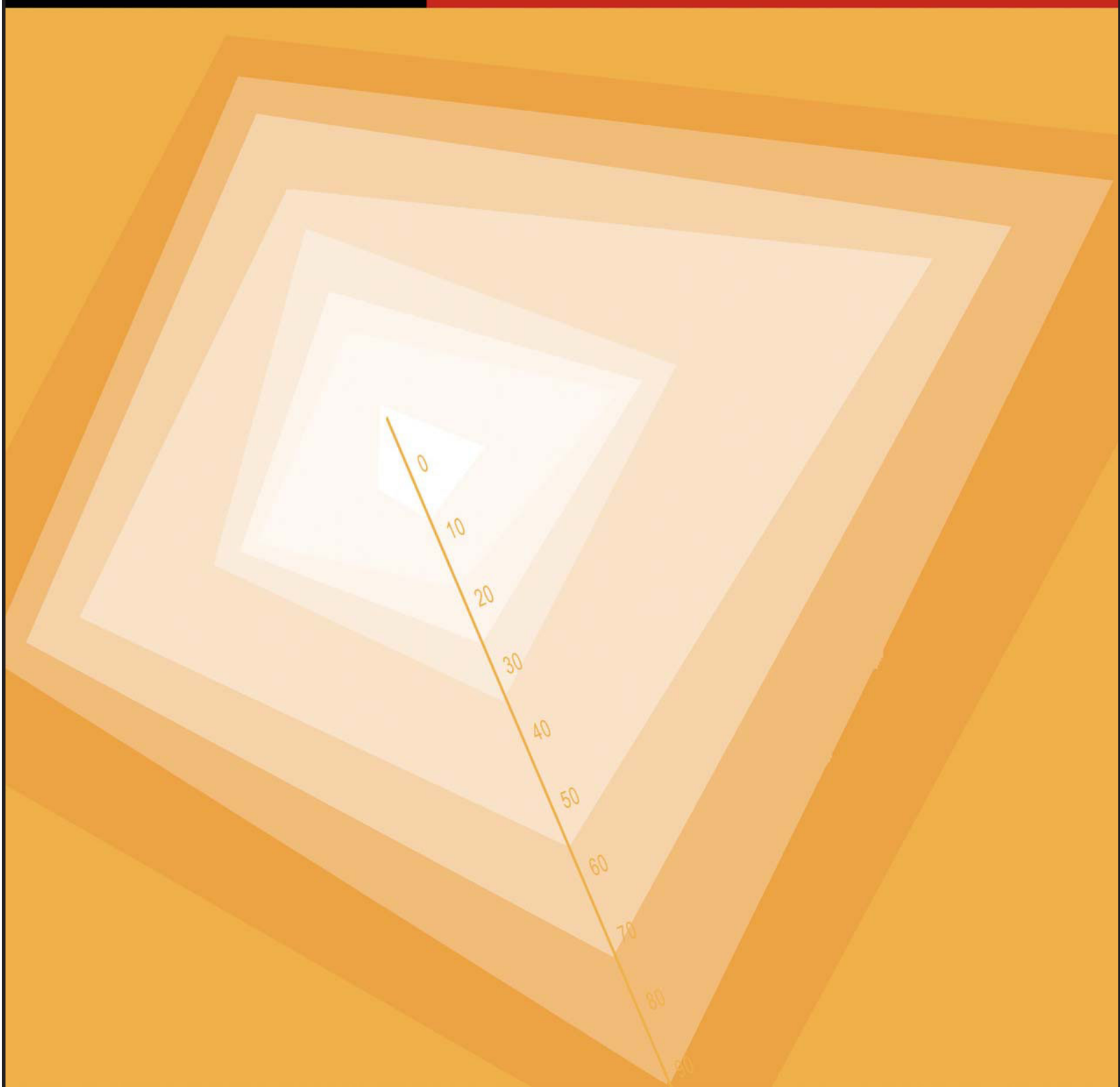




UNITED
NATIONS

PARTNERSHIP ON
MEASURING ICT
FOR DEVELOPMENT

CORE ICT INDICATORS



CORE ICT INDICATORS

Partnership on Measuring ICT for Development



Foreword

Comparable statistics on access to, and use of, information and communication technologies (ICTs), are critical to formulating policies and strategies concerning ICT-enabled growth, for social inclusion and cohesion, and for monitoring and evaluating the impact of ICTs on economic and social developments. However, internationally comparable information society statistics are very limited, in particular in the developing world.

To close the ICT data gap, a key objective of the global *Partnership on Measuring ICT for Development* is to set standards and harmonize ICT statistics at the global level. To this end, it has worked to develop a core list of ICT indicators that could be collected by all countries and serve as a basis for internationally comparable statistics on the information society.

The core list of ICT indicators presented in this document was the outcome of an intensive consultation process of the Partnership with national statistics offices (NSOs). This included a stocktaking exercise through which metadata on the status of official information society statistics were obtained from NSOs worldwide, as well as a series of regional events that

discussed core ICT indicators. From these processes, a proposal for a core list of ICT indicators was presented by the Partnership, and adopted by participants, at the WSIS Thematic Meeting on Measuring the Information Society (Geneva, February 2005).

This report provides definitions, model questions and methodological notes relevant to the core indicators agreed at the February 2005 meeting. By making this information available to a wide audience, in particular in developing countries, it is hoped to be of use to countries developing their statistical data collection programmes on the information society.

The report was drafted by Sheridan Roberts of OECD, based on substantive contributions from ITU, UNCTAD, UNESCO Institute for Statistics, UNECLAC*, UNESCWA and Eurostat, and draws on discussions held in the framework of the OECD Working Party on Indicators for the Information Society and the ITU World Telecommunication Indicators meeting. The report was edited by OECD and Eurostat, and the layout was contributed by the World Bank and UNESCWA. The report was printed by UNESCWA.

* UNECLAC's Information Society programme thanks for the financial support received from the @LIS programme of the European Commission and the International Development Research Center (IDRC-ICA). The views expressed herein cannot be taken to reflect the official opinions of these entities.

Table of Contents

INTRODUCTION AND CORE LIST OF ICT INDICATORS	1
CORE INDICATORS ON ICT INFRASTRUCTURE AND ACCESS	6
CORE INDICATORS ON ACCESS TO, AND USE OF, ICT BY HOUSEHOLDS AND INDIVIDUALS	14
CORE INDICATORS ON USE OF ICT BY BUSINESSES	28
CORE INDICATORS ON THE ICT SECTOR AND TRADE IN ICT GOODS	39
REFERENCE MATERIAL	43
FOOTNOTES	45

Introduction and Core List of ICT Indicators

Introduction

The core list of ICT¹ indicators presented in this document was the outcome of an intensive consultation process by the *Partnership on Measuring ICT for Development*² with national statistics offices (NSOs). This included a stocktaking exercise through which metadata on the status of official information society statistics were obtained from NSOs worldwide, as well as a series of regional events on core ICT indicators. From these processes, a proposal for a core list of ICT indicators was presented by the *Partnership*, and adopted by participants, at the WSIS Thematic Meeting on Measuring the Information Society (Geneva, February 2005).

This document is intended to provide more information on the core list of ICT indicators agreed at the February 2005 meeting. It provides definitions, model questions and methodological notes relevant to the indicators. While much of this material has been debated in developed country forums, for example, the OECD's Working Party on Indicators for the Information Society (WPIIS), the aim of this document is to make this information available to a wider audience, in particular, developing countries. Readers should note that this document is *not* intended to be a

manual for collecting ICT statistics. The reference material at the end of the document provides information on existing guides and manuals which will be useful for that purpose. It is also envisaged that additional material will be prepared as future outputs by the members of the *Partnership*.

The core list contains four sets of indicators: (i) ICT infrastructure and access (ii) access to, and use of, ICT by households and individuals (iii) use of ICT by businesses and (iv) ICT sector and trade in ICT goods. The principal objective of the list is to help countries which are developing ICT surveys, or adding ICT questions to existing collections, to produce internationally comparable data. The list is not mandatory in any sense - countries will always have to respond to national policy needs, which may be only partially covered by the core list.

It is recognised that not all countries are at the same level of development or have well developed statistical systems. In respect of the indicators for which countries would need to collect data (generally those on ICT access and use, and the ICT sector), countries with little or no ICT infrastructure may not see the need to collect those ICT statistics at this stage. Countries

with growing use of ICT may want to monitor this growth by starting to measure ICT use while others, with higher levels of ICT use and perhaps a growing ICT sector, may want to go further. To give further guidance, a distinction has been made between ‘basic core’ and ‘extended core’ indicators. The latter are generally of lower priority and/or somewhat untested. They are therefore more suitable for countries with relatively advanced ICT statistical systems.

An ICT infrastructure - and access to it - are essential prerequisites for benefiting from ICTs. Statistical indicators showing the extent of that infrastructure and access are therefore an obvious starting point for a core list. These indicators are generally already available in the ITU World Telecommunication Indicators database. However, collecting the data is proving more difficult in a world characterised by multiple operators in liberalised markets. Thus there is a need to define a core list upon which regulators and other data providers can focus.

The main actors in a society are people, businesses and governments, therefore the core list should ideally contain indicators on the access to, and use of, ICTs by these actors. In the case of households/individuals and businesses, international standards exist, although indicators are not universally collected. The collection of data for these indicators would therefore require additional efforts by a substantial number of countries. In respect of governments, there are currently no international standards and little comparable collection work. At this stage, alternatives are being considered for so-called ‘e-government’ indicators.

The core list also contains indicators relating to the ICT sector and trade in ICT goods. In-

ternational standards exist for such indicators in the form of definitions and classifications.

As indicated above, most of the indicators in the proposed core list benefit from being based on internationally agreed standards (especially those developed by the ITU, OECD and Eurostat). It is one of the objectives of the *Partnership* to consolidate standards at the global level, taking into consideration the demands and special circumstances of developing countries.

The current set of ICT indicators is not intended to constitute a final list. Rather, the process will be continuous, and the list will undergo periodic review. As countries gain experience with the collection of data for the indicators, and as policy needs evolve, indicators may be modified, removed or added.

The *Partnership* also has a continuing role in developing and proposing new core indicators. At the WSIS Thematic Meeting on Measuring the Information Society (Geneva, February 2005), participants called upon the *Partnership* to work on the development of new policy-relevant indicators in areas such as e-government, education and health and to pursue those topics at WSIS Tunis. Additionally, countries and regional organisations might develop additional indicators that are relevant and specific to them, for example on Web content language, or access to ICT by ethnic and other social groups.

The *Partnership* has two other main objectives which are closely related to the development of a core list of indicators. The first objective is to help build capacity in developing countries, by activities such as methodological support, training and regional working

groups. A core list of indicators, and associated statistical metadata, is instrumental in assisting these capacity building activities.

The second objective is to develop a global database on information society indicators. Actual data collection is an obvious consequence of developing and adopting a core list of indicators. The *Partnership* aims to bring these statistics together in a database that can be accessed easily via the Web.

ily via the Web.

The list of core indicators is presented below. The subsequent four sections discuss each set of indicators in detail, providing definitions, explanatory notes and model questions (where relevant), as well as methodological notes concerning the collection of these indicators. The paper ends by providing information on further statistical resources for measuring the information society.

Core list of ICT indicators³

Core indicators on ICT infrastructure and access

Basic core

A1	Fixed telephone lines per 100 inhabitants
A2	Mobile cellular subscribers per 100 inhabitants
A3	Computers per 100 inhabitants
A4	Internet subscribers per 100 inhabitants
A5	Broadband Internet subscribers per 100 inhabitants
A6	International Internet bandwidth per inhabitant
A7	Percentage of population covered by mobile cellular telephony
A8	Internet access tariffs (20 hours per month), in US\$, and as a percentage of <i>per capita</i> income
A9	Mobile cellular tariffs (100 minutes of use per month), in US\$, and as a percentage of <i>per capita</i> income
A10	Percentage of localities with public Internet access centres (PIACs) by number of inhabitants (rural/urban)

Extended core

A11	Radio sets per 100 inhabitants
A12	Television sets per 100 inhabitants

Core indicators on access to, and use of, ICT by households and individuals

Basic core

HH1	Proportion of households with a radio
HH2	Proportion of households with a TV
HH3	Proportion of households with a fixed line telephone
HH4	Proportion of households with a mobile cellular telephone
HH5	Proportion of households with a computer
HH6	Proportion of individuals who used a computer (from any location) in the last 12 months
HH7	Proportion of households with Internet access at home
HH8	Proportion of individuals who used the Internet (from any location) in the last 12 months
HH9	Location of individual use of the Internet in the last 12 months: (a) at home; (b) at work; (c) place of education; (d) at another person's home; (e) community Internet access facility (specific denomination depends on national practices) ⁴ ; (f) commercial Internet access facility (specific denomination depends on national practices) ⁵ ; and (g) others
HH10	Internet activities undertaken by individuals in the last 12 months- <ul style="list-style-type: none"> • Getting information: (a) about goods or services; (b) related to health or health services; (c) from government organisations/public authorities via websites or email; and (d) other information or general Web browsing • Communicating • Purchasing or ordering goods or services • Internet banking⁶ • Education or learning activities • Dealing with government organisations/public authorities • Leisure activities: (a) playing/downloading video or computer games; (b) downloading movies, music or software; (c) reading/downloading electronic books, newspapers or magazines; and (d) other leisure activities

Extended core

HH11	Proportion of individuals with use of a mobile telephone
HH12	Proportion of households with access to the Internet by type of access: Categories should allow an aggregation to narrowband and broadband, where broadband excludes slower speed technologies, such as dial-up modem, ISDN and most 2G mobile phone access. Broadband will usually have an advertised download speed of at least 256 kbit/s.
HH13	Frequency of individual access to the Internet in the last 12 months (from any location): (a) at least once a day; (b) at least once a week but not every day; (c) at least once a month but not every week; and (d) less than once a month.

Reference indicator

HHR1 ⁷	Proportion of households with electricity
-------------------	---

Core indicators on use of ICT by businesses⁸

Basic core

B1	Proportion of businesses using computers
B2	Proportion of employees using computers
B3	Proportion of businesses using the Internet
B4	Proportion of employees 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

Extended core

B9	Proportion of businesses using the Internet by type of access: Categories should allow an aggregation to narrowband and broadband, where broadband excludes slower speed technologies, such as dial-up modem, ISDN and most 2G mobile phone access. Broadband will usually have an advertised download speed of at least 256 kbit/s.
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 <ul style="list-style-type: none"> • Sending and receiving email • Getting information: (a) about goods or services; (b) from government organisations/public authorities via websites or email; and (c) other information searches or research activities • Performing Internet banking or accessing other financial services • Dealing with government organisations/public authorities • Providing customer services • Delivering products online

Core indicators on the ICT sector and trade in ICT goods

Basic core

ICT1	Proportion of total business sector workforce involved in the ICT sector
ICT2	Value added in the ICT sector (as a percentage of total business sector value added)
ICT3	ICT goods imports as a percentage of total imports
ICT4	ICT goods exports as a percentage of total exports

Core Indicators on ICT Infrastructure and Access⁹

Ensuring universal service and access to information and communication technology is a top national objective in many countries, often enshrined in laws that govern the sector.¹⁰ The proposed ICT infrastructure and access indicators correspond to **individual** use and measure accessibility in terms of **people**. Most of the indicators are *per capita* measures which is the traditional method of illustrating individual access to ICTs. One reason for this is that virtually all ICT service providers compile administrative records for operational and billing purposes. It is then a simple mathematical exercise to divide the installed base of a particular ICT device or service by the population to derive a *per capita* indicator.

Other indicators, for instance *Percentage of population covered by mobile cellular telephony*, are useful for tracking **universal access**, or the percentage of the population that could theoretically use an ICT device or service.

Definitions of basic core indicators

Fixed telephone lines per 100 inhabitants

A *fixed line* has traditionally referred to the

connection - typically a copper wire - from a subscriber to the telephone company's switching exchange. Technological change has since blurred this definition. For example, in some countries, telephone service is provided via coaxial cable over pay television networks. In others, wireless local loop (WLL) technology severs the traditional concept of the physical line represented by a copper wire. The emergence of integrated services digital networks (ISDN) has also dramatically affected the concept of the main line. ISDN converts a single physical line into virtual channels. Basic rate ISDN provides two channels while primary rate provides many more (e.g. 30 in Europe and 23 in North America and Japan).¹¹ This led to the practice, particularly in Europe and Japan, of including ISDN channels in main line statistics. More recently, the use of fixed line broadband technologies (such as digital subscriber line (DSL) or cable modem) has meant that a single subscriber connection can support much higher data connections, including data but also, potentially, several simultaneous telephone conversations (for instance, using voice over IP). In order to enhance comparability, all countries should provide a breakdown of how their main telephone line figure is computed.

Box A1: Fixed telephone lines per 100 inhabitants

Fixed telephone lines refer to telephone lines connecting a customer's terminal equipment (e.g. telephone set, facsimile machine) to the public switched telephone network (PSTN) and which have a dedicated port on a telephone exchange. *Fixed telephone lines per 100 inhabitants* is calculated by dividing the number of fixed telephone lines by the population and multiplying by 100.

Mobile cellular subscribers per 100 inhabitants¹²

Mobile density, or the number of mobile subscribers per 100 inhabitants, has surpassed 100 in some nations. This phenomenon of above 100% ownership may arise due to a number of factors, including the practice in some countries of issuing car phones as standard and because of the inactive use of pre-paid accounts. Statistics regarding mobile users should include both post-paid subscriptions and pre-paid accounts, and should distinguish between the two.

The indicator specifies 'cellular' subscribers, which refers to those mobile services which allow for hand-over of calls between 'cells' as a user moves from the area covered by one mobile transmitter (or base station) to another.

While it is important to measure the total number of lines in a country, for comparable statistics, it is more conventional to express this in terms of lines per 100 inhabitants (teledensity). However, in the case of an increasing number of countries, this is not particularly meaningful now that mobile cellular subscribers outnumber fixed lines. An alternative would be to measure 'mobidensity', or mobile cellular subscribers per

100 inhabitants (see indicator A2), but this would disadvantage those economies where the fixed-line network is well established, or others where the mobile network is still in its infancy. A preferred alternative is therefore 'effective teledensity' which may be defined as either fixed lines or mobile subscribers per 100 inhabitants – whichever is higher.

Box A2: Mobile cellular subscribers per 100 inhabitants

Mobile cellular subscribers refer to users of portable telephones subscribing to an automatic public mobile telephone service using cellular technology, which provides access to the PSTN. Users of both post-paid subscriptions and pre-paid accounts are included. *Mobile cellular subscribers per 100 inhabitants* is obtained by dividing the number of mobile cellular subscribers by the population and multiplying by 100.

Computers per 100 inhabitants

Despite their importance, only a few countries publish reliable data on the number of personal computers (PCs). Unlike television sets, which are basically found in homes or hotel rooms, collecting data on PCs would involve surveying all the places where there might be a PC: schools, homes, offices, libraries, Internet cafés, etc. Therefore, most estimates regarding the installed base of PCs are derived from data on shipments (e.g. the number of PCs sold each year) in a given country. Annual shipment data can be multiplied by an estimated average useful lifespan before replacement to obtain an approximation of the number of PCs for the country. The life of a PC will vary depending on various factors such as wear and tear and obsolescence. Replacement rates differ between developing and developed nations, with the former keep-

ing PCs for longer.¹³ Though there is no precise methodology for determining PC replacement rates, a general rule of thumb is that they are changed every three to five years.

Apart from wear and tear, computers also become obsolete, as software updates require faster chips and more memory. In light of all these factors, an overall country figure for the number of PCs could be estimated by adding up the last five years' sales.¹⁴ It is a major drawback that, as with so many other statistics, reliable data on the number of PCs sold is not available for many developing nations.

A surrogate for PC sales is PC import figures, data that are sometimes available from customs departments of national governments. However, use of import data has limitations. Often only value rather than volume data are available. Also, if PCs were assembled in the country from imported parts, they would not be counted. Customs data would also not include undeclared imports. Additionally, some of the imported PCs may be later exported. Given the difficulties associated with estimating the number of PCs in use in a country,

Box A3: Computers per 100 inhabitants

Computers measures the number of computers installed in a country. The statistic includes PCs, laptops, notebooks etc, but excludes terminals connected to mainframe and mini-computers that are primarily intended for shared use, and devices such as smart-phones and personal digital assistants (PDAs) that have only some, but not all, of the components of a PC (e.g. they may lack a full-sized keyboard, a large screen, an Internet connection, drives etc.). *Computers per 100 inhabitants* is obtained by dividing the estimated number computers in use by the population and multiplying by 100.

and the importance that this measure carries with regard to the implementation of many ICT national policies, a count of PCs using a census may be useful to establish a reliable base.

Internet subscribers per 100 inhabitants¹⁵

Since the early days of Internet use, there have been estimates of the number of *users*. This statistic is represented elsewhere in the core set, and is based on census data, surveys or other estimates. The number of Internet *subscribers* - those paying for access to the Internet - is a more precise indicator of access than users. Subscription suggests a certain intensity of use since it is unlikely one would be paying for Internet access unless it is being utilised regularly. It should be noted that the number of subscribers measures all those who are paying for Internet use, including the so-called 'free Internet' used by those who pay via the cost of their telephone call, those who pay in advance for a given amount of time (pre-paid) and those who pay for a subscription (either flat-rate or volume/usage based).

Many Internet users obtain access without paying directly, either as the member of a household, or from work or school. Therefore the number of Internet users will always be much larger than the number of subscribers, typically by a factor of 2-3 in developed countries or more in developing ones. The number of subscribers thus sets a minimum threshold for the number of users in a country. Data about the nature of the Internet subscription, such as paid or free, business or consumer, fixed or mobile, and the access speed (e.g. dial-up or broadband) and the access device (e.g. PC, mobile phone, games console) are also useful.¹⁶

Data about the nature of the Internet subscription, such as paid or free, business or consumer, fixed or mobile; the access speed (e.g. dial-up

Box A4: Internet subscribers per 100 inhabitants

An *Internet subscriber* is someone who pays for access to the public Internet (a TCP/IP connection). The statistic is measured irrespective of the type or speed of access, the type of device used to access the Internet, or the method of payment. *Internet subscribers per 100 inhabitants* is obtained by dividing the number of Internet subscribers by the population and multiplying by 100.

or broadband); and the access device (e.g. PC, mobile phone, game console) also are useful.¹⁷

Broadband Internet subscribers per 100 inhabitants

Broadband may be defined as technologies that provide speeds of at least 256 kbit/s, where this speed is the combined upstream and downstream capacity.¹⁸ *The number of broadband subscribers* refers to the number of active registered Internet accounts including all fixed network broadband access technologies: digital subscriber line services (DSL), cable modem services, satellite broadband Internet, fibre-to-the-home Internet access, Ethernet LANs, wireless local area network (WLAN) services etc.

International Internet bandwidth per inhabitant

Bandwidth refers to the range of frequencies available to be occupied by signals. In analogue systems it is measured in terms of Hertz (Hz) and in digital systems in bits per second (bit/s) - the higher the bandwidth, the greater the amount of information that can be transmitted in a given time. *International Internet bandwidth* refers to the capacity which backbone operators provision to carry Internet traffic measured in bits

Box A5: Broadband Internet subscribers per 100 inhabitants

A *Broadband Internet subscriber* is someone who pays for high-speed access to the public Internet (a TCP/IP connection). High-speed access is defined as being equal to, or greater than 256 kbit/s, as the sum of the capacity in both directions. The statistic is measured irrespective of the type of access, or the type of device used to access the Internet, or the method of payment. *Broadband Internet subscribers per 100 inhabitants* is obtained by dividing the number of Broadband Internet subscribers by the population and multiplying by 100.

per second. This indicator is intended to represent the *quality* of the experience of Internet users within a country. If the experience of an Internet user in a country is poor, because of slow speed, then either people will not use ICTs, or they will not be able to use them effectively and creatively. In many developing countries, most Internet access is to sites abroad and therefore the amount of international bandwidth has a major impact on performance.

A useful derivative of this indicator is *International Internet bandwidth per Internet subscriber*, which takes out of the equation the differing levels of Internet usage in different countries. It can be used to describe the level of Internet access in countries, in the same way that *Gross Domestic Product (GDP) per capita* is utilised to indicate the level of economic development in comparison with other countries.

One weakness of this indicator is that countries with a large domestic market (like China), which are major generators of local content (like USA),

or which have languages that are not widely used outside the country (like Japan), may have relatively lower than expected levels of international Internet bandwidth, in that domestic bandwidth fulfils most of their needs. A further weakness is that much international bandwidth on leased lines is paid for unilaterally (i.e. the costs are borne by users at one end of the link) even though users at both ends use link. Again, this tends to underestimate the real level of bandwidth available to users in some countries, e.g. the United States. However, this statistic is valid for all developing countries as well as for most developed ones.

Box A6: International Internet bandwidth per inhabitant

International Internet bandwidth refers to the capacity which backbone operators provision to carry Internet traffic measured in bits per second. *International Internet bandwidth per inhabitant* is obtained by dividing the amount of bandwidth by the population.

Percentage of population covered by mobile cellular telephony

One of the most useful indicators of universal access is the *percentage of the population covered by a mobile cellular network*. Inhabitants who are covered by a mobile cellular signal have the potential to subscribe to the network, irrespective of whether or not they actually do so. Where there is a large gap between population coverage and penetration, it suggests that bottlenecks in access are more due to affordability than to infrastructure shortcomings.

Box A7: Percentage of population covered by mobile cellular telephony

Percentage of population covered by mobile cellular telephony refers to the percentage of a country's inhabitants that live within areas served by a mobile cellular signal, irrespective of whether or not they choose to use it. This should not be confused with the percentage of the land area covered by a mobile cellular signal or the percentage of the population that subscribe to mobile cellular service. Note that this measures the theoretical ability to use mobile cellular services if one has a cellular telephone and a subscription.

Internet access tariff (20 hours per month), in US\$, and as a percentage of per capita income

This indicator includes the tariff components of monthly line rental, line usage charge and Internet access charge but excludes the cost of equipment purchase or rental, and connection charges. It may be possible for the consumer to avoid one or more of the tariff components (for instance, the cost of line rental may be waived for mobile Internet access; or the cost of line charge may be bundled with the price of Internet access for 'free Internet' services). The package chosen would normally be the cheapest, but not necessarily the one offering the highest performance (for instance, a dial-up offering may be cheaper than broadband for 20 hours usage per month). In the longer term, it would be preferable to replace this indicator with an indicator that includes reference to the quality of the service (for instance, price per mbit/s per month). However, until broadband is more widely available, an indicator based on simple Internet access is more directly comparable.

Box A8: Internet access tariff (20 hours per month), in US\$, and as a percentage of *per capita* income

The *Internet access tariff* includes the tariff components of monthly line rental, line usage charge and Internet access charge, plus any tax that may be levied (as this is a service used by both residential and business consumers). The tariff chosen for a particular country would be the package for 20 hours per month that is the cheapest, that is widely available (or, in the case of regional service providers, is available in the capital city) and is available to the general public without restriction (e.g. excluding in-company or limited time offers, and excluding offers that are bundled with some other service). The price comparison is expressed in a commonly used currency (such as US\$), which could be converted either at the average exchange rate, or at purchasing power parity (PPP) rates. The indicator should be compared, as far as possible, for the same date between countries. *As a percentage of per capita income* involves dividing the Internet access tariff by the average monthly gross national income *per capita* of the country.

Mobile cellular tariffs (100 minutes of use per month), in US\$, and as a percentage of *per capita* income

The chosen indicator, comparing the cost of 100 minutes of use per month, is intended to represent an average use basket, which is applicable to individual consumers. Mobile users are split between post-paid subscribers and pre-paid accounts, and for some countries, and some operators, the former would be cheaper for 100 minutes use whereas in others the latter would be cheaper.

Box A9: Mobile cellular tariffs (100 minutes of use per month), in US\$, and as a percentage of *per capita* income

The *Mobile cellular tariff* includes the tariff components of monthly service rental (if relevant), 50 minutes of local peak time calling and 50 minutes of local off-peak calling, plus tax. Differences in the distance of calls, which may be applicable in some countries, are not taken into account, nor are international calls or SMS messages. The possible one-time charge for connection is not taken into account, except where this is bundled into the costs of a pre-paid account. Countries should calculate the tariff either on a post-paid or a pre-paid service, whichever one is more popularly used. If more than 50% of the mobile cellular subscribers use pre-paid, then the tariff should also be based on the pre-paid service, and *vice versa*. The price comparison is expressed in a commonly used currency (such as US\$), which could be converted either at the average exchange rate, or at purchasing power parity (PPP) rates. The indicator should be compared, as far as possible, for the same date between countries. *As a percentage of per capita income* involves dividing the mobile cellular tariff by the average monthly gross national income *per capita* of the country.

Percentage of localities with public Internet access centres (PIACs) by number of inhabitants (rural/urban)

The final indicator in the basic core set of infrastructure and access indicators is a measure of community access available to individuals. This is distinct from the measures available to households and to businesses measured elsewhere in the core set.

There are different ways of measuring access to community ICT facilities, for example, through the inclusion of a specific question in an Internet user survey. A specific question should address the *location of Internet access* and allow respondents to choose between different options, such as *at home, at work, at educational institutions, or at public Internet access facilities*. This would provide information on the number or percentage of people using public Internet facilities.

The main approach taken by the ITU is to look at the *percentage of localities with public Internet access centres (PIACs) by number of inhabitants (rural/urban)*. The availability of at least one facility in a locality is what is important here rather than the total number of facilities. Some countries, such as those in the European Union, have started collecting data on the number of public Internet access points.¹⁹ One major limitation with this indicator is that it does not show the distribution of facilities. Nor does it provide a basis for a recommended value since this would be a function of how necessary public Internet access centres are in a particular country (which in turn depends on the underlying level of ICT ownership). Furthermore, localities may be defined differently and/or have varying sizes in different countries. In the case of countries where a major portion of population is centred around a metropolitan area or the capital city, this may result in misleading values.

Definitions of extended core indicators

The indicators for measuring broadcast penetration through conventional ICTs are the *number of radio and television sets*.²⁰ Radio and television are still very dependent and useful ICTs

Box A10: Percentage of localities with public Internet access centres (PIACs) by number of inhabitants (rural/urban)

A *public Internet access centre* (PIAC) is a site, location, or centre of instruction at which Internet access is made available to the public, on a full-time or part-time basis. This may include digital community centres, Internet cafés, libraries, education centres and other similar establishments, whenever they offer Internet access to the general public. All such centres should have at least one public computer for Internet access. *Localities* refer to a country's villages, towns and cities. The percentage of localities with public Internet access centres (PIACs) is computed by dividing the number of localities with at least one PIAC by the total number of the country's localities and multiplying by 100. The indicator should be broken down by range of inhabitants.

for many parts of the world where Internet-based ICTs are not yet available or affordable. Few countries collect the number of devices and thus most data are estimates.²¹ These are derived from sales of sets or estimates based on surveys which ask households whether they have a television. Some countries with licensing regimes collect data on the number of licences. This statistic is often used as a proxy for household availability. However, not all people pay the licence fee so the true figure is underrepresented. This is apparent when licence data is contrasted with data from census or household surveys on the number of homes with a broadcast reception set. For this reason, and because of the underlying unreliability of the data, these indicators are nominated as 'extended core' rather than 'basic core'.²²

Box A11: Radio sets per 100 inhabitants

A *radio set* is a device capable of receiving broadcast radio signals, using popular frequencies, such as FM, AM, LW and SW. A radio set may be a standalone device, or it may be integrated into another device, such as a Walkman, a car, or an alarm clock. *Radio sets per 100 inhabitants* is obtained by dividing the number of radio sets in use by the population and multiplying by 100.

Box A12: Television sets per 100 inhabitants

A *television set* is a device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable and satellite. A television set may be a standalone device, or it may be integrated into another device, such as a computer or a mobile phone. It may be useful to distinguish between digital and analogue signal delivery and between TV sets receiving only a limited number of signals (usually over-the-air) and those that have multiple channels available (e.g. by satellite or cable). *Television sets per 100 inhabitants* is obtained by dividing the number of sets in use by the population and multiplying by 100.

Core Indicators on Access to, and Use of, ICT by Households and Individuals

This section provides definitions and model questions corresponding to the household and individual core ICT use indicators HH1 to HH13. It also contains some methodological notes, the most important of which for comparability purposes are those on statistical units, scope and classificatory variables.

It should be noted that this section does not provide general advice on how to conduct or process household surveys. Its aim is to convey those methodological points and conceptual issues which are most relevant to the collection of household/individual ICT use data.

The suggestions are mainly based on development work undertaken by the OECD's Working Party on Indicators for the Information Society (WPIIS), work being done by Eurostat and individual OECD member countries on this topic, and feedback received on an earlier paper on this topic. These and other resources on ICT statistics are referred to at the end of this document.

Box HH1: Proportion of households with a radio

A *radio* is a device capable of receiving broadcast radio signals, using popular frequencies, such as FM, AM, LW and SW. Radios also include: those combined with other equipment such as cassette players/recorders, portable radios such as transistor radios, and radios in motor vehicles.

The *proportion of households with a radio* is calculated by dividing the number of in-scope households with a radio by the total number of in-scope households. Sub-indicators may be constructed using the household classificatory variables, *household composition* and *household size* (for details, see 'Methodological notes' below), for example, the *proportion of households with a radio where there are one or more children under 16 in the household*.

Suggested model question:

Does any member of this household/ do you^a have access to a radio at home?

a. The term 'do you' is included to cover single person households. It does not refer to individual activities.

Definitions²³ and model questions²⁴ for basic core indicators²⁵

Proportion of households with a radio

This indicator refers to radio **access** (not **use**) by in-scope households.²⁶ The equipment should be in working order or expected to be returned to working order soon.

Box HH2: Proportion of households with a TV

A *TV* (television) is a device capable of receiving broadcast television signals, using popular access means such as over-the-air, cable and satellite. A television set may be a standalone device, or it may be integrated into another device, such as a computer or a mobile phone. The *proportion of households with a TV* is calculated by dividing the number of in-scope households with a TV by the total number of in-scope households. Sub-indicators may be constructed using the household classificatory variables, *household composition* and *household size*, for example, the *proportion of households with a TV where there are no children under 16*.

Suggested model question:

Does any member of this household/do you have access to a television at home?^a

a. The term ‘do you’ is included to cover single person households. It does not refer to individual activities.

Proportion of households with a TV

This indicator refers to television **access** (not **use**) by in-scope households. The equipment should be in working order or expected to be returned to working order soon.

Proportion of households with a fixed line telephone

This indicator refers to fixed line telephone **access** (not **use**) by in-scope households. The equipment should be in working order or expected to be returned to working order soon.

Box HH3: Proportion of households with a fixed line telephone

Fixed telephone lines refer to telephone lines connecting a customer’s terminal equipment (e.g. telephone set, facsimile machine) to the public switched telephone network (PSTN) and which have a dedicated port on a telephone exchange. The *proportion of households with a fixed line telephone* is calculated by dividing the number of in-scope households with a fixed line telephone by the total number of in-scope households. Sub-indicators may be constructed using the household classificatory variables, *household composition* and *household size*.

Suggested model question:

Does this household have a fixed line telephone at home?

Proportion of households with a mobile cellular telephone

This indicator refers to access to (not use of) a mobile phone by in-scope households. The equipment should be in working order or expected to be returned to working order soon.

Box HH4: Proportion of households with a mobile cellular telephone

Mobile cellular telephones refer to portable telephones subscribing to an automatic public mobile telephone service using cellular technology, which provides access to the PSTN. Users of both post-paid subscriptions and pre-paid accounts are included. The *proportion of households with a mobile cellular telephone* is calculated by dividing the number of in-scope households with a mobile cellular telephone by the total number of in-scope households. Sub-indicators may be constructed using the household classificatory variables, *household composition* and *household size*.

Suggested model question:

Does any member of this household/do you^a have access to a mobile telephone at home?

a. The term ‘do you’ is included to cover single person households. It does not refer to individual activities.

Proportion of households with a computer

This indicator refers to access to (not use of) a computer by in-scope households. The equipment should be in working order or expected to be returned to working order soon.

Box HH5: Proportion of households with a computer

A *computer* includes: a desktop, portable or handheld computer (e.g. a personal digital assistant). It does not include equipment with some embedded computing abilities such as mobile phones or TV sets. Note that this is a different definition of a *computer* than the one used for indicator A3, with the main difference being that personal digital assistants (PDA) are included here but excluded from A3. There are practical and historical reasons for this difference but, for the purposes of indicators HH5 and HH6, the functionality of PDAs, which may include Internet connectivity, is of interest.

The *proportion of households with a computer* is calculated by dividing the number of in-scope households with a computer by the total number of in-scope households. Sub-indicators may be constructed using the household classificatory variables, *household composition* and *household size*.

Suggested model question:

Does any member of this household/do you^a have access to a computer at home?

a. The term ‘do you’ is included to cover single person households. It does not refer to individual activities.

Proportion of individuals who used a computer (from any location) in the last 12 months

This indicator refers to use of computers in the previous 12 months by in-scope individuals.²⁷ That use can be from any location, including work.

Box HH6: Proportion of individuals who used a computer (from any location) in the last 12 months

A *computer* includes: a desktop, portable or handheld computer (e.g. a personal digital assistant). It does not include equipment with some embedded computing abilities: such as mobile phones or TV sets.

The *proportion of individuals who used a computer etc* is calculated by dividing the total number of in-scope individuals who used a computer from any location in the last 12 months by the total number of in-scope individuals. Sub-indicators may be constructed using the individual classificatory variables, *age, gender, highest education level, employment status* and *occupation* (see ‘Methodological notes’ below). An example of such a sub-indicator is the *proportion of individuals with lower secondary education or less who used a computer*.

Suggested model question:

Have you used a computer in the last 12 months?

Proportion of households with Internet access at home

This indicator refers to access to (not use of) the Internet by in-scope households. The connection should be functional (that is, any equipment or software needed should be in working order) or expected to be returned to working order soon.

Box HH7: Proportion of households with Internet access at home

The *Internet* is a world-wide public computer network. It provides access to a number of communication services including the World Wide Web and carries email, news, entertainment and data files. Access is not assumed to be only via a computer - it may also be by mobile phone, games machine, digital TV etc. The *proportion of households with Internet access at home* is calculated by dividing the number of in-scope households with Internet access by the total number of in-scope households. Sub-indicators may be constructed using the household classificatory variables, *household composition* and *household size*.

Suggested model question:

Does any member of this household/do you^a have access to the Internet at home regardless of whether it is used?

a. The term ‘do you’ is included to cover single person households. It does not refer to individual activities.

Proportion of individuals who used the Internet (from any location) in the last 12 months

This indicator refers to use of the Internet in the previous 12 months by in-scope individuals. That use can be from any location, including work.

Location of individual use of the Internet in the last 12 months

This indicator refers to in-scope individuals who used the Internet (from any location) in the previous 12 months and specifies the location of that use. (See following page.)

Box HH8: Proportion of individuals who used the Internet (from any location) in the last 12 months

The *Internet* is a world-wide public computer network. It provides access to a number of communication services including the World Wide Web and carries email, news, entertainment and data files. Individuals may have accessed the Internet by any means including a computer, mobile phone, games machine, digital TV etc.

The *proportion of individuals who used the Internet etc* is calculated by dividing the total number of in-scope individuals who used the Internet (from any location) in the last 12 months by the total number of in-scope individuals. Sub-indicators may be constructed using the individual classificatory variables, *age, gender, highest education level, employment status and occupation*. An example of such a sub-indicator is the *proportion of individuals aged 16-24 who used the Internet*.

Suggested model question:

Have you used the Internet in the last 12 months?

Box HH9: Location of individual use of the Internet in the last 12 months

Location of use includes *home, work, place of education, another person's home, community Internet access facility, commercial Internet access facility and other places*. Individuals can respond in respect of more than one location.

For international comparability, output is most simply presented as the proportion of in-scope individuals using the Internet at each location, for instance, the proportion of individuals using the Internet at home, at work etc. An alternative presentation is the proportion of Internet users using the Internet from each location (for a discussion of this, see 'Methodological notes' below). Sub-indicators may be constructed using the individual classificatory variables, *age, gender, highest education level, employment status and occupation*. An example of such a sub-indicator is the *proportion of employed persons who used the Internet at work*.

Suggested model question^a:

Where did you use the Internet in the last 12 months?^b

- Home
- Work: Where a person's workplace is located at his/her home, then he/she would answer yes to the home category only.
- Place of education
- At another person's home
- Community Internet access facility: Includes access at community facilities such as public libraries, publicly provided Internet kiosks, other government agencies; access is typically free or low cost. This category would not appear on country questionnaires. It is expected that each country would tailor categories according to the facilities available.
- Commercial Internet access facility: Includes access at Internet or cyber cafés, hotels, airports; even though the venue is commercial, the cost is not necessarily at full market price. This category would not appear on country questionnaires. It is expected that each country would tailor categories according to the facilities available.
- Other places

a. The question is asked of all in-scope individuals who used the Internet in the last 12 months.

b. Possible country variations to the response categories are to add or split locations according to country data requirements.

Internet activities undertaken by individuals in the last 12 months

This indicator refers to the activities undertaken on the Internet by in-scope individuals in the previous 12 months, from any location including work.

Box HH10: Internet activities undertaken by individuals in the last 12 months

Internet activities are: use of the Internet for getting information (several response categories per the model question below), for communicating, for purchasing or ordering goods or services, for Internet banking, for education or learning activities, for dealing with government organisations and for leisure activities (several response categories per the model question below). Note that these activities are restricted to private purposes and therefore exclude activities such as purchasing over the Internet undertaken as part of a person's job or undertaking online courses as part of a job. Individuals can respond in respect of more than one activity and activities are not mutually exclusive.

For international comparability, output is most simply presented as the proportion of in-scope individuals undertaking each activity, for instance, the proportion of individuals using the Internet to get information about goods or services. An alternative presentation is the proportion of **Internet users** undertaking each activity. Sub-indicators may be constructed using the individual classificatory variables, *age, gender, highest education level, employment status and occupation.*

See Box HH10.B

Box HH10.B:

Suggested model question^a:

For which of the following activities^b did you use the Internet for private purposes in the last 12 months?^c

For getting information

- About goods or services
- Related to health or health services: Health information covers injury, disease, nutrition and improving health generally.
- From government organisations/public authorities (from Web sites or via email): Government organisations/public authorities are preferably defined per the SNA93. They include government organisations at local, regional and national level. See <http://unstats.un.org/unsd/sna1993/wglossform.asp?getitem=219>.
- Other information or general Web browsing

For communicating: Sending or receiving email, using chat rooms/sites, message boards, instant messaging, telephoning via Internet etc.

For purchasing or ordering goods or services: Includes purchasing and downloading of digitised products, such as music, from the Internet.

For Internet banking

For education or learning activities: This refers to formal learning activities such as study associated with school or tertiary education courses as well as distance education involving online activities. (A more narrow interpretation is likely to be less meaningful as it could include a range of activities such as using the Internet to search for information.)

For dealing (interacting) with government organisations/public authorities: Government organisations/public authorities are preferably defined per the SNA93. They include government organisations at local, regional and national level. See <http://unstats.un.org/unsd/sna1993/glossform.asp?getitem=219>.

For leisure activities:

- Playing or downloading video games or computer games: Includes file sharing games and playing games online.
- Downloading or watching movies, TV programs, music or software: Includes file sharing and using Web radio or Web television. For software, includes downloading of patches and upgrades.
- Reading or downloading electronic books, newspapers or magazines: Includes accessing news Web sites.
- Other leisure activities: Includes gambling.

a. The question is asked of all in-scope individuals who used the Internet in the last 12 months.

b. The activities are not necessarily mutually exclusive, for instance, some activities (such as dealing with government and leisure activities) may also involve purchasing online. In such cases, the individual responds in respect of more than one response category.

c. There are alternative ways of asking activities questions. For instance, each could be rated according to its frequency or intensity of use. This question uses a simplified method of presentation which asks respondents for all activities. Possible country variations to the response categories are to add or split categories according to country data requirements. In particular, countries may wish to add an 'Other' category to this question.

Definitions and model questions for extended core indicators

Proportion of individuals with use of a mobile telephone

This indicator refers to in-scope individuals who had personal use of a mobile phone for some period within the last 12 months. The question below is untested in this format so the indicator is included as an extended rather than basic core indicator.

Proportion of households with access to the Internet by type of access

This indicator refers to in-scope households and the Internet access service/s they use at home to access the Internet. The response categories are designed to enable aggregation to broadband and narrowband access. Broadband is defined in terms of technologies; more generally, such technologies provide advertised download speeds of at least 256 kbit/s.

Box HH11: Proportion of individuals with use of a mobile telephone

Mobile telephones refer to portable telephones subscribing to an automatic public mobile telephone service using cellular technology, which provides access to the PSTN. *Use of a mobile telephone* does not mean that the telephone is owned or paid for by the person but should be reasonably available through work, a friend or family member, etc. It excludes occasional use, for instance, borrowing a mobile phone to make a call. The *proportion of individuals with use of a mobile telephone* is calculated by dividing the total number of in-scope individuals with use of a mobile telephone by the total number of in-scope individuals. Sub-indicators may be constructed using the individual classificatory variables, *age, gender, highest education level, employment status* and *occupation*.

Suggested model question:

Did you have personal use of a mobile telephone during some or all of the last 12 months^a?

a. Countries may wish to consider elaborating this question to ask whether individuals accessed the Internet using a mobile phone. Such an indicator could be relevant for countries with rapidly growing mobile phone usage but otherwise relatively poor telecommunications infrastructure.

Box HH12: Proportion of households with access to the Internet by type of access

A major aim of this indicator is to present the proportion of households with broadband access, therefore the response categories chosen allow aggregation to narrowband and broadband. As households can use more than one type of access service, multiple responses are possible. For international comparability, output is most simply presented as the proportion of in-scope households using each type of access service, for instance, the proportion of households accessing the Internet by DSL. Additionally, output should be available for the aggregations, the *proportion of households with broadband and narrowband access to the Internet*. Alternatively, output could be presented as a proportion of households with Internet access. Sub-indicators may be constructed using the household classificatory variables, *household composition* and *household size*.

Suggested model question^a:

What type/s of Internet access services are used for Internet access at home?^b

Analog modem (dial-up via standard phone line): An analog modem converts a digital signal into analog for transmission by traditional (copper) telephone lines. It also converts analog transmissions back to digital.

ISDN (Integrated Services Digital Network): ISDN is a telecommunication service that turns a traditional (copper) telephone line into a higher speed digital link. It is usually regarded as narrowband.

DSL (ADSL, SDSL, VDSL etc.): Digital subscriber line; it is a high-bandwidth, local loop technology carrying data at high speeds over traditional (copper) telephone lines.

Cable modem: A modem which uses cable TV lines for connection to the Internet.

Other narrowband: Including most mobile telephone access and other forms of access with an advertised download speed of less than 256 Kbps (kilobits per second). This wording would not normally be used on questionnaires - countries would add appropriate category/ies based on services available.

Other broadband: Including optic fibre cable, some mobile telephone access (e.g. UMTS), powerline, satellite, fixed wireless, with an advertised download speed of ≥ 256 Kbps. This wording would not normally be used on questionnaires - countries would add appropriate category/ies based on services available.

Do not know

- a. The question is asked of all in-scope households with access to the Internet at home.
- b. Possible country variations to the response categories are: remove categories where items are not feasible, add or split categories according to technologies available and country data requirements.

Frequency of individual access to the Internet in the last 12 months (from any location)

This indicator refers to the frequency of (typical) use of in-scope individuals who used the Internet, from any location including work, in the previous 12 months.

Methodological notes

This section provides limited suggestions regarding methodology for collection of household and individual ICT use indicators. For most countries, there will be established procedures in place for household collections (e.g. labour force surveys) which will apply also to the collection of ICT use data. For this reason, no recommendations are made on the following:

- use of a particular type of sample frame, sampling methodology or sample size, these will vary according to country practices and the availability of information (for instance, administrative information on individuals);
- whether collections should be mandatory or voluntary – both types of collections are used among countries; however, where collections are voluntary, non-response will tend to be higher;
- how to process collected information, including editing, imputation and benchmarking of data; or,
- a particular type of survey vehicle (for instance, labour force surveys, household expenditure surveys etc.).

Box HH13: Frequency of individual access to the Internet in the last 12 months (from any location)

Frequency of use can be: *at least once a day, at least once a week but not every day, at least once a month but not every week, or less than once a month.* For international comparability, output is most simply presented as the proportion of in-scope individuals using the Internet with each frequency, for instance, the proportion of individuals using the Internet at least once a day. An alternative presentation is the proportion of **Internet users** using the Internet with each frequency. Sub-indicators may be constructed using the individual classificatory variables, *age, gender, highest education level, employment status and occupation.*

Suggested model question^a:

How often did you typically^b use the Internet during the last 12 months?^c

At least once a day^d

At least once a week but not every day

At least once a month but not every week

Less than once a month

a. The question is asked of all in-scope individuals who used the Internet in the last 12 months.

b. ‘Typically’ means on most days (or a typical day). It is included so that respondents will ignore weekends (if they only access the Internet from work) and breaks from their usual routine, such as holidays.

c. From any location, including work.

d. To be interpreted as at least once each working day for respondents who only (or most frequently) use the Internet from work.

Particular statistical issues associated with household and individual ICT use measurement

Mobile phones

A particular issue concerns mobile phones, for which there are both household and individual indicators in the core list. In OECD countries, this information has conventionally been collected in respect of the household (therefore whether the household, through one or more of its members, has access to a mobile phone). However, there is increasing recognition that it is more important to examine individual use of mobile phones as they are typically owned and/or used by an individual rather than a group of people. The core list therefore includes an indicator on individual mobile phone use. However, it should be noted that this indicator is based on a relatively untested question which may change as experience increases.

Recall period

Based on the experience of those OECD countries which use it, it is suggested that a 12-month recall period for questions which are less reliant on detailed recollection will not introduce significant recall bias effects. On the other hand, using a different period (for example, three months) potentially introduces seasonal bias effects.²⁸

A 12-month period is therefore suggested for the core indicators in order to avoid such seasonal effects and to also better capture less frequent activities such as purchasing online or searching for health information.

Choice of denominator for indicators

Most indicators arising from ICT use surveys are presented as proportions data. They include: proportions of the whole population of households/individuals or of sub-populations, such as particular household types or age groups. Addi-

tionally, countries might present data as a proportion of households/individuals which have access to or use computers or the Internet etc. However, this can be potentially confusing to users so it is important to be clear which denominator is used to construct a particular indicator and to have a common approach between countries.

It has been suggested in this paper that, for international comparability purposes, the simplest approach is for countries to provide proportions which use the **overall population** as the denominator rather than the **active population** (being the number of households/individuals which have access to, or use, computers or the Internet etc.). Note that, for presentation purposes, it is possible to calculate indicators with the **active population** as the denominator from other output which is proposed in this paper. For example, the proportion of households with Internet access which use broadband is equal to the proportion of households with broadband access divided by the proportion of households with Internet access.

Survey vehicles and collection techniques

There is a variety of survey vehicles which could be used to collect data on household and individual ICT use. A few OECD countries have a stand-alone survey for this purpose but most use existing surveys. Many other countries will also have existing survey vehicles, for instance, labour force surveys, household expenditure surveys, population censuses or general social surveys.

A number of developing countries are likely to start collecting ICT household indicators by adding a few questions to existing surveys. In such cases, the following suggestions on collection techniques may not be practicable to implement.

Most OECD countries use personal interview techniques for collecting data on household and individual use of ICT. Face-to-face interviewing may be better for some situations in that it potentially allows the interviewer to explain any technical terms and to check the type of Internet connection or other technical details.

Telephone interviews should generally be avoided where telephone penetration is low or it is not possible to include mobile or unlisted subscribers. It is also suggested that postal surveys generally not be used. The reasons for this are that they do not involve interaction with the respondent (therefore technical questions on ICT use may be less well understood) and response rates are likely to be lower, leading to higher sampling error and possible non-response bias. In situations where there are several languages or dialects spoken in a country, personal interview using local interviewers is likely to be preferable to postal surveys.

Statistical units

A key issue concerns the appropriate statistical unit for measurement. In general, the household unit is used to elicit information about the facilities in place in the household (for example, whether there is a TV, computer or Internet connection). The individual unit is used to provide information on use of these facilities (both in and away from the home) and, most importantly, the intensity of that use (for instance, frequency and range of activities undertaken).

Both households and individuals are proposed as statistical units. Commonly, a randomly selected in-scope individual would answer all the questions - the household model questions on behalf of the household and the individual questions in respect of him/herself. Alternatively, more than one household member could provide individual

information about themselves. Households, and individuals within those households, should be selected in an unbiased manner.

Because the sample of households and individuals selected is unlikely to be perfectly representative of the population, it is important to weight responses according to independent estimated distributions of the population.

Frequency

Frequency of surveys is likely to relate to national priorities, available resources and the evolution of the ICT market in each country. Where ICTs are being introduced rapidly, an annual survey may be justifiable. Where the level of access to ICT is low and not growing rapidly, it might be more appropriate to adopt a longer interval between surveys.

Survey scope and coverage

Individuals

The scope of individuals would normally be limited by age. OECD and Eurostat recommend that all individuals aged 16 to 74 years be included in the scope of their household model surveys on ICT use.²⁹ For consistency, this age range is suggested as a **minimum individual age scope**. Many developing countries may wish to extend this scope where there are both sufficient resources and supporting national data requirements.

In terms of overall coverage, the sample base would normally be the complete in-scope resident population of a country although countries might consider limiting the survey to those living in private dwellings (therefore excluding individuals in institutions such as prisons, nursing homes and special dwellings such as hotels).

Generally, countries will want to approach the question of scope and coverage with a sense of what can practically be achieved and what ICT

facilities are available to particular social groups or in particular geographic areas. In the case of geographical coverage, it might be unrealistic to ask questions about ICT usage in remote rural areas where it is well known that computers and the Internet are not generally available. Countries will consider such issues in relation to time and cost, but they should also consider that the omission of any element of the resident population should be mentioned in all publications, and that such an omission may affect the calculation of statistics representative of the whole population as well as comparison with other countries.

Households

Consistent with the recommended individual age scope of 16-74, it is suggested that households consisting only of members over 74, or under 16, are excluded from the survey. Other scope and coverage limitations would follow from those applying to individuals, for instance, restricting household surveys to those households in private dwellings and omitting remote areas from coverage. As with individual scope, countries are able to extend the household scope if they wish.

Classificatory variables

The metadata associated with the core indicators will include a set of classificatory variables, with relevant categories. Data for these variables would usually be collected as part of the survey (though note that questions are not suggested in this paper). A minimal set of classificatory variables is proposed below, though many countries will decide to use extra variables and/or additional categories. Of possible interest to those countries where a rural/urban divide exists is a geographical classification. For many countries, an income variable will also be of interest. Because both variables are problematic from a collection and international comparability viewpoint, they have not been suggested in this paper. However, countries are encouraged to

include those variables if they are able to, as the output can provide critical policy information.

Household characteristics

- Household composition (two-way classification: *households with/without children under 16*) and
- Household size (*number of members*, including those outside the age scope).

Individual characteristics

- Age: to show the differences between age groupings, reasonably fine and equal-sized ranges are proposed as follows: *16 to 24; 25 to 34; 35 to 44; 45 to 54; 55 to 64; 65 to 74*.³⁰
- Gender.
- Highest education level received: a four-way classification is proposed as follows: *No formal education or primary education (ISCED 0,1); Lower secondary education (ISCED 2); Upper secondary or post-secondary non-tertiary (ISCED 3,4); Tertiary (ISCED 5,6)*.³¹
- Employment status (four-way classification: *paid employee; self-employed*,³² *unemployed; not in the labour force*);³³ and,
- Occupation (use ISCO88 major groups where possible).³⁴

In terms of output, many countries may want to cross-classify some of these variables. This can produce information which is very useful for analytical purposes. However, it should be noted that cross-classified output is often more detailed and therefore requires higher sample sizes to support reliable estimates.

Core Indicators on Use of ICT by Businesses

This section provides definitions and model questions corresponding to the business core ICT use indicators B1 to B12. It also provides some methodological notes, the most important of which are those relating to statistical unit, scope and classificatory variables. It should be noted that this section does not provide general advice on how to conduct or process business surveys. Its aim is to convey those methodological points and conceptual issues which are most relevant to the collection of business ICT use information.

The suggestions are mainly based on development work undertaken by the OECD's Working Party on Indicators for the Information Society (WPIIS), work being done by Eurostat and individual OECD member countries on this topic, and feedback received on an earlier paper on this topic. These and other resources on ICT statistics are referred to at the end of this document.

Definitions and model questions³⁵ for basic core indicators

Proportion of businesses using computers

This indicator refers to the use of computers by in-scope businesses³⁶ during the 12-month reference period.

Box B1: Proportion of businesses using computers

A *computer* includes: a desktop, portable or handheld computer (e.g. a personal digital assistant), minicomputer, mainframe. A computer does not include equipment with some embedded computing abilities: such as mobile phones or TV sets, nor does it include computer-controlled machinery or electronic tills. The *proportion of businesses using computers* is calculated by dividing the number of in-scope businesses using computers during the 12-month reference period by the total number of in-scope businesses. Sub-indicators may be constructed using the classificatory variables, *industry* and *size* (for details, see 'Methodological notes' below). An example of a sub-indicator is the *proportion of manufacturers using computers*.

Suggested model question:

Did your business use computer/s during <period>^a?

a. 12-month reference period.

Proportion of employees using computers

This indicator refers to the proportion of persons employed by in-scope businesses who routinely used a computer during the 12-month reference period. The indicator refers to actual use of a computer by employees rather than simply access to a computer.

Box B2: Proportion of employees using computers

A *computer* includes: a desktop, portable or handheld computer (e.g. a PDA), minicomputer, mainframe. A computer does not include equipment with some embedded computing abilities: such as mobile phones or TV sets, nor does it include computer-controlled machinery or electronic tills.

Employees refer to all persons working for the business, not only those working in clerical jobs. They include working proprietors and partners, as well as employees. The *proportion of employees using computers* is calculated by dividing the number of employees using computers (in all in-scope businesses) by the total number of employees (in all in-scope businesses). Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

What proportion of persons employed in your business routinely used a computer at work during <period>^b?

- The question is asked of all in-scope businesses which used computer/s during the reference period.
- 12-month reference period.

Proportion of businesses using the Internet

This indicator refers to the use of the Internet by in-scope businesses during the 12-month reference period – whether or not the business used a computer (as the Internet may be accessed in other ways).

Box B3: Proportion of businesses using the Internet

The *Internet* refers to Internet protocol (IP) based networks: WWW (the World Wide Web), an extranet over the Internet, EDI over the Internet, Internet accessed by mobile phones and Internet email. The *proportion of businesses using the Internet* is calculated by dividing the number of in-scope businesses using the Internet by the total number of in-scope businesses. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

Did your business use the Internet during <period>^b?

- The question is asked of all businesses - not only those businesses which used a computer (as the Internet may be accessed in other ways).
- 12-month reference period.

Proportion of employees using the Internet

This indicator refers to the proportion of persons employed by in-scope businesses who routinely used the Internet during the 12-month reference period. The indicator refers to actual use of the Internet by employees rather than simply access to the Internet.

Box B4: Proportion of employees using the Internet

The *Internet* refers to Internet protocol (IP) based networks: WWW, an extranet over the Internet, EDI over the Internet, Internet accessed by mobile phones and Internet email. *Employees* refer to all persons working for the business, not only those working in clerical jobs. They include working proprietors and partners, as well as employees. The *proportion of employees using the Internet* is calculated by dividing the number of employees using the Internet (in all in-scope businesses) by the total number of employees (in all in-scope businesses). Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

What proportion of persons employed in your business routinely used the Internet at work during <period>^b?

- a. The question is asked of all in-scope businesses which used the Internet during the reference period.
- b. 12-month reference period.

Proportion of businesses with a Web presence

This indicator is a measure of the proportion of in-scope businesses with a Web presence as at the reference date. ‘Web presence’ is used rather than ‘Web site’, based on the presumption that a presence is more important than a Web site *per se*.

Box B5: Proportion of businesses with a Web presence

A *Web presence* includes a Web site, home page or presence on another entity’s Web site (including a related business). It excludes inclusion in an online directory and any other Web pages where the business does not have substantial control over the content of the page. The *proportion of businesses with a Web presence* is calculated by dividing the number of in-scope businesses with a Web presence by the total number of in-scope businesses. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

Did your business have a Web presence as at <reference date>^b?

- a. The question is asked of all in-scope businesses which used the Internet during the reference period. In theory, a business could have a Web presence without having used the Internet. For most countries, this is expected to be a rare event. Where it is thought to be common, countries could alter the population to all in-scope businesses which used computer/s during the reference period.
- b. The reference date would usually be at the end of the reference period, or shortly after.

Proportion of businesses with an intranet

This indicator is a measure of the proportion of in-scope businesses with an intranet as at the reference date.

Box B6: Proportion of businesses with an intranet

An *intranet* refers to a network using the same protocol as the Internet and allowing communication within an organisation. It is typically set up behind a firewall to control access. The *proportion of businesses with an intranet* is calculated by dividing the number of in-scope businesses with an intranet by the total number of in-scope businesses. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

Did your business have an intranet as at <reference date>^b?

- The question is asked of all in-scope businesses which used computer/s during the reference period.
- The reference date would usually be at the end of the reference period, or shortly after.

Proportion of businesses receiving orders over the Internet

This indicator refers to selling over the Internet by in-scope businesses during the 12-month reference period.

Box B7: Proportion of businesses receiving orders over the Internet

Orders include orders received via the Internet whether or not payment was made online. This includes orders received via Web sites, specialised Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones and email. It also includes orders received on behalf of other organisations and orders received by other organisations on behalf of the business. It excludes orders which were cancelled or not completed. For international comparability, the *proportion of businesses receiving orders over the Internet* is most simply calculated by dividing the number of in-scope businesses receiving orders over the Internet by the total number of in-scope businesses. Alternatively, output could be presented as the proportion of in-scope businesses using the Internet (for a discussion of this, see ‘Methodological notes’ below). Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

Did your business receive orders^b for goods or services (that is, make sales) via the Internet during <period>^c?

- The question is asked of all in-scope businesses which used the Internet during the reference period. In theory, businesses without Internet access could receive Internet orders (for example, via agents). Where this is thought to be common, countries could alter the population to all in-scope businesses which used computer/s during the reference period.
- Note that the inclusion of email orders differs from the recommendation made to OECD and Eurostat countries to exclude orders made over conventional email. Notwithstanding this, a small number of OECD countries do include conventional email orders as Internet commerce.
- 12-month reference period.

Proportion of businesses placing orders over the Internet

This indicator refers to purchasing over the Internet by in-scope businesses during the 12-month reference period.

Box B8: Proportion of businesses placing orders over the Internet

Orders include orders placed via the Internet whether or not payment was made online. Includes orders placed via Web sites, specialised Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones and email. Excludes orders which were cancelled or not completed. For international comparability, the *proportion of businesses placing orders over the Internet* is most simply calculated by dividing the number of in-scope businesses placing orders over the Internet by the total number of in-scope businesses. Alternatively, output could be presented as the proportion of in-scope businesses using the Internet. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

Did your business place orders^b for goods or services (that is, make purchases) via the Internet during <period>?

a. The question is asked of all in-scope businesses which used the Internet during the reference period.

b. Note that the inclusion of email orders differs from the recommendation made to OECD and Eurostat countries to exclude orders made over conventional email. Notwithstanding this, a small number of OECD countries do include conventional email orders as Internet commerce.

c. 12-month reference period.

Definitions and model questions for extended core indicators

Proportion of businesses using the Internet by type of access

This indicator refers to in-scope businesses and the Internet access service/s they used to access the Internet during the reference period. The response categories are designed to enable aggregation to broadband and narrowband. Broadband is defined in terms of technologies; more generally, such technologies provide advertised download speeds of at least 256 kbit/s.

Box B9: Proportion of businesses using the Internet by type of access

A major aim of this indicator is to present the proportion of in-scope businesses with broadband access, therefore the response categories chosen allow aggregation to narrowband and broadband. As businesses can use more than one type of access service, multiple responses are possible. For international comparability, output is most simply presented as the proportion of in-scope businesses using each type of access service, for instance, the proportion of businesses accessing the Internet by DSL. Additionally, output should be available for the aggregations, the *proportion of businesses with broadband and narrowband access to the Internet*. Alternatively, output could be presented as a proportion of businesses using the Internet. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

How did your business connect to the Internet during <period>^{b?}^c

Analog modem (dial-up via standard phone line): An analog modem converts a digital signal into analog for transmission by traditional (copper) telephone lines. It also converts analog transmissions back to digital.

ISDN (Integrated Services Digital Network): ISDN is a telecommunication service that turns a traditional (copper) telephone line into a higher speed digital link. It is usually regarded as narrowband.

DSL (ADSL, SDSL, VDSL etc.): Digital subscriber line; it is a high-bandwidth, local loop technology carrying data at high speeds over traditional (copper) telephone lines.

Cable modem: A modem which uses cable TV lines for connection to the Internet.

Other narrowband: Including most mobile phone access and other forms of access with an advertised download speed of less than 256 Kbps (kilobits per second). This wording would not normally be used on questionnaires - countries would add appropriate category/ies based on services available.

Other broadband: Including high speed leased lines, optic fibre cable, some mobile phone access (e.g. UMTS), powerline, satellite, fixed wireless, with an advertised download speed of ≥ 256 Kbps. This wording would not normally be used on questionnaires - countries would add appropriate category/ies based on services available.

Do not know

- a. The question is asked of all in-scope businesses which used the Internet during the reference period.
- b. 12-month reference period.
- c. Possible country variations to the response categories are: remove categories where items are not feasible; add or split categories according to technologies available and country data requirements.

Proportion of businesses with a local area network (LAN)

This indicator is a measure of the proportion of in-scope businesses with a local area network (LAN) as at the reference date.

Box B10: Proportion of businesses with a local area network (LAN)

A *local area network* (LAN) refers to a network connecting computers within a localised area such as a single building, department or site; it may be wireless. The *proportion of businesses with a LAN* is calculated by dividing the number of in-scope businesses with a LAN by the total number of in-scope businesses. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

Did your business have a local area network (LAN) as at <reference date>^b?

- a. The question is asked of all in-scope businesses which used computer/s during the reference period.
- b. The reference date would usually be at the end of the reference period, or shortly after.

Proportion of businesses with an extranet

This indicator is a measure of the proportion of in-scope businesses with an extranet as at the reference date.

Box B11: Proportion of businesses with an extranet

An *extranet* is a private, secure extension of an intranet running on Internet protocol. It allows selected external users to access some parts of an organisation's intranet. The *proportion of businesses with an extranet* is calculated by dividing the number of in-scope businesses with an extranet by the total number of in-scope businesses. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

Did your business have an extranet as at <reference date>^b?

- a. The question is asked of all in-scope businesses which used computer/s during the reference period.
- b. The reference date would usually be at the end of the reference period, or shortly after.

Proportion of businesses using the Internet by type of activity

This indicator refers to the type of activities in-scope businesses undertook using the Internet during the 12-month reference period.

Box B12: Proportion of businesses using the Internet by type of activity

Internet activities are: use of the Internet for *getting information* (several response categories per the model question below), *for sending or receiving emails*, *for performing Internet banking or accessing other financial services*, *for dealing with government organisations*, *for providing customer services* and *for delivering products online*. Businesses can respond in respect of more than one activity. For international comparability, output is most simply presented as the proportion of in-scope businesses undertaking each activity, for instance, the proportion of businesses using the Internet for sending or receiving emails. An alternative presentation is the proportion of business Internet users undertaking each activity. Sub-indicators may be constructed using the classificatory variables, *industry* and *size*.

Suggested model question^a:

For which of the following activities did your business use the Internet during <period>^b?^c

For getting information:

- About goods or services
- From government organisations/public authorities (from Web sites or via email): Government organisations/public authorities are preferably defined per the SNA93. They include government organisations at local, regional and national level. See <http://unstats.un.org/unsd/sna1993/glossform.asp?getitem=219>.
- Other information searches or research activities

For sending or receiving emails

For performing Internet banking or accessing other financial services

For dealing (interacting) with government organisations/public authorities: Includes downloading/requesting forms, completing/lodging forms online, making online payments and purchasing from, or selling to, government organisations. Government organisations/public authorities are preferably defined per the SNA93. They include government organisations at local, regional and national level. See <http://unstats.un.org/unsd/sna1993/glossform.asp?getitem=219>.

For providing customer services: Includes providing online or emailed product catalogues or price lists, product specification or configuration online, after sales support and order tracking online.

For delivering products online: Refers to products delivered over the Internet in digitised form e.g. reports, software, music, videos, computer games and online services, such as computer-related services, information services, travel bookings or financial services.

a. This question is asked of all in-scope businesses which used the Internet during the reference period.

b. 12-month reference period.

c. Possible country variations to response categories are to add or split categories according to country data requirements. In particular, countries may wish to add an 'Other' category to this question.

Methodological notes

This section provides limited suggestions regarding methodology for collection of business ICT use indicators. For most countries, there will be established procedures in place for conducting business surveys which will apply also to collection of ICT use data. For this reason, no recommendations are made on the following:

- use of a particular type of sample frame;
- sampling methodology;
- whether collections should be mandatory or not;
- how to process collected information, including editing, imputation (for unit and item non-response) and weighting of data; and,
- survey vehicle (which could be a dedicated or existing business survey).

Particular statistical issues associated with business ICT use measurement

Measuring Internet e-commerce

According to the OECD definition, it is the method by which the order is placed or received, not the payment nor channel of delivery, which determines whether a transaction is an e-commerce transaction. Accordingly, an “Internet (e-commerce) transaction is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over the Internet. The goods and services are ordered over the Internet, but the payment and the ultimate delivery of the good or service may be conducted on or offline”.

The Internet e-commerce indicators, B7 and B8, could present some collection challenges, for instance, the need to have a larger sample size

where the incidence of Internet e-commerce is low.³⁷ There are also definitional and data availability issues. The latter apply especially to purchasing over the Internet given that many businesses do not have a centralised purchasing function.

In addition, countries might wish to consider how the collection of such data would affect survey methods. For instance, if interviewers are used, they may require some technical training.

Choice of denominator for indicators

Most indicators arising from ICT use surveys are presented as proportions data. They include: proportions of the whole population of businesses or of sub-populations, such as particular industries or size classes. Additionally, countries might present data as a proportion of businesses which use the Internet or have a Web site etc. This can be very confusing to users so it is important to be quite clear which denominator is used to calculate a particular indicator and to have a common approach between countries.

It has been suggested in this paper that, for international comparability purposes, the simplest approach is for countries to provide proportions which use the **overall population** as the denominator rather than the **active population** (being the number of businesses which use the Internet or have a Web site etc.). Note that, for presentation purposes, it is possible to calculate indicators with the **active population** as the denominator from other output which is proposed in this paper. For example, the proportion of business Internet users which have broadband access is equal to the proportion of businesses with broadband access divided by the proportion of businesses which use the Internet.

Survey vehicles and collection techniques

Most OECD countries conduct dedicated postal surveys of ICT use by businesses. Countries which do not have such a survey vehicle, for instance many developing countries, could add questions to an existing economy-wide survey or to separate industry surveys. Note that data can also be collected by means of personal interview (face-to-face or telephone) or other methods such as drop-off/call-back (or post back). In the future, electronic data capture may be viable for some respondents, though very few OECD countries are yet using such methods.

Statistical unit

The following discussion refers to the unit about which data are collected. This may be different from the unit which reports the data (a 'reporting unit'). The OECD and Eurostat both specify the 'enterprise' as the statistical unit and this is the unit used by most OECD countries. Choice of unit is important as it influences the results obtained. As output from ICT use surveys is mainly proportions data, comparability between countries is more likely to be attained where the unit chosen is the same. As an example, if country A uses the establishment as a unit and country B uses the enterprise, then it is likely that country B will report higher proportions, especially of more sophisticated uses of ICT, such as buying and selling over the Internet, or use of an intranet.

Unfortunately, there is no single definition of an enterprise that is used in all countries. The two main definitions are those of the ISIC (Rev. 3.1)³⁸ and the European Union.³⁹ While they have common characteristics that enterprises exercise a certain degree of autonomy in decision-making and have full financial accounts, the EU concept is narrower and it is suggested that this concept be used where possible.

Frequency and reference period/date

There is perhaps a greater requirement than for household surveys for the frequency of business surveys to be sensitive to the evolution of ICT and its use. OECD countries which conduct such a survey do so on an annual basis. However, for some countries, an annual collection will not be feasible, in which case it is important that those countries try to align their collection years as far as possible. As much of the information collected is point-in-time data, it would be preferable to have alignment of reference dates across countries or regions.

Survey scope and coverage

Type of organisation

This is generally interpreted as those business enterprises from the private and public sectors, which are operating in the country. General government organisations are excluded. Most OECD countries exclude non-employers.

Industry (activity) scope

OECD collects business ICT use data from member countries in respect of the following industries: manufacturing (ISIC D), construction (ISIC F), wholesale trade (ISIC 51), retail trade (ISIC 52), hotels and restaurants (ISIC H), transport, storage and communications (ISIC I), finance and insurance (ISIC J)⁴⁰ and real estate, renting and business services (ISIC K). Eurostat receives data from most countries for NACE⁴¹ sections D, F, G, H⁴², I, K and O⁴³.

It is recommended that the **minimum industry scope** be: ISIC sections D, F, G, H, I and K. Countries are encouraged to extend this scope where there are both sufficient resources and supporting national data requirements. In particular, some developing countries might wish to collect data from ISIC sections A, B and C and part of O (covering agriculture, hunting, forestry,

fishing and mining, recreational, cultural and sporting activities, and other service activities). It is likely that a methodology similar to those used for household surveys would be appropriate for many of the units in these industries.

Size scope

Most OECD countries specify that in-scope businesses are employers and they define size scope in terms of number of employees. Eurostat specifies a size cut-off of 10 or more employees. For comparability, OECD does likewise even though there is a range of cut-offs used among OECD (including European) countries, with at least two member countries including enterprises with a single employee.

This paper proposes a **minimum size scope** of 10 or more employees. It is recognised that there are important policy issues pertaining to businesses which are smaller than this. Additionally, in most developing countries, very small businesses make up such a large part of the overall business community that their inclusion is highly desirable. Developing countries are therefore encouraged to extend the scope to include smaller businesses where resources permit.⁴⁴

Classificatory variables

The metadata associated with the core questions need to include classificatory variables with relevant categories. Data for these variables will usually be collected as part of a survey or may be available from the population frame (for example, a business register). For business surveys, the classification variables will generally be the same as, or a subset of, the stratification variables (though the detail may be different). A minimal set of classification variables and categories which are consistent with the scope recommendations above, is suggested below. This set is consistent with advice offered by OECD and Eurostat for collection of business use of ICT

data. As with the household survey, countries may decide to use extra classificatory variables and/or additional categories. In particular, developing countries with a significant rural/urban divide may wish to add a geographic classification.

Industry (activity)

A broad industry output classification consistent with the suggested industry scope is proposed as follows: manufacturing (ISIC D), construction (ISIC F), wholesale and retail trade (including repair of motor vehicles, motorcycles and personal and household goods) (ISIC G), hotels and restaurants (ISIC H), transport, storage and communications (ISIC I), and real estate, renting and business services (ISIC K).

Size (number of employees)

The size classification proposed is based on the minimum size scope and is: *10-49 employees; 50-249 employees and 250 or more employees.*

Core Indicators on the ICT Sector and Trade in ICT Goods

This section suggests classifications and definitions relevant to the basic core indicators, ICT1 to ICT4. The suggestions are based on work of the OECD's Working Party on Indicators for the Information Society (WPIIS).

ICT sector core indicators

- ICT1. Proportion of total business sector workforce involved in the ICT sector
- ICT2. Value added in the ICT sector (as a percentage of total business sector value added).

ICT1 and ICT2 would generally come from surveys which collect income and expenses data for national accounts. Metadata characteristics of these indicators include the definition of the ICT sector and the indicator terms. These are discussed below.

Defining the ICT sector

It is recommended that countries use the definition of the ICT sector agreed by WPIIS in 1998 (and revised in 2002). It consists of manufacturing and services industries whose products *capture, transmit or display data and information electronically*.

For *manufacturing* industries, the products of a candidate industry:

- Must be intended to fulfil the function of information processing and communication including transmission and display.
- Must use electronic processing to detect, measure and/or record physical phenomena or control a physical process.

For *services* industries, the products of a candidate industry:

- Must be intended to enable the function of information processing and communication by electronic means.

The definition was initially based on ISIC Rev. 3 and updated in 2002 to reflect changes in ISIC Rev. 3.1. The 2002 definition of the ICT sector is shown in the box above.

It should be noted that the OECD's ICT sector definition is likely to change somewhat with the major revision of ISIC in 2007 (to ISIC Rev. 4).

Countries might encounter the following problems in applying the OECD ICT sector definition and collecting data:

- For countries which do not use ISIC Rev. 3.1

OECD ICT sector definition, 2002 (ISIC Rev 3.1)

Manufacturing:

3000	Office, accounting and computing machinery
3130	Insulated wire and cable
3210	Electronic valves and tubes and other electronic components
3220	Television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
3312	Instruments and appliances for measuring, checking, testing, navigating and other purposes except industrial process control equipment
3313	Industrial process control equipment

Services:

5151	Wholesale of computers, computer peripheral equipment and software
5152	Wholesale of electronic and telecommunications parts and equipment
6420	Telecommunications
7123	Renting of office machinery and equipment (including computers)
72	Computer and related activities

(or NACE Rev. 1.1) to classify economic units, there may be some concordance issues which need to be addressed.

- For confidentiality reasons, some countries may be unable to report data for telecommunications services. Aggregation into total ICT services as proposed below will often solve this problem.

For output purposes, the OECD sometimes presents only two categories: ICT manufacturing and ICT services. Individual countries may also do this where confidentiality or industry concordance is a problem.

Defining variables used in core indicators ICT1 and ICT2

The indicator ICT1 refers to the total workforce involved in the ICT sector as a proportion of the total business workforce. ICT2 refers to value added in the ICT sector as a proportion of total

business value added.

Both are usually calculated using data for the ICT and total business sector which are compatible with national accounts tables. Where ICT sector industries are not present in a country's national accounts by activity tables, estimates are made based on business survey results (often provided specifically for the ICT sector by NSOs). OECD is currently reviewing the definition of the total business sector and has more recently been using ISIC 10-74 (excluding 70)⁴⁵ as an activity-based business sector definition (rather than a business sector defined on an institutional basis).

The underlying measures used in these indicators are **workforce** and **value added**.

ICT workforce (or ICT employment) consists of those persons employed in businesses which

are classified to the ICT sector. Total business workforce represents all persons engaged in domestic production in the business sector. In a national accounts framework, employment can be measured in terms of headcounts, jobs, full-time equivalents or hours worked. Currently, total headcounts or jobs are used for most countries. Further efforts are required to determine best practices for global ICT sector indicators based on labour inputs.

Value added for a particular industry represents its contribution to national GDP. It is sometimes referred to as GDP by industry and is not directly measured. In general, it is calculated as the difference between production (gross output) and intermediate inputs (the energy, materials and ser-

vices required to produce final output).

The valuation can be made at factor costs, at basic prices or at producers' prices. The relationship between these three valuations is shown in the figure below.

ICT goods trade core indicators

- ICT3. ICT goods imports as a percentage of total imports
- ICT4. ICT goods exports as a percentage of total exports.

ICT3 and ICT4 would normally come from trade

Valuation of Value Added(1)

Value added at **factor costs**
 + *other taxes, less subsidies, on production*(2)
 = Value added at **basic prices**
 + *taxes less subsidies, on products*(3)
(not including imports and VAT)
 = Value added at **producer's prices**
 + *taxes, less subsidies, on imports*
 + Trade and transport costs
 + Non-deductible VAT
 = Value added at **market prices**(4)

(1). This table draws on concepts outlined in both the 1968 and 1993 versions of the *System of National Accounts* (SNA68 and SNA93). Until the late 1990s, most countries adhered to recommendations in SNA68 (where the notions of factor costs, producer prices and market prices were

nant). However, many OECD Member countries have now implemented SNA93 (or the EU equivalent, ESA95) which recommends the use of basic prices and producer prices (as well as purchaser prices for input-output tables).

(2). These consist mostly of current taxes (and subsidies) on the labour or capital employed, such as payroll taxes or current taxes on vehicles and buildings.

(3). These consist of taxes (and subsidies) payable per unit of some good or service produced, such as turnover taxes and excise duties.

(4). Market prices are those which purchasers pay for the goods and services they acquire or use, excluding deductible VAT. The term is usually used in the context of aggregates such as GDP, whereas purchaser prices refer to the individual transactions.

statistics. Metadata characteristics of these indicators include the definition of ICT goods and sources and concepts concerning international trade statistics more generally. These are discussed below.

Defining and classifying ICT goods

In late 2003, the OECD released a definition and classification of ICT goods, based on work done by WPIIS. The OECD ICT goods classification uses the 2002 version of the World Customs Organization's *Harmonized System* (HS) but has a concordance to the 1996 version. The full list of six-digit HS categories included in the classification can be found on the OECD Web site as an annex to the paper *ICT goods classification*.⁴⁶ Countries using the HS 1996 version should note that there are differences between the 1996 and 2002 versions in 7 HS codes. These differences are detailed in the above-mentioned paper.

ICT goods are defined by the OECD as “.....intended to fulfil the function of information processing and communication by electronic means, including transmission and display, or use electronic processing to detect, measure and/or record physical phenomena, or to control a physical process”.

It should be noted that this definition results in a broad interpretation of an ICT good and therefore an extensive classification. For output purposes, it is suggested that detailed categories be aggregated into the five broad categories recommended in the OECD paper, that is, *telecommunications equipment, computer and related equipment, electronic components, audio and video equipment* and *other ICT goods*.

It should also be noted that software products (including packaged software) are not included in this classification. The OECD will include all

software in its forthcoming classification of ICT services.

Trade statistics sources and concepts

International trade statistics are available for most countries from the United Nation's *Comtrade* database. The *Comtrade* Web site⁴⁷ includes extensive metadata by country, including data availability, classifications for which data are available (different versions of HS or SITC) and concepts used (such as valuation, currency and trade system). All data are available in current US\$. Note that re-exports⁴⁸ and re-imports⁴⁹ are not netted out from exports and imports respectively. This may be problematic for some countries.

The *Comtrade* Web site also has a glossary which explains terms and concepts.

Reference Material

Eurostat

Eurostat's *Methodological Manual* is an operational manual containing recommended guidelines for the Eurostat model surveys on ICT use by enterprises and households/individuals. It was first published in late 2005 to assist countries conduct the 2006 surveys and will be updated each year.

The following Web site provides methodological information (including questionnaires) for the Eurostat surveys http://europa.eu.int/estatref/info/sdds/en/infosoc/infosoc_base.htm.

ITU

Definitions of key indicators, including ICT infrastructure and access core indicators, may be found in *Key indicators of the telecommunication/ICT sector* available from: http://www.itu.int/ITU-D/ict/material/Top50_e-WTIM-2005-8June.doc.

OECD

Guide to Measuring the Information Society. The *Guide* brings together OECD and member country work on information society statistics. Of particular relevance for methodologies for the household/individual and business core indicators, the *Guide* explains OECD work on ICT statistical standards. It also provides:

- metadata in respect of the collection practices of OECD countries (in a Web-based annex);
- an annex on non-member country work (including the relevant activities of non-OECD countries, regional networks and international organisations); and,
- an annex on the application of OECD recommendations to developing countries (the latter contributed by the UNESCO Institute for Statistics).

The *Guide* can be found on the OECD Web site at: <http://www.oecd.org/sti/measuring-infoeconomy>. The ICT statistics metadata annex is also available on the OECD Web site at: <http://www.oecd.org/sti/ictmetadata>.

Partnership on Measuring ICT for Development

UNCTAD is the host for material on Partnership activities. The home page is http://measuring-ict.unctad.org/QuickPlace/measuring-ict/Main.nsf/h_Toc/281E7067B40AD764C1256EE80048DACC/?OpenDocument.

Partnership project document, <http://measuring-ict.unctad.org/QuickPlace/measuring-ict/>

[Main.nsf/h_Index/FBFD3BDF8A2AC11EC1256EF5005C2CC5/?OpenDocument](http://www.unesco.org/webworld/observatory/index/FBFD3BDF8A2AC11EC1256EF5005C2CC5/?OpenDocument).

Measuring ICT: The Global Status of ICT Indicators (2005).

UNCTAD

The Web site on measuring ICT <http://measuring-ict.unctad.org> includes papers and presentations from WSIS thematic meetings on ICT measurement and other useful information, for example, regional initiatives.

UNECLAC

Towards an Information Society measurement instrument for Latin America and the Caribbean: getting started with census, household and business surveys, <http://www.cepal.org/cgi-bin/getProd.asp?xml=/publicaciones/xml/5/21595/P21595.xml&xsl=/ddpe/tpl/p9f.xsl&base=/socinfo/tpl/top-bottom.xsl>.

UNESCO Institute for Statistics

Measuring and Monitoring the Information and Knowledge Societies: a Statistical Challenge.⁵⁰

This report was written as one of UNESCO's inputs to the first phase of the World Summit on the Information Society (WSIS) in 2003. Its focus is on measurement issues with regard to information and communication technologies (ICTs) and gives an overview of the data that exist as well as where the gaps lie. Issues relating to data quality are also addressed.

UNESCO Observatory on the Information Society

<http://www.unesco.org/webworld/observatory/>

As a part of UNESCO's strategy to build knowledge societies and in compliance with

UNESCO's function as a 'clearing house', the Observatory aims at monitoring the development of knowledge societies by:

- collecting pertinent information on the evolution of ethical, legal, socio-cultural and policy issues related to the information society, with particular attention to education, science, culture and communication;
- timely presentation of new trends and contexts; and
- sharing information about the challenges of the information society and advances in ICT.

Monitoring the progress towards an equitable information/knowledge society very much depends upon the availability of reliable data and key indicators on all aspects of ICT, including access, usage and impact. For that reason, the UNESCO Observatory dedicates one of its categories to **Measuring the Information Society**.

http://www.unesco.org/webworld/portal/observatory/pages/Measuring_the_Information_Society/index.shtml.

UN Statistics Division

Comtrade database <http://unstats.un.org/unsd/comtrade/default.aspx>.

Footnotes

1. Information and communication technology.
2. The *Partnership on Measuring ICT for Development* was launched in June 2004, and currently includes the following members: Eurostat, the International Telecommunication Union (ITU), the Organisation for Economic Cooperation and Development (OECD), the United Nations Conference on Trade and Development UNCTAD, four United Nations Regional Commissions (the UN Economic Commission for Africa (UNECA), the UN Regional Commission for Latin America and the Caribbean (UNECLAC), the UN Economic and Social Commission for Asia and the Pacific (UNESCAP) and the UN Economic and Social Commission for Western Asia (UNESCWA)), the United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS), the UN ICT Task Force and the World Bank. For further information on the objectives and activities of the Partnership, see <http://measuring-ict.unctad.org>.
3. For statistical reasons, there are several minor differences between the wording of the response categories suggested in the core list of indicators presented here and the list agreed upon at the February 2005 WSIS thematic meeting.
4. In the list adopted by the February meeting, this response category was entitled *Free Public Internet Access Centre*. It is proposed that it be changed to *Community Internet access facility* to reflect the fact that community access may be charged, albeit often at subsidised rates.
5. In the list adopted by the February meeting, this response category was entitled *Charged Public Internet Access Centre*. It is proposed that it be changed to *Commercial Internet access facility* to reflect the fact that commercial access is not necessarily charged.
6. In the list adopted by the February meeting, this response category was entitled *Internet banking or other financial services*. It is proposed that it be changed to *Internet banking* following changes made to the OECD and Eurostat model questionnaires.
7. 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.
8. This group of indicators was referred to as 'Core indicators on access and use of ICTs by businesses' in the list adopted by the February meeting. The title has been changed to better reflect the nature of indicators (which deal with usage rather than access). The term access, in this context, is used for household sur-

veys and refers to the availability of a technology to household members rather than its use.

9. These indicators were discussed during the World Telecommunication Indicators February 2005 meeting, available from: <http://www.itu.int/ITU-D/ict/wict05/index.html> and contained in the *Key indicators of the telecommunication/ICT sector*, available from: http://www.itu.int/ITU-D/ict/material/Top50_e-WTIM-2005-8June.doc.

10. There is no shortage of references to universal service/access being the main goal of telecommunication policy. For further information see ITU (1998), *World Telecommunication Development Report: Universal Access*, available from: http://www.itu.int/ITU-D/ict/publications/wtdr_98/index.html; and ITU (2003), *Trends in Telecommunication Reform: Promoting Universal Access to ICTs – Practical Tools for Regulators*, available from: <http://www.itu.int/publications/docs/trends2003.html>.

11. Variations on basic and primary ISDN exist in some countries, sometimes referred to as fractional ISDN. For example in Denmark a variant known as Flex-ISDN provides 12 channels per line.

12. Indicators A1 and A2 comprise the Millennium Development Goals (MDG) indicator # 47.

13. According to some researchers, the PC replacement rate in the US is as high as 70 per cent per year. On the other hand “In more developing regions, PC replacement rates are much lower.” CyberAtlas (2003), “PC Market headed for geographic shift”, available from: http://cyberatlas.internet.com/big_picture/hardware/article/0..5921_988841.00.html.

14. Prince and Cooke, December 1998, *Mercado Informático*, available from: <http://www.spkrsbr.com/biblioteca/htm/resultados.htm>.

15. Indicators A3 and A4 comprise the MDG indicator # 48. Together, they may be used to indicate the level of ICT penetration and utilisation

in a country, and hence its readiness to evolve towards an Information Society.

16. http://www.isoc.org/inet2000/cdproceedings/8e/8e_1.htm#s6.

17. http://www.isoc.org/inet2000/cdproceedings/8e/8e_1.htm#s6.

18. For more on broadband developments, see ITU (2003), *Birth of Broadband*, available from: www.itu.int/birthofbroadband.

19. European Union, *eEurope 2005: Benchmarking Indicators*, available from: http://europa.eu.int/comm/lisbon_strategy/pdf/655_EN.pdf.

20. The broadcast industry uses other metrics such as ‘universe estimates’ (e.g. potential television audience). See “FAQ – About Ratings” at the Nielsen Media Research website: <http://www.nielsenmedia.com>.

21. In the past, UNESCO had published the number of radio and television sets in different countries but stopped with its *1999 Statistical Yearbook*. UNESCO has conducted a consultation exercise which may lead to the revival of this data series in 2006.

22. This lack of data may be a problem in the future, as countries shift towards digital radio and television broadcasting. Important policy-decisions on when to turn off analogue broadcast channels may be delayed due to lack of reliable data on homes with radios and televisions.

23. For historical and practical reasons, some definitions of ICTs such as a computer and the Internet differ from those used by the ITU.

24. It is not expected that the structure, question wording or definitions which comprise the model questions would necessarily be used unchanged (or literally translated) in national surveys. However, it is desirable for comparability purposes that their meanings are preserved and that the logic is preserved to the extent that the specified populations of households or individuals are asked each question.

25. Note that a question for the reference

indicator on electricity, HHR1 (proportion of households with electricity) is not included.

26. For household scope, see discussion on scope under ‘Methodological notes’.

27. For individual scope, see discussion on scope under ‘Methodological notes’.

28. The OECD model questionnaire uses a 12-month recall period for all questions. The Eurostat model asks some questions in respect of both 12 months and three months (for instance, individual use of a computer and the Internet, whether the individual has purchased products over the Internet) but asks others (e.g. location of use and activities undertaken) in respect of the last three months.

29. Reasons for the lower age limit include legal restrictions in some countries on interviewing children. Regarding the upper age limit, some countries ask these questions as supplements to labour force surveys and therefore interview people most likely to be in the labour force.

30. This is consistent with recommendations made by OECD and Eurostat for their model surveys.

31. Note that this differs from the Eurostat and OECD levels which combine ISCED 0,1 and 2. For more information on ISCED (1997), see http://www.uis.unesco.org/ev.php?ID=3813_201&ID2=DO_TOPIC.

32. Self employed includes: employers; own account workers; contributing family workers; and members of producers’ cooperatives.

33. For more information on the ILO definitions, see <http://www.ilo.org/public/english/bureau/stat/class/icse.htm>.

34. For more information on ISCO, see <http://www.ilo.org/public/english/bureau/stat/class/isco.htm>.

35. It is not expected that the structure, question wording or definitions which comprise the model questions would necessarily be used unchanged (or literally translated) in national surveys. However, it is desirable for comparability

purposes that their meanings are preserved and the logic is preserved to the extent that the specified populations of businesses are asked each question.

36. For business scope, see discussion on scope under ‘Methodological notes’.

37. This is still the case in most OECD countries.

38. ISIC is the International Standard Industrial Classification of all Economic Activities. For details of ISIC Rev 3.1, see <http://unstats.un.org/unsd/cr/registry/regcst.asp?CI=17>. According to ISIC, an enterprise has “autonomy in respect of financial and investment decision-making, as well as authority and responsibility for allocating resources for the production of goods and services. It may be engaged in one or many productive activities. The enterprise is the level at which financial and balance sheet accounts are maintained and from which international transactions, and international investment position (when applicable) and the consolidated financial position can be derived.”

39. Defined by the European Commission as: “.....the smallest combination of legal units that is an organisational unit producing goods or services, which benefits from a certain degree of autonomy in decision-making, especially for the allocation of its current resources. An enterprise carries out one or more activities at one or more locations. An enterprise may be a sole legal unit.”

40. The revised (2005) OECD model survey of business ICT use suggests that ISIC section J be ‘non-core’ for OECD member countries. Eurostat developed a specific module of the enterprise survey for a pilot study of the sector in 2004. In 2005, the Eurostat model questionnaire was revised but limited to general ICT variables. For 2006, the Eurostat model questionnaire was improved and includes variables on e-commerce.

41. NACE is the Statistical Classification of

Economic Activities in the European Community, Rev. 1.1 (2002).

42. In respect of section H, only about half the countries which do the Eurostat survey collect data for NACE 55.3 to 55.5 (restaurants, bars etc.).

43. Not all countries which do the Eurostat survey collect data for all classes of Section O (Other community, social and personal service activities). For collection purposes, divisions 92 and 93 are most relevant. The revised (2005) OECD model survey of business ICT use suggests that ISIC Division 92 (recreational, cultural and sporting activities) be 'non-core' for OECD member countries.

44. Countries should note that the broader the scope, the larger the sample size generally required to obtain adequate aggregate estimates. Extending the scope to businesses with fewer than 10 employees might increase the sample size by a factor of two or more.

45. The business sector therefore excludes: agriculture, hunting, forestry and fishing (mainly because of problems measuring employment in some countries); real estate activities (because a significant proportion of its value added consists of imputed rent of owner-occupied dwellings); and, community, social and personal services (which consists mainly of non-market activities such as public administration, education and health services).

46. The full URL is <http://www.oecd.org/dataoecd/5/61/22343094.pdf>.

47. The full URL is <http://unstats.un.org/unsd/comtrade/default.aspx>.

48. **Re-exports** are exports of foreign goods in the same state as previously imported.

49. **Re-imports** are goods imported in the same state as previously exported.

50. The full URL is http://www.uis.unesco.org/ev.php?ID=5504_201&ID2=DO_TOPIC.

Printed in UN-ESCWA, Beirut
05-0552 - November 2005 - 1000