	Playing or downloading video games or computer games
	Downloading movies, images, music, watching TV or video, or listening to radio or music
	Downloading software
	Reading or downloading on-line newspapers or magazines, electronic books
HH10	Proportion of individuals with use of a mobile cellular telephone
HH11	Proportion of households with access to the Internet by type of access (narrowband, broadband (fixed, mobile)):
	Narrowband
	Fixed broadband
	Mobile broadband
HH12	Frequency of individual use of the Internet in the last 12 months (from any location):
	At least once a day
	At least once a week but not every day
	Less than once a week
HHR1	Proportion of households with electricity

Core indicators on use of ICT by businesses	
B1	Proportion of businesses using computers
B2	Proportion of persons employed routinely using computers
B3	Proportion of businesses using the Internet
B4	Proportion of persons employed routinely using the Internet
B5	Proportion of businesses with a web presence
B6	Proportion of businesses with an intranet
B7	Proportion of businesses receiving orders over the Internet
B8	Proportion of businesses placing orders over the Internet
B9	Proportion of businesses using the Internet by type of access (narrowband, broadband)
	Narrowband
	Fixed broadband
	Mobile broadband
B10	Proportion of businesses with a local area network (LAN)
B11	Proportion of businesses with an extranet
B12	Proportion of businesses using the Internet by type of activity:
	Sending or receiving e-mail
	Telephoning over the Internet/VoIP
	Posting information or instant messaging
	Getting information about goods or services
	Getting information from general government organizations
	Interacting with general government organizations
	Internet banking
	Accessing other financial services
	Providing customer services
	Delivering products on line
	Internal or external recruitment
	Staff training

Core indicators on the ICT (producing) sector	
ICT1	Proportion of total business sector workforce involved in the ICT sector (expressed as a percentage)
ICT2	ICT sector share of gross value added (expressed as a percentage of total business sector gross value added).

Core indicators on trade in ICT goods	
ICT3	ICT goods imports as a percentage of total imports
ICT4	ICT goods exports as a percentage of total exports

Core indicators on ICT in education	
ED1	Proportion of schools with a radio used for educational purposes (by ISCED level 1 to 3)
ED2	Proportion of schools with a TV used for educational purposes (by ISCED level 1 to 3)
ED3	Proportion of schools with a telephone communication facility (by ISCED level 1 to 3)
ED4	Student-to-computer ratio (by ISCED level 1 to 3)
ED5	Proportion of schools with Internet access, by type (by ISCED level 1 to 3):
	Fixed narrowband
	Fixed broadband
	Both fixed narrowband and broadband
ED6	Proportion of students who have access to the Internet at school (by ISCED level 1 to 3)
ED7	Proportion of students enrolled by gender at the tertiary level in ICT-related fields (for ISCED levels 5 and 6)
ED8	Proportion of ICT-qualified teachers in primary and secondary schools
EDR1	Proportion of schools with electricity (by ISCED level 1 to 3) ¹¹

¹¹ Since electricity is not specifically an ICT commodity, but an important prerequisite for using many ICTs, it is not included in the core list, but included as a reference indicator. International studies reviewed by UIS reveal that the lack of electricity is such a significant barrier in many developing economies that monitoring trends of its provision is as relevant as monitoring the supply and use of ICT.

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