

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT

Manual

for the Production of Statistics
on the Information Economy

2009
Revised Edition



UNITED NATIONS
New York and Geneva, 2009

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Measuring-ict.unctad.org

UNCTAD/SDTE/ECB/2007/2/REV.1
UNITED NATIONS PUBLICATION
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PREFACE

Producing statistics on the information society is becoming an important component of the work programme of national statistical organizations. The demand for ICT statistics continuously increases as more countries seek to design, monitor and review national policies and strategies to take advantage of the rapid advances in information technology. In addition, business communities require information about access to, and use of, ICTs by various consumer groups, as well as information about the impact of ICTs. This is a particular challenge for the developing countries, many of which are just starting their statistical work on measuring the information society. At the international level, comparable ICT indicators are critical to cross-country comparisons of ICT development, to monitoring the global digital divide and to establishing policy-relevant benchmarks.

The United Nations Conference on Trade and Development (UNCTAD) is a founding member of the global Partnership on Measuring ICT for Development (see <http://measuring-ict.unctad.org>), which promotes the measurement of the information society at the international level. One of the key achievements of the *Partnership* is the development of a core list of ICT indicators for the production of internationally comparable statistics, which was endorsed by the United Nations Statistical Commission at its 38th session in March 2007. The UN Statistical Commission encouraged countries to use that list in their data collection programmes and a first version of the *Manual for the Production of Statistics on the Information Economy* was published at the end of 2007. UNCTAD prepared this *Manual* to guide statisticians from developing countries in all steps involved in the production and dissemination of business ICT statistics.

To reflect the evolving nature of many ICTs, the core list of ICT indicators was revised in late 2008. UNCTAD and the UN Statistics Division (UNSD) collaborated to subject the *Manual for the Production of Statistics on the Information Economy* to an extensive consultation process. Through this process, national and international experts have provided detailed feedback and suggestions aimed at making the *Manual* as practical a tool as possible for staff of national statistical organizations responsible for measuring the information economy. The process was supported by members of the *Partnership on Measuring ICT for Development* and an expert group meeting was held in Geneva in May 2008. Further discussions on the *Manual* were facilitated by an online forum hosted by the UNSD and moderated by UNCTAD.

This second edition of the *Manual for the Production of Statistics on the Information Economy* will be introduced to the 40th UN Commission for Statistics in February 2009. It is a valuable tool in our common efforts towards enhancing the availability of internationally comparable indicators of the information economy.



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ACKNOWLEDGEMENTS

The first version of this *Manual* was prepared by a team consisting of UNCTAD staff members Susan Teltscher (team leader), Scarlett Fondeur Gil, Muriel Guigue, and Sonia Boffa, under the overall supervision of Geneviève Feraud. The main author of the Manual was José Luis Cervera Ferri and substantive editing was provided by Sheridan Roberts, both consultants to UNCTAD.

The *Manual* was submitted to a consultation process in view of its revision in order to improve its content and practical usability by beneficiary countries. This revision process was organized by Susan Teltscher and Torbjörn Fredriksson (team leaders), Scarlett Fondeur Gil, Sonia Boffa and Rémi Lang, under the overall supervision of Mongi Hamdi. José Luis Cervera Ferri drafted most of the modifications.

Monica Morrica provided administrative support and helped in the formatting. The overall layout, graphics and desktop publishing were done by MédiaCime. Sophie Combette designed the cover and the text was edited by Graham Grayston.

Useful comments on various aspects of the Manual were provided by Aarno Airaksinen (Statistics Finland), Henri Laurencin, Head of UNCTAD's Central Statistics and Information Retrieval Branch and Ralf Becker, Chief of the Economic Statistics and Classifications Section of the United Nations Statistics Division. The UNCTAD team also acknowledges the Partnership on Measuring ICT for Development, the OECD and Eurostat, whose work provided the basis for several of the chapters.

A number of national statistical offices provided useful information to this *Manual*, in particular those of Kazakhstan, Morocco and Thailand. National statistical experts also provided useful contributions to the revision of the *Manual*, in particular Tapas Kunar Sanyal, Candido Astrologo, Mohamaed Jallouli, Sihar Lumbantobing and Yusif Yusifov, as well as most of the participants to the *Expert Group Meeting for the revision of the Manual for the Production of Statistics on the Information Economy*, which took place in Geneva on 26 May 2008.

Finally, the United Nations Statistics Division offered valuable support to the elaboration of the publication, including by providing the online forum that hosted the discussions for the revision.

All contributions are gratefully acknowledged.

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LIST OF ABBREVIATIONS

1xEV-DO	Evolution data optimized, or Evolution data only
1xEV-DV	Evolution Data and Voice
2G, 3G	Second, third generation
ABS	Australia Bureau of Statistics
ADSL	Asymmetric digital subscriber line
B2B	Business-to-business (transactions conducted over computer-mediated networks)
B2C	Business-to-consumer (transactions conducted over computer-mediated networks)
BOP	Balance of payments
CAD	Computer-aided design
CAM	Computer-aided manufacturing
CAPI	Computer assisted personal interviewing
CATI	Computer assisted telephoning interviewing
C&SD	Census and Statistics Department (Hong Kong, province of China)
CDMA	Code Division Multiple Access
CNAE	Classificação Nacional de Atividades Econômicas (Brazil national classification of economic activities)
CPC	Central Product Classification (UN)
CRM	Customer relationship management
CV	Coefficient of variation
DQAF	Data Quality Assessment Framework (IMF)
DSL	Digital Subscriber Line
ECOSOC	Economic and Social Council
EDI	Electronic data interchange
ERP	Enterprise resource planning
EU	European Union
FAQ	Frequently asked question
FSU	First stage unit
GDP	Gross domestic product
GPRS	General packet radio service
GSM	Global system for mobile communications
HS	Harmonized System (WCO)
HSDPA	High-speed downlink packet access
HSUPA	High-speed uplink packet access
IBGE	Instituto Brasileiro de Geografia e Estatística
ICT	Information and communication technology
ICTs	Information and communication technologies
ILO	International Labour Organization
IMF	International Monetary Fund
INDEC	Instituto Nacional de Estadística y censos (Argentina National Institute of Statistics and Census)

INE	Instituto Nacional de Estadística (National Institute of Statistics, Chile, Spain,)
INEI	Instituto Nacional de Estadística e Informática (National Institute of Statistics and Informatics, Peru)
INS	Institut National de la Statistique (National Institute of Statistics, Cameroon)
IP	Internet protocol
ISDN	Integrated services digital network
ISIC	International Standard Industrial Classification of All Economic Activities (UN)
ISP	Internet service provider
IT	Information technology
IT&T	Information technology and telecommunications
ITU	International Telecommunication Union
Kbit/s	Kilobits per second
LAN	Local area network
LDCs	Least developed country
Mbit/s	Megabits per second
MINPOSTEL	Ministère des Postes et des Télécommunications (Ministry of Posts and Telecommunications, Cameroon).
NACE	Nomenclature Générale des Activités Economiques dans L'Union Européenne
NAICS	North American Industry Classification System
NSCB	National Statistical Coordination Board (Philippines)
NSDS	National strategy for the development of statistics
NSO	National statistical office
OCR	Optical character recognition
OECD	Organisation for Economic Co-operation and Development
ONS	Office for National Statistics (UK)
PC	Personal computer
PDA	Personal digital assistant
RAIS	Relação Annual de Informações Sociais
R&D	Research and development
SCM	Supply chain management
SDSL	Symmetric digital subscriber line
SME	Small and medium enterprise
SNA	System of National Accounts
TFSCB	Trust Funds For Statistical Capacity Building
UMTS	Universal mobile telecommunications system
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNECA	United Nations Economic Commission for Africa
UNECLAC	United Nations Regional Commission for Latin America and the Caribbean
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNESCWA	United Nations Economic and Social Commission for Western Asia
UNSC	United Nations Statistical Commission
UNSD	United Nations Statistics Division

URL	Uniform resource locator
VAT	Value Added Tax
VDSL	Very high speed digital subscriber line
WAP	Wireless application protocol
WCO	World Customs Organization
WiMAX	Worldwide interoperability for microwave access
WPIIS	Working Party on Indicators for the Information Society (OECD)
WSIS	World Summit/s on the Information Society
WWW	World Wide Web

PART A. INTRODUCTION

CHAPTER 1 - OBJECTIVES AND OVERVIEW OF THE MANUAL

1. The Manual for the Production of Statistics on the Information Economy has been prepared for the benefit of statistical agencies, in particular in developing and transition economies.¹ It is directed towards those staff that are responsible for producing official statistics on the information economy. The main aim of the *Manual* is to support the production of information and communication technology (ICT) statistics that are internationally comparable – more specifically, statistics on the ICT sector, ICT trade and use of ICT by businesses. The *Manual* does not cover household statistics.² The *Manual* has been prepared by the United Nations Conference on Trade and Development (UNCTAD) and reflects its mandate to assist developing economies in measuring and monitoring the information economy.
2. The *Manual* is intended to be a practical tool for producing ICT statistics at the national level; these, in turn, serve as key inputs to countries' national ICT policies and strategies. The *Manual* explains the international standards that guide work in this area and offers advice on collecting, processing and disseminating ICT statistics and associated metadata.
3. Statistical systems in developing economies are diverse and reflect, among other things, a country's wealth, culture, and legal and political frameworks. Understandably, the level of statistical capacity is unequal with respect to adherence to internationally recommended standards and methods, data collection systems and collection frequency, and the availability of key social and economic indicators. The *Manual* takes the differing practices and capabilities of national statistical offices (NSOs) into account and highlights specific challenges that some developing economies face in their production of ICT statistics. Its contents are based largely on the work of the members of the Partnership on Measuring ICT for Development. In 2005, the *Partnership* developed a core list of ICT indicators, which was endorsed by the UN Statistical Commission at its 2007 meeting.³ The Commission encouraged countries to use the list as a basis for their ICT measurement activity. The *Manual* presents the *Partnership* core indicators on ICT use by business and the ICT sector, and provides associated definitions, classifications, methodologies and model questions.
4. The *Manual* will refer to international standards, definitions and model questionnaires on ICT statistics that have been developed by the Organisation for Economic Co-operation and Development (OECD) and Eurostat (both of which are members of the *Partnership*). In addition, it addresses statistical issues that are of particular interest to developing economies and are not extensively covered in the work of the OECD and Eurostat. For example, the *Manual* identifies areas of ICT use in developing economies which should be measured (such as use of email) and provides relevant methodological advice (for instance, on construction of business frames, data collection methods and use of existing surveys where resources are insufficient for carrying out stand-alone ICT surveys).
5. As well as covering these and other technical aspects of ICT statistics, the *Manual* reviews important institutional aspects of the statistical process, such as collaboration with data providers, and cooperation with data users and producers.

¹ Henceforth referred to as "developing economies".

² A Manual on household statistics is under preparation by the International Telecommunications Union (ITU), to be published in 2009.

³ See UNSC 2007.

6. The *Manual* is organized as follows:

- Part A introduces the *Manual* and describes the background to the measurement of ICT.
- Part B covers the methodological and practical aspects of the production of ICT statistics on the information economy, including:
 - Information economy measurement concepts;
 - The core indicators and associated statistical standards;
 - Data sources for business ICT indicators;
 - Model questions and questionnaires;
 - Methodological issues relating to data collection, survey design and processing; and
 - The dissemination of data and metadata.
- Part C deals with institutional issues such as coordination between actors in the national statistical system, the work of international organizations and capacity-building.

7. The *Manual* is supported by 8 annexes that provide further technical advice and useful references.

8. The material presented in this *Manual* serves as the basis for the UNCTAD training course on “Measuring the Information Economy”. The training course, which is based on the UNCTAD *TrainForTrade* methodology, is broadly organized around modules following the structure of the content of the *Manual*.⁴ The training courses are useful tools in building the capacities of countries to produce statistics on the use of ICT by businesses and on the ICT sector.

9. ICTs play an increasingly important role in the economic and social development of countries, and governments formulate policies on ICT for development in order to seize the opportunities offered by these technologies. ICT statistics are essential to plan, monitor and evaluate these policies. This is a new area of measurement for most countries, as is the development of the necessary statistical standards and collection methodologies. Rapid technological change requires that new indicators be introduced and old ones discarded more frequently than in other areas of statistics. The UNCTAD secretariat will therefore regularly update and revise this *Manual*, with the objective of keeping member States informed of the most recent developments on the subject matter.

⁴ Countries interested in the course should contact the UNCTAD secretariat at emeasurement@unctad.org. The training course uses the *Manual* as the principal reading material, and complementary course material includes presentation slides, an instructor’s guide, tests and evaluation questionnaires.

CHAPTER 2 - BACKGROUND

2.1 ICT indicators for policymaking

10. The potential for ICT to increase economic growth and reduce poverty is receiving increasing attention from Governments and the international community. Designing and implementing ICT policies and strategies require proper knowledge of the state of ICT in a country and its use by organizations (government as well as business) and individuals (and often, the main barriers to such use). Consequently, calls for ICT statistics have become more frequent, both at the national and the international level (see Box 1). Furthermore, the measurement of ICT access, use and impact enables assessment and monitoring of the digital divide within a country and between countries.

Box 1. The WSIS mandate

The measurement of ICT has been an important part of international debates on ICT for development. While ICTs can present opportunities for economic and social development for developing economies, the digital divide between developed and developing economies also presents new challenges. The UN Millennium Development Goals, for example, include the target of making available the benefits of new technologies, especially ICT, to developing economies.

Measuring ICT for development was a principal concern of the World Summit on the Information Society (WSIS), which was held in two phases, Geneva in 2003 and Tunis in 2005. The Geneva phase highlighted the importance of benchmarking and measuring progress towards the information society through internationally comparable statistical indicators. The Tunis phase recognized that the development of ICT indicators is important for measuring the digital divide, and called upon countries and international organizations to allocate appropriate resources for the provision of ICT statistics, and to develop effective measurement methodologies including basic ICT indicators and an analysis of the state of the information society. In particular, member States called for periodic evaluation, using an agreed methodology, such as described in paragraphs 113–120 of the Tunis Agenda for the Information Society, and referring to the work of the Partnership on Measuring ICT for Development.⁵

In 2008, the UN Economic and Social Council (ECOSOC) in its resolution E/2008/31 acknowledged the work of the Partnership on Measuring ICT for Development to develop indicators and noted the lack of indicators to measure progress made towards achieving the targets of the Geneva Plan of Action. The ECOSOC thus recommended that the *Partnership* consider the creation of benchmarks and indicators, including impact indicators, for further consideration and decision by the UN Statistical Commission, in order to track progress towards the attainment of the specific goals and targets set out in the outcome documents of the WSIS.

11. During the past decade or so, a number of countries have made efforts to collect data on ICT in their society.⁶ As a result, they are now in a better position to:
 - Assess the impact of ICT on their economies;
 - Benchmark their economies and social situation against those of other countries;
 - Identify the type of qualified people needed to advance their country's information economy; and
 - Calculate the investment needed to provide businesses with access to different ICTs.

⁵ WSIS 2005.

⁶ "Society" is used in a broader context here and covers both social and economic realms.

12. In short, ICT statistics have helped policymakers and business people to make informed decisions about public policy measures and private investment in ICT.
13. Among developed economies, the NSOs of the members of the OECD have been producing statistics on the ICT sector and use of ICT by businesses in a reasonably harmonized way, on the basis of statistical developments facilitated by the OECD's Working Party on Indicators for the Information Society (WPIIS). As a result of this effort, a comparable set of such statistics is available for most OECD countries.
14. However, in developing economies, the availability of ICT indicators is still scarce, even though Governments, civil society and the business sector explicitly recognize the urgent need for such information. Many developing economies are preparing ICT-related policies and strategies without the guidance of statistical evidence. Reliable and timely indicators on ICT are needed to maximize its potential to facilitate a range of economic and social developments, including poverty reduction, increases in health and education standards, generation of new industries and employment opportunities, and improvements in competitiveness (see Box 2).

Box 2. Lack of data for ICT policymaking

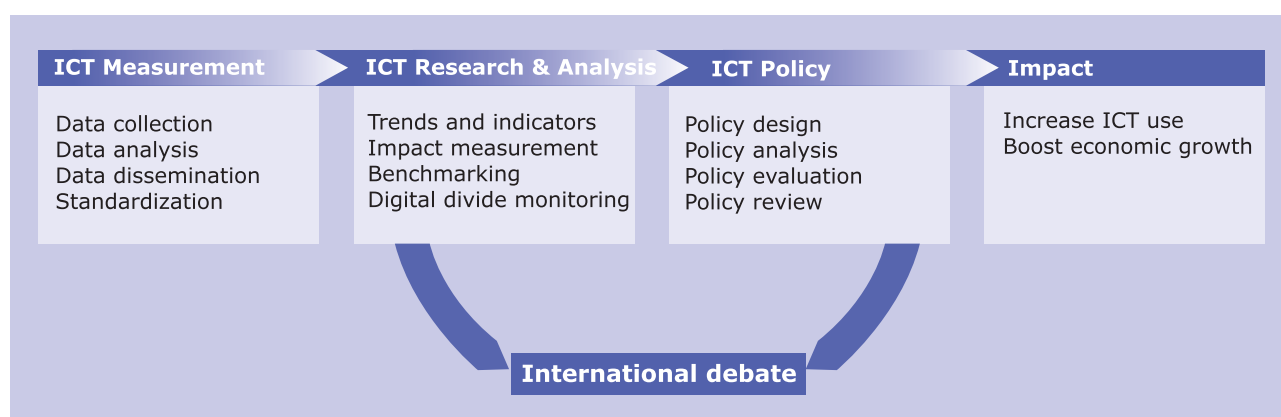
In many developing economies, ICT policies and strategies have been set up to foster access to, and use of, ICTs by individuals and organizations, and to integrate national markets into the global information economy. According to an UNCTAD survey, in 2006, 116 developing economies had introduced national ICT Master Plans (UNCTAD, 2006). At the same time, only 28 countries already had official statistics on the use of ICT by businesses. Without data on ICT access, use and impact, it will be difficult for policymakers to design, analyse, evaluate and review national ICT policies.

15. In many cases, developing economies need to increase their awareness about measurement efforts of other countries and may require assistance to incorporate ICT topics into their statistical programmes. With the increasing use of ICT by governments, businesses and households in those countries, it is essential to start measuring ICT now, for at least two reasons:
 - First, the development and growth of the information economy is irreversible – organizations and individuals all over the world are increasingly demanding and using ICT; and
 - Second, the experiences of countries that have started to collect information economy statistics show that it takes several years to design and implement a good national strategy for measuring the information economy and to incorporate ICT statistics into national strategies for the development of statistics (NSDS). Hence, the earlier that countries begin work on an e-measurement strategy, the more likely it is that they will achieve good results as ICT and e-business spread to more parts of the developing world.

2.2 UNCTAD's work on ICT measurement

16. With the aim of improving the ability of developing economies to formulate policies that will enable them to seize the benefits of ICT, the ICT Analysis Section of UNCTAD collects and publishes data on ICT use by businesses and on the state of the ICT sector. It also provides technical assistance and undertakes research and analysis (see Figure 1). These activities strengthen the statistical capacity of developing economies, allow UNCTAD to track global progress in the use of ICT and contribute to the evaluation of the WSIS implementation (see Box 1).

Figure 1. UNCTAD and ICT for development



17. Since 2004, UNCTAD has been collecting statistics on ICT business use and the ICT sector through an annual survey. The questionnaire is based on the *Partnership's* core list of ICT indicators (see Annex 1). Results from the annual survey feed into a database that supports UNCTAD research and analysis, and its advisory work on ICT policies, including ICT policy reviews.
18. UNCTAD analyses trends and developments in ICT access, use and impact in developing economies. In particular, it follows trends in e-commerce, the use of ICT by businesses for management and production, the impact of ICT on productivity, international trade in ICT goods and services, and the ICT sector. The research is published in UNCTAD's annual *Information Economy Report*, and disseminated at national, regional and international events, and through the dedicated website (<http://measuring-ict.unctad.org>). At the same time, UNCTAD raises the awareness of Governments about the importance of ICT statistics for monitoring ICT-related policies and assessing their impact.
19. UNCTAD provides technical assistance to developing economies on the measurement of ICT use by businesses and the ICT sector, focusing on:
 - Assisting NSOs in undertaking data collection, analysis and dissemination, including through advisory missions;
 - Organizing expert meetings and conducting technical workshops for practitioners in developing economies to enable exchanges of experiences and discussions of methodological, analytical and dissemination issues; and
 - Conducting training courses and developing training material, guidelines and other technical documentation on the collection of ICT statistics and the production of indicators.

20. UNCTAD is an active member of the Partnership on Measuring ICT for Development and a member of its Steering Committee. It also leads the *Partnership's* task group on capacity-building. This *Manual*, which is a contribution of UNCTAD to the *Partnership*, is aligned with the *Partnership's* objectives and recommendations.

2.3 The Partnership on Measuring ICT for Development

21. The international, multi-stakeholder *Partnership* was launched during UNCTAD XI in June 2004. It aims to identify and further develop different initiatives regarding the availability and measurement of ICT indicators at regional and international levels. It provides an open framework for coordinating ongoing and future activities, and for developing a coherent and structured approach to advancing the development of ICT indicators globally, and in particular in developing economies. The collaboration between Partner agencies ensures that there is no duplication of work and that resources are utilized efficiently.
22. The main objectives of the *Partnership* are:
- To facilitate agreement on internationally comparable ICT indicators and to develop methodologies to collect those indicators;
 - To assist in building statistical capacity in developing economies for the production of ICT statistics; and
 - To set up a global database on ICT indicators.
23. In 2009, partners are the ITU, the OECD, UNCTAD, the UNESCO Institute for Statistics (UIS), UN Regional Commissions (UNECLAC, UNESCWA, UNESCAP and UNECA), the World Bank and Eurostat. The Partnership Steering Committee is composed of the ITU, UNCTAD and UNECLAC.⁷
24. The *Partnership* has developed a core list of ICT indicators in the areas of ICT infrastructure and access, ICT access and use by households and individuals, ICT use by businesses, the ICT sector, trade in ICT goods, and ICT in education (see Annex 1). The core list was drawn up after an intensive consultation process involving NSOs worldwide (see Box 3) and was endorsed by the United Nations Statistical Commission (UNSC) at its 38th session in March 2007.⁸ The core list was revised in 2008 and presented to the UNSC at its 40th session in 2009.⁹

⁷ See List of Abbreviations at the beginning of this *Manual*.

⁸ The *Partnership* publication Core ICT Indicators (2005b) provided the first version of the definitions for the indicators and model questions for their collection.

⁹ The revised core list of ICT indicators is contained in Annex 1 of this *Manual* and in the document prepared by the *Partnership* (2009b) for the 40th session of the UNSC. See also <http://measuring-ict.unctad.org> for more information on the core list.

Box 3. Development of the core list of ICT indicators

Following the stocktaking exercise carried out by the *Partnership* in 2004, the United Nations Regional Commissions hosted several regional statistical workshops on ICT measurement. At these workshops, NSOs discussed the status of ICT statistics in their respective regions, and proposed regional core lists of indicators. The regional lists of indicators were presented for information to the United Nations Statistical Commission (UNSC) at its thirty-sixth session (New York, March 2005). Based on the regional lists, and feedback received from NSOs, the *Partnership* consolidated a core list of ICT indicators. The list was circulated to all NSOs for further comments and suggestions. A final list was discussed, and agreed upon, at the WSIS Thematic Meeting on Measuring the Information Society (Geneva, February 2005). The core list was endorsed by the UNSC at its thirty-eighth session (New York, March 2007). The core list was subsequently revised, including the addition of new indicators on ICT in education, and discussed by countries at the *Partnership's* Global Event on Measuring the Information Society (Geneva, May 2008), which was part of the WSIS cluster of events. The revised core list was presented to the UNSC at its fortieth session (New York, February 2009). The core list of ICT indicators has been widely disseminated and serves as a basis for the *Partnership's* work on measuring ICT.

25. The need for establishing international comparisons and benchmarks requires comparable sets of statistics across countries. The core list of ICT indicators is recommended as the basis for the collection of internationally comparable ICT statistics. The development of ICT indicators is a continuous process, and the *Partnership* will continue to review the list periodically to address evolving policy needs.
26. The core list is not mandatory and nor is it intended to be limiting – it is expected that national ICT policies may require larger numbers of indicators for planning, monitoring and evaluation (see Example 1). It is also expected that countries with different levels of development will have different priorities for the production of indicators.

Example 1. Inclusion of ICT indicators in household surveys in Latin America

In Latin America, thirteen countries (as of February 2007) are including the necessary questions in their permanent household surveys to collect the information required to calculate the core indicators on access to, and use of, ICT by households and individuals. The collection of these indicators is related to the interest in national policies targeted to providing access to ICT by the population.

Source: Partnership on Measuring ICT for Development, 2007.

27. The *Partnership* also monitors the availability of national statistics on ICT, and its partners collaborate to build the capacities of statisticians in order to help them improve the availability and quality of ICT statistics, as well as their analysis.
28. The ongoing work of the *Partnership* focuses on capacity-building, dissemination and database development, the development of new ICT indicators in the area of government, and the analysis of ICT impacts.
29. More information on the *Partnership*, its members and its activities can be found on UNCTAD's website (see <http://measuring-ict.unctad.org>).

PART B. METHODOLOGICAL ISSUES

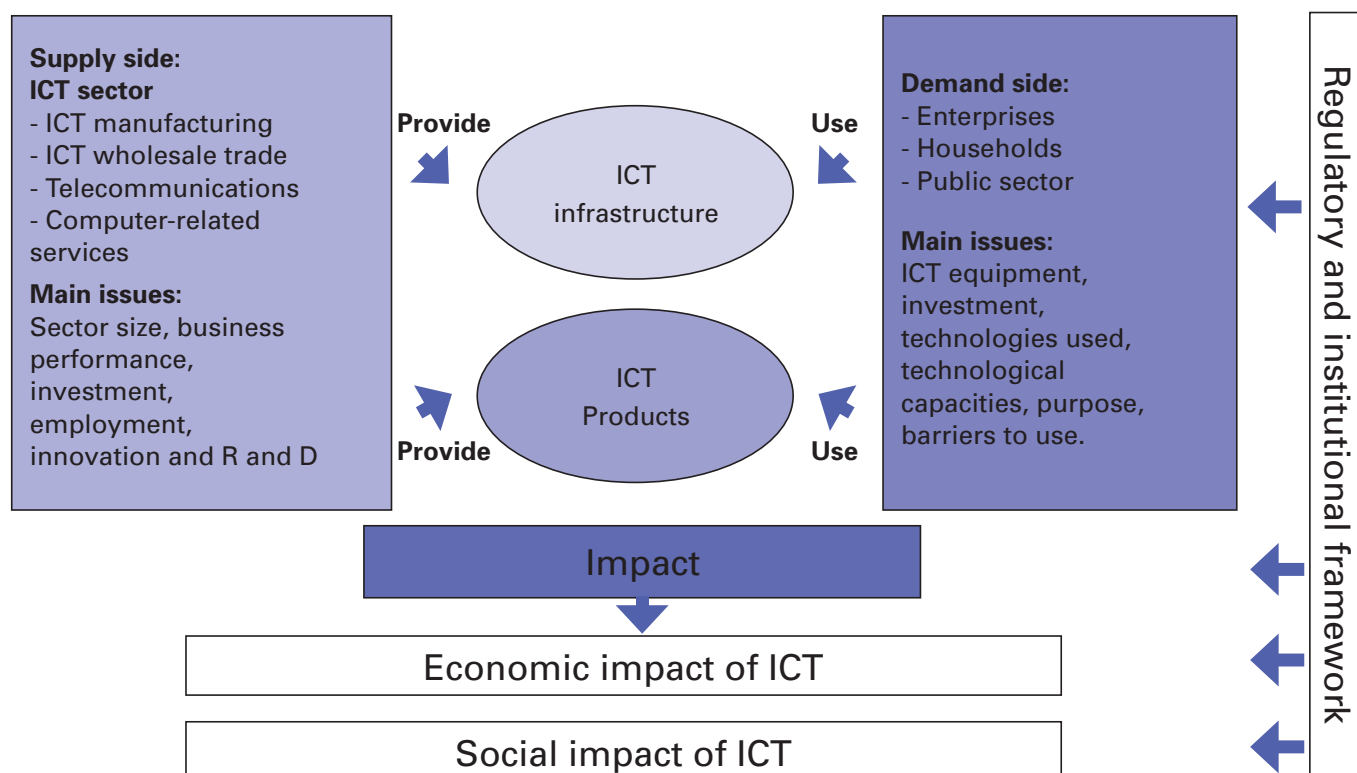
CHAPTER 3 - CONCEPTUAL FRAMEWORKS FOR ICT MEASUREMENT

30. This chapter presents the concepts underlying ICT measurement, with the objective of providing official statisticians, and others with an interest in ICT statistics, with a basic framework for measuring ICT. It includes a conceptual framework for information economy measurement and defines a number of concepts associated with e-business measurement.

3.1 A conceptual framework for the measurement of the information economy

31. A distinctive characteristic of the information economy is the intensive use by businesses of ICT for the collection, storage, processing and transmission of information. Business data from some industrialized countries show that improvements in productivity can be explained, at least partly, by use of ICT.
32. Use of ICT is supported by supply of goods and services produced by the ICT sector and through trade. Additionally, a robust ICT sector can contribute to aggregate labour productivity growth (OECD, 2007a; UNCTAD, 2007).
33. The information economy can be defined and measured, based on the 'building blocks' of supply and demand (see Figure 2). Statistical measurement instruments (surveys and other statistical operations) can cover these 'blocks' or conceptual areas.

Figure 2. The building blocks of the information economy



Source: adapted from OECD (2005).

34. Statistical operations can separately investigate the supply of and demand for ICT, as well as ICT infrastructure and trade.¹⁰ From the supply side, statistics are collected about the ICT sector, that is, ICT manufacturing and services industries that supply ICT infrastructure, goods and services. The output of the ICT sector in terms of goods can be classified using the World Customs Organization's (WCO) Harmonized System (HS) and equivalent national classifications.¹¹ ICT services are mainly estimated using the International Monetary Fund's (IMF) Balance of Payments (BOP) classification which is rather broad and only captures transactions between residents and non-residents. The ICT sector is defined in terms of the UN's International Standard Industrial Classification of All Economic Activities (ISIC) and equivalent national classifications (see Chapter 4).¹² Measurement from the demand side addresses access to, and use of, ICT by businesses, households and government organizations (though this *Manual* provides methodological advice on demand side measures of the business sector only).
35. The types of ICT indicators respond to different needs of policymakers and other data users, at different stages of ICT development:
- ICT readiness indicators (i.e. on the readiness of a country's infrastructure, society, economy and business sector to undertake ICT-related activities) are of particular interest to policymakers in countries at early stages of ICT maturity, but are likely to lose relevance or evolve as technologies become more prevalent;
 - ICT intensity indicators (i.e. on the use of ICT and the extent to which ICT-related activities are carried out by businesses and other institutional actors) are likely to be of interest to policymakers in countries where ICT is spreading;
 - Indicators on the outcomes and impacts of ICT on business activities and economic growth are likely to be of interest in countries with a relatively high level of ICT development.
36. Priorities for statistical work on ICT should follow users' needs. As national ICT policies move from diagnostic or design to implementation and to evaluation, decision makers will be interested in the corresponding phases of the statistical work (see Table 1).

¹⁰ Some countries have surveys for the measurement of other topics relating to the information economy, such as innovation and R&D in firms (based in the OECD/Eurostat Oslo Manual and OECD Frascati Manual), patents, and human resources in Science and Technology (OECD Canberra Manual).

¹¹ The UN's Central Product Classification has been used for the OECD's revised ICT goods classification (released in 2008).

¹² The ICT sector definition was revised by the OECD in 2006 in order to comply with ISIC Rev. 4.

Table 1. Policymaking and corresponding statistical work

Policymaking stages	Phases of statistical work	Main statistical issues
Diagnostic and design	Consultation with policymakers on their data needs Choice of indicators to be collected Data collection activity	Available statistical sources Definition of concepts Definition of indicators and questions Preparation of data collection instruments (questionnaires)
Implementation	Production of statistics Ongoing refinement of statistical needs	Relevance and accuracy of statistics and the resulting indicators Availability of sector, geographical and other breakdowns Accessibility of information (timeliness, metadata)
Evaluation	Data analysis	Coherence with other statistical data Sustainability of statistical series over time International comparability ICT satellite accounts

37. As indicated above, statistical programmes should reflect the evolution of information needs and are generally expected to extend and improve ICT measurement activities as technologies permeate society and the economy.
38. Evaluations of the impact of ICT on an economy may be studied through the compilation of ICT satellite accounts. Such an account is a national accounting tool and represents a statistical framework for organizing and presenting information about ICT products and ICT-related activity. It is based on the System of National Accounts (SNA) concepts, definitions and methods. Satellite accounts enable the calculation of the direct contribution of ICT to the main national accounting aggregates, such as gross fixed capital formation and gross domestic product (GDP). Few countries have to date made use of this approach.¹³ It integrates statistics related to the supply of ICT products (production, imports), and to the demand and use (intermediate consumption, final use, exports, capital formation, etc.) and can be considered as a major milestone in the statistical work on ICT. A pre-requisite for the preparation of satellite accounts is to establish classifications on industries and products used in all ICT-related surveys. It helps also to identify areas where deficiencies may exist in the collection of ICT statistics.

¹³ The Australian Bureau of Statistics has prepared several presentations of the progress made on this statistical exercise (http://www.unescap.org/stat/ict/ict2004/12.ABS_ICT_Satellite_Account_Framework.pdf). Other countries, including Chile (http://www.itu.int/ITU-D/ict/conferences/panama06/material/27_Chile_Presentation_satellite_account_s.pdf) and Azerbaijan have also worked on this topic.

39. In developing economies, especially the least developed countries (LDCs), ICT infrastructure, supply and use may be at a low level. Data on ICT are therefore likely to be scarce and measurement programmes will probably need to be prioritized. The internationally agreed core list of ICT indicators (see Annex 1) should provide guidance on the choice of priorities, while this *Manual* will help countries by providing guidance on the collection of relevant statistics.

3.2 Concepts of e-business

E-business

40. E-business refers to the use of ICT to facilitate business processes. Businesses can use ICT to communicate with government organizations, suppliers and clients (via email, for example) or to purchase and sell goods and services on line (e-commerce). ICT can also be used to automate business processes, to manage resources and to implement business policies (in marketing, human resources, finance, etc.). A diversity of business processes as well as barriers that hamper their use can be investigated in statistical surveys (see Example 2).

Example 2. Measurement of e-business processes in Senegal

In 2001, a survey of medium-sized and large industrial enterprises was carried out in Senegal. While almost all of the businesses (92 per cent) were connected to the Internet, in most cases only the head of the enterprise had access (because of the perception of high cost relative to the benefits). The most common use of the Internet was for email, to communicate primarily with suppliers, followed by internal business exchanges and customers. A reason cited for a low level of use of the Internet for other e-business processes (such as customer relationship management, banking and finance management or dealing with government institutions for administrative purposes) was that other partners, such as customers and suppliers, the Government, banks and insurance companies, were not using the Internet (yet) and therefore were not able to interact on line. The overall lack of local content useful for entrepreneurs (including business information, legal and regulatory documents, and administrative forms) was noted as another major reason for not using the Internet more frequently. At the same time, business owners felt that, in particular, on-line government could significantly contribute to reducing costs in terms of both time and transport.

Source: UNCTAD(2004).

41. For a definition of e-business that could be used for statistical purposes, several broad business functions are identified and described in terms of e-business processes (see table 2). In 2003, an OECD expert group on the measurement of e-business processes proposed a definition of e-business processes as those “(automated) business processes (both intra and inter-business) over computed mediated networks”. In addition, the group proposed that e-business processes should integrate tasks and extend beyond a stand-alone or individual application.

Table 2. Types of e-business processes

E-business process	Description
Customer acquisition and retention	Customer relationship management (CRM); marketing campaign management, planning and execution; database marketing, direct marketing and telemarketing; electronic catalogues; web activity analysis and web advertising; call centres; arranging repairs and maintenance; handling customer complaints
E-commerce	Sale or purchase/procurement of goods or services (includes getting estimates, negotiating, ordering, arranging contracts); electronic data interchange (EDI); mobile commerce; integration of ordering system with that of customers/suppliers; integrated invoicing and payment by customers; full integration with back-end systems; use of an extranet; secure transactions; automated payment of suppliers
Order fulfilment and order tracking	Order control, product control, order tracking; data processing that relates to order fulfillment or tracking; sales force automation
Logistics (inbound & outbound) and inventory control	Supply chain management (SCM); production and inventory control (including of raw materials, parts, finished goods), distribution control, management of inventory, management of customers' inventory, transportation and shipping, automated warehouse; arranging and managing transport, dispatch of goods, tracking, provision of services
Finance, budget and account management	Enterprise resource planning (ERP); managing, planning and evaluating finance; invoicing and payment systems; software systems
Human resource management	External and internal recruitment, on-line job applications; automation of administrative tasks such as time reporting, payment of salaries and pension schemes, travel reimbursement, tracking working hours and production time; training; tele-working
Product service and support	Website support, frequently asked questions (FAQ), downloadable manuals; on-line queries; after-sales support
Research and development	Research, development and design of products, services or processes; computer-aided design (CAD), computer-aided manufacturing (CAM) and collaborative design
Knowledge management	Systematically aggregating and disseminating information and knowledge within the business; content management system; e-learning

42. For the purpose of preparing a survey questionnaire, a pragmatic approach to the measurement of e-business is to select processes of particular interest for which feasible questions (easily responded to with yes/no) could be included in an economy-wide survey. The model questionnaires on ICT use by businesses proposed by OECD and Eurostat include questions that cover some e-business processes. This approach has also been followed in those developing economies that have started to collect ICT data from businesses (see Example 3).

Example 3. ICT business survey in Thailand

Since 2004, the National Statistical Office of Thailand, which reports to the Ministry of ICT, has carried out annual business surveys on the use of ICT. Previously, the NSO had included ICT-related questions in the Manufacturing Survey of 2003.

The questionnaires for the stand-alone surveys on the use of ICT investigate different aspects of e-business practices, such as the purposes of the use of Internet, the use of the firm's website and reasons for carrying out Internet purchases and sales. Options that can be recorded in the questionnaire (as yes/no answers) include use of the Internet for information search and monitoring the market, email and other communications, advertising, purchase and sale of goods and services, and, banking and financial services. On the use of a website, the questionnaire allows for multiple responses such as marketing of products, inquiries and contact facilitation, receiving purchase orders, providing after sales service, on-line payment and information networking. On the reasons for carrying out Internet transactions, the questionnaire allows grading the importance of a list of possible reasons. The questionnaire is structured in modules, which makes it easier for the firm to respond.

The 2004 and 2005 Information and Communication Technology Surveys implemented by the National Statistical Office of Thailand can be linked with the Manufacturing Surveys carried out for different reference years (2003, 2006) via the unique 11-digit registration code for firms. ICT variables collected in the Information and Communication Technology Surveys can therefore be linked, at the firm level, with business performance and other (for instance, employment) variables. Econometric models (in particular, Cobb-Douglas production functions) can thus be estimated and tested with microdata, to analyse the relationship between adoption and use of ICT and economic results. An alternative that does not allow for measuring a delayed impact is to jointly analyse the economic and ICT variables contained in only one survey, namely the Manufacturing Survey 2003.

The results showed that firms with a combined use of computers, the Internet and the website had an average 21% higher sales than firms without any of the ICTs considered, after controlling for a series of firm-specific economic characteristics, as well as industry and regional aspects of demand and supply. Among the three ICTs considered, computers contributed with 14%, Internet access with 3% and web presence with 4%. Results also suggested that an increase of 10% in the share of employees using computers is associated with 3.5% higher sales per employee in Thai manufacturing firms. Differences were found regarding to size: the link between ICT use and labour productivity is strongest in large firms. Regional patterns were also found.

The approach followed by the NSO of Thailand can be considered good practice for countries willing to start the collection of ICT indicators. In a first phase, a set of indicators is produced by including a module on ICT in an existing survey. In a second phase, the available information is increased by carrying out a stand-alone survey on the use of ICT.

Source: UNCTAD (2008) and Thailand NSO 2004 and 2005 Information and Communication Technology Survey (<http://web.nso.go.th/>).

43. Analyses of the impact of e-business on business performance and growth have so far been supported by statistical evidence consisting of aggregate indicators and business micro-data from developed countries. Developing economies should take into account their requirements for further data analysis when planning investigations on e-business and determining a particular form of data collection. In particular, the need for linking data on e-business from stand-alone ICT surveys with other information on the business' performance (such as information from taxation records and general business surveys) should be taken into account.
44. Developing economies could also consider the possibility of including a module on e-business in current business surveys, thereby enabling the linkage of ICT with economic variables in order to analyse the impact of e-business processes on business performance. These options are further discussed in Chapter 5.

E-commerce

45. Electronic transactions (or e-commerce) are at the core of the statistical measurement of e-business. The great policy interest in measuring the volume and characteristics of e-commerce has driven theoretical work in expert groups (such as the OECD's WPIIS) and practice by statistical offices and other institutions.
46. The need for an operational definition of e-commerce, suitable as a basis for items in statistical questionnaires, was recognized early by expert groups. In 2000, OECD member countries endorsed two definitions of electronic transactions based on a narrow and a broad definition of the communications infrastructure. According to the OECD definitions, it is the method by which the order is placed or received, not the payment or channel of delivery, which determines whether the transaction is an electronic commerce transaction. The narrow definition of electronic commerce transactions refers to those conducted over the Internet, whilst the broad definition refers to all computer-mediated networks (see Box 4).

Box 4. OECD definitions of electronic commerce transactions and interpretation guidelines

The OECD provides two definitions for e-commerce transactions and guidelines for their interpretation:

Broad definition of e-commerce transactions: An electronic transaction is the sale or purchase of goods or services, whether between businesses, households, individuals, Governments, and other public or private organizations, conducted over computer-mediated networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off line.

As a guideline for the interpretation of the definition above, the OECD notes that the broad definition includes orders received or placed on any on-line application used in automated transactions, such as Internet applications, electronic data interchange (EDI) or interactive telephone systems.

Narrow definition of e-commerce transactions: An Internet transaction is the sale or purchase of goods or services, whether between businesses, households, individuals, Governments, and other public or private organizations, 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 off line.

As a guideline for the interpretation of the definition above, the OECD notes that the narrow definition includes orders received or placed on any Internet application used in automated transactions, such as web pages, extranets and other applications that run over the Internet such as EDI over the Internet or over any other web-enabled application regardless on how the Web is accessed (e.g. through a mobile phone or a TV set, etc.). The definition excludes orders received or placed by telephone, facsimile or conventional email.

Source: Adapted (slightly) from OECD, 2005 and 2007a.

47. The measurement of electronic transactions presents specific difficulties. In relation to the communications infrastructure over which the transactions are carried out, technological convergence (in particular the inter-operability of communication networks) is making it more difficult to distinguish Internet electronic commerce from electronic commerce conducted over other networks. Potential data collection problems include:
 - The small volume of e-commerce activity in the economy, with consequent high standard errors and poor reliability of disaggregated data, and
 - Poor quality of reported data resulting from the lack of record keeping and often misunderstanding of statistical e-commerce concepts.¹⁴

¹⁴ Other statistical difficulties in e-commerce measurement are described in OECD, 2005 and 2007a.

48. In order to take into account the different situations in countries in terms of technological development, the *Partnership* recommends collecting data only on whether orders are received or placed *over the Internet*, including by email (the latter is excluded from the OECD definitions).
49. Some countries have collected data on e-commerce by relevant breakdowns such as the nature of products or location of the buyer/seller. The reliability of these splits has been questioned (for instance, a business may not know or have recorded the destination of its on-line sales) and therefore such a breakdown is not recommended for countries starting data collection on the use of ICT by businesses.

CHAPTER 4 - STANDARDS FOR INDICATORS ON ICT USE BY BUSINESSES, THE ICT SECTOR, AND TRADE IN ICT GOODS

50. This chapter describes the main statistical standards covering the calculation of the core ICT indicators on: use of ICT by businesses, the ICT sector, and trade in ICT goods. It presents the *Partnership's* core ICT indicators and associated metadata, such as methods of calculation and definitions of terms. Related information can be found in Chapter 6 (model questions and questionnaires for business ICT use surveys) and Chapter 7 (designing business ICT surveys, including questions of scope, coverage, units, sampling and data processing).
51. Besides the core list of indicators, other measurement areas are briefly mentioned in the chapter regarding the access to and use of ICT by businesses. These include the use of mobile phones, investment in ICT, IT security measures, as well as advanced topics related to e-commerce. It is likely that these topics will be of interest in countries with high penetration of ICT in the business sector, but the inclusion of related questions in survey modules on ICT (rather than stand-alone surveys, see Chapter 5) will probably not be considered in countries with little experience in ICT surveys. OECD and Eurostat model questionnaires can be adapted for investigating these topics.

4.1 Measuring ICT demand (use)

Core indicators on the use of ICT by businesses

52. The core list of ICT indicators includes 12 indicators on the use of ICT by businesses. Two of the core indicators (indicators B9 and B12) are breakdowns of another indicator (B3). For each indicator, a definition of the main concepts involved is provided in Table 3, as well as references to the method of calculation. Chapter 6 provides model questions that may be included in questionnaires to collect the necessary information to compute the indicators. A questionnaire provided in Annex 2 shows a logical sequence for the model questions.
53. The core ICT indicators are expressed in terms of *proportions* obtained as quotients of a numerator that refers to the characteristic to be measured and a denominator that refers to the reference population. The use of proportions rather than absolute figures allows ready comparison of the resulting data across industries, size intervals, countries and any other available classificatory variables. Methods for estimating proportions (and their associated statistical errors) from a sample are further discussed in Chapter 7 and Annex 5 of this *Manual*.
54. The denominator of the core indicators on use of ICT by businesses is the population to which the indicator refers (e.g. the total number of businesses or the total number of employees). The population will be determined by the scope (and coverage) of the survey. Ideally, countries should collect indicators in respect of the whole business sector (or at least per the scope recommendations associated with the core indicators). However, countries may decide, according to their industrial structure, policy needs or resources available, to investigate only parts of the business sector (e.g. the manufacturing sector). In any case, the description of the scope (and coverage) of the survey is a key item of metadata (see Chapter 7).

Table 3. Core indicators on the use of ICT by businesses

Core indicator		Definitions and method of calculation	Concepts
B1	Proportion of businesses using computers	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.	A computer refers to a desktop or a laptop computer. It does not include equipment with some embedded computing abilities such as mobile cellular phones, personal digital assistants or TV sets.
B2	Proportion of persons employed routinely using computers	The proportion of persons employed routinely using computers is calculated by dividing the number of persons employed routinely using computers (in all in-scope businesses) by the total number of persons employed (in all in-scope businesses).	Persons employed refer to all persons working for the business, not only those working in clerical jobs. They include short-term and casual employees, contributing family workers and self-employed persons, who may be paid or unpaid. The definition is aligned with UNSD and ILO standards. Computer: as above
B3	Proportion of businesses using the Internet	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.	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, irrespective of the device used (not assumed to be only via a computer it may also be by mobile phone, games machine, digital TV etc.). Access can be via a fixed or mobile network
B4	Proportion of persons employed routinely using the Internet	The proportion of persons employed routinely using the Internet is calculated by dividing the number of persons employed routinely using the Internet (in all in-scope businesses) by the total number of persons employed (in all in-scope businesses).	Persons employed: as above Computer: as above Internet: as above
B5	Proportion of businesses with a web presence	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.	A web presence includes a website, home page or presence on another entity's website (including a related business). It excludes inclusion in an on-line directory and any other web pages where the business does not have control over the content of the page.
B6	Proportion of businesses with an intranet	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.	An intranet refers to an internal communications network using Internet protocols and allowing communication within an organization (and to other authorized persons). It is typically set up behind a firewall to control access.

Core indicator	Definitions and method of calculation	Concepts
B7 Proportion of businesses receiving orders over the Internet	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 can be presented as the proportion of in-scope businesses using the Internet.	Orders received include orders received via the Internet whether or not payment was made online. They include orders received via websites, specialized Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones and email. They also include orders received on behalf of other organizations – and orders received by other organizations on behalf of the business. Orders received exclude orders that were cancelled or not completed.
B8 Proportion of businesses placing orders over the Internet	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 can be presented as the proportion of in-scope businesses using the Internet.	Orders placed include orders placed via the Internet whether or not payment was made online. They include orders placed via websites, specialized Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones and email. Orders placed exclude orders that were cancelled or not completed.
B9 Proportion of businesses using the Internet by type of access (narrowband, fixed broadband and mobile broadband) Response categories:	This indicator should be calculated as the proportion of in-scope Internet-using businesses that use each type of access service, for instance, the proportion of Internet-using businesses that use a broadband service as their means of access.	It is expected that countries will collect data at a finer level than 'narrowband' and 'broadband'. The categories chosen by countries should allow aggregation to total narrowband and total broadband, as well as fixed and mobile broadband, as defined below. As businesses can use more than one type of access service, multiple responses are possible.
- Narrowband		Narrowband includes analogue modem (dial-up via standard phone line), ISDN (Integrated Services Digital Network), DSL at speeds below 256kbit/s, and mobile phone and other forms of access with an advertised download speed of less than 256 kbit/s. Note that narrowband mobile phone access services include CDMA 1x (Release 0), GPRS, WAP and i-mode.
- Fixed broadband		Fixed broadband refers to technologies such as DSL (Digital Subscriber Line) at speeds of at least 256kbit/s, cable modem, high speed leased lines, fibre-to-the-home, powerline, satellite, fixed wireless, Wireless Local Area Network and WiMAX.
- Mobile broadband		Mobile broadband access services include Wideband CDMA (W-CDMA), known as Universal Mobile Telecommunications System (UMTS) in Europe; High-speed Downlink Packet Access (HSDPA), complemented by High-Speed Uplink Packet Access (HSUPA); CDMA2000 1xEV-DO and CDMA 2000 1xEV-DV. Access can be via any device (mobile cellular phone, laptop, PDA, etc.)

Core indicator		Definitions and method of calculation	Concepts
B10	Proportion of businesses with a local area network (LAN)	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.	A LAN refers to a network connecting computers within a localized area such as a single building, department or site; it may be wireless.
B11	Proportion of businesses with an extranet	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.	An extranet is a closed network that uses Internet protocols to securely share a business' information with suppliers, vendors, customers or other businesses partners. It can take the form of a secure extension of an Intranet that allows external users to access some parts of the business' Intranet. It can also be a private part of the business' website, where business partners can navigate after being authenticated in a login page.
B12	Proportion of businesses using the Internet by type of activity Response categories:	The proportion of businesses using the Internet by type of activity can be calculated as: either the proportion of in-scope businesses or the proportion of Internet-using businesses that undertook each 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.	Internet: as above. Businesses should be asked about all Internet activities (that is, the question used by countries should specify multiple responses). Activities are not necessarily mutually exclusive.
	- Sending or receiving e-mail		
	- Telephoning over the Internet/VoIP, or using video conferencing		Using Skype, iTalk, etc. Includes video calls (via webcam)
	- Use of instant messaging, bulletin boards		

Core indicator	Definitions and method of calculation	Concepts
- Getting information about goods or services		
- Getting information from general government organizations		General government organizations should be consistent with the SNA93 (2008 revision) concept of general government. According to the SNA "... the principal functions of government are to assume responsibility for the provision of goods and services to the community or to individual households and to finance their provision out of taxation or other incomes; to redistribute income and wealth by means of transfers; and to engage in non-market production." (General) government organizations include central, state and local government units.
- Interacting with general government organizations		Includes downloading/requesting forms, completing/ lodging forms on line, making on-line payments and purchasing from, or selling to, government organizations. It excludes getting information from government organizations.
- Internet banking		Includes electronic transactions with a bank for payment, transfers, etc. or for looking up account information.
- Accessing other financial services		Includes electronic transactions via the Internet for other types of financial services such as share purchases, financial services and insurance.
- Delivering products on line		Delivering products on line refers to products delivered over the Internet in digitized form, e.g. reports, software, music, videos, computer games; and on-line services, such as computer-related services, information services, travel bookings or financial services.
- Internal or external recruitment		Including having details of vacant positions on an intranet or website.
- Staff training		Includes e-learning applications available on an intranet or from the WWW.

Source: Partnership on Measuring ICT for Development, 2009b.

55. For all indicators, sub-indicators may be calculated by using the classificatory variables *economic activity* (referred to as *industry* in many countries) and size (in terms of number of employees). In order to investigate the existence of digital gaps or economic differences between businesses located in *urban* and *rural* areas, countries could also present the results broken down by geographical classification (usually, according to the location of a business' headquarters). This may be difficult where the recommended statistical unit – the enterprise – is used because some enterprises consist of a number of establishments in different locations. In this case, it is recommended that data be presented at the enterprise level (see Chapter 7).
56. The recommended breakdown of indicators on the use of ICT by size of business, economic activity and geographical location is further examined in Chapter 7 and discussed in terms of dissemination in Chapter 8.
57. As Table 3 shows, some indicators (B7, B8, B9 and B12) may be alternatively presented as proportions of the population of businesses that use the Internet (see Box 5). This requires changing the denominator to the total number of businesses that use the Internet and users should be informed of that difference. For international comparisons, it is simpler to compare results when referred to the whole population of businesses.

Box 5. Alternative presentations of ICT indicators

The following tables show the alternative ways in which indicator B9 can be calculated and presented (for each size category and for the total population): in Table A, absolute numbers provide a reference to the proportions; in Table B, indicator B9 is calculated as a proportion of the total business population (i.e., dividing each row in Table B by row 1 of Table A and expressing the result as a percentage); in Table C, indicator B9 is calculated as a proportion of the Internet-using business population (i.e. dividing each row in Table B by row 2 of Table A).

Table A. Absolute figures

Indicator	All businesses	Number of employees			
		0-9	10-49	50-249	250 and more
Number of businesses	36,200	30,000	5,000	1,000	200
B3: Proportion of businesses using internet	4,150	3,000	800	200	150
B9: of which:	-	-	-	-	-
- narrowband	1,265	1,000	200	50	15
- broadband	2,885	2,000	600	150	135
- fixed broadband	2,620	1,900	500	120	100
- mobile broadband	265	100	100	30	35

Table B. B9 expressed as proportions of the total business population

Indicator	All businesses	Number of employees			
		0-9	10-49	50-249	250 and more
Number of businesses	36,200	30,000	5,000	1,000	200
B3: Proportion of businesses using internet	4,150	3,000	800	200	150
B9: of which:	-	-	-	-	-
- narrowband	3.5%	3.3%	4.0%	5.0%	7.5%
- broadband	8.0%	6.7%	12.0%	15.0%	67.5%
- fixed broadband	7.2%	6.3%	10.0%	12.0%	50.0%
- mobile broadband	0.7%	0.3%	2.0%	3.0%	17.5%

Table C. B9 expressed as proportions of the Internet-using business population

Indicator	All businesses	Number of employees			
		0-9	10-49	50-249	250 and more
Number of businesses	36,200	30,000	5,000	1,000	200
B3: Proportion of businesses using internet	4,150	3,000	800	200	150
B9: of which:	-	-	-	-	-
- narrowband	30.5%	33.3%	25.0%	25.0%	10.0%
- broadband	69.5%	66.7%	75.0%	75.0%	90.0%
- fixed broadband	63.1%	63.3%	62.5%	60.0%	66.7%
- mobile broadband	6.4%	3.3%	12.5%	15.0%	23.3%

58. For indicator *B9 Proportion of businesses using the Internet by type of access*, the response categories should cover the range of technological options and should enable aggregation to *total narrowband* and *total broadband*. The interest is usually focused on the bandwidth of the connection, that is, the amount of data that can be sent or downloaded measured in kilobits per second (Kbit/s). There is a distinction between narrowband and broadband, defined as bandwidths below or above 256 Kbit/s respectively.
59. The importance of measuring the bandwidth is related to the significant improvements that the adoption of broadband brings in terms of enabling the full capabilities of Internet-based applications, such as Internet-based telephony (which can significantly reduce the cost of communications); reducing the time required for performing e-business processes; and allowing more users to connect simultaneously to the Internet. Different technological options are presented in Table 4 (including the distinction between narrowband and broadband), but it is expected that countries will collect data at a more detailed level in their questionnaires. The categories chosen by countries should allow aggregation to total narrowband and total broadband, as well as fixed and mobile broadband (see definitions in Table 4). Co-operation with national telecommunications authorities may help statistical offices in preparing the list of response categories, based on the available technologies at the moment of the survey.

Table 4. Types of connection to the Internet

Type of connection	Description
Narrowband (download speed of less than 256 Kbit/s, in one or both directions)	Analogue modem (dial-up via standard phone line). The modem converts a digital signal into analogue for transmission by traditional (copper) telephone lines. It also converts analogue transmissions back to digital.
	Integrated Services Digital Network (ISDN). ISDN is a telecommunication service that turns a traditional (copper) telephone line into a higher speed digital link. ISDN is usually considered to be narrowband.
	DSL (Digital subscriber Line) at speeds below 256kbit/s
	Other narrowband includes mobile phone and other forms of access. Narrowband mobile phone access services include CDMA 1x (Release 0), GPRS, WAP and i-mode. Countries should add appropriate category/ies to questionnaires based on services available.
Broadband (download speed equal to or greater than 256 Kbit/s, in one or both directions)	Fixed broadband Fixed broadband refers to technologies such as DSL (Digital Subscriber Line) at speeds of at least 256kbit/s, cable modem, high speed leased lines, fibre-to-the-home, powerline, satellite, fixed wireless, Wireless Local Area Network and WiMAX.
	Mobile broadband Mobile broadband access services include Wideband CDMA (W-CDMA), known as Universal Mobile Telecommunications System (UMTS) in Europe; High-speed Downlink Packet Access (HSDPA), complemented by High-Speed Uplink Packet Access (HSUPA); CDMA2000 1xEV-DO and CDMA 2000 1xEV-DV. Access can be via any device (mobile cellular phone, laptop, PDA, etc.)
	Countries should add appropriate category/ies to questionnaires based on services available.

Source: Partnership on Measuring ICT for Development, 2009b.

Other ICT demand (use) indicators

60. In addition to collecting information to produce the core ICT indicators, countries may be interested in information on other aspects of ICT demand, including: the use of mobile phones for business-related activities, current and capital expenditure on ICT, IT security measures and experiences, type and value of goods purchased and sold via e-commerce, and barriers to ICT.
61. The use of mobile phones is increasingly changing the way small businesses in developing countries are conducting their operations, in particular when fixed telephone lines are not available.¹⁵ The potential impact of mobile phones on business performance is therefore gaining increasing attention. Collecting indicators on business mobile phone use is a new area and so far untested by most NSOs. Table 5 offers possible indicators on business mobile phone use. Mobile phone use indicators and model questions will be further developed as users' needs and mobile services available become clearer. Countries interested in collecting mobile phone indicators may also want to include questions on the use of fixed telephony, which would allow comparison between the two technologies.

Table 5. Proposed indicators and model questions on mobile phone use in businesses

Code	Indicator	Calculation	Definitions and notes
M1	Proportion of businesses using mobile phones	The proportion of businesses using mobile phones is calculated by dividing the number of in-scope businesses using mobile phones during the 12-month reference period by the total number of in-scope businesses.	<i>Mobile phones</i> refer to portable telephones subscribing to a 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.
M2	Proportion of businesses receiving orders via mobile phones	The proportion of businesses receiving orders via mobile phones is calculated by dividing the number of in-scope businesses receiving orders via mobile phones by the total number of in-scope businesses. Alternatively, output can be presented as the proportion of in-scope businesses using mobile phones.	<i>Mobile phones</i> : as above <i>Orders received</i> include orders received via mobile phones whether or not payment was made via mobile phones.
M3	Proportion of businesses placing orders via mobile phones	The proportion of businesses placing orders via mobile phones is calculated by dividing the number of in-scope businesses placing orders via mobile phones by the total number of in-scope businesses. Alternatively, output can be presented as the proportion of in-scope businesses using mobile phones.	<i>Mobile phones</i> : as above <i>Orders placed</i> include orders placed via mobile phones whether or not payment was made via mobile phones.

¹⁵ For more information on mobile phone use by businesses, see UNCTAD, 2006 and UNCTAD, 2008.

M4	Proportion of businesses using mobile phones by type of activity	The proportion of businesses using mobile phones by type of activity can be calculated as: either the proportion of in-scope businesses or the proportion of mobile phones-using businesses that undertook each activity. Possible response categories:	<i>Mobile phones</i> : as above
		- For getting information about goods or services	
		- For sending or receiving email	
		- For accessing the Internet	
		- For accessing banking or other financial services	Includes electronic transactions with a bank for payment, transfers, etc. or for looking up account information.
		- For interacting with general government organizations	General government organizations are defined in table 3.
		- For providing customer services	<i>Customer services</i> include providing prices and product information through SMS, information on available account credit, product configuration, etc.
		- For delivering products over the mobile phone line	Delivering products over the mobile phone line refers to goods and services delivered over the line in digitized form, e.g. ring tones, software, music, videos, games.

62. Investment in ICT by businesses indicates the effort to update operations of the business sector and can also provide a partial measure of the size of the national ICT market (see Example 4). It is important to recall that in many countries, national policies to foster the use of ICT also provide fiscal benefits to businesses adopting technologies.

Example 4. Measurement of investment in ICT goods and services in the Republic of Moldova

The survey 'Situation regarding the informatisation and availability of computer techniques' carried out by the Department of Statistics of the Republic of Moldova includes a set of quantitative questions on: total expenditure on acquisition of ICT goods (broken down by own budget and governmental grants), investment and current expenditure on ICT projects, purchase and licensing of software, and training of staff in ICT. These values can be aggregated at the firm level and further broken down by economic activity, size of firm and other classification variables recorded on the questionnaire, as well as analysed in relation to the performance of firms, via the linkage of questionnaires from different surveys.

Source: Survey questionnaire, Department of Statistics, Republic of Moldova.

63. IT security measures are included in the OECD model questionnaire (Annex 3) and in the Eurostat 2006 model questionnaire via specific yes/no questions on security measures in place. The OECD model includes the following IT security measures: virus protection software, anti-spyware, firewall, spam filter, secured communication between clients and servers, authentication software or hardware, intrusion detection systems, regular backup of critical data and offsite backup. IT security problems experienced (e.g. virus attacks resulting in loss of data or time) may also be asked about (though businesses may be reluctant to provide information on security breaches).
64. Countries wishing to further explore the extent of e-commerce can include questions on the type and value of goods purchased or sold via e-commerce. In order to overcome the difficulty of recording exact values, questionnaires could include a question on the percentage of total purchases and/or sales attributable to e-commerce, in intervals (e.g. less than 1 per cent, 1 per cent to 5 per cent, 6 per cent to 10 per cent, 11 per cent to 25 per cent, more than 25 per cent). An alternative approach that enables aggregation of values for the business sector is to include questions asking for the percentage of value of e-commerce (purchases and/or sales) and the total value of all purchases and/or sales, so that e-commerce values are obtained, at the business level, by multiplication. The resulting values can then be aggregated for the business sector. For example, the Eurostat 2008 questionnaire presents alternative questions for measuring the purchases over computer networks (see Example 5 and Annex 4), while the OECD model questionnaire distinguishes the value of physical and digitized products, as well as services ordered on line (but provided off line).

Example 5. Measurement of purchases by e-commerce in the Eurostat 2008 questionnaire

The Eurostat 2008 questionnaire includes two alternative questions to measure the value of purchases (orders placed via computer networks):

Please indicate for 2007 the percentage of orders that were sent electronically in relation to the total purchases' value (in monetary terms, excluding VAT)

- Less than 1%
- 1% or more and less than 5%
- 5% or more and less than 10%
- 10% or more and less than 25%
- 25% or more

Alternative question:

Please state the value of purchases resulted from orders that were placed electronically (in monetary terms, excluding VAT) (national currency)

If you can't provide this value:

Please indicate an estimate of the percentage of the total purchases that resulted from orders placed electronically, in 2007 _____(%)

Source: Eurostat.

65. The types of indicators described above will not be fully explored in this *Manual*; countries interested in their measurement should consider existing experiences, such as those of OECD and Eurostat countries and some developing economies with a particular interest in information economy measurement.

4.2 Measuring the ICT sector (supply of ICT goods and services)

66. Central to the ICT statistical system is the measurement of the supply side, that is, the ICT sector and its products (goods and services). This requires the statistical coverage of economic activities such as ICT manufacturing, wholesale trade of ICT goods, telecommunications and computer-related services. As for any other economic activity, key statistical information about the ICT sector includes indicators on production of goods and services, labour force and business performance (income, value added and productivity measures). This section deals with the statistical definition of the ICT sector and with the relevant core indicators.
67. General business surveys and censuses of manufacturing or services sectors may partly cover the ICT sector, and complementary information can be obtained via the analysis of foreign trade in ICT goods (see section 4.3).

Definition of the ICT sector

68. The definition of the ICT sector used in this *Manual* was established by the OECD's WPIIS. The original definition was agreed in 1998 and based on ISIC Rev. 3. With the revision of ISIC to Rev. 3.1, a refinement to ICT wholesaling was introduced in 2002.
69. The principles applied to the 1998 and 2002 definitions of the ICT sector by the OECD were (OECD, 2005):

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, or
- must use electronic processing to detect, measure and/or record physical phenomena or to 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.

70. The ISIC Rev. 3.1 categories comprising the ICT sector (2002) are shown in Box 6 below.

Box 6. The 2002 OECD ICT sector definition (based on ISIC Rev. 3.1)

ICT Manufacturing

- 3000 Manufacture of office, accounting and computing machinery
- 3130 Manufacture of insulated wire and cable*
- 3210 Manufacture of electronic valves and tubes and other electronic components
- 3220 Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
- 3230 Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
- 3312 Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment*
- 3313 Manufacture of industrial process control equipment*

ICT 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

* The activity of these classes is excluded from the OECD's 2007 definition of the ICT sector (see Box 7).

Source: OECD, 2005 and 2007b.

71. In 2006, a WPIIS expert group recommended a revision based on (the then near final) ISIC Rev. 4; the revision was agreed by OECD countries in 2007. An important point to note is that the 2007 definition is different to the 2002 version in respect of the 'guiding principles' used to define the ICT sector. The major change is to remove the principle that products of the ICT sector include those that "...use electronic processing to detect, measure and/or record physical phenomena or to control a physical process." Both the 2002 and 2007 definitions exclude retail trade of ICT goods. The main reason for this is that a large part of the value of such trade is undertaken by non-specialized retailers (such as department stores).
72. With a medium-term view, this revision of the *Manual* recommends to adopt the 2007 definition of the ICT sector in Box 7 below, based on ISIC rev. 4 codes. However, it is important to note that, while correspondences have been established between ISIC rev. 3.1 and ISIC rev. 4, the new definition is not a one-to-one transformation of industry codes.¹⁶

¹⁶ Given that the implementation of ISIC Rev. 4 will take several years for most countries, it is likely that many countries will continue to use the 2002 definition (based on ISIC Rev. 3.1) for at least the next 3–4 years. The timetable proposed for countries to adapt national classifications to ISIC Rev. 4 is 2009 and to use it for statistical programmes from 2011. The UNSC has requested that the timeline is reviewed, recognizing the need for flexibility and the desirability of advancing the adoption (UNSC, 2007).

Box 7. The 2007 OECD ICT sector definition (based on ISIC Rev. 4)

ICT manufacturing industries

- 2610 Manufacture of electronic components and boards
- 2620 Manufacture of computers and peripheral equipment
- 2630 Manufacture of communication equipment
- 2640 Manufacture of consumer electronics
- 2680 Manufacture of magnetic and optical media

ICT trade industries

- 4651 Wholesale of computers, computer peripheral equipment and software
- 4652 Wholesale of electronic and telecommunications equipment and parts

ICT services industries

- 5820 Software publishing
- 61 Telecommunications
- 62 Computer programming, consultancy and related activities
- 631 Data processing, hosting and related activities; Web portals
- 951 Repair of computers and communication equipment

Source: OECD, 2007b.

73. The United Nations Statistics Division (UNSD) has recognized the OECD ICT sector definitions (both 2002 and 2007) and publishes them as 'alternate structures' of ISIC.¹⁷
74. In conjunction with its 2006 review of the ICT sector, the OECD defined a *Content and media sector*. It includes: publishing (including music but excluding software); programme activities (motion picture, video and television); sound recording; and programming and broadcasting activities.
75. Many countries use national industrial classifications that correspond with ISIC Rev. 3.1 and can therefore establish correspondences with ISIC rev. 4. They should establish a definition of the ICT sector based on their national classification, noting that it should be as comparable as possible with the international standard shown in Box 6 and Box 7. Ideally, the level of detail for the collection of information about the economic activity of businesses should allow classifying them both by ISIC rev. 3.1 and rev. 4 codes.
76. It is likely that some countries use national classifications of activities that do not correspond well with ISIC Rev. 3.1, or that the statistics on the ICT sector are based on a business register that does not include an industry code (or at least not at a level of detail enabling identification of all the ISIC classes comprising the ICT sector). In such cases, special efforts should be made by the statistical office to establish the necessary correspondences.¹⁸

¹⁷ The ISIC Rev. 3.1 alternate structure for the ICT sector can be found at: http://unstats.un.org/unsd/cr/registry/docs/i31_ict.pdf. The ISIC Rev. 4 alternate structure has been agreed and can be found at: <http://unstats.un.org/unsd/cr/registry/isic-4.asp>.

¹⁸ The harmonization of classifications of economic activities goes beyond the scope of this *Manual*.

77. The introduction of ISIC Rev. 4 should be taken as an opportunity to update national classifications and classification fields on business registers (or other registers used as population frames for business surveys). The adaptation of international classifications by countries can involve the addition of extra detail in selected areas or the collapse of some categories if certain breakdowns are deemed not to be relevant. In the latter case, care should be taken not to collapse any of the 4-digit categories comprising parts of the ICT sector (for instance, ICT manufacturing). It is proposed that countries adapt national classifications to ISIC Rev. 4 by 2009 at the latest and use it for statistical programmes starting in 2011.¹⁹
78. To help countries to assess the compliance of a national classification with ISIC (or other international standards), the UNSD has outlined a series of checks which cover compliance with the classification structure and classification principles, comparability of data and use of the national classification in the statistical system (UNSD, 2005).

Core indicators on the ICT sector

79. The core list of ICT indicators recommended by the *Partnership* includes two core indicators on the ICT sector: the proportion of total business sector workforce involved in the ICT sector and the proportion of total value added (see Table 6).

Table 6. Core indicators for the ICT sector

Code	Indicator	Calculation	Definitions and notes
ICT1	Proportion of total business sector workforce involved in the ICT sector	The proportion of total business sector workforce involved in the ICT sector is calculated by dividing the ICT sector workforce by the total business sector workforce (expressed as a percentage).	ICT workforce (or ICT employment) consists of those persons employed in businesses that are classified as belonging 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 (FTE) or hours worked. Currently, total headcounts or jobs are used for most countries.
ICT2	Value added in the ICT sector (as a percentage of total business sector value added).	Value added in the ICT sector is calculated as the estimated value added of the ICT sector divided by total business sector value added (expressed as a percentage).	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 (but is estimated in a national accounts framework). In general, it is calculated as the difference between production (gross output) and intermediate inputs (the energy, materials and services required to produce final output).

Source: Partnership on Measuring ICT for Development, 2009b.

¹⁹ The UNSC requested the timeline to be reviewed recognizing the need for flexibility and the wish of advancing the adoption at the same time (UNSC, 2007).

80. In calculating proportions or percentages with respect to the total business sector, a definition based on business activities is recommended in preference to an institutional definition. The business sector, in this case, is defined as ISIC (Rev. 3.1) divisions 10 to 74, excluding 70 (real estate activities²⁰). Some countries may have particular interest in including in the scope of their measurement agriculture, fishing and forestry activities - which are largely informal in developing countries, as well as community, social and personal services. The relevant definition of the business sector should be stated for the international comparability of indicators.
81. The calculation of value added for a sector is done in the framework of a country's national accounts (in particular the System of National Accounts – SNA93 and its predecessor, SNA68). Value added can be calculated at factor costs, at basic prices or at producers' prices. The numerator and denominator of the indicator should be calculated using the same methodology. The differences between the methods are based on the inclusion of taxes, subsidies on products and production, trade and transport costs and value added taxes (see Table 7 for more details).

Table 7. Valuation of value added

Value added at factor costs	(1). 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.
+ other taxes, less subsidies, on production (1)	
= Value added at basic prices	
+ taxes less subsidies, on products (2)	(2). These consist of taxes (and subsidies) payable per unit of some good or service produced, such as turnover taxes and excise duties.
(not including imports and VAT)	
= Value added at producers' prices	
+ taxes, less subsidies, on imports	(3). Market prices are those that 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.
+ Trade and transport costs	
+ Non-deductible VAT (value added tax)	
= Value added at market prices (3)	

Source: Partnership on Measuring ICT for Development (2005b), based on concepts outlined in both the 1968 and 1993 versions of the System of National Accounts (SNA68 and SNA93).

82. The calculation of indicators for the ICT sector requires obtaining macroeconomic aggregates (total employment, value added) which are central for the compilation of ICT satellite accounts (supply side). It has to be recalled that no international standards exist for ICT satellite accounts and the ongoing work is mainly exploratory (see Example 6 and chapter 3).

²⁰ It is excluded because a significant proportion of its value added consists of imputed rent of owner-occupied dwellings.

Example 6. Calculation of ICT satellite accounts in Australia

The Australian Bureau of Statistics (ABS) carries out research on the production, distribution and use of ICT goods and services since the late 1980s ICT Industry Survey. Official statistics on ICT supply have been produced since 1987-88 and are currently produced biennially.

The ABS also compiles statistics on international trade, imports and exports, in ICT goods and services. Complementary research on a range of ICT issues (for example, investment in ICT, ICT employment and wages and salaries, business payments to consultants and contractors for ICT related work, in house production of software for own final use, etc.) has also been conducted. Major measurement difficulties that have been identified include trade in software, treatment of computer games, capitalization of own account software and other.

Source: Australian Bureau of Statistics.

4.3 Measuring trade in ICT goods

83. The ICT goods classification used in this *Manual* was developed by the OECD's WPIIS and released in late 2003. As for the ICT sector, the classification of ICT goods is based on an existing international statistical classification, in this case, the WCO's Harmonized System (HS) for trade statistics (1996 and 2002 versions). The list is available in the OECD's Guide to Measuring the Information Society (2005) and shown in Annex 7.
84. In 2007-2008, the OECD worked to finalize a classification of information economy products,²¹ which include ICT goods, ICT services, and content and media products, based on the UN's 2007 Central Product Classification (CPC) Ver. 2. Annex 8 contains the list of ICT goods under the CPC Ver. 2. classification. However, like for the ISIC rev. 4, it is expected that it will take some time before most countries are using the revised CPC. This Manual therefore recommends that the 2003 version of the list of ICT goods be used for the next few years. A correspondence between the goods component of the ICT product definition based in CPC and the HS is expected to be prepared shortly, providing countries with a revised classification for measuring trade in ICT goods.
85. WPIIS developed the 2003 classification in accordance with the guiding principle that ICT goods "must either be 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".
86. The OECD aggregates detailed HS categories for ICT goods (based on the 2003 definition) into five broad categories²² for output purposes, as follows:
 - Telecommunications equipment;
 - Computer and related equipment;
 - Electronic components;
 - Audio and video equipment and
 - Other ICT goods.

²¹ "Products" meaning both goods and services.

²² OECD, 2005.

87. The *Partnership* core ICT indicators on trade are imports and exports of ICT goods expressed as a percentage of total imports or exports, as described in Table 8.

Table 8. Core indicators on trade in ICT goods

Code	Indicator	Calculation	Definitions and notes
ICT3	ICT goods imports as a percentage of total imports	ICT3 is calculated as the quotient of the value of imports of all ICT goods divided by the total value of imports (expressed as a percentage).	ICT goods are defined by the OECD's ICT goods classification in terms of the 1996 and 2002 HS classification (see Annex 7). Other concepts are per the UN COMTRADE database e.g. re-exports and re-imports are not netted out, and data are presented in US dollars (converted by the UN from country currencies).
ICT4	ICT goods exports as a percentage of total exports	ICT4 is calculated as the quotient of the value of exports of all ICT goods divided by the total value of exports (expressed as a percentage).	

Source: Partnership on Measuring ICT for Development, 2009b.

88. The usual source for indicators ICT3 and ICT4 is foreign trade data, which are usually compiled by national customs authorities in collaboration with statistical offices. A high level of harmonization has been achieved in international statistics on foreign trade, which has allowed the production and maintenance of harmonized databases such as the *UN COMTRADE* database.²³ The valuation of imports and exports in the SNA is generally identical with that in the Balance of Payments methodology, to which the reader should refer for details on the methods.
89. In order to produce the core indicators on trade in ICT goods, countries should investigate the availability of suitable classifications of goods by their customs authority, and establish cooperative procedures between this institution and the NSO. Countries that use national classifications of goods not compatible with the WCO's Harmonized System should establish the necessary correspondence tables (it is, of course, recommended that countries adopt international standards in classifications wherever possible).
90. Statistics on trade in ICT services are also important. Many ICT services exports, such as those of computer-related services, are growing strongly in some developing economies (UNCTAD, 2006). Discussion about an ICT services definition started around the same time and resulted in the release of an OECD definition in 2007 (see OECD, 2007b), based on a draft version of the CPC Ver. 2. These are not further discussed here, however, since the core indicators refer only to trade in ICT goods.

²³ See <http://unstats.un.org/unsd/comtrade/default.aspx>.

CHAPTER 5 - DATA SOURCES AND DATA COLLECTION METHODS

91. This chapter describes and compares potential sources of ICT statistics and explores various data collection methodologies. The major ICT data sources covered by the chapter are:
- Administrative data (such as, telecommunications regulatory information and customs data) and business registers;
 - Ongoing economic surveys and censuses which may collect a small amount of ICT use data and often cover at least some of the ICT sector; and
 - Stand-alone ICT surveys and substantial ICT modules included in other surveys.
92. Administrative sources and ongoing collections can be useful but are unlikely to completely satisfy policymakers' needs (or deliver all of the core ICT indicators). This leaves stand-alone ICT collections or substantial ICT modules included in 'host' survey vehicles as the main sources of business ICT data (especially for the demand side). The choice of a particular source or survey vehicle for the collection of business ICT data should take into account international practices and standards, as well as national specificities (such as the functioning of the national statistical system), the needs of policymakers, and available technical and financial resources.
93. The data collection methodologies presented in this chapter are based on country practices (in OECD countries as well as in developing economies) and on best practice recommendations that are broadly applicable to business statistics. A number of data collection methodologies are described and compared in terms of cost and effectiveness, from a development point of view. They include face-to-face interviews, personal telephone interviews, questionnaires sent by ordinary mail or forms posted on web pages. Countries' practices depend very much on the costs (of interviewers, transports and communication) and the existing infrastructure (call centres, regional or municipal offices, etc.).

5.1 Sources for business ICT use data

94. There are various data sources used by countries that compile data on business use of ICT (see Example 7). They include administrative sources, business registers, questions or modules in host survey vehicles, as well as stand-alone data collections.

Example 7. Data sources for indicators on the use of ICT by businesses: country examples

The stocktaking exercise on methods and sources for ICT indicators carried out for the WSIS meeting in Tunis (November 2005) identified the following types of data sources for indicators on the use of ICT by businesses in African countries: economic censuses (Mauritius, Zimbabwe), general enterprise surveys (Rwanda), stand-alone ICT business surveys (Morocco, Tunisia, Benin, Madagascar) and information collected from the suppliers of ICT (Senegal, United Republic of Tanzania). In Central Asia and the Caucasus, the identified sources included general enterprise surveys (Kyrgyzstan) and stand-alone ICT surveys (Armenia, Kazakhstan).

Source: Partnership on Measuring ICT for Development, 2005a.

95. These sources do not have equal potential for producing data on the use of ICT by businesses. The appropriateness of each source is largely determined by the balance between the type of information sought (reflecting users' needs) and available resources. Table 9 presents different sources, the indicators for which they are likely to be most suited, and indications of their relative cost.

Table 9. Statistical sources for the collection of indicators on the use of ICT by businesses

Type of source	Indicators that may be collected	Level of costs
Administrative sources	Limited number of indicators on the availability of basic ICT infrastructure	Inexpensive (by-product of administrative activities)
Statistical business registers	Limited number of indicators on the availability of basic ICT infrastructure with selected breakdowns (size, sector)	Medium cost (for establishment and maintenance)
Module or questions on ICT embedded in existing sample surveys or censuses (these are often economic surveys, such as those of the manufacturing sector)	- Indicators on the availability of basic ICT infrastructure with selected breakdowns (size, sector). - Generally limited number of indicators on use of ICT.	Mainly marginal costs with respect to the cost of the survey to which it is attached.
Stand-alone ICT survey	- Indicators on the availability of basic ICT infrastructure with selected breakdowns (size, sector) - Indicators on use of ICT - Indicators on barriers to the use of ICT - Indicators on costs, value of investments, etc.	Mainly marginal costs with respect to the cost of the survey to which it is attached.

96. It should be noted that official business surveys are routinely carried out in most developing economies but that total resources for statistical production are often scarce. Even so, it is unlikely that statistics on business ICT use can be produced efficiently outside the national statistical system. In particular, one-off surveys by unofficial agencies are unlikely to be efficient or sustainable over time. They should therefore be avoided and donor organizations that support the strengthening of statistical systems need to be wary of devoting resources to such surveys. The preferred alternative is that business ICT use surveys are included in national statistical programmes.

Administrative sources

97. In some countries, suppliers of ICT services (such as fixed and mobile telephone, and the Internet) compile information about their clients' businesses and supply such information to government regulatory bodies. As a by-product of this regulatory activity, it is possible to produce at a low cost statistical information on access²⁴ to ICT by businesses.
98. However, the indicators that can be produced this way are likely to be limited in number and in other ways as well. For instance, they will usually be restricted in scope to legal entities that have contracted particular ICT services and such entities may not correspond exactly to a business as defined statistically. Additionally, unless the necessary information is required for the contracts, disaggregation by business size or industry is not possible.
99. In many countries, even this source of administrative information will not be available as ICT service providers do not distinguish business subscribers from household subscribers and so cannot provide data on business access to ICT.
100. In summary, administrative sources will usually be insufficient for collecting data on the use of ICT by businesses.

Statistical business registers

101. Business registers or directories are a key element of the statistical infrastructure of most NSOs. Their role is to maintain an updated record of a country's businesses (usually enterprises and their establishments), with information on the location, contact details and other characteristics such as industry and size. Business registers are used in the statistical process for the compilation of business demographic data and to generate population frames for business surveys. Most NSOs regularly update their business registers using administrative sources, such as tax or social security registers, and through their own statistical operations.
102. The main advantages of using a business register as a source to produce statistical indicators (besides its use as a population frame from which to draw samples) are that:
 - Indicators can be quickly aggregated (no fieldwork is required); and
 - The marginal cost of statistical production is very low.
103. The main disadvantage is that the number of indicators on the use of ICT that can be produced from statistical business registers is generally limited to basic indicators on the presence of certain technologies such as telephony (fixed and mobile), computers or the presence of email or a website (which may be present for contact purposes). Such indicators will only be feasible, of course, if the business register contains high-quality (complete and updated) information.
104. Administrative sources that are used to update an NSO's business register are usually good for identifying new businesses but less effective at detecting businesses that disappear from the population. The problem of having a high rate of "dormant businesses" (or "dead units") is generally more severe for small businesses.

²⁴ There is usually a distinction drawn between ICT access and ICT use. The former is whether entities have access to an ICT, and the latter is whether they actually use it. For businesses, the distinction is less important than it is for households. Surveys of business use of ICT tend to measure only use of ICT, whereas household surveys measure access (by the household) and use (by individuals of that household).

105. In developing economies, the importance of the informal sector²⁵ implies that a big share of economic activity occurs outside the administrative framework (for example, activities of retail trade without licensing or tax control). The economic agents involved will usually be excluded from business registers.
106. Coverage problems such as those described above can produce biases in statistical data - for example, underestimation of the total number of businesses (if there is a large share of informal activity) or overestimation (if there is a large proportion of dormant businesses; see Example 8). Developing economies are often faced with both situations.

Example 8. Activity ratios as a measure of quality of business registers in the Western Balkans

The ratio of active to registered firms provides a measure of the quality of administrative business registers and their suitability for use as population frames for statistical surveys. The activity of firms can be monitored by investigating administrative files that record compulsory activities, such as paying taxes, social security or pension contributions for employees. According to recent statistics, the ratio of active to registered firms in Western Balkan countries is around 40 per cent: Albania (37 per cent in 2004), Croatia (42 per cent in 2004) and Montenegro (38 per cent in 2005). That means that, for those countries, around 60 per cent of units included in the business register are dormant or no longer in existence. Surveys that are selected from the register will therefore be inefficient and also suffer from a low response rate (because inactive businesses are unlikely to respond). Resulting estimates are therefore likely to suffer from significant non-response bias (as well as having relatively large standard errors).

Source: Statistical institutes and agencies for small and medium businesses of the countries mentioned.

Economic censuses

107. Economic censuses are exhaustive surveys of the business sector (or parts of it), with the objective to collect statistical information from all in-scope businesses in a country. In some countries, they include also the economic activities carried out by households. They are often used to construct population frames for sample surveys.
108. Because of exhaustiveness, economic censuses are expensive to conduct, due to the cost of collection (which may require a detailed cartography of the country), and therefore, their periodicity is usually very low (5 or 10 years). This may make them inadequate for continuous monitoring of fast-growing phenomena such as Internet access.
109. Countries that have used censuses to investigate the use of ICT have included some questions on the availability of certain technologies in the business (e.g. telephone, fax, computer). However, the number of questions that can generally be included in a census questionnaire is necessarily limited (see Example 9).
110. Because of the limitation on the number of ICT questions that can be included and their low periodicity, economic censuses are generally not well suited to monitoring ICT use by businesses.

²⁵ The coverage of the informal sector is not described in detail in this *Manual* and statisticians in countries where the informal sector has a relevant weight in the economy may refer to the OECD (2002). In some countries, informal sector is investigated through a combination of household surveys, surveys to small enterprises and to self-employed persons, which could serve as survey vehicles where questions on ICT access and use can be included.

Example 9. Use of economic censuses for the collection of ICT indicators: country examples

Egypt, Oman and Qatar have all included questions on the use of ICT in their economic censuses. Egypt, for example, conducted an exhaustive survey of establishments and recorded the presence of fixed telephone, mobile telephone, computers and access to the Internet.

The General Statistics Office of Viet Nam introduced several questions on access to ICT by businesses in the Establishment Census of 2002. The establishments recorded the presence of PCs, of a website, the existence of e-commerce activities, and the number of PCs connected to LAN and to the Internet. These indicators may be broken down by different classification variables such as industry, size, type of establishment (headquarters, branches, etc.), detailed geographical level and by any other variable recorded in the Census.

Source: Partnership on Measuring ICT for Development, 2005a, and General Statistical Office of Vietnam (data disseminated on 01/07/2002) <http://www.gso.gov.vn/>.

5.2 Modules and stand-alone surveys on the use of ICT by businesses

111. Collecting data from businesses is usually a costly task that has to be undertaken to the highest technical standards to ensure quality of collected data (and resulting aggregates). The effectiveness and efficiency of a data collection system can be assessed from the viewpoints of different actors in the statistical system, namely data producers, data providers and data users:

- Data producers are interested in obtaining high quality data at the lowest cost and in the shortest possible time. Data collection costs include outlays for preparation of collection instruments (usually, questionnaires), training interviewers and other staff, and the costs of collecting and capturing data; beyond the data collection phases, there are additional costs for data processing and dissemination;
- Data providers (respondents) wish to minimize the burden of providing responses in terms of their costs and time (for gathering requested data and completing questionnaires, see Example 10); and
- From the data users' point of view, a data collection system will be satisfactory if it ultimately provides relevant and reliable information, in an accessible way and in a timely manner.

Example 10. Measurement of response burden in the ICT survey in Kazakhstan

The 2006 pilot survey on electronic commerce carried out in the Republic of Kazakhstan routinely recorded the time needed by respondents to fill in a self-administered questionnaire, via a question with closed answers in the form of time intervals: less than 1 hour, 1 to 4 hours, 4 to 8 hours, 8 to 40 hours and more than 40 hours. The same intervals are used in other Kazakhstan business surveys. This information allows comparison of the difficulty of completing the questionnaire on e-commerce with other business surveys.

Source: Survey questionnaire, Agency for Statistics of the Republic of Kazakhstan.

112. Respondents' and users' needs should always be considered when choosing a survey vehicle and data collection method. Mechanisms for consultation with respondents and users are described in Chapter 9.

113. There are several possible techniques for data collection: face-to-face interviews, mailed questionnaires, telephone-assisted interviews, computer-assisted interviews, or a combination of these. Country practice depends on the costs (of interviewers, transport and communication), and the existing infrastructure (call centres, regional or municipal offices, reliable business register, etc.). Advantages and drawbacks of each method from the developing country perspective, together with quality controls that can be applied to data collection, are reviewed later in this chapter.
114. The majority of OECD countries, as well as many developing countries, have collected data from businesses on the use of ICT through questions included in current business surveys (hereafter referred to as 'modules on the use of ICT') or through stand-alone surveys on the topic. The choice of one or other approach is related to several factors, including policy needs for information on use of ICT by businesses, and the resources and organization of the statistical system.
115. Developing economies may not be able to afford stand-alone surveys on ICT and instead may prefer to include questions in existing surveys that also include background information such as employment and industry. This can also be a useful way to estimate statistical parameters that may be needed later in the design of stand-alone surveys (as explained in detail in Chapter 7).
116. Stand-alone surveys on ICT use are generally necessary for countries that are interested in investigating more sophisticated ICT applications (such as e-business, e-commerce and IT security measures). The decision to carry out a stand-alone survey should take into consideration its inclusion in the current national statistical programme (the work programme of surveys, censuses and other statistical operations implemented by the public authorities in a country and usually established by a legal act). This aspect is examined in part C of this *Manual* (Institutional issues).
117. The next two sections discuss statistical issues relevant to modules on the use of ICT and stand-alone ICT surveys. Chapter 6 provides further guidance on the design of a module to be embedded in an existing survey by providing model questions to collect the data needed for the production of the core indicators. This is the option that will generally be chosen by developing economies that are starting to collect ICT data in order to produce the core ICT use indicators.

Modules on the use of ICT

118. Many countries regularly carry out statistical surveys with the objective of investigating industry sectors of importance to their economy. Surveys on the manufacturing or trade sectors are two common examples for many developing economies. The maintenance of comparable statistical time-series is favoured by the use of the same or similar questions over several years. However, the introduction of new questions in the questionnaire enables an NSO to be responsive to new information needs, and to relate the newly introduced variables to the ones that are already investigated. Thus, the inclusion of specific modules in existing business surveys is a practice followed by many countries in order to study new interest areas, such as the use of ICT by businesses.

119. The decision to include a module on the use of ICT in an existing survey has to take into account:
- The information needs that can be satisfied with such a module (variables that can be included and variables in the survey vehicle that can be used for analysing ICT data). If the survey vehicle records classification variables such as industry and size, it will be possible to break down ICT indicators by these classificatory variables (see Example 11) and
 - The methodology of the candidate survey vehicle in terms of population scope and coverage, periodicity, sample design, sample size and distribution. Data collected via the module will reflect the statistical characteristics of the survey vehicle (population frame used, sampling method, factors to weight the observations, collection and processing methods, level of detail for economic activities, etc.). This may be a significant disadvantage if, for instance, the scope of the survey vehicle is narrower than that recommended for the ICT use core indicators, or the sample size is too small, leading to large sampling errors.

Example 11. Inclusion of questions on ICT in the Manufacturing Survey in Thailand

In Thailand, the inclusion of questions on the use of ICT in the questionnaire of the Manufacturing Survey of 2003 (which records economic and financial information about establishments), has enabled a research programme assessing the impact of ICT on productivity. Econometric models that include ICT variables (such as presence of computers and proportion of employees with access to computers) as explanatory variables for productivity measures can be estimated and interpreted in terms of gains in productivity due to the use of ICT (based on Cobb-Douglas-type models).

The ICT indicators for Thailand reflect the sample design of the Manufacturing Survey – the survey vehicle – which is a stratified random sample, where strata are defined by ISIC classes (4-digit level) and size (12 intervals defined in terms of number of employees). The questions on the use of ICT were included in a section on general information about the establishment (legal form, form of economic organization, registered capital, foreign investment, exporting and importing behaviour).

The questions are presented as yes/no questions or multiple choice questions and filters, as follows:

In 2002, did this establishment use a computer? (yes/no)

If yes, please fill in total number of computers: _____

Number of persons using a computer: _____

In 2002, did this establishment have access to the Internet? (yes/no)

If yes, how did this establishment access the Internet? (circle one or more choices):

- ISP subscriber
- Internet café
- Internet package
- Others (specify)

Which of the following Internet activities did this establishment use? (circle one or more choices)

- Email
- Information searches
- Shopping
- Business promotion such as advertising on website
- Others (specify)

In 2002, did this establishment have a web site presence? (yes/no)

If yes, please fill in:

Primary URL _____

Activities or services on website:

- Advertising of own business (yes/no)
- Selling goods and services (yes/no)

A total of 10 ICT questions are included on the questionnaire though several are answered only if the preceding filter questions are positive.

Source: Questionnaire on the Thai Manufacturing Survey, 2003, National Statistical Office of Thailand.

120. Candidate survey vehicles that have been selected in different countries include:

- *Economy-wide business surveys*: the coverage of all economic sectors allows investigation of the use of ICT in different industries. These surveys are generally carried out to monitor the productive sector and have secondary uses such as the preparation of input-output tables and national accounts. Some countries conduct exhaustive economy-wide surveys (censuses) but the frequency is generally low;
- *Surveys on the Manufacturing Sector*: are implemented in the majority of countries. Some countries further investigate specific manufacturing industries for their relevance to the economy;
- *Surveys on the Services Sector*: in many developing economies, the services sector is investigated via a series of service industry surveys. Important service industries include: wholesale trade, transport and communications, tourism, and financial services; and
- *Innovation surveys and Research and Development (R&D) surveys*: many countries have implemented stand-alone innovation or R&D or surveys to understand the technological behaviour of businesses (see Example 12). The OECD and Eurostat have developed methodologies (described in the Oslo and Frascati Manuals) and a Manual for developing economies (the Bogotá Manual) has been prepared and is applied principally in Latin American countries. These surveys can be well suited to the inclusion of a module on ICT use, since the adoption of technology is often associated with innovative processes, especially in developing economies.

Example 12. ICT questions in the Survey on Technological Behaviour of Industrial Businesses, Argentina

The 'Survey on Technological Behaviour of Industrial Businesses' has been carried out by the National Statistical Institute of Argentina (INDEC) since 1993, in response to the information needs of the Federal Ministry of Science and Technology. It uses a methodology based on the OECD/Eurostat Oslo Manual.

In 2004, the survey was enlarged to include a module on the use of ICT and thereafter called the 'National Business Survey on Innovation, R&D and ICT'. The module on ICT was designed to produce indicators on the presence of computers, access to the Internet, presence of a website and of an intranet, proportion of employees with access to ICT, and purposes of use of the Internet (including receiving orders). Because ICT questions are included in the Innovation Survey, ICT indicators can be broken down by innovative behaviour of the firm, as well as by other classifications.

Source: Workshop on Measuring the Information Society in Latin America and the Caribbean, Panama (November, 2006).

121. Once an existing business survey has been chosen to serve as a vehicle for an ICT module, the focus should be on the design of the module itself (wording of questions and definitions to be used). The sample design may boost the sample size in certain sectors and size classes in order to obtain more reliable estimates. It is important to recall that the methodological recommendations for the design of a stand-alone ICT use survey also apply to modules, in particular, those related to the requirement for a quality business register, definitions of statistical units and use of relevant industry classifications. However, control over the methodology of the survey vehicle may be limited.

122. Where modules on the use of ICT are implemented by developing economies, they generally include a small number of questions in order to limit costs and response burden. In terms of size, they generally consist of 10 to 20 ICT-related variables (see Example 11).
123. The cost of collecting ICT data via modules is generally marginal to that of the survey vehicle, since the most important part of the survey cost is usually related to data collection (including fieldwork, where relevant). In addition, staff involved in data collection and processing are already trained and will require only complementary training on ICT questions. For countries with severe budgetary restrictions, the inclusion of a module should be more cost-efficient than the implementation of a stand-alone ICT survey of businesses (though this will depend on factors such as the size of the survey vehicle and the complexity of the ICT module).
124. The design of the module itself consists of choosing a limited number of relevant questions that can be easily interpreted by respondents. Suggested model questions to collect the necessary data for the production of the core ICT indicators are provided in Chapter 6.

Stand-alone surveys

125. Stand-alone surveys on ICT allow for the collection of significantly more information than modules in other surveys. Stand-alone surveys are especially designed to collect information on different topics of interest in the measure of ICT use by businesses, such as access to ICT, purposes of use, e-commerce, security, skills, etc., that usually go beyond the possibilities of a module embedded in an existing business survey.
126. A number of developing economies have implemented stand-alone ICT surveys of the business sector (see Examples 13 and 14). These countries have relatively widespread access to ICT in comparison with other countries of their region or have an economy increasingly based on ICT. In general, in countries that have carried out stand-alone ICT surveys, there is a high demand for business ICT indicators from policymakers, the market and society.

Example 13. Design of a stand-alone survey on the use of ICT by Brazilian enterprises

In 2005 and 2006, the Brazilian Internet Steering Committee (a private institution that regulates Internet names and IP addresses) carried out stand-alone surveys on the use of ICT by Brazilian enterprises.

Quotas for the sample were calculated from the social security register (RAIS, *Relação Anual de Informações Sociais*) of the Ministry of Labor which includes information about the industry of firms based on the National Classification of Economic Activities (CNAE) that is approved by the National Commission of Classifications, officially adopted by the National Statistical System, and based on the international standard, ISIC.

The questionnaire is based on the OECD and Eurostat questionnaires, and data were collected from a sample of 2,700 enterprises (in 2006) by telephone interviews with the person in the business responsible for ICT. The questionnaire includes items organized in modules that allow collection of information on ICT usage (module A), Internet usage (module B), E-commerce (module C), E-government (module D), E-security (module E) and E-skills (module F), altogether totalling 46 questions in 2005 and 55 in 2006.

The increase in the number of questions is due to adding items on adoption of ERP and CRM systems, of Linux software, on restrictions to use by employees and on skills and training of ICT specialists and other employees. Questions on e-commerce via external computer networks other than the Internet were suppressed. Some questions were simplified, such as the types of access to the Internet, in order to allow for classification into narrowband, fixed broadband and mobile broadband.

Source: Country presentation at the Third Workshop on Measuring the Information Society in Latin America and the Caribbean, Panama (November 2006)..

Example 14. The Survey on Information Technology Usage and Penetration in Hong Kong, China

The Census and Statistics Department of Hong Kong, China (C&SD) conducts an annual *Survey on Information Technology Usage and Penetration in the Business Sector*. Apart from questions on computer and Internet usage, presence and use of a website and e-commerce, it includes items on the IT budget, IT security and use of wireless and mobile technologies, services and applications. C&SD also measures the ICT sector, with a stand-alone *Manpower Survey of the IT Sector* and compilation of ICT sector statistics from annual economic survey data.

Source: Leung, 2004.

127. In some cases, the surveys have been carried out by organizations outside the statistical system and linked with ICT policymaking institutions. There is a risk in carrying out stand-alone ICT surveys outside the national statistical system, due to the limitations on the use of key statistical infrastructure such as business registers, data collection systems (call centres, trained interviewers in regional or municipal offices, etc.), sampling methodology and the possibility that methodologies are not harmonized with those of the national statistical system (which are usually linked to international statistical standards).
128. The coordination of stand-alone surveys on ICT use by businesses with other ongoing or planned work of the national statistical system must be considered from at least two perspectives:
 - The first is related to the use of common methodologies. Methodological coordination with existing business surveys requires the use of coherent definitions of statistical units (enterprise, establishment, business, etc.), classifications (such as industry breakdowns) and common concepts (e.g. for income). Such harmonization will facilitate comparison of results on ICT use with those of other surveys (for example, those investigating production, financial results, labour costs, etc.).
 - The second is related to minimizing the response burden of businesses participating in a large number of surveys. In some countries, the business sector is intensively surveyed by public and private organizations, and the response burden can be overwhelming. In particular, large businesses are usually included exhaustively (i.e. without sampling) in surveys, thereby having to answer a large number of questionnaires. In addition, some strata may contain a small number of businesses that are therefore surveyed particularly often (such as businesses in the telecommunications sector).

129. In relation to methodological coordination, a key issue is the use of comparable business registers from which samples are drawn. For instance, the implementation of stand-alone surveys based on a sample of businesses drawn from commercial directories (e.g. telephone directories such as 'yellow pages') and not statistical business registers can make it impossible to obtain breakdowns comparable to those that would be obtained by using a statistical business register that uses consistent unit concepts and classifies units to the national classification of economic activities.
130. Methodological coordination (between surveys and countries) requires the use of comparable definitions of concepts. In particular, for the calculation of the core indicators on the use of ICT by businesses, it is necessary that surveys adopt the same definition of a business (see Chapter 4) and of an employee (the definition proposed for the indicators *proportion of employees using computers and the Internet* includes all persons employed by the business (including working proprietors and employees)).²⁶
131. Finally, coordination with existing business surveys is important if, for research purposes, it is required to link data at the micro-level (i.e. at the individual business level) in order to analyse the relationship between ICT and other variables, such as those related to performance (labour productivity, value added, etc.). It is of the utmost importance that the confidentiality of individual business information be guaranteed and, if the survey on ICT use is not carried out by the statistical office, that the necessary legal arrangements be made according to national statistical legislation.
132. Ideally, stand-alone ICT surveys would be based on representative samples of the business sector, requiring a sample size that allows for estimation with sufficient precision. Logically, stand-alone surveys usually incur higher costs than modules included in an existing survey, since they require a specific design, dedicated fieldwork with specialized training for the interviewers (if used), independent data processing and dissemination.
133. It is important to recall that, in order to monitor effectively the rapid changes in the information economy, surveys should be conducted reasonably frequently. This will allow the compilation of time series data. One-off ICT surveys may quickly lose their relevance and should be avoided due to their high costs relative to the validity of results over time. International donors should consider the national statistical programme before funding such surveys, particularly because their sustainability cannot be guaranteed.

Surveys of the ICT sector and ICT trade data

134. In Chapter 4, the ICT sector was defined in terms of the international classification, ISIC. It includes classes (4-digit codes) in the manufacturing sector, as well as ICT services. Accordingly, surveys of the manufacturing and services sectors will partially cover the ICT sector and may provide useful data if the level of detail is sufficient (noting that much of the ICT sector is defined in terms of 4-digit ISIC classes). Data that are collected in other industry surveys are also useful for the ICT sector. They may include the number of enterprises and establishments, turnover and production, value added, labour force information, wages and salaries, capital expenditure, expenditure on R&D and innovation.

²⁶ The ILO definition of an employed person is anyone who worked for remuneration or was self-employed or was a family worker for at least one hour in the one-week reference period. Also, persons formally having a job and not having performed that job only temporarily within the reference period are considered employed. In countries with a large informal sector, there is an interest in defining employees in the informal sector according to the recommendations of the International Conference of Labour Statisticians (www.ilo.org/public/english/bureau/stat/download/guidelines/defempl.pdf).

135. The level of detail to which the ICT sector is defined (that is, 4-digit ISIC codes of economic activity) may present challenges in terms of sample size for economy-wide surveys, or even surveys covering the whole manufacturing or services sectors (economic censuses would not present this problem). NSOs with a high demand for indicators on the ICT sector may therefore consider the possibility of increasing the sample size in some classes, if the current coverage does not allow offering accurate estimates for these classes, or running a stand-alone survey of the ICT sector (see Example 15).

Example 15. Statistics on the ICT sector in Hong Kong, China

The coverage of the information technology and telecommunications (IT&T) sector in Hong Kong, China is defined per the OECD definition of the ICT sector, with local adaptations. The Hong Kong Standard Industrial Classification (HSIC) is used to demarcate the IT&T sector, which covers establishments engaged in the manufacturing, distribution, installation and maintenance of IT&T products, and provision of IT&T services. Statistics on the characteristics of the IT&T sector have been collected in a series of annual economic surveys, recording the number of establishments, persons employed, vacancies, business receipts and value added.

Source: Presentation to the 2004 Asia Pacific Technical Meeting on ICT statistics (Wellington, New Zealand, 2004).

136. Some countries conduct sectoral trade surveys that may cover the wholesale trade of computers, peripheral equipment and software, as well as electronic and telecommunications parts and equipment (classes 5151 and 5152 of ISIC Rev. 3.1, or the corresponding classes 4651 and 4652 of ISIC Rev. 4). Statistical offices may consider increasing the sample size for these classes in trade surveys if the current coverage does not allow offering accurate estimates for these classes. Note that an increase in sample size entails an increase in the associated costs for collection and data processing and may not be sustainable over time for NSOs with scarce resources.
137. One way to improve coverage of the ICT sector is to collaborate with industry associations to identify ICT sector businesses. Further refinement of the classification of these businesses may be obtained by cross-checking with statistical directories and business registers. In some countries, there is a separate register for ICT businesses that helps to define the in-scope population.
138. In the questionnaire for the ICT sector survey, businesses may be asked a question on their activities or be invited to self-classify their activities with sufficient level of detail. This enables exclusion of businesses that are not part of the ICT sector as internationally defined and better classification of those that are. Questions on products offered by the business may also be of help in establishing the correct industry (using a correspondence between products and industries, such as the existing correspondence between the Central Product Classification, CPC, and ISIC²⁷).
139. A good administrative source for ICT trade data are foreign trade registers, which are managed by customs authorities and are often used as a source to compile trade statistics – either by these institutions or by statistical offices. The regulations for declaring import and export transactions depend on national legislation, but there are international standards for compiling foreign trade statistics that are widely used, such as the classification of goods based on the HS. Data on exports and imports of ICT goods can be compiled using the OECD definition of ICT goods (see Annex 7) as it is based on the HS (1996 and 2002). In 2008, the OECD issued a revised list of ICT products based on the CPC classification, including ICT goods (available in Annex 8), which will be adopted over the next few years (see paragraph 84).

²⁷ Available at the United Nations Statistical Division website on international economic and social classifications (<http://unstats.un.org/unsd/cr/registry/regso.asp?Ci=17&Lg=1>) and <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=27>.

5.3 Data collection methods and quality control

Data collection methods

140. There are several methods of data collection according to the nature of the contact between the data provider (respondent) and the data producer (statistical office). They are personal (face-to-face) interviews, personal telephone interviews, questionnaires sent by ordinary mail or forms posted on web pages. Combinations of the different data collection methods are also used in some countries, in order to select the most suitable method of contact for different kinds of businesses.
141. Table 10 describes the relative advantages and disadvantages of each data collection method. In developing economies, the selection of data collection method should take into account the transport and communications infrastructure of the country, including:
 - Density and quality of roads and railways (especially if interviewers have to cover rural areas);
 - Efficiency of the postal service (in particular in rural areas);
 - Easy identification and accuracy of postal addresses, and
 - Density of the telephone network.
142. Usually, the best approach is to have a mix of techniques, according to the location of businesses (urban/rural), their size and their industry.
143. For surveys on ICT use by businesses (be they modules of business surveys or stand-alone surveys), the use of a combination of personal and telephone interviews may be the best option. The relative novelty of ICT (and ICT surveys) often necessitates helping respondents to provide accurate answers, and this is largely provided by interviewers and written instructions. Telephone interviews can complement a data collection, particularly with requests to complete missing data. Before choosing a particular collection method, pilot tests to measure the time needed to complete the questionnaire and the understandability of questions should be carried out on a small sample of businesses from a variety of industries and size classes.

Table 10. Data collection methods

Method	Main advantages	Main disadvantages
Face-to-face personal interview	This is the most direct method of collecting information. It facilitates direct interaction of the interviewer and the interviewee, allowing checking and follow-up questions. An interviewer can also assist respondents to answer complex questions and can clarify concepts such as definitions of particular ICTs. Because the interviewer is in view, s/he can use visual prompts such as prompt cards. In addition, face-to-face interviews are especially useful for questions about opinions or impressions, and for surveys that take a long time to complete. The technique usually produces lower non-response rates. Data collection can be managed efficiently with specific software (Computer Assisted Personal Interviewing – CAPI, see below).	Interviewers are part of the measurement tool and they can induce important biases if they have not received suitable training. High personnel costs may be incurred (for hiring and training interviewers). However, this could be a minor issue in developing economies where salaries of interviewers are low, or agreements are reached with certain institutions to provide part-time interviewers (such as university students). In developing economies with poor quality transport infrastructure, reaching businesses located in some country areas may prove difficult.
Telephone personal interview	Although to a lesser extent than the face-to-face personal interview, telephone interviewing allows direct interaction between the interviewer and interviewee. It is a fast and relatively inexpensive way to collect information, since a small number of interviewers from a single call centre can carry out a great number of interviews. The data collection can be managed efficiently with specific software (Computer Assisted Telephoning Interviewing – CATI, see below).	Correct and comprehensive telephone numbers may not be available, particularly in developing economies where mobile telephony may be more common than fixed telephone. Interviews must be relatively short, since a long telephone conversation can be perceived as an annoyance. Some people also feel that it is intrusive to be interviewed by telephone. Telephone interviews may not be suitable for collecting quantitative information, for which the interviewee may have to check business records. The non-response rate is usually larger than for face-to-face interviews (but lower than for mail-based surveys).

Method	Main advantages	Main disadvantages
Interview assisted by computer (CAPI/CATI)	CAPI and CATI systems can eliminate errors of flow and data consistency, and can thus improve input data quality and reduce the time for data capture and validation. Questionnaires can possibly be customized based on available information about the business. Modern IT equipment such as PDAs may present a cheap and comfortable tool for data collection.	CAPI and CATI techniques require interviewers with some technical skills. CAPI and CATI systems are usually based on commercial software that may be costly. Skilled staff are required to adapt the software to the questionnaire. CAPI requires that interviewers carry costly IT equipment, which can be damaged, stolen, etc. during field operations. In developing economies with poor road networks, there is a risk of damaging the equipment.
Mail survey	This method is relatively inexpensive and the statistical office can send the same measurement instrument (questionnaire) to a large number of businesses. It allows the respondent to complete the questionnaire at his or her convenience. It eliminates the problem of interviewer bias though note that: interviewer follow-up (e.g. for non-response or inconsistent answers) can potentially introduce bias if not managed properly, and if questionnaires are not properly designed and tested, they can introduce bias to the survey results.	Requires separate data entry unless advanced Optical Character Recognition (OCR) tools are available. It usually suffers from high non-response rates. It is not designed for detailed written responses, but for numerical questions or those that can be answered by selecting a limited list of choices (including yes/no responses). The lack of help from an interviewer can produce information of low quality. It therefore requires clear questions and instructions. Delays in mailing back questionnaires can induce delays in the survey. In developing economies with a low quality postal system, such delays may be prohibitive. Some of the problems inherent to a postal survey can be partially solved by, for instance, use of written or telephone reminders to reduce non-response rates. In addition, data quality can often be improved if a telephone helpline is available.

Method	Main advantages	Main disadvantages
Electronic survey	With the growth in ICT skills and availability of ICT, possibilities for electronic surveys have increased. Data collection mechanisms can be of several types, but the most common are electronic questionnaires sent by e-mail or posted on web pages that respondents can access. This method has almost all of the advantages of mail surveys, but is usually faster and cheaper. Because respondents complete the questionnaire electronically, manual data entry is not required and edits can be applied at the time of data entry (and resolved by the respondent).	Businesses that can be surveyed this way do not cover the entire business population, in particular in developing economies with low ICT penetration. This will cause either biases in the data, or the necessity of using another method as well (e.g. mail out questionnaires) for data capture. There is an extra need for technology to ensure security and confidentiality of data and for staff with the training and skills to handle the data collection tools. Costs associated with this expertise can offset savings offered by electronic data capture. The technique is in general not suitable to be used as the only channel for collecting data. However, if complemented with other methods, it can be a useful tool.

Quality control of the data collection

144. The quality of the data collected will determine the quality of aggregate ICT indicators, whichever survey vehicle is used. Controls at data entry stage (whether by respondents or interviewers) are more effective than corrections at later stages. In this sense, computer-assisted personal interviewing (CAPI) or computer-assisted telephone interviewing (CATI) systems enable good quality control, since data collection and entry are simultaneous. Note that controlling for data quality after data capture requires actions that can be costly or introduce bias to the results, for example:

- Re-contacting a business and asking it to respond to, or clarify, questions that were asked perhaps weeks or months before is not always feasible, annoys the respondent and gives a poor image of the statistical office; in addition, it can significantly increase the costs of the operation if the number of re-contacts is high;
- Estimating responses to individual questions that have not been answered, or amending answers which are not valid, can be a complex technical exercise (though should result in unbiased responses if done correctly); and
- Finally, ignoring an incorrect questionnaire, although sometimes the only solution, is an action with consequences, since the effective sample diminishes and bias may be introduced.

145. Although it is impossible to carry out a survey without errors in data collection, there are measures that can be put into practice by statistical offices, which will help to minimize the error rate. Examples of such measures are:

- Establishing good frames that include in-scope businesses and are free of coverage errors such as inactive businesses or erroneous addresses;
- Providing suitable training to interviewers on the questionnaire contents (especially required for complex technical concepts), and on dealing with respondents;
- Preparing questionnaires so that questions are worded in a correct, clear and unambiguous manner, and respondents can perceive a logical flow in the order of questions (especially in self-administered questionnaires);
- Filtering the collected data by a series of controls that are applied at the moment of data capture and in the data entry process;
- Giving wide publicity before the start of the survey, highlighting the relevance of data collection for national policies and therefore the need for respondents' collaboration. This may include a mention to the compulsory response required in countries where the statistical law grants this; and
- Establishing a policy of incentives and sanctions that encourage the provision of good answers to interviews or questionnaires.

CHAPTER 6 - MODEL QUESTIONS AND QUESTIONNAIRES FOR MEASURING ICT USE IN BUSINESSES

146. This chapter presents model questions corresponding to the core ICT use indicators that were introduced in Chapter 4. It also discusses the structure of modules and questionnaires that could be adapted by countries planning on including an ICT use module in an existing business survey or undertaking a stand-alone survey.
147. The model questions presented in this chapter obviously need to be translated into local languages and adapted for other conditions, such as cultural norms. However, in order to respect international comparability, care must be taken that changes made do not alter the meaning of the questions nor any inherent logic (e.g. the populations to which they refer).
148. A complete model questionnaire for the core indicators on ICT use by businesses is shown in Annex 2. Countries wishing to go beyond those core indicators are referred to the model questionnaires of the OECD and Eurostat (shown in Annexes 3 and 4).
149. Model questions for the proposed indicators on the use of mobile phones (not part of the list of core indicators) are presented in Table 12 in this chapter and in Annex 2. The little experience in collecting these indicators requires further validation of the model questions.
150. Besides the technical recommendations for the preparation of questions to measure the ICT indicators, other important issues are to be taken into consideration such as the use of appropriate language (providing definitions and explanations to technical terms, prevention of bias due to the wording of questions, avoiding the use of acronyms without their definition, use of different official languages in a country, etc.), clear logical flow (filtering questions, order of questions, etc.), layout of the questionnaire (separate sections, visual display, etc.), and inclusion of instructions to the interviewers (also called “prompts”). Good practices in the design of questionnaires are usually identified by NSOs, and should be valid also for ICT modules or stand-alone ICT surveys. They are therefore not discussed in this *Manual*.

6.1 Model questions for a module

151. The inclusion of a module on the use of ICT in existing business surveys (‘survey vehicles’) is an option that developing economies could consider as an alternative to carrying out stand-alone surveys. The model questions presented in this chapter enable production of the core indicators on ICT use by businesses and have been used by a number of countries that undertake ICT use surveys.²⁸

²⁸ With equivalent meaning though not necessarily with the same wording.

152. The survey questionnaire in which the module on ICT is included will very likely contain a number of general (background) questions on the business activity, such as industry in which it operates (principal, secondary and ancillary activities), principal economic indicators (turnover and its breakdown by activities and/or products, number of employed persons and their categories or gender, location, type of property, etc.). For international comparability, it is suggested that countries apply international standards (such as ISIC codes for economic activity or ILO standards for the measurement of employment²⁹) for the recording of such variables. While all these variables can be used for in-depth analysis of ICT indicators, they are not strictly part of the module on ICT, and therefore also not further discussed in this *Manual*.
153. The development of a module on the use of ICT consists of choosing a limited number of high priority and measurable topics, selecting appropriate questions and structuring them logically within a module. The module, in turn, should be logically placed within the survey vehicle questionnaire.
154. The ordering of items in a questionnaire is particularly important, as respondents will generally respond better if they perceive a coherent flow of information through the form. In addition, some questions lead to others through logical filters³⁰ (see Box 8).

Box 8. Presentation of a filter question

The question on the proportion (or number) of employees using computers should only be asked if the businesses has a computer(s). Therefore, a logical filter could take the following form:

Question i) Did your business use computer(s) during <reference period>?

Yes ☐ Go to question i+1)

No ☐ Go to question i+2)

Question i+1) What proportion of persons employed in your business routinely used a computer at work during <reference period>? (From 0% to 100%)

Question i+2).....

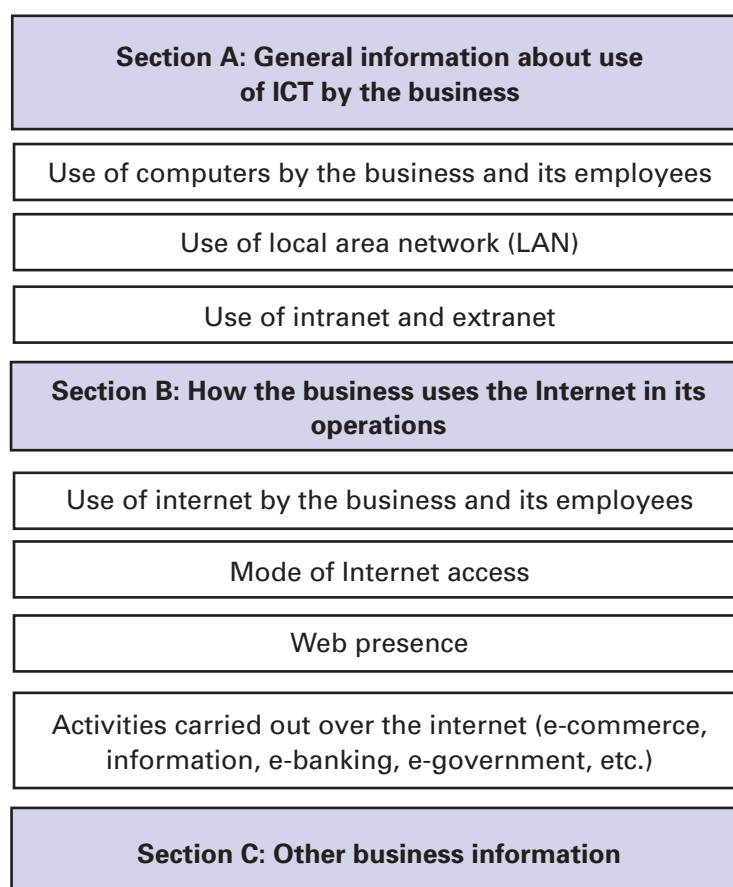
²⁹ Relevant issues regarding the measurement of employment include: type of relation to the business (ownership, contractual, informal), dedication (full-time vs part-time), and the time reference (reference date or reference period). The adoption of international standards is highly recommended.

³⁰ Several assumptions are made for the logical filtering of model questions for the core indicators. If a business does not have a computer, it is still considered that it may be able to use the Internet (e.g. by using a mobile phone or by accessing the Internet through community centres or from home).

155. It is possible to order the model questions into sections (see Figure 3) as follows:

- **SECTION A:** General information about the use of ICT by the business and the available infrastructure. The related model questions provide data for core indicators B1, B2, B6, B10, and B11.
- **SECTION B:** Information on how the business uses Internet in its operations, including the activities for which the Internet is used and whether the business has a web presence. The related model questions provide data for core indicators B3, B4, B5, B7, B8, B9, and B12.
- **SECTION C:** Any general (background) information about the business that is required but is not included in the survey vehicle.

Figure 3. Schematic structure of a module on the use of ICT by businesses



156. The majority of the core indicators require information in respect of a single reference period (indicators B1, B2, B3, B4, B7, B8, B9 and B12). In order to achieve international comparability, it is recommended that countries use a 12-month reference period, and refer to it in the question. Countries wishing to collect information about other periods as well can do this by using period rows or columns to collect data for consecutive years ($t-1$, t , $t+1$ referring to the previous, current and next years). Reference dates are used for core indicators B5, B6, B10 and B11 and are usually the last day of the reference period or shortly after it. As with reference periods, the reference date should be referred to in the question and countries can collect information in respect of more than one reference date (see Box 9).

Box 9. Presentation of a question on ICT activities in multiple years

The question on web presence can be presented in the following way to allow recording of historical information and expectations for the future.

Question: Does your business have a web presence?

Yes, had a web presence as at <ref date, year t-1> ☐ (e.g. 31 December 2006)

Yes, established a web presence during <year t> ☐ (e.g. 2007)

No, but plan to establish a web presence in <year t+1> ☐ (e.g. 2008)

No, do not plan to establish a web presence in <year t+1> ☐ (e.g. 2008)

Note that even though the questions following the first one refer to periods (for ease of understanding), the information is in respect of a reference date, which is the last day of the year.

An alternative presentation for collecting this information is to have a yes/no filter question, where a 'yes' leads to a question with the first two options above and a 'no' leads to one with the third and fourth options.

157. Table 11 proposes model questions to collect the information for the core indicators (in the order of indicators rather than logical questionnaire order). For each indicator, the following information is provided: a suggested wording for the question (to be translated into the local language, respecting as far as possible its meaning), valid response items, and notes, including the applicable population for each question. Annex 2 shows the UNCTAD model questionnaire, which is suitable for use as a module in a survey vehicle or as a stand-alone questionnaire.

Table 11. Model questions for the core indicators on the use of ICT by businesses

Code	Indicator	Model question and response items	Notes
B1	Proportion of businesses using computers	Did your business use computer(s) during <reference period> ^a ? Yes/ No	A <i>computer</i> is defined in Table 3.
B2	Proportion of persons employed using computers	What percentage of persons employed in your business routinely used a computer at work during <reference period>? Percentage values (no decimals) from 0% to 100%	The wording refers to actual use of a computer rather than just having access. Persons employed are defined in Table 3. The definition should be aligned with UNSD and ILO standards. Routinely refers to at least once a week. The question is only asked of those businesses answering 'yes' to the question Did your business use computer(s)? (logical filter)
B3	Proportion of businesses using the Internet	Did your business use the Internet during <reference period>? Yes/ No	Businesses that do not use computers are not filtered out for this question since they can still access the Internet by using other devices (such as mobile telephones). The Internet is defined in Table 3.
B4	Proportion of persons employed using the Internet	What percentage of persons employed in your business routinely used the Internet at work during <reference period>? Percentage values (no decimals) from 0% to 100%	The wording refers to actual use of the Internet rather than just having access. Persons employed as above The question is only asked of those businesses answering 'yes' to the question Did your business use the Internet? (logical filter)
B5	Proportion of businesses with a web presence	Did your business have a web presence as at <reference date> ^b ? Yes/ No	The question is only asked of those businesses answering 'yes' to the question Did your business use computer(s)? (logical filter) An intranet is defined in Table 3.
B6	Proportion of businesses with an intranet	Did your business have an intranet as at <reference date>? Yes/ No	The question is only asked of those businesses answering 'yes' to the question Did your business use computer(s)? (logical filter) An intranet is defined in Table 3.

Code	Indicator	Model question and response items	Notes
B7	Proportion of businesses receiving orders over the Internet	Did your business receive orders ^c for goods or services (that is, make sales) via the Internet during <reference period>? Yes/ No	The question is only asked of those businesses answering 'yes' to the question Did your business use the Internet? (logical filter) Internet orders received are defined in Table 3. In theory, a business without access to the Internet could receive Internet orders via agents. Where this is thought to be common, countries could alter the scope of the question to those businesses using computer(s).
B8	Proportion of businesses placing orders over the Internet	Did your business place orders ^c for goods or services (that is, make purchases) via the Internet during <reference period>? Yes/ No	The question is only asked of those businesses answering 'yes' to the question Did your business use the Internet? (logical filter) Internet orders placed are defined in Table 3. In theory, a business without access to the Internet could place Internet orders via agents. Where this is thought to be common, countries could alter the scope of the question to those businesses using computer(s).
B9	Proportion of businesses using the Internet by type of access (narrowband, fixed broadband and mobile broadband)	How did your business connect to the Internet during <reference period>? The list of response categories should allow the grouping into narrowband and broadband, and for the later, into fixed and mobile. Yes/ No or tick box for each response category	The question is only asked of those businesses answering 'yes' to the question Did your business use the Internet? (logical filter) Type of access categories are defined in Table 4. The response categories should allow aggregation into narrowband access and broadband access, which are defined in terms of technologies and speed. Broadband provide advertised download speeds of at least 256Kbit/s, with narrowband less than 256Kbit/s. Multiple responses are possible as a business may use more than one form of Internet access. 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.
B10	Proportion of businesses with a local area network (LAN)	Did your business have a local area network (LAN) as at <reference date>? Yes/ No	The question is only asked of those businesses answering 'yes' to the question Did your business use computer(s)? (logical filter). A LAN is defined in Table 3. A LAN is a type of internal network (others include WANs and VPNs). Substituting the question by Did your business have an internal network? could provide relevant information on information sharing within businesses rather than the actual technology used.

Code	Indicator	Model question and response items	Notes
B11	Proportion of businesses with an extranet	Did your business have an extranet as at <reference date>? Yes/ No	The question is only asked of those businesses answering 'yes' to the question Did your business use computer(s)? (logical filter). An extranet is defined in Table 3.
B12	Proportion of businesses using the Internet by type of activity	For which of the following activities did your business use the Internet during <reference period>? Response categories: - Sending or receiving e-mail - Telephoning over the Internet/ VoIP or using video conferencing - Use of instant messaging, bulletin boards - Getting information about goods or services - Getting information from general government organizations - Internet banking - Accessing other financial services - Interacting with general government organizations - Providing customer services - Delivering products online - Internal or external recruitment - Staff training Yes/ No or tick box for each response category	The question is only asked of those businesses answering 'yes' to the question Did your business use the Internet? (logical filter) Internet activities are defined in Table 3. Multiple responses are possible as the business may use the Internet for various purposes. Possible country variations to response categories are to add or split categories according to country data requirements.

Source: Partnership on Measuring ICT for Development (2005b and 2009b). Includes some updates to some of the questions.

Notes:

a. <reference period> refers to the period used by the NSO (typically the previous 12 months, or the last calendar year).

b. <reference date> would usually be at the end of the reference period, or shortly after.

c. OECD and Eurostat recommend excluding orders placed or received via conventional email; however, not all OECD non-Eurostat countries comply with this recommendation.

Part B. Methodological issues

158. With respect to procedures for calculating the indicators (see Box 10), it should be noted that all core indicators are expressed as proportions of businesses satisfying certain conditions (as indicated by a particular answer or combination of answers to questions). The statistical estimation of a proportion depends on the survey design (complete enumeration of businesses, simple random sampling, stratified random sampling or a combination of designs). More information on survey design can be found in Chapter 7, while Annex 5 describes the statistical estimation of a proportion.

Box 10. Selection of responses for the calculation of an indicator

The calculation of the indicator Proportion of businesses with narrowband access to the Internet requires selecting the surveyed businesses that answered 'yes' to the question "Did your business use the Internet during the reference period?" and selected either/both the categories corresponding to narrowband (analogue modem, other narrowband) in the question "How did your business connect to the Internet during <the reference period>?" The estimation formula for the indicator will depend on the sample weights given to each selected business according to the sample design. Note that, as multiple responses to the connection question are possible, a business may report both narrowband and broadband access. The percentage of businesses with narrowband access plus the percentage with broadband access could therefore exceed 100 per cent.

159. Core indicators broken down by industry, size and location are compiled by cross-tabulating the information collected through the model questions with that of the background questions (generally present in the main questionnaire of the survey vehicle or as extra questions in a stand-alone survey). The advantage of embedding a module on ICT in an existing business survey is that the number of possible crossing variables is potentially large.

6.2 Model questionnaires for a stand-alone ICT use survey

160. Some developing economies will be interested in measuring ICT topics that go beyond the core ICT indicators and would therefore, almost certainly, require a stand-alone survey. Recalling the examples mentioned in Chapter 4, such topics could cover the following areas:

- Business use of mobile phones;
- ICT security measures in place and security problems experienced by the business;
- Current and capital expenditure on ICT goods and services, including the mechanisms for financing them;
- Particular uses of the Web, such as marketing research;
- Availability of ICT skills in the business and provision of training; and
- Barriers to the adoption of ICT.

161. If a country decides to collect more indicators on the use of ICT through a stand-alone business survey, it would be useful to refer to the experiences of OECD and Eurostat countries; the ICT statistics metadata of OECD countries could be of particular value.³¹ Most OECD/EU countries have stand-alone ICT surveys that enable compilation of reasonably comparable ICT statistics.
162. The approach followed by the OECD's WPIIS led to a model ICT use questionnaire, dealing with key aspects of readiness and intensity. In some situations, measures of the impact of the ICT use on business performance may be achieved by linking data from ICT use surveys with those collected by economic surveys (measuring turnover, labour, investment, etc.).
163. The OECD model questionnaire (Annex 3) has three sections: A) General information about ICT use by the business, B) How the business uses ICT in its operations, and C) Other information about the business. Section A includes questions on use of computers, Internet and other networks, as well as IT security measures and experiences. Section B goes into more detail about how ICT is used by the business. It covers a range of e-business processes including e-commerce (via the Internet and other computer networks); barriers to, and benefits of, Internet selling; and features of the business' web site. Section C collects the background information required to calculate values and to classify data. Not all surveys will need to include all background questions, as the information needed may be available from other sources, such as the business register. Questions in Section C should include: the main activity of the business (indicating its industry), its size (number of employees) and its turnover (indicating size but mainly used as a denominator to calculate the values associated with e-commerce selling). Other background variables may be included if required for further analysis or policy purposes (see Box 11).

Box 11. Background variables in the Eurostat questionnaires

The model questionnaires proposed by Eurostat for the Member States of the European Union to carry out the Community Survey on ICT Usage and E-Commerce in Enterprises include the following background variables: 1) Main economic activity of the enterprise, during the reference year; 2) Average number of persons employed, during the reference year; 3) Total purchases of goods and services (in value terms, excluding VAT) for the reference year; 4) Total turnover (in value terms, excluding VAT) for the reference year; 5) location (convergence/non-convergence region). The last variable is defined in terms of a classification of European regions by level of GDP per capita with respect to the EU average.

Source: Eurostat questionnaires (see also Annex 4).

164. Figure 4 schematically outlines the questionnaire's contents, adding the topic of mobile phone use (see also Table 12). Inherent in its structure is a filtering logic based on certain assumptions (such as 'businesses without a computer can still use the Internet') and designed to move respondents efficiently through the questionnaire.

³¹ Annex 3 of OECD (2005) may be of particular interest to countries undertaking survey development work (it provides metadata for OECD member countries ICT collection work), available at: <http://www.oecd.org/sti/ictmetadata>.

Figure 4. Schematic outline of a model questionnaire on ICT use by businesses

Section A: General information about use of ICT by the business
Use of computers by the business and its employees
Use of mobile phones
Use of local area network (LAN)
Use of intranet and extranet
IT security
Section B: How the business uses ICT in its operations
Use of internet by the business and its employees
Mode of Internet access
Web use
Systems integration (for e-commerce)
Activities carried out over the internet
Barriers to using the internet
Section C: Other information about the business
Main activity
Number of employed persons
Value of fixed assets and turnover

Source: Adapted from "OECD model questionnaire for ICT use by businesses (2005)", see Annex 3.

165. Eurostat model questionnaires typically cover more topics than the OECD model and rotate topics between years. For instance, the 2007 Eurostat model questionnaire had a separate module on e-skills, while the 2008 questionnaire included more detail on e-business processes, with separate modules on automated data exchange, electronic sharing of information on supply chain management and sharing of information within the enterprise as well as perceived benefits of the use of ICT (see Annex 4).

166. Model questions are provided in this *Manual* only for the core ICT indicators and for mobile phone use by businesses. It is suggested that additional questions, if required, be adapted from the model questions presented in Table 12 or from the OECD and Eurostat model questionnaires presented in Annexes 3 and 4. Table 12 offers possible indicators and model questions on mobile phone use for statistical agencies wishing to include them in their ICT surveys. Mobile phone use indicators and model questions will be further developed as users' needs and mobile services available become clearer. Countries interested in collecting mobile phone indicators may also want to include questions on the use of fixed telephone in businesses, which would allow comparison between the two technologies.

Table 12. Model questions on the use of mobile phones

Code	Indicator	Model question	Notes
M1	Proportion of businesses using a mobile phone	Did your business use a mobile phone during <reference period>?	<i>Mobile phones</i> are defined in Table 5.
M2	Proportion of businesses receiving orders via a mobile phone	Did your business receive orders for goods or services (that is, make sales) via a mobile phone during <reference period>?	The question is only asked of those businesses answering 'yes' to the question <i>Did your business use mobile phones?</i> (logical filter) Orders received are defined in Table 5.
M3	Proportion of businesses placing orders via a mobile phone	Did your business place orders for goods or services (that is, make purchases) via a mobile phone during <reference period>?	The question is only asked of those businesses answering 'yes' to the question <i>Did your business use mobile phones?</i> (logical filter) Orders placed are defined in Table 5.
M4	Proportion of businesses using a mobile phone by type of activity	For which of the following activities did your business use the mobile phone during <reference period>? Possible response categories - For getting information about goods or services - For sending or receiving email - For accessing the Internet - For accessing banking or other financial services - For interacting with government organizations/ public authorities - For providing customer services - For delivering products over the mobile phone line	The question is only asked of those businesses answering 'yes' to the question <i>Did your business use mobile phones?</i> (logical filter) <i>Mobile phones</i> are defined in Table 5. The possible response categories are defined in Table 5. Multiple responses are possible as the business may use mobile phones for various purposes. Countries could add or split categories according to country data requirements.

CHAPTER 7 - DESIGNING ICT BUSINESS SURVEYS AND PROCESSING DATA

167. This chapter focuses on the design of ICT use surveys and the processing of collected data. It covers:
- a) The design of business surveys of ICT use:
 - Definition of target populations and statistical units;
 - Preparation of population frames; and
 - Sample design and selection.
 - b) The processing of collected business ICT use data:
 - Data editing, the treatment of missing data and misclassified units;
 - Weighting (grossing-up) procedures for sample data, to produce aggregates; and
 - Calculation of ICT indicators from survey data.
168. Some information on ICT sector surveys is also included where relevant, for instance, the scope of such surveys. While much of the general information presented in this chapter will apply generally to business surveys (and therefore to surveys of the ICT sector), the emphasis is on ICT use surveys.
169. The information on survey design is relevant mainly for stand-alone ICT use surveys. The design of an ICT use module embedded into an existing survey will be strongly influenced by the statistical features of the survey vehicle. However, where possible, the recommendations given here should be considered when designing such modules. Recommendations on data processing will apply to both stand-alone surveys and modules, though in the latter case, survey vehicle practices may also determine some aspects of processing (for instance, treatment of misclassified units and weighting procedures).

7.1 Business surveys on the use of ICT

Target population and scope

170. The target population for a statistical collection (whether a sample survey or a census) is the group of statistical units that are of interest. The target population is defined by the scope of the survey, which is based on attributes of the units. In the case of business surveys, the scope (and therefore target population) is usually defined in terms of economic activities performed (i.e. the industries in which the units operate), size of units (expressed in terms of the number of persons employed and/or turnover) and, in some cases, location.
171. Target populations for surveys of ICT use in the business sector vary between countries, and within a country. They may also change over time; for example, a country may decide to investigate the use of ICT in the manufacturing sector in a first phase, and then extend the target population in subsequent surveys to include the services sector. Several EU countries started by collecting information about ICT use by businesses with 10 or more employees and have, more recently, undertaken surveys on micro-businesses (i.e. those with fewer than 10 employees).

172. As with other business surveys, the scope and target population for statistical investigations on ICT use are usually defined in terms of:
- Economic activity
 - Business size and, sometimes
 - Geographical location.
173. The use of international classifications, such as ISIC, to define industry of activity enhances comparability of statistical results across countries. Most national classifications³² have established correspondences with regional classifications (such as the European NACE or the North American NAICS) and with ISIC. At the most detailed level, ISIC codes consist of 4-digit identifiers of economic activities (for ISIC rev. 3.1, there are approximately 300 classes, hierarchically aggregated into 3-digit groups, 2-digit divisions and an alphabetic character for sections); for ISIC rev. 4, the level of detail has increased to 420 classes, 238 groups, 88 divisions and 21 sections.³³ International working groups continuously revise the adequacy of international classifications and revisions are adopted at the highest level by the UNSC. This *Manual* will describe industries in terms of ISIC codes, in particular, revision 3.1.
174. The OECD recommends that member countries collect ICT use data from businesses operating in manufacturing; construction; wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods; hotels and restaurants; transport, storage and communications; and real estate, renting and business activities. Two industries are proposed by OECD as non-core: financial intermediation services and recreational, cultural and sporting activities. Industries not included in the OECD recommendations are: agriculture, hunting and forestry; fishing; mining and quarrying; electricity, gas and water; community, social and personal services (ISIC sections L, M, N, P except for the non-core division 92); and extraterritorial organizations and bodies.³⁴
175. In developing economies, the scope of business surveys of ICT use may deviate from the OECD recommendation to better suit country requirements (see Example 16). In particular, the agriculture and mining sectors are important in many developing economies and the use of ICT for specific purposes (such as getting price information via mobile phone where Internet and fixed telephone lines are unavailable) can increase economic returns in an important way. Of the sectors within scope of the OECD recommendation, hotels and restaurants (an important element of tourism activities) make up an industry which developing economies may have a particular interest in measuring ICT use. In particular, the facilities that e-tourism increasingly provides to foreign customers (e.g. information about destinations, reservations and payment on line) has favoured the economic development of new destinations in developing economies.

³² National classifications are available at <http://unstats.un.org/unsd/cr/ctryreg/ctrylist2.asp>.

³³ ISIC Rev. 3.1 and ISIC rev. 4 are available at <http://unstats.un.org/unsd/>.

³⁴ The scope recommended by OECD for surveys on ICT use by businesses is: Manufacturing (ISIC D., divisions 15 to 37); Construction (ISIC F, division 45); Wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods (ISIC G, divisions 50 to 52); Hotels and restaurants (ISIC H, division 55); Transport, storage and communications (ISIC I, division 60 to 64); Financial intermediation (ISIC J, divisions 65 to 67) (non-core); Real estate, renting and business activities (ISIC K, divisions 70 to 74); and Recreational, cultural and sporting activities (ISIC O, division 92) (non-core). In this last division, Eurostat only considers the two following classes: Class: 9211 - Motion picture and video production and distribution and Class: 9212 - Motion picture projection.

Example 16. Coverage of the ICT surveys in Brazil, Thailand and Mauritius

The survey on ICT use by businesses in Brazil (carried out from August to September 2005) used the OECD and Eurostat model questionnaires. The target population of the survey was defined as those businesses with operating in ISIC Rev. 3.1 sections D, F, G, K, I, H and groups 921 and 922 of section O.

The population frame for the survey was the RAIS (annual listing of social information) maintained by the Ministry of Labour. This directory provides administrative information on employment and other variables from all registered businesses, employers and persons with economic activities (including those in the agricultural sector), as well as administrative bodies. It is used as an input to the Central Business Register maintained by the National Statistical and Geographical Institute of Brazil (IBGE).

In Thailand, the ICT surveys carried out since 2004 by the National Statistical Office cover establishments with at least one worker, engaged in economic activities classified according to ISIC Rev. 3.1 divisions 15-37, 45, 50, 52-55, 70-74, 92-93 (all classes) and a selection of classes in divisions 60 (transport excluding railways and pipelines), 63 (including only 6304, travel agencies) and 85 (including only 8511, hospitals).

In 2001, the National Computer Board of the Island of Mauritius carried out a survey on the infrastructure and use of ICT by businesses, collecting information from 2,132 establishments selected (as a stratified random sample) from the business register of the Central Statistical Office. The sample covered all sectors, with 48 per cent of the surveyed establishments belonging to the tertiary sector (services), 45 per cent to the secondary sector (manufacturing and construction) and 7 per cent to the agriculture sector.

Sources: Committee for the Management of Internet in Brazil, <http://www.cetic.br/empresas/index.htm>, Thai NSO (presentation to the Joint UNCTAD-ITU-UNESCAP Regional Workshop on Information Society Measurements in Asia-Pacific, Bangkok, 26-28 July 2006, Government of Mauritius, www.gov.mu/portal/goc/ncb/file/ictusagesurvey2001.pdf.

176. This *Manual* recommends that countries wishing to collect ICT use indicators for the business sector include as many industries as possible (including the OECD non-core industries). The *Manual* encourages a broader scope than the OECD recommendation for its member countries, suggesting that developing economies could extend the scope to agriculture, hunting and forestry; fishing; mining and quarrying; and recreational, cultural and sporting activities. The inclusion of an ICT use module embedded in an economy-wide business survey may favour a broader scope.
177. A common scope criterion for ICT use surveys is business size based on the number of employees. There is no universal categorization of businesses based on this criterion, but in many countries, businesses are classified as micro-businesses (0 to 9 employees), small (10 to 49), medium (50 to 249) and large (250 or more). This size classification is consistent with OECD and *Partnership* recommendations (although the OECD suggests a minimum size scope of 10 or more employees for international comparability). Maintaining current size information in statistical business registers is generally more difficult for smaller businesses and, in many countries, businesses without employees do not follow the same registration procedures as employing businesses and so may be difficult to investigate.

178. For reasons of cost and respondent burden, most OECD countries do not include all micro-businesses in the target population (though some, for example Finland, include businesses with five or more employees). However, the exclusion of micro-businesses from ICT use surveys in developing economies would bias the results and should be carefully considered for the following reasons:
- Micro-businesses can account for a very high proportion of the total number of businesses (as high as 90 per cent or more);
 - They can account for a significant share of total employment; and
 - ICT enables businesses of any size, including micro-businesses (for example, in the ICT consultancy sector), to collaborate and generate economic growth.
179. It is therefore recommended that the establishment of a threshold for the size of businesses in the target population be based on the representativeness of the in-scope population in terms of total employment. Specific methods for investigating the micro-business segment may be needed (see Example 17).

Example 17. Investigating micro-business in India

In many developing countries, the Business Register may be outdated in relation to micro-businesses, which change more rapidly than larger firms. In India, a specific multi-stage sampling scheme is used to investigate micro-businesses.

Strata are defined inside the administrative units (districts) according to “rural” and “urban” units. First stage units (FSUs) are villages (in rural areas) and urban blocks (in urban areas, defined by taking into account relevant facilities such as markets, industrial areas, public services). In each stratum, FSUs are sampled with probability proportional to the number of non-agricultural workers (in rural areas) or the number of urban blocks (as per the latest economic census). Micro-businesses are then listed through a survey in the FSUs to form a sampling frame (recording several auxiliary variables) for the selection of second stage sampling units. Further stratification can also be made by economic activity.

Source: National Sample Survey Organisation, Government of India.

180. In some countries, the legal or administrative definition of business size is based not only on the number of employees, but also on a combination of the number of employees and the turnover (classified in intervals). Some harmonization of turnover intervals has been achieved at the regional level (for example in the EU, where the above classification of micro, small, medium and large businesses is used, in combination with common thresholds for turnover). However, given the variety of national situations and, within a country, the change over time of appropriate interval values for turnover, it is difficult to make recommendations on the definition of the target population in terms of turnover. Moreover, the ratio of turnover values to size (number of employees) varies considerably by industry.
181. The third variable used to describe units of a survey on ICT use is the geographical location. The geographical scope of the business sector (and its parts) should in principle include the entire economic territory of the country. The geographical scope within a country should ideally include both urban and rural areas. This is likely to be particularly important in countries where there is an urban/rural digital divide. Rural areas of many developing economies, especially LDCs, suffer from a lack of the basic infrastructure, such as electricity and telephone lines, which are important to build a solid ICT base. Consequently, the use of ICT by rural businesses may present an important gap or even

be almost non-existent. In some countries, the presence of businesses (in particular unorganized manufacturing businesses) in rural areas can be of great importance. As the use of ICT spreads throughout a country, it is recommended that rural areas be also included within the scope of ICT use surveys.³⁵

182. The definition of rural and urban locations has not been harmonized at the international level, and therefore comparisons are problematic. Where there is a statistical definition for urban and rural localities in a particular country, it is generally based on the number (or density) of inhabitants. The definition of urban agglomerations (which can include localities with a small number of inhabitants but geographically connected to larger cities) is also not unique. Therefore, in order to break down indicators by urban/rural location of the business, it is necessary to establish a definition at the country level (see Example 18) and make it available in the metadata so that users can compare the data across countries. Recommendations about the classification of localities as urban or rural can be found in the UNSD Principles and Recommendations for Population and Housing Censuses, Revision 2 (UNSD, 2008).

Example 18. Definition of urban and rural areas in England and Wales

Choosing a suitable urban and rural definition is complicated by the number of different definitions in use. In fact, no single classification meets the needs of all users. In 2002, a review of urban and rural definitions was concluded. It clarified the definitions available but it also that the current definitions were not a suitable long-term solution as they were based on various criteria. A new project was set up to produce a harmonised classification of both urban and rural areas for England and Wales and several government agencies, including the Office for National Statistics (ONS), participated. Urban areas had previously been defined as settlements with a population of 10,000 or more. Under the new classification, areas for which statistics are produced were described as urban or rural depending on whether the majority of the population falls inside a settlement of population 10,000 or more. The new classification is based on a settlement approach and builds upon the identification of rural towns, villages and scattered dwellings within a grid framework of cell size 1 hectare. These new classifications have been endorsed as National Statistics classifications.

Source: Office for National Statistics, <http://www.statistics.gov.uk/geography/nrudp.asp>.

Population frames and coverage

183. The population frame for a survey is the operational form of the target population and consists of a list of all relevant statistical units. The frame is generally used to extract samples of units (such as random samples of specific sub-populations).
184. In the case of business surveys, the frame population is usually extracted from the business register, which lists the economic agents operating in the economy. Business registers for statistical purposes (to be distinguished from registers for other administrative purposes) are generally established and maintained by NSOs and are based on both external sources (such as tax registers) and internal ones (such as the results of ongoing 'unit surveys' or other unit investigations). Business registers are key infrastructure for a statistical system and the quality of business statistics depends heavily on the quality of the underlying register.
185. Common quality problems of business registers in terms of coverage are: duplication of units, overcoverage (i.e. inclusion of units that are not part of the target population) and

³⁵ Clearly, indicators resulting from a survey with such scope limitations will not be representative of the entire country (and would be upwardly biased if they purported to be).

undercoverage (i.e. non-inclusion of units that should be part of the target population). Ideally, the frame population and the target population will be very close, though this is rare (in developed as well as developing economies). The quality of business statistics is usually sensitive to the quality of the business register, which should therefore be as high as possible. Maintenance of the business register can occur through feedback from periodic enterprise and establishment censuses, ad hoc or regular 'unit surveys' to investigate over and undercoverage, checks of duplicates, and cross-verification against other registers – such as tax or administrative registers.

186. In many developing economies, inadequacies of statistical business registers include:

- The presence of a large informal sector which is not recorded in administrative systems (such as those dealing with licences or taxes), leading to undercoverage of the business register;
- Micro-businesses (and in particular self-employed persons) may be more difficult to identify and update, since they usually follow different administrative procedures for registration; this could lead to undercoverage;
- The existence of a large number of 'dormant' businesses that were originally registered but have not been removed from the business register when they ceased to be active (or merged with other businesses). This is due to the administrative difficulties (or lack of administrative processes) that can be found in some countries in relation to ceasing a business; this leads to overcoverage; and/or
- The content of the business register is not adequate for correctly classifying businesses in terms of industry, size and/or location.

187. Obviously, the improvement of the statistical business register is not a task related to the collection of ICT indicators, but a responsibility of the entire national statistical system. Usually, the best way of improving the adequacy of the business register is to coordinate general administrative registers (related to taxes, registrations, licences, social security etc), specific registers (such as licences for operating telecommunications businesses) and statistical databases (updated from economic censuses). In countries with a well-developed tax or social security system, frames generated directly from associated registers could be an option if the law allows for use of registry information for this purpose.

188. In countries where there are no adequate statistical business registers, it is more difficult to conduct surveys on ICT use by businesses. It will be necessary to consider the possibility of constructing a population frame from other sources such as lists of live units in economic censuses or external directories such as commercial telephone listings or industry association lists. Since it is unlikely that all businesses will be included in those lists, the frame may suffer from undercoverage, thereby producing biased estimates. It is recommended in that case to compare the coverage of the frame with other sources and, if possible, to adjust estimates by a process of reweighting. In addition, the necessary documentation and metadata should be provided to inform users how the frame was constituted.

189. Countries using a population frame that lacks accurate information on industry should include a supplementary question in the survey to classify with sufficient detail the main activity of the respondent unit (using ISIC or the national classification) as well as its secondary and auxiliary activities. The same can be done to measure the size of the business. Clearly, samples based on incomplete frames will not be as efficient in this situation (as samples cannot be stratified by industry and/or size).

Statistical units

190. The statistical unit of a sample survey or census is defined as the basic unit of the target population about which data are compiled. Statistical operations such as estimation, imputation (for non-response) and tabulation are carried out on statistical units. The statistical unit may take the form of an observation unit (for which information is collected) or an analytical unit, information about which is created by statisticians.
191. Business surveys usually use enterprises or establishments (i.e. local units of enterprises) as the statistical unit but other choices are possible (enterprise groups, kind-of-activity units, etc.). The choice of the statistical unit is relevant for ICT indicators, since it is probable that lower order units (such as establishments) will have a lower intensity of ICT use. Importantly, most of the denominators used to calculate the core ICT use indicators are related to the choice of statistical unit (proportion of enterprises or establishments) and should be well documented for international comparability purposes.
192. Since ICT use is not easy to attribute to the different establishments of an enterprise (the very nature of enterprise networks implies sharing some elements of ICT infrastructure, such as networks, between establishments), the enterprise is the statistical unit most commonly adopted by countries that have implemented ICT surveys. It is also the unit recommended by the *Partnership* and the OECD. Although there is no universally adopted definition of an enterprise (see Box 12), common criteria for defining an enterprise are autonomy of decision-making for allocation of resources, and engagement in one or more productive activities.

Box 12. SNA 93 and Eurostat definition of an enterprise

In the framework of 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.”

The definition of an enterprise according to the SNA93 methodology is “an institutional unit in its capacity as a producer of goods and services. An enterprise “may be a corporation (a quasi-corporate enterprise being treated as if it were a corporation in the System), a non-profit institution, or an unincorporated enterprise. Corporate enterprises and non-profit institutions are complete institutional units. An unincorporated enterprise, however, refers to an institutional unit - a household or government unit - only in its capacity as a producer of goods and services. It covers only those activities of the unit which are directed towards the production of goods or services. Many households do not contain an unincorporated enterprise”.

The definition used by the European Commission of an enterprise is “the smallest combination of legal units that is an organizational 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.”

Sources: ISIC (Rev. 3.1), Glossary of SNA terms (<http://unstats.un.org/unsd/sna1993/glossary.asp>) and Eurostat, 2006.

193. The *Manual* recommends that countries adopt the SNA93 concept of enterprise, in which an enterprise has some degree of autonomy in decision-making, and consists of one or more legal units involved in one or more activities at one or more locations. The definition of an enterprise according to the SNA93 methodology is “an institutional unit in its capacity as a producer of goods and services” which could be a corporation or an unincorporated enterprise. In some countries, the fact that (registered) legal units

have to submit certain financial reports to an administrative or fiscal authority is seen as an operational criterion for determining autonomy of decision-making. In addition, the sharing of production factors (buildings, capital goods, employees and management) is a strong indication for combining legal units into one enterprise unit. In developing countries, adopting the SNA93 definition may broaden the scope of ICT indicators to include the informal sector. The definition used should in all cases be clearly stated in the metadata.

194. The definition of the enterprise as the appropriate statistical unit poses some limitations in relation to geographical breakdown. Many enterprises, especially larger ones, will consist of several establishments. Because of this, a geographical breakdown of the results using the location of the main headquarters of the enterprise may be of limited use. An economic activity breakdown may also be problematic for enterprise units engaged in more than one type of industrial activity.
195. In practice, the preferred statistical unit may not be able to provide data for a survey. In such a case, a reporting unit could be defined as a unit that reports to the survey authority and provides data for the statistical unit (if possible) or otherwise the most practicable alternative unit. An example is where the objective of the survey is to collect data at the establishment level (which is therefore the statistical unit) but the parent enterprise (the 'reporting unit' in this case) provides data for each of its establishments. The alternative choice of establishments or enterprises as the statistical unit is relevant for firms with multiple locations, and in particular for large firms. Usually, large firms constitute a stratum which is investigated exhaustively (that is, without sampling). In that case, the enterprise may provide information on all its establishments.
196. The choice of statistical units for ICT surveys will depend on organizational considerations such as the availability and detail of business registers (whether it consists of establishments or enterprises), the data collection method, and the business sector environment (business legislation, prevalence of small businesses and other considerations based on the country's economic and administrative environment). In developing economies, where the share of micro and small enterprises is high, it may be convenient to collect data at the establishment level, as establishments and enterprises will generally be equivalent (large firms may be investigated exhaustively). Survey metadata need to specify information about the statistical unit chosen.

Sample design

197. Stand-alone surveys on ICT use by businesses are usually designed to collect information on a large number of topics from businesses across a wide range of industries. For cost and respondent burden reasons, countries will usually wish to select a representative sample of the population of businesses. A complete enumeration of in-scope businesses would usually only be feasible if the number of businesses were small (see Example 19). This could occur, for instance, if the incidence of ICT use in the country were very low (and both ICT and non-ICT using businesses could be identified), or if a high size cut-off were used, thus limiting the scope to large businesses. From this point, we will assume that neither of these situations applies and that countries will be using samples of their population rather than selecting all units.

Example 19. Exhaustive business surveys in the Commonwealth of Independent States

In many countries of the Commonwealth of Independent States, business surveys aim to collect information from all existing businesses in a country. For ICT surveys, only those declaring that they use computers are required to return the questionnaire. In order to derive the proportion of businesses using a specific technology, the estimates will have to be calculated by dividing the number of businesses responding to the survey by the total number of businesses in the country (not by the number of businesses answering the survey).

198. In order to guarantee the representativeness of a sample selection, it should be made using probabilistic techniques. Only probabilistic (random) sampling allows calculation of estimates of the sampling error (also known as 'sample error'), which is defined as the deviation from the true value attributable to the fact that only a sample of the population was observed. The design of a random sample should be based on considerations of the structure of the population of businesses (its stratification), the cost of collecting data and the maximum acceptable statistical error associated with estimates.
199. In the case of modules on ICT use embedded in other survey vehicles, ICT use data may be collected from all selected units or only a portion of them. In either case, the design of the survey vehicle will influence the quality of ICT statistics. Comments and recommendations in this *Manual* will have to be adapted to the particular survey vehicle design.

Stratification of the population

200. Stratification is the technique of dividing the business sector into relatively homogeneous groups (called strata) for the purposes of sample design and estimation. If done properly, stratification will minimize the sample variance of estimates for a given sample size. It allows the use of different sampling ratios (the number of selected businesses divided by the total number of businesses) across strata, reflecting characteristics such as their size, importance or homogeneity.
201. Optimal stratification strategies are based on variables closely related to the variables that are being measured. For the measurement of ICT use in the business sector, the experience of statistical offices of OECD countries shows that at least two criteria are useful for stratification: economic activity and size of business (in terms of number of employees). Use of these stratification variables will generally reduce the overall variance of estimates as well as disaggregations of ICT use statistics by industry and size.
202. A third stratification variable sometimes used is the geographical location of the business. This is especially important if it is anticipated that some areas of the country (such as the capital) have a different intensity of ICT use than other areas. In large countries or countries with a strong regional structure (such as federal states), strata that can also be defined according to the region or to the political-administrative organization; in practice, it is equivalent to designing independent samples in each region. Where location is used for stratification (or as an output classification), the way the location of businesses is determined is important. For example, if the statistical unit is the enterprise and it has a number of locations corresponding to geographically distributed establishments, the criteria for determining location of the enterprise need to be established. In OECD countries, the location will usually be the address of the head office, or equivalent.
203. It is recommended that the design of a sample to collect ICT use statistics take into account at least the stratification of the business sector according to industry and business size.

Sample size

204. The sample size, that is, the number of statistical units from (or about) which information is to be collected, is calculated according to the stratification of the population of businesses for which estimates are to be calculated. If the tabulation plan includes dissemination of data by industry, size and/or location, the sample size will need to be sufficiently large such that disaggregated data estimates have an acceptable level of sampling error.
205. It will be necessary to balance the required precision (reflecting the size of sampling error) of estimates with available resources. A large sample size involves higher costs for data collection and processing. For a given stratum, doubling the precision (i.e. halving the sampling error) for an estimate of a proportion requires multiplying the sampling size in that stratum by four.
206. The sample size and design are derived using bottom-up procedures that calculate the minimum sample size such that output estimates for the most important variables have a specified maximum sampling error. Estimates of the sampling error for these variables may be used to design the sample and may be based on previous surveys or pilot tests (see Example 20).

Example 20. Use of important variables in the design of a random sample in the Netherlands

In the Netherlands, a qualitative variable used to allocate the sample is the reception of orders on line. Strata with very high or very low proportions of businesses receiving on-line orders are surveyed less intensively than businesses with a proportion close to 50 per cent, in accordance with sampling theory.

207. There are no international recommendations for the precision to be achieved for ICT indicators. The precision is usually expressed in terms of the coefficient of variation (i.e. the standard deviation divided by the value of the estimate, usually expressed as a percentage).
208. The final sample size will be the sum of individual strata samples. If the total size is too large, it may be necessary to reconsider the errors of some of the population groups, and to recalculate the total size. The usual approach to setting the precision required for estimates is to fix a maximum sample error for one-dimensional breakdowns of indicators and higher sampling errors for two-dimensional breakdowns. Eurostat recommendations for member States specify a maximum coefficient of variation for overall proportions of 2 per cent and 5 per cent for proportions relating to different sub-groups of the business population, where these sub-groups constitute at least 5 per cent of the total population in the scope of the survey (see Box 13).

Box 13. Design of a business survey with different levels of precision

A sample survey can be designed to provide a maximum statistical error of, say 5 per cent, for the total number of employees for sections of ISIC, while accepting statistical errors up to 10 per cent for the two-dimensional breakdown of ISIC section by business size interval. The sample will be smaller than that required for a maximum statistical error of 5 per cent for both one- and two-dimensional breakdowns.

209. A top-down procedure that is sometimes useful is to calculate the maximum sample size based on the available budget for the survey and the unit cost for collecting data from one business, and then allocate (distribute) the sample by strata according to some

operational rule. The Neyman allocation (based on the cost and the variance of variables in each stratum), for example, guarantees that overall error is minimized.

210. These methods may be modified to adapt them to the survey requirements. Some of the most frequently applied modifications used are: 1) to fix minimum sizes to some strata, with the objective of calculating estimates with a minimum precision; 2) to completely enumerate some important strata (such as those containing large businesses); or 3) to select a larger sample than optimal, to anticipate the reduction of the effective sample caused by non-response.
211. It is important to note that, irrespective of sample size, a high non-response rate means that the calculated estimates are likely to be biased, and that bias will increase with the non-response rate if non-respondent businesses differ significantly from respondent ones (it is likely that businesses that have responded use ICT more intensively than those which have failed to respond). Therefore, one of the important goals of the survey is to minimize the non-response rate (note that the non-response rate does not give complete information about the bias of estimations).

Sample selection methods

212. Assuming that the population is stratified as described above, it is important to consider how to select samples within strata. Two of the simplest and most used methods are systematic sampling and simple random sampling. They are described in Box 14.

Box 14. Sample selection methods

Systematic sampling

The simplest method for random selection of businesses is systematic sampling. Units in the stratum must be arranged from 1 to N , where N is the number of units in the stratum. If n is the number of units to be selected, an interval K should be calculated, such that $K=N/n$ (ignoring the remainder). Now, a random number (the starting point) between 1 and K is selected, call it t , and the sample will consist of the units t , $t+K$, $t+2K$, etc. This method can generate sample sizes of n or $n+1$ which means that the estimate will be biased, unless the weighting factor is adjusted to reflect the larger sample. The systematic sampling method allows distribution of the sample among the population of firms, by means of introducing some order in the frame. For example if, in each stratum, companies are ordered by geographic code, the systematic sample will gather representative elements of all the localities.

Simple random sampling

Random sampling can be thought of as randomly drawing n numbers between 1 and N , where units in the stratum that correspond to those numbers will be included in the sample. Random numbers can be generated by means of randomization routines present in most statistical software. Another possibility is to use a fixed table of random numbers, but this procedure will be cumbersome. Usually selection will be without replacement, that is, there is no possibility of selecting the same unit more than once.

213. It is important to note that the sample selection method must correspond with the method of estimation. Thus, if it is considered appropriate to select businesses in a given stratum with unequal probabilities (e.g. proportional to their size), the estimates will have to weight the units by a weight that is the reciprocal of those probabilities in their formula.

7.2 ICT sector surveys

214. The ideal scope of ICT sector surveys is determined by the OECD definition of the ICT sector (see Chapter 4), but the coverage in individual countries may be more limited.
215. Statistical units for ICT sector surveys are normally determined by the economic surveys that cover the ICT sector. Note that, as ICT sector indicators are ratios of summations, the choice of unit is not as critical as for business ICT use surveys, where most of the indicators are presented as proportions of businesses.
216. Sample design and size for ICT sector surveys will be determined by several factors, including the level of detail of output required. In this context, it should be noted that UNCTAD has collected until 2008 the data on the core indicators for the ICT sector at the most detailed level (4-digit) of the ISIC rev. 3.1 (see Table 13). Starting in 2009, UNCTAD will collect such data according to the ISIC rev. 4. Countries should take into account the correspondence between both ISIC versions when reporting data or when comparing their data with that of other countries.

Table 13. Breakdown by industry for the UNCTAD data collection on the ICT sector (until 2008)

ISIC Rev. 3.1	Activity
Section D	
3000	Manufacture of office, accounting and computing machinery
3130	Manufacture of insulated wire and cable
3210	Manufacture of electronic valves and tubes and other electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated goods
3312	Manufacture of instruments and appliances for measuring, checking, testing, navigating and other purposes, except industrial process control equipment
3313	Manufacture of industrial process control equipment
Section G	
5151	Wholesale of computers, computer peripheral equipment and software
5152	Wholesale of electronic and telecommunications parts and equipment
Section I	
6420	Telecommunications
Section K	
7123	Renting of office machinery and equipment (including computers)
7210	Hardware consultancy
7221	Software publishing
7229	Other software consultancy and supply
7230	Data processing
7240	Database activities and online distribution of electronic content
7250	Maintenance and repair of office, accounting and computing machinery
7290	Other computer-related activities

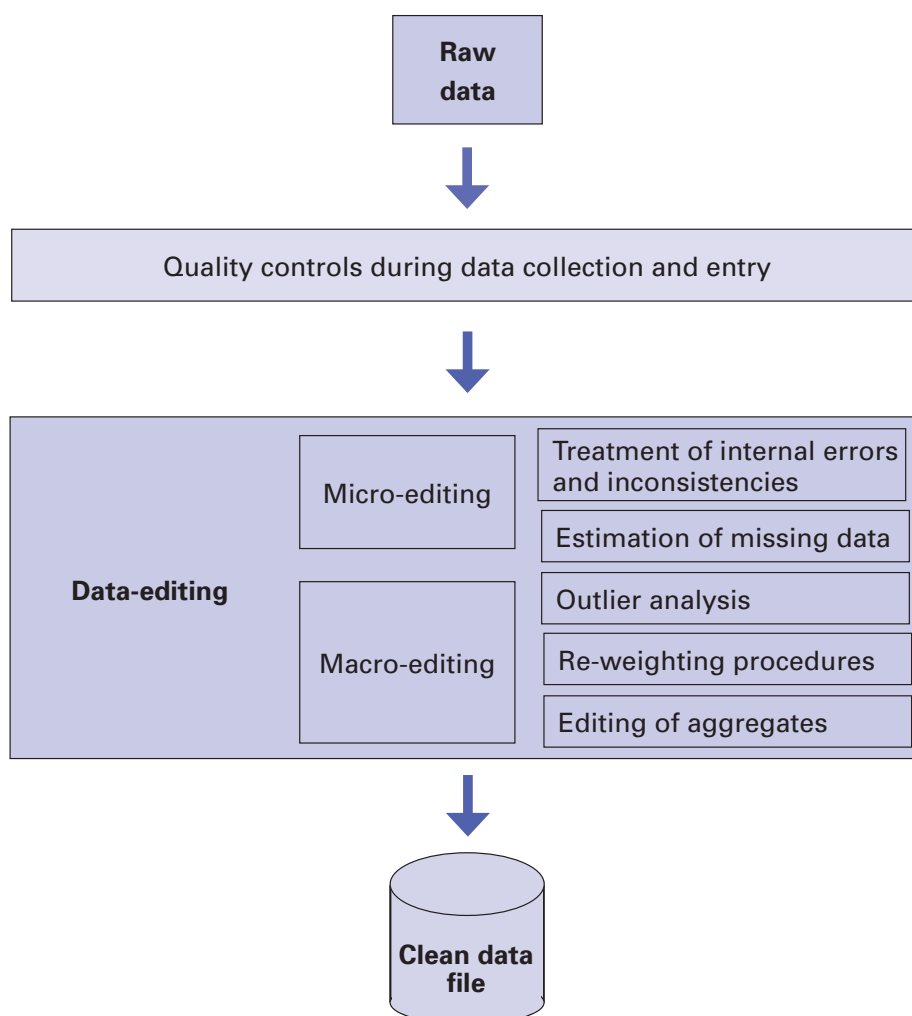
7.3 Data processing

217. The numerical processes that take place after data collection and before aggregate information is disseminated include data editing and data weighting. Data processing practices are fairly country-specific, as data producers will usually have defined them for other business surveys. When ICT surveys are embedded into existing business surveys, data processing for ICT-related variables will tend to follow that of the vehicle survey, with the addition of edits that are specific to ICT questions.

Data editing

218. For many reasons, statistical information provided by businesses, whatever the instrument of data capture, can contain errors. These include erroneous or missing data, incorrect classifications, and inconsistent or illogical responses. In order to minimize such errors, it is important to apply techniques which optimize the effectiveness of data capture instruments and collection procedures. In addition, robust data editing techniques should be used to transform raw data provided by respondents into valid and coherent ('clean') data that can be used to produce aggregated statistics.
219. In this *Manual*, the term "editing" is used to cover all the phases of data processing, from the inspection of raw information provided by the respondent to the production of a clean data set from which aggregates are generated. Data editing covers the sub-processes referred to as 'micro-editing' and 'macro-editing' (also sometimes referred to as 'input' and 'output' editing, see Figure 5):
- Micro-editing refers to controls, validations and modifications applied to the data of a given business. The process includes the treatment of incomplete or missing data and the detection and treatment of answers that are inconsistent with other questions, and
 - Macro-editing refers to controls, validations and modifications of whole datasets by means of the analysis of particular aggregations. The aim of the process is to check whether certain estimates are jointly compatible and are consistent with other knowledge. A sophisticated macro-editing procedure consists of readjusting sample weights according to frame errors detected during the survey. This point is elaborated later in this chapter.

Figure 5. Steps in data validation



Treatment of internal inconsistencies and errors

220. Data editing involves checking and often manipulation of the original data. Such processes can introduce errors that affect aggregate data. Thus, although the process of data editing is essential, it is very important that practices be established that decrease the incidence of incomplete or inconsistent data, so that the impact of data editing is minimized. Quality controls already embedded in data collection instruments or at the data entry stage will directly improve the quality of raw data and reduce the task of data processing.
221. The choice of collection instrument has a direct impact on data quality. Both computer-assisted personal interviewing (CAPI) and computer-assisted telephone interviewing (CATI) can be expected to improve the quality of input data since they provide automatic controls for detecting response errors. Paper questionnaires require validation by statistical staff before and/or after data are entered into a computer for further processing.

222. Validity control of an individual data item consists of checking if the answer belongs to a predefined set (or range) of valid responses. In order to check questions for validity, it is necessary to check them against those defined valid responses. To check the internal consistency of a questionnaire, it is necessary to establish and apply rules that define the relationships between questions, so that certain answers restrict the valid values that other questions can accept (see Box 15). Arithmetic checks (for instance, that percentage distributions add to 100) may be applied during data entry or later run in batch mode across a set of records.

Box 15. Application of micro-editing rules

The question “How many employees use the Internet?” should only be answered if the business has declared in a previous question that it has used the Internet. In logical terms, the question on the business’ use of the Internet can only take two values (0=No or 1=Yes, for example). If the answer is *No*, then the second question on the number of employees using the Internet should not be answered by the respondent. If the answer to the business Internet use question is *Yes*, the question on employees’ use can only be answered with a numerical value that is more than zero but less than or equal to the number of employees of the business. (Please recall also the discussion earlier about the definition of ‘employees’ including employed persons such as owners.)

Treatment of missing data

223. Unit non-response refers to the failure to collect any information from some survey units. Item non-response refers to missing data in a returned questionnaire. Since both forms of non-response have the potential to introduce bias, data collection agencies should strive to reduce the extent of non-response, by means of advertising the survey to data providers through the best available media, improved questionnaires, high-quality fieldwork (if used) and good non-response follow up. However, even with such controls, a certain level of non-response is unavoidable. Analysis of patterns of non-response in relation to the type of unit (e.g. micro-businesses) or particular questions may enable improvement in data collection tools and procedures. Improvements include modification of question wording or instructions, and introduction of simplified questionnaires for some businesses (e.g. micro-businesses).

Unit non-response

224. The usual statistical practice for correcting unit non-response is to change weights in order to compensate for non-responding units. Two methods are possible: sample-based and population-based (see Box 16).
- Sample-based corrective weighting consists of modifying the original sample weights by multiplying them by the inverse of the non-response rate in each affected stratum (or segment); and
 - Population-based corrective weighting is equivalent to classical post-stratification in which survey data are benchmarked against known population totals. This method will also correct poor frame coverage if the benchmarks are independent of the population frame.

Box 16. Corrective weighting for unit non-response**Recalculation of sample weights for unit non-response**

A simple example of computation of sample-based non-response weights is presented in the following table. Suppose we have an ICT survey of 200 enterprises selected with simple random sampling out of 100,000 units, broken down in segments that are considered homogeneous in respect of non-response (in a stratified random sample, the segments would usually be strata). In order to account for unit non-response, design weights have to be modified as shown below.

	Enterprises			Weights		
	Population	Sample	Non-response	Design	Non-response	Final
Segment	a	b	c	$d=a/b$	$e=b/(b-c)$	$d*e$
A	90,000	100	5	900	1.053	947.37
B	10,000	100	10	100	1.111	111.11

The impact of non-response

A sample of 1,000 businesses selected from a population is formed by two groups of equal size, but with different proportions of Internet use. Group A has 70 per cent and group B has 10 per cent (so 40 per cent of businesses in the whole sample use the Internet). The following table shows the impact on the estimate of Internet access, due to different non-response rates in each group.

	Sample	Non-response (rate)	Effective sample	Sample with Internet use
A	500	90 (18%)	410	287
B	500	10 (2%)	490	49
Total	1,000	100	900	336

Now, the sample estimate of the proportion is $336/1,000=33.6\%$, which has a bias of 6.4% (that is, $40 - 33.6$). It can be seen that if the hypothesis of homogeneous non-response ratio fails, the mechanical application of non-response weights leads to biased estimates.

225. It is important to recall that the hypothesis underlying both treatments for unit non-response is that businesses that do not answer are well represented, within the same homogeneous segment (or stratum), by those that do. When there is a risk that non-response is correlated with the variables of interest, neither method will remove the inherent non-response bias.

226. There are more sophisticated methods to correct the weights, based on econometric models (logit, probit and log-linear models). However, they will not be discussed in this *Manual*.

Item non-response

227. The difference between item non-response and unit non-response is not always clear. In particular, if a business has failed to answer many questions, including some important items, it may be more effective from an operational viewpoint to treat that business as a unit non-response, instead of imputing estimates for a large number of item non-responses.
228. Item non-response is generally caused by one of the following:
- The respondent refuses to answer a question (possibly because the information sought is sensitive);
 - The respondent does not know the answer (for instance, the information may not be available from business records);
 - The respondent misunderstands the question and so does not attempt to answer it; and/or
 - The respondent has unintentionally omitted an answer (possibly because the questionnaire has been poorly designed with confusing wording or unclear logic).
229. In the case of more technical ICT questions (such as type of Internet access), non-response may be decreased if it is specified that a person with ICT knowledge (e.g. the chief information officer) should respond for the business.
230. Ignoring missing answers can lead to statistically biased estimates, because the latter are calculated from an unrepresentative part of the sample. Following up item non-response is an obvious solution, especially in cases where the item non-response is extensive, the unit is significant or important questions have been omitted (e.g. those pertaining to the core ICT indicators). Obtaining responses may be easier where the collection is legally mandatory and, in any case, should be carried out as soon as possible after the incomplete response is received.
231. Where it is impractical to re-contact respondents, missing data could be estimated (imputed). Mathematical procedures for imputing missing data are described in Annex 6.

Treatment of misclassified units

232. A frequent problem affecting the quality of business statistics is that some responding businesses may be initially included in the wrong stratum in the population frame from which the sample is drawn. This is more likely when the frame (and the underlying business register) is of poor quality. Statistical business registers maintained by NSOs usually contain information on size (usually in terms of number of employees and/or turnover), industry and location (based on business address). Since ICT indicators are usually broken down by these classification variables, it is important to correct misclassified units.

233. Once the scope (target population) for a survey on ICT in business is defined, a list of 'eligible' ('in-scope') businesses for investigation has to be put together in order to create a population frame. It is possible that misclassified units are erroneously included as eligible, and that eligible units are misclassified such that they do not appear on the frame or appear in the wrong stratum. In the first case, if a surveyed business is eliminated from the sample because of non-eligibility, this will reduce the effective sample size unless a reserve list is prepared. Elimination of misclassified units should only be considered if the rate of misclassification is small.
234. In the second case, the unit is eligible, but was included in the wrong stratum or omitted from the frame altogether. For example, a business selected in the size interval (stratum) of 10 to 20 employees, may report that, in fact, it has only eight employees. The technical solution consists of recalculating sample weights. A new estimate of the size of strata has to be produced and weights corrected accordingly (see Box 17). Clearly, the establishment and maintenance of an up-to-date business register from which to draw a reliable population frame is of utmost importance.

Box 17. How to treat misclassification

Assume that the business population is stratified into two strata (say urban and rural according to their location), and that the population frame includes 1,000 businesses classified as rural and 2,000 as urban. A sample size of 10 businesses is extracted from each stratum, giving a priori sample weights equal to $w_{\text{rural}} = 1,000/10 = 100$ and $w_{\text{urban}} = 2,000/10 = 200$. Suppose that after data collection, the following ex post classification of sample data is as follows:

	Stratum 1	Stratum 2
Stratum 1 rural	7	1
Stratum 2 urban	3	9
Total	10	10

The table indicates that, out of the 10 businesses that were selected from stratum 1, in fact 3 belonged to stratum 2. A corrected estimate of the total number of rural businesses is:

$$1,000 \times 7/10 + 2,000 \times 1/10 = 900;$$

and an estimate of the total number of urban businesses is:

$$1,000 \times 3/10 + 2,000 \times 9/10 = 2,100.$$

Accordingly, the new sample weights for the rural and urban businesses will be $w'_{\text{rural}} = 900/10 = 90$ and $w'_{\text{urban}} = 2,100/10 = 210$.

Weighting procedures

235. ICT indicators are generally referred to the whole business sector or to a relevant part of it. If only a sample of businesses is surveyed, the data collected have to be weighted in order to obtain estimates in respect of the target population. The procedure by which sample data become population estimates is called 'weighting' (or 'grossing-up'). The weighting mechanism must be consistent with the design of the sample.

236. When the survey is a census - that is, data are collected from all units - there is no need for sample weighting. However, as discussed earlier, censuses are generally expensive and less efficient than sample surveys. Although there are exceptions to this, for example if the country has a population frame that identifies all users of computers, and there is a manageable number of such businesses, they could be completely enumerated.
237. In line with international recommendations for business statistics, surveys on ICT use by businesses are generally based on a stratified random sample design, with strata defined by industry and size (at least). Businesses should be selected at random from strata (except for those that are completely enumerated e.g. large business strata). It is assumed that the sample design is based on random selection, without replacement, within strata. Stratum estimates are therefore calculated based on a simple expansion (weighting) to the total number of businesses in the stratum. The method also applies if the selection is systematic with a random starting point in each stratum. The method explained below can be applied to both qualitative variables (such as the *presence of a website*) and quantitative variables (such as the *number of employees who used the Internet*).
238. In the case of quantitative variables, let y_{hi} be the value of the variable, y , for business i in stratum h (for example, the *number of employees with access to Internet*). For qualitative variables, y_{hi} will be 1 if the business has a particular characteristic (for example, if it *has a website*) and 0 otherwise. The sample average in stratum h is defined as the sum of all the sample values in the stratum divided by the number of sampled businesses, say n_h i.e.

$$\bar{y}_h = \frac{1}{n_h} \sum_{i=1}^{n_h} y_{hi}$$

239. If the variables are qualitative and coded as 0 or 1, the answer will represent the sample proportion of businesses with the investigated characteristic. Following the examples, $\bar{y}_h$ would be the estimated average number of employees with access to the Internet in stratum h or the proportion of businesses with a website in stratum h .
240. The estimate for stratum h is calculated by multiplying the stratum average $\bar{y}_h$ by the total number of businesses in the stratum (procedure also referred to as the Horvitz-Thompson estimator), i.e.

$$Y'_h = \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi} = N_h \bar{y}_h$$

241. See Box 18 for the calculation of stratum estimates. It should be noted that stratum estimates will generally be further aggregated for dissemination purposes. For example, the stratification variable for industry may be at the 4-digit (class) level but this level is too detailed for dissemination (which might be at the 1 or 2-digit level).

Box 18. How to make a stratified estimate for an ICT indicator

A survey on ICT use in the manufacturing sector has been stratified according to size with two strata: '0 to 19 employees' and '20 or more employees'. The sizes of the strata are 50,000 and 4,000 businesses respectively. A survey with a sample of 500 and 1,000 businesses in each stratum respectively provides the following non-weighted sample data on the question "Does your business use computers?"

Businesses that use computers:

0 to 19 employees	125	(out of 500 selected)
20 or more employees	750	(out of 1000 selected)

The stratum estimates for the number of businesses with a computer are given by $(50,000/500) \times 125 = 12,500$ and $(4,000/1,000) \times 750 = 3,000$ (i.e. stratum weights multiplied by stratum estimates of the number of businesses using computers). Note that the weights are the inverse of the sampling rate.

242. The population total of the variable of interest is estimated by addition of the estimates for each stratum i.e. $Y'_1 + Y'_2 + Y'_3 + \dots + Y'_L$, where L is the number of strata (see Box 19). When estimates are generated by means of standard statistical software, weights equivalent to N_h/n_h are assigned to each unit in the sample. The formula for the estimate for stratum h (given above) can be written in the following way to show the assignment of weights to each unit:

$$Y'_h = \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi} = \sum_{i=1}^{n_h} \frac{N_h}{n_h} y_{hi}$$

Box 19. How to make a stratified estimate with an exhaustive and a sampled stratum

The survey on ICT use in business run in a particular country was stratified with two strata, one exhaustive (businesses with 20 or more employees) and the other sampled with a sampling fraction of 5 per cent (businesses with fewer than 20 employees).

Using information in the table below, the number of businesses having a website in the total business sector is estimated by weighting each business with fewer than 20 employees in the sample by $1/0.05 = 20$ and each business with 20 or more employees by 1. The population total is estimated by:

$$Y' = \sum_{h=1}^2 Y'_h = \sum_{h=1}^2 \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi} = \frac{200,000}{10,000} \times 1,250 + \frac{3,000}{3,000} \times 2,100 = 27,100$$

Or equivalently, an estimated 13.35 per cent of businesses have a website ($27,100/203,000 \times 100$).

Stratum	Number of businesses in the country	Sampling fraction	Sample size	Number of businesses in the sample with a website
Fewer than 20 employees	200,000	5%	10,000	1,250
20 employees or more	3,000	100%	3,000	2,100

243. Weighting procedures for producing estimates that combine qualitative and quantitative variables are also possible. For example, to estimate the *number of employees* (quantitative) who work in businesses that sell via the Internet (qualitative), it is possible to proceed in the following way: let y_{hi} be the number of employees in business i of stratum h that sells via the Internet (its value is zero for businesses which do not sell via the Internet). The sum of all values y_{hi} in the stratum, multiplied by N_h/n_h is an estimate of the desired stratum value. This weighting procedure allows calculation of estimates for totals, but also for proportions, percentages and ratios (see Box 20 for the estimation of a ratio).

Box 20. Formula for estimating a ratio

To estimate the percentage of employees in businesses that sell via the Internet, out of the total number of employees in the business sector, it can be verified that the procedure for weighting each unit (as described above) is equivalent to estimating the number of employees in businesses that sell via the Internet, the total number of employees in the business sector, and their ratio. Let y_{hi} be the number of employees in business i of stratum h , if that business sells via the Internet (its value is 0 otherwise) and let x_{hi} be the number of employees in business i of stratum h . L is the number of strata. The estimate can be written in the following way:

$$\frac{\sum_{h=1}^L Y'_h}{\sum_{h=1}^L X'_h} = \frac{\sum_{h=1}^L \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi}}{\sum_{h=1}^L \frac{N_h}{n_h} \sum_{i=1}^{n_h} x_{hi}} = \frac{\sum_{h=1}^L \sum_{i=1}^{n_h} \frac{N_h}{n_h} y_{hi}}{\sum_{h=1}^L \sum_{i=1}^{n_h} \frac{N_h}{n_h} x_{hi}}$$

244. The calculation of sample weights is a key step in data processing and should be carefully implemented and documented. Procedures for weighting data will depend *ex ante* on a country's business statistical system including quality of the business register, definition of strata in the business sector and sampling practices (e.g. whether some strata are exhaustively sampled). *Ex post*, once the data collection is carried out, the weights should be revised according to misclassification and non-response.

Calculation of ICT indicators

245. The core ICT indicators are expressed as proportions of businesses or employees that have a particular characteristic (e.g. they use computers). The core indicators can be estimated from samples of businesses following the steps described above (weighting the data from a 'clean' data file, obtained by editing collected data). The technicalities of the calculation of weights depend on the design of the sample including sampling fractions in each stratum.
246. Estimation of a proportion and its sampling error is further detailed in Annex 5.

CHAPTER 8 - DISSEMINATION

247. This chapter describes the statistical dissemination phase, which takes place once estimates for ICT indicators have been produced. Dissemination activities consist of preparation and distribution of ICT data and associated metadata (meaning 'data about data'). While numerical information is most commonly presented as a set of predefined or tailored tables, metadata usually takes the form of notes to tables and technical reports on data quality. This chapter describes tabulation plans for the presentation of survey results and discusses the related metadata, both at the indicator and survey level.
248. Statistical offices aim to produce statistics that are useful for decision-making and an important aspect of data usability is provision of associated metadata. This is especially important for ICT statistics, given the high level of interest in internationally comparable ICT indicators (for instance, from international conferences such as the WSIS). Agencies that produce and disseminate ICT indicators should therefore enhance their usability by routinely disclosing associated metadata. It is strongly recommended that production of these reports is integrated into the statistical production process and not undertaken as a separate activity. Related institutional issues are discussed in Part C.
249. Various NSOs and international bodies have defined quality frameworks and reports for statistical output. These constitute useful guidelines for determining the metadata that should be disseminated with ICT data. NSOs that have done work in this area include the US Bureau of the Census and the statistical offices of Australia,³⁶ Canada and Sweden. International efforts include the IMF's Data Quality Assessment Framework (DQAF)³⁷ and Eurostat's quality reporting tools.³⁸ The latter are well documented and can be used to specify appropriate quality information about ICT use indicators according to six quality dimensions: relevance, accuracy, timeliness and punctuality, accessibility and clarity, comparability, and coherence. Between them, the six dimensions cover the range of metadata that result from statistical collection work.
250. Experience suggests that quality reports are best prepared by the same unit that produces the statistical indicators. Some NSOs may have a quality control system that includes standard documentation of all statistical products. Quality reports are needed to improve statistical operations and, for that reason, should be actively used by NSO staff (for instance, as part of an approval process for the release of statistics). At the same time, an adapted version of the report may be prepared for external users and made available along with statistical output.

³⁶ The ABS quality template outlines and explains the six dimensions of quality, see: <http://www.nss.gov.au/nss/>.

³⁷ The DQAF (<http://dsbb.imf.org/Applications/web/dqrs/dqrsdqaf/>) has been applied to other statistical measurement systems such as National Accounts, Consumer Price index, Producer Price index, monetary statistics, etc. It has also been used by other international organizations such as UNESCO (on education statistics) and the World Bank (on poverty statistics).

³⁸ See Eurostat's quality reporting tools for the EU at <http://epp.eurostat.ec.europa.eu/>.

Tabulation plan

251. The presentation of survey results by NSOs most frequently takes the form of a pre-defined set of tables that are released as paper or electronic publications ('static dissemination'). Users may also request tailored tabulations, which the NSO will prepare for them (often for a fee). Some NSOs have gone further and have adopted web-based technology that allows users to specify the tabulation to be displayed ('dynamic dissemination'). This form of dissemination is beyond the scope of this *Manual*.³⁹
252. Dissemination activities are usually complemented with other communication activities by NSOs, addressing the general population or specific groups of data users (such as decision-makers or the media). These activities target at providing information about the range of statistical products, increasing statistical literacy or trust in statistical institutions. They will not be discussed in this *Manual*, since their scope is larger than ICT statistics. Good practices in dissemination and communication have been identified for example, by the United Nations Statistics Division.⁴⁰
253. The set of statistical tables to be disseminated must take into account the reliability of figures that will be released. Increasing the number and detail of table cells (for example, as a result of cross-tabulation by industry and business size, which can deliver small absolute figures due to a small sample size, or in the case of small economies with a reduced number of enterprises in specific strata) will decrease the precision of figures displayed, since the effective sample size on which cell estimates are based are lower. Confidentiality problems can also arise if the number of businesses contributing to a statistical aggregate displayed in one table cell is small (see Box 21).

Box 21. Statistical disclosure control rules

In order to decide which cells may be published, some NSOs use a minimum of three contributors as the threshold for the number of businesses that contribute to a cell total.

Other rules for protecting confidentiality are defined in terms of the value that is contributed by each unit in the cell. For instance, a tabulation cell may be 'sensitive' and therefore not published if the contribution of one unit is greater than 80 per cent of the total value. This is especially important for developing economies where there are industries with a small number of competing businesses (for instance, in the telecommunications and energy sectors where very large businesses may be dominant in terms of value).

Possibilities for preventing the disclosure of confidential data include collapsing rows and/or columns, suppressing data (and indicating that data are not available for confidentiality reasons) and more technical approaches (such as microdata alteration) which will not be discussed here.

254. In each table cell, statistical estimates can be presented as absolute figures (*number of businesses using computers, number of businesses using the Internet, etc.*) or as proportions (*proportion of businesses using computers, proportion of businesses using the Internet, etc.*). In the latter case, it is important that the table title specifies the reference population (that is, whether the reference population is the total number of in-scope businesses or the total number of in-scope business that use the Internet) and that the value of denominators used is also made available.

³⁹ For an example of this kind of web-based application, several examples are available from developed and developing economies. For instance, the Eurostat database organized by subject matter (available at <http://epp.eurostat.ec.europa.eu/ortal/>), or the on-line dissemination systems for population census data implemented by the Statistical Office of Colombia (http://200.21.49.233/Tot_censo05/inicio_col.htm).

⁴⁰ See the Database of Good Practices at <http://unstats.un.org/unsd/dnss/gp/searchgp.aspx>.

255. A basic tabulation plan of ICT indicators in the business sector would take into account the core indicators and the main breakdowns suggested by the *Partnership*, that is, business size and industry. This basic tabulation plan would consist of at least 24 tables (the 12 core indicators, each broken down by size and industry). Further cross-tabulation by industry and size can be of interest for many countries (should the sample size allow for sufficient accuracy of estimates). The breakdown by urban/rural location of the business is very much dependent on the availability of good classificatory data. As discussed earlier, such a breakdown is encouraged where feasible.
256. It is important that output data include some indication of the reliability of data in table cells. This is especially important for countries that base the production of ICT indicators on surveys whose sample size is small. It is recommended that figures with a low level of precision be highlighted (for instance, those that have a coefficient of variation higher than 20 per cent). Countries may set different reliability levels for different sectors or size categories (for example, allowing more sample error for the small enterprises than for larger enterprises).
257. For international dissemination purposes, UNCTAD recommends a breakdown for the size and industry classification variables (based on ISIC rev. 3.1) as shown in Box 22.
258. The display for the proposed tables could be as shown in Tables 14 and 15. Indicators are expressed as proportions, consistent with the *Partnership's* core indicators list

Box 22. Breakdown by classification variables

For size of business

TOTAL

0–9 employees (micro-businesses)

10–49 (small businesses)

50–249 (medium-sized businesses)

250 or more (large businesses)

For industry (ISIC Rev. 3.1)

TOTAL

ISIC A: Agriculture, hunting and forestry

ISIC B: Fishing

ISIC C: Mining and quarrying

ISIC D: Manufacturing

ISIC E: Electricity, gas and water supply

ISIC F: Construction

ISIC G: Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods

Divisions:

50: Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel,

51: Wholesale trade and commission trade, except of motor vehicles and motorcycles

52: Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods

ISIC H: Hotels and restaurants

ISIC I: Transport, storage and communications

Divisions:

60: Land transport; transport via pipelines

61: Water transport

62: Air transport

63: Supporting and auxiliary transport activities; activities of travel agencies

64: Post and telecommunications

ISIC J: Financial intermediation

ISIC K: Real estate, renting and business activities

Divisions:

70: Real estate activities

71: Renting of machinery and equipment without operator and of personal and household goods

72: Computer and related activities

73: Research and development

74: Other business activities

ISIC L: Public administration and defence; compulsory social security

ISIC M: Education

ISIC N: Health and social work

ISIC O: Other community, social and personal service activities

Table 14. Model table for the publication of core ICT indicators broken down by business size

Indicator	Business size (number of employees)			
	0 to 9	10 to 49	50 to 249	250 and more
<i>Total number of businesses</i>				
<i>Total number of employees</i>				
B1 - Proportion of businesses using computers				
B2 - Proportion of persons employed routinely using computers				
B3 - Proportion of businesses using the Internet				
B4 - Proportion of persons employed routinely using the Internet				
B5 - Proportion of businesses with a web presence				
B6 - Proportion of businesses with an intranet				
B7 - Proportion of businesses receiving orders over the Internet				
B8 - Proportion of businesses placing orders over the Internet				
B9 - Proportion of businesses using the Internet by type of access <i>Response categories:</i>				
- Narrowband				
- Fixed broadband				
- Mobile broadband				
B10 - Proportion of businesses with a local area network (LAN)				
B11 - Proportion of businesses with an extranet				
B12 - Proportion of businesses using the Internet by type of activity <i>Response categories:</i>				
- Sending or receiving e-mail				
- Telephoning over the Internet/VoIP				
- Use of instant messaging, bulletin boards				
- Getting information about goods or services				
- Getting information from general government organizations				
- Interacting with general government organizations				
- Internet banking				
- Accessing other financial services				

Table 15. Model table for the publication of core ICT indicators broken down by economic activity

Indicator	Economic activity (ISIC rev. 3.1)																											
	Category	A	B	C	D	E	F	G			H	I						J	K					L	M	N	O	
								50	51	52		Tot	60	61	62	63	64		Tot	70	71	72	73					74
Total number of businesses	Division							50	51	52	Tot		60	61	62	63	64	Tot		70	71	72	73	74	Tot			
Total number of employees																												
B1 - Proportion of businesses using computers																												
B2 - Proportion of persons employed routinely using computers																												
B3 - Proportion of businesses using the Internet																												
B4 - Proportion of persons employed routinely using the Internet																												
B5 - Proportion of businesses with a web presence																												
B6 - Proportion of businesses with an intranet																												
B7 - Proportion of businesses receiving orders over the Internet																												
B8 - Proportion of businesses placing orders over the Internet																												
B9 - Proportion of businesses using the Internet by type of access																												
Response categories:																												
- Narrowband																												
- Fixed broadband																												
- Mobile broadband																												

Tot = Total for a category. Where disaggregation is not possible, countries could report on proportions referring to the total number of enterprises in a category.

259. The proposed tables correspond to UNCTAD's international collection of indicators on the use of ICT by businesses,⁴¹ and should be complemented by data that correspond to national needs (such as relevant geographical breakdowns or specific details for important industrial sectors, for example the manufacturing sector).⁴²

8.1 Dissemination of metadata at the indicator level

260. Some quality dimensions of statistical products are related to indicators (such as accuracy, reference date and scope) and others to the whole survey. This section covers indicator level metadata.

Accuracy and precision

261. Accuracy refers to the degree to which an estimate correctly describes the phenomenon it was designed to measure. It covers both sampling error and non-sampling error (bias). Precision is related only to the sampling error and may be measured by the standard error of an estimate (the higher the standard error, the lower the precision). Agencies compiling ICT indicators should publish the precision of published estimates as well as the formulas used to calculate precision. Note that bias, the other element of statistical error, is usually not measurable. However, possible sources of bias should be described, along with efforts to minimize it.

Sampling error

262. As we have seen, sampling error arises as a result of obtaining an estimate based on a sample. Most ICT indicators are expressed as proportions. In order to calculate the variance of the estimates, formulas shown in Annex 5 can be applied. Alternatively, the precision of an estimate can be indicated by the standard error (the square root of the sampling variance), the coefficient of variation or a confidence interval (see Box 23). The coefficient of variation (CV) is the ratio of the standard error to the expected value of the estimate to which it refers; it is usually expressed as a percentage. For proportions, the coefficient of variation may be a more easily understood measure of precision.

Box 23. Expressions for the precision of an indicator

If an estimate $\hat{Y}$ has a standard error $SE(\hat{Y})$, then the coefficient of variation is calculated as:

$$CV(\hat{Y}) = SE(\hat{Y}) / \hat{Y}$$

and is usually shown as a percentage.

The 95% confidence interval for $\hat{Y}$ (assuming a normal distribution) is expressed as the approximation,

$$\hat{Y} - 2SE(\hat{Y}) \text{ to } \hat{Y} + 2SE(\hat{Y})$$

⁴¹ See http://new.unctad.org/templates/Page_777.aspx.

⁴² The UNCTAD questionnaire on ICT usage by businesses and on the ICT sector is available at <http://measuring-ict.unctad.org>.

263. Sampling error usually increases as breakdowns become more detailed (see Box 24). Some statistical offices disseminate the precision measures for highly aggregated indicators (e.g. the *proportion of businesses using the Internet* and the same indicator by broad size interval). In addition, NSOs should indicate any cell estimates where the CV is over a particular level (e.g. 20%).

Box 24. Precision levels for an indicator and its breakdowns

A business sample may be designed using information from previous or pilot surveys so that the maximum standard error for the indicator proportion of businesses using computers is 5 per cent for the total business population and less than 10 per cent for any ISIC section.

Bias

264. Bias (often referred to as non-sampling error) in statistical estimates is caused by various imperfections of the measurement system. As it is usually not possible to give a measure of bias, it is necessary to inform users about possible sources of bias and attempts made to minimize it. It is important to recognize that bias errors can be in opposite directions and can therefore cancel to some extent. Bias can arise from:
- Non-response (where the characteristics of the responding population differ from those of the non-responding population);
 - Respondent errors (e.g. a tendency to underestimate income);
 - Errors in the population frame (e.g. coverage errors, misclassification errors);
 - Sub-optimal questionnaire design (e.g. unclear instructions or definitions, poor flow);
 - Systematic errors by interviewers (e.g. leading respondents to particular answers); and
 - Processing errors (e.g. in data entry, data editing, estimation and tabulation errors).

Reference date and period

265. The reference date and reference period are the date and period (respectively) to which the indicators refer. Characteristics such as *use of the Internet* or *number of employees who use computers* vary over time and therefore questions must refer to specific dates or periods.
266. For ICT indicators, the time references are of two types: *reference period* (generally last 12 months, last calendar year or fiscal year) and *reference date*. Core indicators B1, B2, B3, B4, B7, B8, B9 and B12 (which relate to ICT use) have a 12-month reference period. If the question is asked in respect of the *last 12 months*, then problems can arise if the data collection phase spans several months. For this reason, it is suggested that a particular period (such as the last calendar year or the *year ended 30 June 200X*) is used as the reference period and that the survey date (date of interview or dispatch of questionnaires) is as close as possible to the last day of the reference period.

267. Core indicators B5, B6, B10 and B11 (related to existing infrastructure) have as their time reference a specific day prior to the survey date. This is usually the last day of the reference period, for example *31 December 200X*, or shortly after.
268. Metadata should refer to the reference date and period used, and explain any discrepancies arising from changes or from delays in data collection. Such information would typically be included in table headings, as notes to tables and/or in a survey execution report.

Scope of indicators

269. The scope of an indicator is defined by the population to which it refers. Most indicators on the use of ICT by businesses are proportions,⁴³ the denominator of which is determined by the scope specification of the survey in terms of size, economic activity, and so forth:
- Indicators B1, B3, B5, B6, B7, B8, B9, B10, B11 and B12 are calculated as proportions with respect to all in-scope businesses, i.e. with respect to the target population of businesses;
 - Indicators B2 and B4 are calculated using as denominator the total number of employees of all in-scope businesses; and
 - For indicators B7, B8, B9 and B12, an alternative calculation is possible. These indicators can be calculated as a percentage of the subpopulation of *businesses that use the Internet* (i.e. the numerator of indicator B3), as is indicated in Box 25.
270. It is especially important that the denominator of indicators B7, B8, B9 and B12 is made quite clear in each table (whether it is the total number of in-scope businesses or the total number of in-scope businesses that use the Internet, or the total number of the in-scope business in a particular industry or size categories, see Box 25). For international comparisons, it is desirable that these indicators are presented and published as proportions of the whole population of in-scope businesses, although international reporting might require that data is submitted in absolute numbers.⁴⁴

⁴³ For national purposes and for specific users (such as analysts), the publication of absolute figures may also be convenient.

⁴⁴ For example, the UNCTAD questionnaire on ICT usage by businesses and on the ICT sector requests absolute numbers for analysis (calculation) purposes.

Box 25. Alternative presentation of indicators

Tables A, B and C below show alternative displays for indicators, depending on the use of absolute numbers (Table A) or proportions (Tables B and C). Table B shows proportions (indicators B3 and B7) referred to the *total business population*, while Table C displays indicator B7 using as a proportion of the *businesses using the Internet* (row 2 of Table A).

Table A. Absolute figures

Indicator	All businesses	Number of employees			
		0-9	10-49	50-249	250 and more
Number of businesses	36,200	30,000	5,000	1,000	200
Proportion of businesses using the Internet	4,150	3,000	800	200	150
Proportion of businesses receiving orders over the Internet	900	500	200	100	100

Table B. Proportions referred to the total business population (denominators are the figures in row 1 of the Table A)

Indicator	All businesses	Number of employees			
		0-9	10-49	50-249	250 and more
Number of businesses	100.0%	100.0%	100.0%	100.0%	100.0%
Proportion of businesses using the Internet	11.5%	10.0%	16.0%	20.0%	75.0%
Proportion of businesses receiving orders over the Internet	2.5%	1.7%	4.0%	10.0%	50.0%

Table C. Proportions referred to the businesses using Internet (denominators are the figures in row 2 of the Table A)

Indicator	All businesses	Number of employees			
		0-9	10-49	50-249	250 and more
Number of businesses	-	-	-	-	-
Proportion of businesses using the Internet	-	-	-	-	-
Proportion of businesses receiving orders over the Internet	21.7%	16.7%	25.0%	50.0%	66.7%

8.2 Dissemination of metadata for surveys

271. At the survey level, there is a variety of metadata of interest to users. All indicators produced from the survey will share these metadata. They are related to the type of data source (be it a stand-alone survey or a module attached to an existing sample survey or census), the scope and coverage of the survey, classifications and definitions, and methodological issues including any technicalities of data collection. All of these metadata are of relevance for assessing comparability with other national and international data. The metadata for a survey can be presented as a 'survey execution report'.

Rationale

272. Usually, a survey to collect ICT indicators derives from user demand and is expressed formally by a decision to include the necessary measurement work in the national statistical programme. The survey execution report should describe any legislation that refers to the origin of the data collection exercise and details of decisions taken to implement the operation (such as a recommendation by a national statistical council).

Description of data sources

273. As we have seen, data sources for indicators on ICT use by businesses can be diverse and include administrative records, stand-alone ICT surveys and modules in existing surveys. For that reason, metadata should refer to the nature of the data source(s) used for the calculation of ICT indicators. This is particularly important in the case of indicators expressed as a proportion since the numerator and denominator may be obtained from different data sources.

Timeliness and punctuality

274. Timeliness can be defined as the time interval between the availability of results and the date of reference of the information presented. Punctuality is the measurement of the delay between the anticipated date of release and the actual date of release. Both characteristics are easy to quantify and a quality report should include appropriate measures.

Data accessibility

275. Data accessibility is related to how easy it is for data users to obtain statistical results and associated metadata. It is related to the physical means available for data publication (paper, electronic, web-based), to the requirements for access (subscription, payment, free of charge, use of copyright, references to the producer institution, etc.) and how aware users are of available data and how it can be accessed (dissemination calendars, lists of distribution, etc.).

Statistical units, scope and coverage

276. Metadata should describe the statistical units used (establishments, enterprises, etc.), and how they have been defined. Any distinctions between reporting, observation and analytical units should be made clear. Impacts on the estimates from deviations from the recommended unit (enterprise) or changes over time should be described, even if it is not possible to quantify them.

277. Scope and coverage of a survey were discussed earlier in this *Manual* (Chapter 7). Metadata should specify the scope of the survey in terms of at least size and economic activity (and often geography). Any coverage limitations related to the scope should be specified e.g. whether there are some industries or geographical areas that have not been included in the survey or have been treated differently.

Response rate

278. An important item of metadata is the final response rate for the survey (overall and for major disaggregations). The response rate is calculated as the proportion of live (eligible) units responding to the survey. Disaggregations of response rate, by size for example, are useful in conveying an indication of non-response bias.

Statistical standards: concepts, classifications and definitions

279. Major concepts used should be described in the metadata set. An example would be concepts underlying the measurement of e-commerce.
280. Classificatory variables are used to break down indicators. The key classifications for ICT indicators are economic activity and size. The metadata for the survey should indicate whether the classifications used correspond to international classifications (ISIC, for example), or whether there are important differences. Metadata should also describe any classificatory concepts that could be ambiguous. For example, descriptions like “small and medium businesses” need to be precisely defined (generally in terms of number of employees).
281. Definitions (for instance, of ‘broadband’ or ‘computer’) and classifications are key elements for the assessment of international comparability of ICT indicators and coherence with alternative information sources (such as private surveys). Changes in definitions and classifications can also affect comparability of indicators over time and should be well documented.

Data collection method and questionnaire

282. Users should be informed about the data collection method, in particular, about the sample design and method of data collection used (face-to-face interviews, telephone interviews, mailed questionnaires). Publishing the questionnaire used to collect data is generally of great help for more advanced users who may benefit from knowing the exact wording of questions.

8.3 Metadata reports

283. Many countries have their own reporting proformas for survey reports and indicator-level reporting.⁴⁵ It is suggested that metadata reported for ICT use surveys include a description of the topics shown in the Table 16.

⁴⁵ For example, see Eurostat’s quality reporting tools for the EU at <http://epp.eurostat.ec.europa.eu/portal/>.

Table 16. Suggested topics to be included in metadata reporting for ICT use surveys

Topic	Description (metadata to be included)
General information	Rationale for survey, data sources used, reference period and date, date of survey, survey vehicle (where applicable), data collection methods, pilot tests undertaken (if any); major methodological differences compared to previous or related data collection exercises; timeliness and punctuality including changes over time; data accessibility.
Statistical units, scope and coverage	Definition of statistical units used: enterprises, establishments, multinational groups etc.; differences between national unit concepts and international standards and an assessment, if available, of the consequences of the differences; use of reporting, observation and analytical units. Definition of scope and target population including economic activity, size and geography; description (and quantification if possible) of any coverage limitations in respect of the scope.
Concepts, classifications and definitions	Concepts and their basis (e.g. OECD information society statistics standards) should be described, along with any deviation or changes over time; classifications used should be stated and any inconsistencies with international standards described (with a broad impact analysis if possible); classification categories should be defined (e.g. size and geographic categories); definitions of key terms (e.g. computer) should be presented and major deviations from international standards and changes over time described.
Information on the questionnaire	The actual questionnaire used in the survey should be included in the report, if possible, with indications of significant changes over time and major deviations from international model questions.
Population frame	Name and description of the population frame or underlying business register used, origin, updating periodicity, available segmentation variables, and any known shortcomings (e.g. size intervals or sector information not reliable; particular under- or over-coverage issues); changes in the frame over time (e.g. introduction of new updating sources for the business register) should be described and their impact indicated (if significant).
Sample design	Type of sample design (simple or stratified random sample, systematic sample, multi-stage, clustered etc.), sampling units (one stage, two stages), stratification and sub-stratification criteria, sample size and allocation criteria, sample selection schemes, additional measures taken at the time of sampling design to improve representativeness, sample overlap control and sample rotation.
Weighting procedures	Calculation of weights based on sample design, non-response adjustments, adjustments to external data (level, variables used and sources) and final weights. Types of estimates used for each kind of indicator (percentages, means, percentiles, totals, etc.) and its corresponding breakdowns.

Topic	Description (metadata to be included)
Unit non-response and misclassification	Final response rate (total and for major aggregations), gross sample size (final selected sample), number of misclassification cases and ineligible cases, number of eligible businesses, number of non-contacts, number of cases unable to respond, other non-response, net sample size (final effective sample); additionally, the report can give further detail on the methods used for minimizing non-response as well as the methods for dealing with unit non-response (e.g. telephone follow up or written reminders). Size and distribution of unit non-response. A simple indicator that can be calculated for the whole sample and for significant breakdowns is the ratio between non-responding and live units in the sample; the definition of the ratio is $r = n^*/n$, where n is the number of eligible units in the sample and n^* the number of completed interviews or questionnaires for eligible units. It should be noted that out-of-scope units should be removed from both the numerator and denominator, and if substitutions are made in the case of unit non-response, non-response rates should be provided before and after substitution; if substitution is applied, the following information should be provided: method of selection of substitutes and any major differences in the characteristics of substituted units compared to original units.
Item non-response	Item non-response: details of any variables or items with response rates below a specified break value (50% for instance) and methods used for dealing with item non-response e.g. the form of imputation. An indication of the number and percentage of missing or invalid responses for the main variables of the questionnaire is useful.
Item non-response	Item non-response: details of any variables or items with response rates below a specified break value (50% for instance) and methods used for dealing with item non-response e.g. the form of imputation.
Accuracy and precision measures	The report should indicate, at least, the standard error or coefficient of variation (relative standard error) for a selected group of indicators or sub-indicators; other alternatives are to provide some information (e.g. lookup tables) that allows users to calculate approximate errors. The formulas used for calculating sampling errors of main indicators and their corresponding breakdowns should be presented; it is also helpful to provide the effective sample size. In respect of indicator level metadata, it is useful to indicate any table cells that have a high CV (for instance, as notes to tables). While bias is usually not measurable, the report should include likely sources of bias and attempts made to minimize it.

PART C. INSTITUTIONAL ISSUES

CHAPTER 9 - COOPERATION AND COORDINATION

284. Chapter 9 addresses relationships between actors in the statistical system, namely the cooperation and coordination between NSOs and other stakeholders – data providers, other data producers and data users. It also covers the inclusion of ICT statistics in official statistical work programmes; international data collection and methodological work; and capacity-building activities.
285. It is of the utmost importance that ICT statistics be included in official statistical work programmes. Not only is this generally the most efficient way of using statistical infrastructure resources but it also provides strong support for indicators by giving an official “stamp” to the results.

9.1 Cooperation among stakeholders of the national statistical system

286. ICT indicators can be produced from a variety of sources and be generated by different national institutions and private organizations. In order to optimize the use of existing resources, it is important to foster institutional coordination between data providers, producers and users (see Figure 6). This includes collaboration with data providers (especially regarding response burden), coordination among data producers (to increase the efficiency of technical and financial resources for data production) and cooperation with data users (to help them understand the statistics and to satisfy their data requirements).
287. It is strongly recommended that production of ICT indicators be undertaken by an independent National Statistical Office (NSO). Where a national statistical system is decentralized, there may be several official statistical agencies. For simplicity, this *Manual* refers to them as constituting an National Statistical Office. This will provide advantages in managing relationships within the national statistical system. Additionally, statistical surveys carried out by NSOs often benefit from legislation ensuring compulsory response, which thus reduces non-response. The NSO is usually a central government institution specializing in statistics and able to optimize the efficient use of physical, human and technical resources (such as data collection networks, trained interviewers, statistical specialists, business registers and survey vehicles). Users will also benefit from using official statistics and associated metadata, and will have confidence in the data released.

Figure 6. Stakeholders in the ICT statistical system



Collaboration with data providers

288. As Figure 6 shows, providers of data that can be used to produce ICT indicators (on the use of ICT by businesses, the ICT sector and trade in ICT goods) are potentially diverse. Before planning the collection of ICT indicators, NSOs should take into account the response burden that businesses and other providers would bear, defined as the effort required of them to assemble and communicate data. A high response burden may result in non-response to surveys and, consequently, bias in statistical estimates.
289. Data collection procedures should be designed to minimize the response burden of all data providers, but especially individual businesses. Mechanisms to reduce burden include the use of administrative information, well-designed questionnaires, electronic data collection, and use of rotating and non-overlapping samples (see Example 21). It is in the interests of data quality that response burden be kept reasonable in relation to the usefulness of the information provided and that data providers' requests be taken into account by statistics producers. Frequent consultation with data providers, both in formal settings (e.g. statistical councils where they are represented) and in informal ones (e.g. via NSO operations staff), is useful in improving the relationship with them.

Example 21. Reduction of response burden in Thailand business surveys

The National Statistical Office of Thailand applies a system of non-overlapping samples for business surveys. Thus, firms that are selected in a survey will generally be excluded from others. However, because of their significance, large businesses are selected in all business surveys. While a system of non-overlapping samples reduces the potential response burden by preventing the same firm from receiving a number of statistical questionnaires, it means that data from different surveys can be linked only for large businesses.

290. The collection of data by statistical agencies may be required by law. This is the case in most countries, for at least some of the statistical operations carried out by NSOs and data collections by regulatory authorities. Foreign trade operations (above a certain value threshold) are also recorded on a mandatory basis. Units to be surveyed have to be properly informed of the legal basis of the data collection, including their legal obligations and any penalties for failure to comply.
291. Confidentiality is a crucial issue in the relationship between data producers and data providers. Decisions on investment and use of ICT by businesses are an integral part of their business strategies, and they may be reluctant to disclose sensitive information to third parties.⁴⁶ Statistical laws usually provide a guarantee of data confidentiality and protection. These safeguards need to be effectively communicated to respondents, for instance through explicit mention in questionnaires or covering letters, or by interviewers (see Example 22). Chapter 8 explores the implications of confidentiality protection for dissemination plans.

⁴⁶ Anecdotal evidence indicates that sensitivity applies particularly to revealing information about IT security breaches.

Example 22. Legal provisions for compulsory response in the Republic of Moldova

The questionnaire for the survey on use of ICT and computational techniques run by the statistical office of the Republic of Moldova refers to relevant statistical legislation on the cover page of the questionnaire. The law provides that State statistical institutions are entitled to ask for data from all physical and legal persons. At the same time, the *Statistical Law* guarantees the confidentiality of individual unit data, and this fact is also indicated on the cover page.

Source: Survey Questionnaire, Department of Statistics.

292. Some NSOs have put in place incentive systems to foster the cooperation of data providers, thereby minimizing non-response. One such incentive is to provide useful information in exchange for data (such as information comparing the situation of the business with that of others in its industry).

Cooperation and coordination among data producers

293. While it is strongly recommended that indicators on the information economy be produced by NSOs, in a number of developing economies there is currently a variety of public and private producers of ICT data, including relevant ministries, regulatory authorities (issuing licences and supervising markets), private observatories and research organizations (see Example 23). Coordination and cooperation among data producers are thus fundamental to the production of high-quality statistics. Other benefits include reduction of the overall response burden, avoidance of duplication of effort and optimization of the efficient use of resources.

Example 23. Different institutions collecting ICT data in Africa

In a stocktaking survey carried out in 2004, it was noted that in Africa, ministries responsible for telecommunications and their agencies have carried out surveys on ICT use by businesses. In Morocco, for instance, the association of ICT professionals also releases ICT indicators. In sub-Saharan African countries, NSOs were in charge of those operations, while telecommunications regulatory agencies produce ICT-related information in Congo, Rwanda and the United Republic of Tanzania.

Source: Partnership on Measuring ICT for Development, 2005a.

294. While technical expertise on ICT subject matters may be higher in ICT-related institutions, for a number of reasons NSOs are generally in a better position than other organizations to collect statistics. In many countries the NSO is the central point of the national statistical system and plays a coordinating role enshrined by law. The multiplicity of actors involved in national statistical systems, particularly in relation to ICT indicators, necessitates institutional leadership, and, given their area of expertise, NSOs are usually best placed to exercise this.
295. National statistical systems have varying degrees of structure and coordination. Most countries have a system structured within a legal framework, which puts in place coordination bodies (for example, inter-ministerial commissions or national statistical councils) where stakeholders are represented. Such inter-institutional structures may also work in thematic groups (for instance, related to particular topics). In the case of ICT statistics, the existence of formal institutional links between the NSO and relevant ministries is an advantage for the coordination of data production (see Example 24).

Example 24. The decentralized system of ICT statistics in the Philippines

The Philippines has a highly decentralized national statistical system, but with strong coordination mechanisms. As the highest policy making and coordinating body on statistical matters, the National Statistical Coordination Board (NSCB) maintains and creates sectoral inter-agency committees to resolve issues on statistical matters, to assist the Board in the formulation of policies for adoption by all concerned (such as statistical standards and classification systems), and to make recommendations on the improvement of data generation and dissemination.

ICT indicators are produced by various government agencies in the country. Administrative-based ICT data come from the Department of Transportation and Communications (National Telecommunications Commission, Telecommunications Office, Philippine Postal Office), Department of Science and Technology, Department of Trade and Industry, National Economic and Development Authority and the Commission on Information and Communications Technology as a product of their administrative and/or regulatory functions. Meanwhile, most household and establishment-based ICT data are generated through surveys conducted by the National Statistics Office.

The NSCB created the Inter-Agency Committee on ICT Statistics in 2006, among others, to formulate a national ICT statistical framework; discuss and resolve issues relating to ICT statistics; review the concepts, techniques, and methodologies used in the collection, processing and reporting of ICT statistics to ensure conformity with prescribed statistical standards; provide inputs to the NSCB Technical Committee on Statistical Standards and Classification in the development of standard concepts and definitions on ICT statistics and ICT classification systems; recommend policies geared towards improved generation, dissemination and utilization of ICT statistics including the data gaps; and to monitor the overall development of ICT statistics in the Philippines.

Source: UNCTAD, based on information provided by the NSCB, the Philippines.

296. Other forms of collaboration among data-producing organizations could take the form of thematic cooperation agreements or inter-agency working groups with clearly defined responsibilities for establishing technical standards (e.g. for data collection and analysis, fieldwork and the verification and dissemination of findings) (see Example 25). Before starting collection of data on ICT, the NSO should carefully assess the existence, in other governmental organizations, of technical expertise and data infrastructure (such as business or administrative registers).

Example 25. Co-ordination instances in the Spanish Statistical System

The statistical system in Spain comprises the National Statistical Institute (INE), statistical units in the sector ministries and the Central Bank, and statistical institutes of the 17 autonomous regions, which have technical and financial autonomy from INE. Three major instances of co-ordination are in place at the national level: the Higher Statistical Council, with a representation of data users (businesses, trade unions, academia), data providers (business associations, consumers' associations) and producers (INE plus statistical units of the ministries and the Central Bank); the Inter-ministerial Statistical Commission (with a representation of INE and the ministries), and the Inter-territorial Statistical Committee (with the representation of the central administration and the regional statistical institutes). Besides this, in each region there are equivalents to the Statistical Council (data users, providers and producers) and of the producers' committee. At the same time, a Statistical Law at the national level and 17 statistical laws coexist. Several duplications of data collection and possible legal conflicts have been identified. The system is supported by a series of bilateral protocols of collaboration between institutions.

Source: INE <http://www.ine.es/normativa/leyes/organi.htm>.

297. The powers of NSOs may be such that, inter alia, other organizations are obliged to consult them before altering administrative records that could be used for statistical purposes or before undertaking statistical work. Also, NSOs confer official status on the data they produce and may have responsibility for the preparation of national statistical plans. Legislation may endow NSOs with certain powers, for instance the power to establish technical procedures and standards, definitions, nomenclatures and survey frameworks.
298. Coordination of statistical activities between NSOs and other agencies in the national statistical system for the production of ICT indicators should include the following:

Technical coordination

- Establishment and coordinated use of definitions of ICT concepts and relevant classifications. These definitions should be based on international standards, but adapted to country conditions;
- Establishment of population frames for business surveys; and
- Establishment of procedures for the preparation and dissemination of standardized metadata by agencies in the national statistical system.

Legal coordination

- Establishment of an adequate institutional framework to represent the institutions that produce information, including (at least) the national authorities, in the areas of technological infrastructure, science, telecommunications and so forth;
- Legal provisions that NSOs can use (following appropriate analysis and consensus) to establish technical standards that are obligatory for other data producers;
- Legal provisions to confer official status on statistics from data collection exercises conducted by institutions that are members of the national statistical system (this is particularly important in the case of statistical operations financed by external agents without prior integration into national programmes of statistical activities); and
- A legal framework to ensure sustainable funding from the national budget (or from donor cooperation, where relevant) for the operation of national statistical systems and for the implementation of programmes of statistical work.

Coordination in resource allocation

- Development of synergies among the different institutions' financial resources for the implementation of large-scale surveys (for example, collaboration with registration offices for the design of business population frames; see Example 26);
- Making good use of the technical capacities of highly qualified staff in the national statistical system, for instance by having them participate in inter-agency task forces and training programmes as well-trained survey enumerators;
- Efficient use of ICT resources available within different agencies in the national statistical system, and other cooperating organizations, for data collection, processing and dissemination; and
- Coordination of financial resources (from external sources and between agencies involved in the project).

Example 26. Distribution of roles in the collection of ICT statistics in Cameroon

Cameroon implemented a survey on penetration and use of ICT in the framework of the SCAN-ICT project. The institutions in charge were the Ministry of Post and Telecommunication (MINPOSTEL) and the National Statistical Institute (INS). The division of tasks between the two institutions enabled the sharing of technical, human and financial resources.

The responsibilities were as follows:

- Preparation of data collection instruments (INS & MINPOSTEL)
- Recruitment of interviewers (MINPOSTEL)
- Training of interviewers (INS & MINPOSTEL)
- Data collection (MINPOSTEL)
- Data processing (INS)
- Data analysis (INS & MINPOSTEL)
- Dissemination of results (INS & MINPOSTEL)
- Communication to specific users (MINPOSTEL)
- Web dissemination (MINPOSTEL).

Source: Ministry of Post and Telecommunications (www.minpostel.gov.cm/scan-ict2006) and National Statistical Institute (www.statistics-cameroon.org).

299. In many countries, private institutions collect ICT data and disseminate estimates on different aspects of the information economy. Unfortunately, they often produce incoherent results, rely on non-transparent methodologies and release unreliable predictions. Many private sources have therefore been deemed unreliable (UNCTAD, 2001).

Cooperation with data users

300. ICT indicators are required by a variety of users: public policymakers to design technology policies, businesses to benchmark against competitors and make informed decisions, researchers to evaluate the impact of ICT use on productivity and working conditions, and the international community to compare the deployment of ICT across a range of countries. Because public resources are devoted to the production of ICT statistics, NSOs and other data producers wish to maximize their dissemination and facilitate their use (see Example 27).

Example 27. Cooperation with ICT data users in Peru

The survey carried out in Peru in 2004 on innovation and use of ICT was the subject of a convention between the National Statistical Institute (INEI), and the National Council of Science and Technology (CONCYTEC), which is an important user of data. The orientation towards users was also present before this agreement: the INEI published a User Manual of ICT Indicators which included not only the results of the survey, but also a description of the methodology, a glossary of technological terms related to ICT and a copy of the questionnaire used for data collection.

Source: INEI, www.inei.gob.pe/biblioineipub/bancopub/Inf/Lib5136/Libro.pdf.

301. Dissemination of ICT data should be guided by the needs of users and follow best international practices. Data producers should constantly assess the demand for ICT indicators. Contacts with – and feedback from – data users, in the framework of national statistical councils or technical working groups, can help the NSO and other data producers to better understand demand for ICT statistics. In developing economies, civil society groups and NGOs have a major role to play in bridging the digital divide and assisting socially excluded groups. Civil society participation in the specification of data collection, via the participation of business associations, the media, universities and research centres, is more likely to ensure that data will be relevant to the ICT data needs of such groups.
302. Dissemination formats and tools should increase the transparency of methodology. ICT statistics publications (in paper, in electronic format and/or on the Web) should provide not only numerical estimates, but also the metadata that are required in order to understand the data (see Chapter 8 for a discussion of metadata topics to be disseminated). An example is the quality reporting profiles prepared by Eurostat, which cover a number of areas of statistics.⁴⁷
303. Other aspects of cooperation with users relate to the timeliness and accessibility of statistical information. ICT evolution is faster than the evolution of other economic and social processes, and data quickly become outdated. The earliest possible dissemination of data, preferably on the basis of a pre-determined dissemination calendar, will be of great help to users.
304. Equity of access is an important principle that dictates that all users should have equal access to data, irrespective of their economic and social circumstances. Arranging such access is becoming easier with tools such as web-based statistical dissemination. The use of a variety of data dissemination formats (rapid notices, yearbooks, specific publications, electronic databases, etc.) should be considered in order to maximize the use of statistics.

9.2 Statistical work programmes

305. As we have seen, effective monitoring of the information economy requires high-quality and timely statistical information. One-off measuring exercises may provide a picture of the ICT situation at a given point in time, but the rapid evolution of technologies, usage practices and policy interests quickly render one-off estimates outdated. A medium-term sustained programme of surveys and analysis is therefore necessary in order to monitor changes.
306. National statistical programmes are coordination and planning tools that are increasingly being adopted by countries. They comprise a set of statistical operations to be carried out and assign responsibilities to the various institutions that constitute the national statistical system. They would normally also include estimates of financial resources required in order to undertake the statistical programme. They can span annual or multi-annual periods and are periodically revised to reflect changes, including users' new data requirements. Usually, statistical programmes are validated by a high-level multi-institutional group, where data producers and users are represented, before their approval and adoption by Governments.

⁴⁷ Eurostat has applied quality profiles to various data sets such as those on employment, innovation and research, environment, social cohesion and others. The reports are available at <http://epp.eurostat.ec.europa.eu/>.

307. ICT collections should be included in national statistical programmes (see Example 28) in order to:
- Increase the engagement of Governments for funding and other assistance, in a sustainable manner;
 - To communicate plans to users, including when data are expected to be available, and
 - To coordinate the technical and financial resources of the NSO and other data producers.

Example 28. Inclusion of ICT surveys in the statistical programme of Chile

The national statistical system of Chile is organized by means of a national statistical programme that is updated annually. The programme includes structured information about all the official statistical operations carried out not only by the NSO (INE) but also by ministries and other public institutions. In particular, it includes the description of statistical operations in terms of responsible institutions, general and specific objectives, targets for data dissemination, periodicity, geographical coverage and sources of information. In the field of ICT indicators, it mentions the different statistical operations that record data on ICT use (surveys on SMEs, surveys of the trade sector and an ICT satellite account).

Source: INE, National Statistical Programme, available at PARIS21 website, <http://www.paris21.org/>.

308. It is recommended that business ICT statistics collections be coordinated with other business surveys in terms of timing and target populations, so that combined analysis of the use of ICT and other economic variables can be undertaken.
309. Several developing economies are preparing their national strategy for the development of statistics (NSDS) and statistical master plans, which are also being promoted by the international community of donors.⁴⁸ NSDSs are intended to encompass all statistical activities of public institutions in a country, not only those of the NSO. They therefore provide a tool for coordination and sustainability of statistical production. Countries that are in the process of preparing master plans and NSDSs should consider the inclusion of ICT measurement work in medium- and long-term planning.

9.3 International data collection and methodological work

310. The need for international benchmarking, research and policy advice on ICT issues has led to data collection initiatives by several international organizations. Many countries cooperate with international organizations to compile internationally comparable ICT data, whilst also satisfying national needs for indicators. Several regional and international initiatives on the collection of harmonized ICT data have been undertaken in the past few years by UNCTAD, the ITU, the UN Regional Commissions, OECD and Eurostat, and via specific projects such as the @LIS and SCAN-ICT initiatives.
311. The Partnership on Measuring ICT for Development has a coordination and facilitation role in the area of international ICT measurement (see Chapter 2 for more information).

⁴⁸ For instance, the STATCAP and the TFSCB funds managed by the World Bank support the preparation and implementation of statistical master plans.

312. At the global level, the UNSC, at its 38th session in March 2007, reviewed the work of the *Partnership*, endorsed the core list of ICT indicators and encouraged countries to adopt the indicators. It also recommended future expansion of the core list to include areas such as government, education and impact measurement. A revised core list was presented to the UNSC at its 40th session in February 2009, including a new set of core indicators on ICT in education.
313. Important initiatives on international ICT data collection include the following:
- An international database has been established by UNCTAD based on a questionnaire sent to countries (starting in 2004), which collects data on the core indicators on the use of ICT by businesses and on the ICT sector.⁴⁹ The data collected by UNCTAD are used for policy advice, technical assistance activities, and research and analysis with a focus on developing economies. The results are published in the annual *Information Economy Report*.
 - The International Telecommunication Union (ITU) collects a range of ICT indicators on infrastructure and access and has recently started collecting the core ICT indicators on household/individual access and use. Results are made available through the *World Telecommunication Indicators Database* and are used to calculate other indicators such as the *ICT Opportunity Index*.⁵⁰
 - The OECD and Eurostat collect and disseminate comparable information from member countries on ICT access and use, the ICT sector and the economic impact of ICT. Both organizations also provide statistical standards in the form of model questionnaires and other information.⁵¹

9.4 Capacity-building issues

314. The production of ICT indicators in developing economies has to be seen in the context of the general strengthening of national statistical systems. Countries that are willing to start producing such indicators should coordinate this activity with current or planned national capacity-building activities for statistical infrastructure (e.g. legal frameworks for statistics, business registers and data collection networks) and statistical practices (e.g. implementation of business surveys). Production of indicators on the use of ICT by businesses should not be considered separately from those other issues since duplication of efforts and other inefficiencies can arise. In particular, countries starting the collection of ICT indicators should take into account the following capacity-building issues:
- Improvement of the legal framework for statistical surveys: ICT business surveys (whether dedicated to ICT or vehicles for ICT modules) should ideally be subject to statistical laws that establish obligations such as compulsory provision of data and protection of those data by the NSO and other official statistical agencies. The legislative framework may also establish legal mechanisms for implementation and funding of statistical operations. In some countries, revision of the legal framework for statistical surveys could increase the efficiency of the data collection system (see Box 26).

⁴⁹ UNCTAD data are available at the website <http://measuring-ict.unctad.org>.

⁵⁰ Available at <http://www.itu.int/ITU-D/ict/index.html>.

⁵¹ OECD data, methodological reports and analytical documents can be found at <http://www.oecd.org/sti/measuring-infoeconomy/guide>. Eurostat data and reports are available at <http://epp.eurostat.ec.europa.eu/>.

Box 26. The case for revision of statistical legislation to improve ICT statistics

The statistical legislation of developing economies may be the subject of revision, especially when countries have experienced important political or economic changes. In respect of ICT statistics, such changes might lead to the inclusion, on national statistical councils, of ministries responsible for science and technology or telecommunications, organizations representing the business and research community, and so forth.

In transition economies, the exhaustiveness of business surveys established by statistical laws for centrally planned economies may not be efficient compared with sample surveys if the business sector is developed (in particular, if the small and medium-sized enterprise (SME) sector is very large).

In some countries, respect for the confidentiality of individual data may not be fully reflected in current laws, a fact that should be carefully considered.

- Establishment and improvement of business registers: The process of creating a business register for ICT data collection should be coordinated with general plans to establish a business register or improve an existing one (see Chapter 7).
- Improvement of data collection systems: Capacity-building projects for enhancing ICT data collection should avoid duplication of structures that already exist, such as a network of data collection centres (which are generally spread over the country) that report to the central or regional statistical authorities.
- Coordination of the system of business statistics: Current programmes of capacity-building for business statistics should be coordinated. In many developing economies, there are international cooperation programmes devoted to implementing new business surveys or to adapting international standards within existing systems (see Box 27). These programmes should be taken into account by countries willing to carry out ICT surveys.

Box 27. Reform of business statistics in former centrally planned economies

A number of Central and Eastern European, as well as Central Asian, countries have undergone a political and economic transition from centrally planned to market economies since the 1990s. Business surveys have been redesigned so that samples are used instead of complete enumeration of businesses. Samples for ICT surveys should be coordinated with those of other business surveys (such as manufacturing or service industry surveys) in order to reduce response burden, and increase the coherence and usability of statistical results.

- Training human resources for statistical production: Different types of staff are needed for the production and analysis of ICT statistics: interviewers, data coders, statisticians and economists. Besides specific knowledge (for example, of ICT standards, concepts and definitions), staff will usually need to have statistical expertise (for example, in collecting data, units and classifications, business sampling methods, statistical estimation, data processing techniques and statistical dissemination practices). Capacity-building programmes in business statistics should include staff involved in the production of ICT indicators.
- Enhancing the capacity for data dissemination: The implementation of statistical dissemination systems for ICT indicators such as online databases or web dissemination can be coordinated with similar initiatives for other statistical projects within statistical organizations.

315. There are several international initiatives that support the improvement of ICT statistics in developing economies. The following capacity-building initiatives may be of interest to those economies:

- The Partnership on Measuring ICT for Development has a capacity-building task group led by UNCTAD.⁵² In the field of business ICT indicators, including indicators on the ICT sector and trade in ICT goods, UNCTAD provides technical assistance to countries interested in improving their ICT data production systems in the form of training and advisory missions. In order to improve the availability of comparable statistics on ICT for development, this technical assistance must be combined with a commitment by countries to collect the recommended core ICT indicators.
- The consortium Partnership for Statistics in the 21st Century, PARIS21 (www.paris21.org), provides a reference library for the preparation of statistical development strategies and master plans. PARIS 21 organizes regional seminars to foster the use of statistics for development and provides assistance to countries wishing to apply for funding under programmes such as the Trust Fund for Statistical Capacity Building (TFSCB) (grants) and the lending programme STATCAP managed by the World Bank.⁵³

⁵² For an overview of the capacity-building activities of the *Partnership*, see http://new.unctad.org/templates/Page____605.aspx.

⁵³ For information about the TFSCB and STATCAP, see <http://web.worldbank.org/>.

ANNEXES

ANNEX 1

REVISED CORE LIST OF ICT INDICATORS (2008)

The core list of indicators was revised in 2008 and is to be presented to the UN Statistical Commission at its 40th session in February 2009.

ICT Infrastructure and access	
Code	Core indicator
A1	Fixed telephone lines per 100 inhabitants
A2	Mobile cellular telephone subscribers per 100 inhabitants
A3	Fixed Internet subscribers per 100 inhabitants
A4	Fixed broadband Internet subscribers per 100 inhabitants
A5	Mobile broadband subscribers per 100 inhabitants
A6	International Internet bandwidth per inhabitant (bits/second/inhabitant)
A7	Percentage of population covered by a mobile cellular telephone network
A8	Fixed broadband Internet access tariffs (per month), in US\$, and as a percentage of monthly per capita income
A9	Mobile cellular prepaid tariffs, in US\$, and as a percentage of monthly per capita income
A10	Percentage of localities with public Internet access centres (PIACs) by number of inhabitants
Access to, and use of, ICT by households and individuals	
Code	Core indicator
HH1	Proportion of households with a radio
HH2	Proportion of households with a TV
HH3	Proportion of households with telephone <i>Response categories:</i> - Proportion of households with fixed telephone only - Proportion of households with mobile cellular telephone only - Proportion of households with both fixed and a mobile cellular telephone
HH4	Proportion of households with a computer
HH5	Proportion of individuals who used a computer (from any location) in the last 12 months
HH6	Proportion of households with Internet access at home
HH7	Proportion of individuals who used the Internet (from any location) in the last 12 months
HH8	Location of individual use of the Internet in the last 12 months <i>Response categories:</i> - Home - Work - Place of education - Another person's home - Community Internet access facility - Commercial Internet access facility - Any place via a mobile cellular telephone - Any place via other mobile access devices

HH9	Internet activities undertaken by individuals in the last 12 months (from any location) <i>Response categories:</i> - Getting information about goods or services - Getting information related to health or health services - Getting information from general government organizations - Interacting with general government organizations - Sending or receiving e-mail - Telephoning over the Internet/VoIP - Posting information or instant messaging - Purchasing or ordering goods or services - Internet banking - Education or learning activities - Playing or downloading video games or computer games - Downloading movies, images, music, watching TV or video, or listening to radio or music - Downloading software - Reading or downloading on-line newspapers or magazines, electronic books.
HH10	Proportion of individuals with use of a mobile cellular telephone
HH11	Proportion of households with access to the Internet by type of access (narrowband, broadband (fixed, mobile)) <i>Response categories:</i> - Narrowband - Fixed broadband - Mobile broadband
HH12	Frequency of individual use of the Internet in the last 12 months (from any location) <i>Response categories:</i> - At least once a day - At least once a week but not every day - Less than once a week
	Reference indicator
HHR1	Proportion of households with electricity
Use of ICT by businesses	
Code	Core indicator
B1	Proportion of businesses using computers
B2	Proportion of persons employed routinely using computers ¹
B3	Proportion of businesses using the Internet
B4	Proportion of persons employed routinely using the Internet ²
B5	Proportion of businesses with a web presence
B6	Proportion of businesses with an intranet
B7	Proportion of businesses receiving orders over the Internet

¹ Note that this indicator is not equivalent to the employment weighted indicator 'proportion of persons employed working in businesses with a computer'.

² Note that this indicator is not equivalent to the employment weighted indicator 'proportion of persons employed working in businesses with Internet access'.

B8	Proportion of businesses placing orders over the Internet
B9	Proportion of businesses using the Internet by type of access (narrowband, broadband (fixed, mobile)) <i>Response categories:</i> - Narrowband - Fixed broadband - Mobile broadband
B10	Proportion of businesses with a local area network (LAN)
B11	Proportion of businesses with an extranet
B12	Proportion of businesses using the Internet by type of activity <i>Response categories:</i> - Sending or receiving e-mail - Telephoning over the Internet/VoIP, or using video conferencing - Use of instant messaging, bulletin boards - Getting information about goods or services - Getting information from general government organizations - Interacting with general government organizations - Internet banking - Accessing other financial services - Providing customer services - Delivering products on line - Internal or external recruitment - Staff training
ICT sector and international trade in ICT goods	
Code	Core indicator
ICT1	Proportion of total business sector workforce involved in the ICT sector (expressed as a percentage)
ICT2	ICT sector share of gross value added (expressed as a percentage of total business sector gross value added).
ICT3	ICT goods imports as a percentage of total imports
ICT4	ICT goods exports as a percentage of total exports
ICT in education	
Code	Core indicator
ED1	Proportion of schools with a radio used for educational purposes
ED2	Proportion of schools with a TV used for educational purposes
ED3	Proportion of schools with a telephone communication facility
ED4	Student-to-computer ratio
ED5	Proportion of schools with Internet access, by type <i>Response categories:</i> - Fixed narrowband Internet access - Fixed broadband Internet access - Both fixed narrowband and broadband Internet access
ED6	Proportion of students who have access to the Internet at school
ED7	Proportion of students enrolled by gender at the tertiary level in ICT-related fields
ED8	Proportion of ICT-qualified teachers in primary and secondary schools
	Reference indicator
EDR1	Proportion of schools with electricity

Source: Partnership on Measuring ICT for Development, 2009b.

ANNEX 2

UNCTAD MODEL QUESTIONNAIRE

UNCTAD Model Questionnaire for core indicators on use of ICT by businesses, 2009¹

Module A: General Information about use of ICT by your business		
A1. Did your business use computer/s during <reference period>^a? <i>A <u>computer</u> refers to a desktop or a laptop computer. It does not include equipment with some embedded computing abilities such as mobile cellular phones, personal digital assistants (PDA) or TV sets.</i>	☐ Yes	☐ No → Go to B1
A2. How many persons employed in your business routinely used a computer at work during <reference period>? If you can't provide this value, Please indicate an estimate of the percentage of the number of persons employed that used computers during <reference period>. <i>Persons employed refers to all persons working for the business, not only those working in clerical jobs. They include short-term and casual employees, contributing family workers and self-employed persons, who may be paid or unpaid.</i>	(Number) %	
A3. Did your business have an intranet as at <reference date>^b? <i>An <u>intranet</u> refers to an internal communications network using Internet protocols and allowing communication within an organization (and with other authorized persons). It is typically set up behind a firewall to control access.</i>	☐ Yes	☐ No
A4. Did your business have a local area network (LAN) as at <reference date>? <i>A <u>LAN</u> refers to a network connecting computers within a localized area such as a single building, department or site; it may be wireless.</i>	☐ Yes	☐ No
A5. Did your business have an extranet as at <reference date>? <i>An <u>extranet</u> is a closed network that uses Internet protocols to share securely a business' information with suppliers, vendors, customers or other business partners. It can take the form of a secure extension of an intranet that allows external users to access some parts of it. It can also be a private part of the business' website, where business partners can navigate after authentication.</i>	☐ Yes	☐ No

Module B: How your business uses Internet in its operations		
B1. Did your business use the Internet during <reference period>? <i>The <u>Internet</u> is a worldwide 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, irrespective of the device used (not assumed to be only via a computer - it may also be by mobile phone, games machine, digital TV, etc.). Access can be via a fixed or mobile network.</i>	☐ Yes (in business) ☐ Yes (outside the business) - go to B4	☐ No → Go to C1
B2. Did your business have a web presence as at <reference date>? <i>A <u>web presence</u> includes a website, home page or presence on another entity's website (including a related business). It excludes inclusion in an on-line directory or any other webpages where the business does not have control over the content of the page.</i>	☐ Yes	☐ No
B3. How many persons employed in your business routinely used the Internet at work during <reference period>? If you can't provide this value, Please indicate an estimate of the percentage of the number of persons employed that used the Internet at work during <reference period>.	(Number) %	

¹ This model questionnaire is based on the revised version of the Partnership core list of ICT indicators released in 2009.

B4. How did your business connect to the Internet during <reference period>?	<i>Multiple responses allowed</i>	
Narrowband <i>Narrowband includes analogue modem (dial-up via standard phone line), Integrated Services Digital Network (ISDN), Digital Subscriber Line (DSL) at speeds below 256 kbit/s, and mobile phone and other forms of access with an advertised download speed of less than 256 kbit/s. Narrowband mobile phone access services include CDMA 1x (Release 0), GPRS, WAP and i-mode</i>	☐ Yes	☐ No
Fixed broadband <i>Fixed broadband refers to technologies such as DSL, at speeds of at least 256 kbit/s, cable modem, high speed leased lines, fibre-to-the-home, powerline, satellite, fixed wireless, Wireless Local Area Network (WLAN) and WiMAX.</i>	☐ Yes	☐ No
Mobile broadband <i>Mobile broadband access services include Wideband CDMA (W-CDMA), known as Universal Mobile Telecommunications System (UMTS) in Europe; High-speed Downlink Packet Access (HSDPA), complemented by High-Speed Uplink Packet Access (HSUPA); CDMA2000 1xEV-DO and DCMA 2000 1xEV-DV. Access can be via any device (mobile cellular phone, laptop, PDA, etc.)</i>	☐ Yes	☐ No
Do not know	☐ Yes	☐ No
B5. Did your business receive orders for goods or services (that is, make sales) via the Internet during <reference period>? <i>Orders received include orders received via the Internet whether or not payment was made online. They include orders received via websites, specialized Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones and email. They also include orders received on behalf of other organizations – and orders received by other organizations on behalf of the business. They exclude orders that were cancelled or not completed.</i>	☐ Yes (web) ☐ Yes (email)	☐ No
B6. Did your business place orders for goods or services (that is, make purchases) via the Internet during <reference period>? <i>Orders placed include orders placed via the Internet whether or not payment was made online. They include orders placed via websites, specialized Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones and email. They exclude orders that were cancelled or not completed.</i>	☐ Yes (web) ☐ Yes (email)	☐ No
B7. For which of the following activities did your business use the Internet during <reference period>?	<i>Multiple responses allowed</i>	
Sending and receiving e-mail	☐ Yes	☐ No
Telephoning over the Internet/VoIP, including video conferencing <i>VoIP refers to Voice over Internet Protocol</i>	☐ Yes	☐ No
Getting information about goods and services	☐ Yes	☐ No
Getting information from general government organizations	☐ Yes	☐ No
Interacting with general government organizations <i>Includes downloading/requesting forms online, making online payments and purchasing from, or selling to, government organizations. It excludes getting information from government organizations.</i>	☐ Yes	☐ No
Internet banking <i>Includes electronic transactions with a bank for payment, transfers, etc. or for looking up account information.</i>	☐ Yes	☐ No
Accessing other financial services <i>Includes electronic transactions via the Internet for other types of financial services such as purchasing shares (stocks), financial services and insurance.</i>	☐ Yes	☐ No
Providing customer services <i>Includes providing online or emailed product catalogues or price lists, product specification or configuration online, after-sales support, and order tracking online.</i>	☐ Yes	☐ No
Delivering products online <i>Refers to products delivered over the Internet in digitized form, e.g. reports, software, music, videos, computer games; and online services, such as computer-related services, information services, travel bookings or financial services.</i>	☐ Yes	☐ No

	Internal or external recruitment <i>Including providing information about vacancies on an intranet or website, and allowing online applications</i>	☐ Yes	☐ No
	Staff training <i>Includes e-learning applications available on an intranet or from the World Wide Web.</i>	☐ Yes	☐ No

Module C: Other information about your business²

C1.	Main activity of your business (please describe)	
C2.	Number of persons employed at <reference date>	
C3.	Total purchases of goods and services (in value terms, excluding VAT)	
C4.	Total turnover (in value terms, excluding VAT)	

a. <reference period> refers to a period up to 12 months before the data collection or whatever considered most appropriate by the NSO.

b. <reference date> would usually be at the end of the reference period, or shortly after.

² Questions regarding total purchases and total turnover (value), as well as other financial questions, would allow carrying out certain types of ICT impact analysis.

ANNEX 3

OECD MODEL QUESTIONNAIRE FOR ICT USE BY BUSINESSES (2005)

Section A: General information about your business' use of ICT	Logic ¹	Definitions and notes
1 Did your business use computer/s during <period>?	☐ No ☐ Yes	A computer includes: a desktop, portable or handheld computer (e.g. a personal digital assistant), minicomputer and mainframe. A computer does not include computer controlled machinery or electronic tills.
2 Did your business use the Internet or any other computer network during <period>?²	☐ No ☐ Yes	The Internet refers to Internet Protocol (IP) based networks: WWW, extranets, intranets, Internet EDI, Internet access by mobile phone and Internet e-mail. <u>Other computer networks</u> include internal networks (e.g. a LAN), proprietary external networks which are not IP-based (for instance, the networks originally set up for EDI), and automated telephone systems. EDI is electronic data exchange with other organisations via the Internet or other networks. The exchange is in a computer readable specified form based on agreed standards e.g. EDIFACT, RosettaNet.
3 Which of the following information technologies, if any, did your business have at <reference date>?	Tick all which apply ☐ Intranet within your business ☐ Extranet between your business and other organisations (including related businesses) ☐ Local area network (LAN) ☐ Wide area network (WAN) ☐ None of the above information technologies	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. A private, secure extension of the intranet running on Internet protocol that allows selected external users to access some parts of an organisation's intranet. A network connecting computers and associated devices within a localised area such as a single building, department or site; it may be wireless. A network that connects computers and associated devices within a wide geographic area, such as a region or country.

Section A: General information about your business' use of ICT		Logic	Definitions and notes
4	Did your business use the Internet during <period>?	☐ No Go to 19 ☐ Yes	The Internet is defined in Question 2. Use of the Internet may be on your business premises or elsewhere.
5	What proportion of persons employed in your business routinely used the Internet at work during <period>? ³	NC %	This question refers to all persons employed by the business, not only those working in clerical jobs. It includes working proprietors, partners and employees. The Internet is defined in Question 2.
6	How did your business connect to the Internet during <period>? ⁴	Tick all which apply Analog modem (dial-up via standard phone line) ☐ ISDN (Integrated Services Digital Network) ☐ Other narrowband ⁵ ☐ DSL (ADSL, SDSL, VDSL etc) ☐ Cable modem ☐ Other broadband ⁵ ☐	This question refers to the business as the subscriber rather than individual employees. 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 is a telecommunication service that turns a traditional (copper) telephone line into a higher speed digital link. It should be regarded as narrowband. Including most mobile phone access (e.g. WAP, i-mode) and other forms of access with an advertised download speed of less than 256 kbps (kilobits per second). Digital subscriber line: it is a high-bandwidth, local loop technology carrying data at high speeds over traditional (copper) telephone lines. A modem which uses cable TV lines for connection to the Internet. Including optic fibre cable, some mobile phone access (e.g. UMTS, EDGE), power line, satellite, fixed wireless, with an advertised download speed of greater than or equal to 256 kbps.

Section A: General information about your business' use of ICT	Logic	Definitions and notes
7 Did your business have any of the following IT security measures in place at <reference date>? Tick all which apply Virus checking or protection software <u>which is regularly updated</u> ☐ Anti-spyware software <u>which is regularly updated</u>⁶ NC ☐ Firewall ☐ Spam filter ☐ Secured communication between clients and servers (e.g. via SSL, SHTTP) ☐ Authentication software or hardware for internal users ☐ Authentication software or hardware for external users (e.g. customers) ☐ Intrusion detection system ☐ Regular back up of data critical to your business operations⁶ NC ☐ Offsite data backup ☐ No IT security measures in place ☐ 8 Did your business experience an attack by a virus or similar (for example, a trojan horse or worm) which has resulted in loss of data or time, or damage to software during <period>?⁷ NC ☐ No <i>Excluding: attacks which were successfully prevented by security measures in place.</i> ☐ Yes		Software which detects and responds to malicious programs such as viruses, trojan horses and worms. Regular update refers to automatic or manual downloading of virus definitions. Software which detects and removes spyware from a computer system (spyware gathers user information through an Internet connection without the user's knowledge). May be standalone or included in security software packages or operating systems. Software or hardware that controls access into and out of a network or computer. Software that diverts incoming spam (junk e-mail). Spam filters trap messages using various criteria such as e-mail addresses or specific words (or word patterns) in the e-mail. SSL is an encryption protocol which creates a secure connection between a client and a server. SHTTP supports the secure transmission of individual messages over the WWW. Authentication software or hardware verifies the identity of an internal or external user, user device, or other entity. Forms of credentials include passwords, tokens, PIN codes and digital signatures. Any system which attempts to detect intrusion into a computer or network by observation of actions, security logs or audit data. Backup copies of computer files stored at a different site to your main data store. Includes both automated and non-automated backups. A <i>virus</i> is a self-replicating, malicious program which attaches itself to a host program. A <i>Trojan horse</i> is a program that performs like a real program a user may wish to run, but also performs unauthorised actions. A <i>worm</i> is a malicious program that self-replicates across networks.

Section B: How your business uses ICT in its operations	Logic	Definitions and notes
Purchasing and selling goods or services via the Internet		
9 Did your business place orders (make purchases) for goods or services via the Internet during <period>? <i>Including: via Web sites, specialised Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones but excluding orders submitted via conventional e-mail</i>	☐ No ☐ Yes	An order is a <u>commitment</u> by the business to purchase goods or services, where the commitment was made via the Internet. The order may be with or without online payment and excludes orders which were cancelled or not completed. EDI is defined in Question 2. Purchases include all capital and current purchases (raw materials, components, office items, equipment, maintenance and repair items, services etc). An order is a <u>commitment</u> to purchase goods or services from the business, where the commitment was made via the Internet. The order may be with or without online payment and excludes orders that were cancelled or not completed. EDI is defined in Question 2. The Internet and Internet orders are defined in Question 10.
10 Did your business receive orders (make sales) for goods or services via the Internet during <period>? <i>Including: via Web sites, specialised Internet marketplaces, extranets, EDI over the Internet, Internet-enabled mobile phones but excluding orders submitted via conventional e-mail</i> <i>Including: orders received on behalf of other organisations and orders received by other organisations on behalf of your business</i>	☐ No ☐ Yes	
11 What proportion of your business' total turnover during <period> (excluding value added taxes) did those Internet orders (sales) represent?⁸ <i>Note: In respect of Internet orders received on behalf of other organisations, include only fees or commissions earned. Include the value of Internet sales orders received by other organisations on your behalf. For financial services, include only commissions, fees and premiums earned in respect of services offered over the Internet and, in respect of Internet-only accounts, net interest income.</i> Note: Careful estimates are acceptable.	%	

Section B: How your business uses ICT in its operations		Logic	Definitions and notes
12	Please provide percentage breakdowns of the value of those Internet orders (sales), by:⁹ <i>Note: Careful estimates are acceptable.</i>	NC	
	Types of products your business sold		
	Physical products (ordered on line and delivered off line)	%	Via the Internet For instance, raw materials, components, stationery, equipment, hardware, books. Products which are delivered over the Internet in digitised form, replacing physical products, e.g. reports, software; and new kinds of Web products which are accessed on line (e.g. online financial and information services).
	Digitised products (downloaded or accessed on line)	%	
	Services which are ordered on line but delivered off line	%	These include services which are ordered on line but are delivered, or substantially delivered, off line (e.g. accommodation, air travel).
	How orders were received	=100 %	Via the Internet
	Via an online ordering facility on your Web site	%	For instance, a shopping cart facility. Excludes conventional e-mail linked from a Web site.
	Through another Web site (e.g. specialised Internet marketplace or an agent's site)	%	
	Via EDI over the Internet	%	For example XML/EDI. EDI is defined in Question 2.
	Via other Internet technologies (please specify).....	%	
	Types of customers your business sold to	=100 %	Via the Internet
	Other businesses	%	Including related businesses.
	Individual consumers	%	
	Government and other non-business organisations	%	Including non-profit organisations.
		=100 %	

Section B: How your business uses ICT in its operations	Logic	Definitions and notes
12 Please provide percentage breakdowns of the value of those Internet orders (sales), by: ⁹ (continued)	NC The location of customers your business sold to Customers within your country % Customers outside your country % =100 %	Via the Internet
13 Which of the following benefits, if any, did your business realise through Internet selling during <period>? ¹⁰	Tick all which apply Reduced transaction time ☐ Increased quality of customer service ☐ Lower business costs ☐ Increased sales volume and/or number of customers ☐ Keeping pace with competitors ☐ Able to better target customers individually ☐ Other (please specify)..... ☐ No benefits realised ☐	Internet selling (that is receiving orders for goods or services over the Internet) is defined in Question 10. Including transaction and other costs.

Section B: How your business uses ICT in its operations	Logic	Definitions and notes
14 Which of the following factors, if any, limited or prevented Internet selling by your business during <period>?¹¹		Internet selling (that is receiving orders for goods or services over the Internet) is defined in Question 10.
Products of your business are not well suited to sale via the Internet	☐	
Security concerns	☐	Includes concerns the business has and the perceived concerns of customers (e.g. on providing credit card details over the Internet).
Privacy concerns	☐	Includes concerns the business has and the perceived concerns of customers (e.g. about providing personal information over the Internet).
Prefer to maintain current business model, e.g. face to face interaction	☐	
Customers' or suppliers' computer systems are incompatible with yours ¹²	☐	Refers to interoperability issues which could also be described as the inability of systems to exchange information.
Insufficient level of customer demand for purchasing via the Internet	☐	
Uncertainty concerning legal/regulatory framework for selling over the Internet	☐	
Cost of development and/or maintenance is too high	☐	
Lack of skilled employees to develop, maintain or use the technology required	☐	
No limitations to selling over the Internet ¹³	☐	
Not relevant ¹⁴ as selling over the Internet is currently under development or planned for the near future	☐	
Other (please specify).....	☐	

Section B: How your business uses ICT in its operations	Logic	Definitions and notes
Use of the Internet for other business processes within your business		
15 Did your business have a Web site at <reference date>? <i>Including: Web site, home page or presence on a third party's site where your business has substantial control over the content of the page/s but excluding inclusion in an online directory and advertising on a third party's site</i>	☐ No Go to 17 ☐ Yes	Includes the business' Web site/home page or a presence on a third party's site (including a related business) where the business has substantial control over the content of the site/page. It excludes a listing in an online directory, advertising on a third party's site, or other Web pages where the business does not have substantial control over content. May be called privacy guidelines, notice or guarantee. It explains the privacy practices of the business regarding handling and using personal information. Refers to third party privacy certification. May also be called a trademark. Ranges from a simple order form which is completed on line to a <i>shopping cart</i> system. May involve an intermediary, for example, a transaction processor. Products include goods and services. For example, online queries, customer feedback, customer services organised on line, FAQ facility. A security policy statement explains the business' practices on security of customer information (transmission and/or storage) or financial transactions. Refers to third party security certification. May also be called a trademark.
16 As at <reference date> did your business' Web site have any of the following features?¹⁵ Tick all which apply	☐	
Product catalogues or price lists	☐	
Customised Web page or information provided for repeat clients	☐	
Facility for collecting customer information on line	☐	
A privacy policy statement ⁶	☐ NC	
A privacy seal or certification ⁶	☐ NC	
An online ordering facility for your business' products	☐	
Facility for online payment	☐	
Provision of online after sales support	☐	
Order tracking available on line	☐	
A security policy statement ⁶	☐ NC	
A security seal or certification ⁶	☐ NC	

Section B: How your business uses ICT in its operations	Logic	Definitions and notes
17 Did your business use the Internet for dealing with government organisations during <period>? ¹⁶	NC Tick all which apply	Government organisations are defined by the SNA93 as entities which "assume responsibility for the provision of goods and services to the community or to individual households and to finance their provision out of taxation or other incomes; to redistribute income and wealth by means of transfers; and to engage in non-market production." They include government organisations at local, regional and national level. Includes downloading from Web sites or e-mailing requests for forms; includes taxation forms, claims, applications for permits etc. Includes online completion and submission of forms (e.g. Web forms) and sending completed forms, for instance, by e-mail; includes taxation forms, applications for permits and tender documents. Includes payment of fees, payments for purchases, taxation remittances etc. Online payments to government organisations may be made via an intermediary, for instance, a bank's Web site.
For obtaining information from government organisations (e.g. from Web sites or via e-mail)	☐	
For downloading or requesting government forms	☐	
Completing forms on line or sending completed forms	☐	
For making online payments to government organisations	☐	
Other dealings with government (please specify).....	☐	
Did not use the Internet for dealing with government organisations	☐	
18 Did your business use the Internet in any of the following areas of your business during <period>? ¹⁷ <i>Including: the WWW, extranets, intranets, EDI over the Internet but excluding conventional e-mail</i>	NC Tick all which apply	Includes invoicing and making payments via the Internet, online banking. For instance, including details of vacant positions on an intranet or Web site. Includes e-learning applications available on an intranet or from the WWW. Includes via an intranet or knowledge management software. For instance, collaboration with business partners.
Finance	☐	
Internal or external recruitment	☐	
Staff training	☐	
Sharing or distribution of information within your business	☐	
Sharing or distribution of information with other organisations	☐	
Did not use the Internet for any of the above business activities	☐	

Section B: How your business uses ICT in its operations	Logic	Definitions and notes
Purchasing and selling goods or services via computer networks other than the Internet		
19 Did your business place orders (make purchases) for goods or services via computer networks other than the Internet during <period>? <i>For instance: non-Internet based EDI, automated telephone systems</i>	☐ No ☐ Yes	An order is a commitment by the business to purchase goods or services, where the commitment was made via a computer network (other than the Internet). The order may be with or without online payment and excludes orders which were cancelled or not completed. EDI is defined in Question 2. Purchases include all capital and current purchases (raw materials, components, office items, equipment, maintenance and repair items, services etc).
20 Did your business receive orders (make sales) for goods or services via computer networks other than the Internet during <period>? <i>For instance: non-Internet based EDI, automated telephone systems</i>	☐ No ☐ Yes	An order is a commitment to purchase goods or services from the business, where the commitment was made via a computer network (other than the Internet). The order may be with or without online payment and excludes orders which were cancelled or not completed. EDI is defined in Question 2.
21 What proportion of your business' total turnover during <period> (excluding value added taxes) did those orders (sales) represent? <i>Note: In respect of orders received on behalf of other organisations, include only fees or commissions earned. Include the value of sales orders received by other organisations on your behalf. For financial services, include only commissions, fees and premiums earned in respect of services offered over computer networks other than the Internet.</i> <i>Note: Careful estimates are acceptable.</i>	%	Orders are defined in Question 20.
Integration of your business' processes¹⁸		
22 Did your business place or receive orders for goods or services via any computer networks during <period>? ¹⁹ <i>Including: the Internet and other computer networks (e.g. non-Internet based EDI) but excluding orders submitted via conventional e-mail</i>	☐ No ☐ Yes	An order is defined in questions 9, 10, 19 and 20.

Section B: How your business uses ICT in its operations	Logic	Definitions and notes
23 Did your systems for placing orders via computer networks link automatically with any of the following internal or external systems as at <date>? ²⁰ Tick all which apply Your suppliers' computer system/s ☐ Your purchasing partners' computer system/s ☐ Your business' computer system/s ☐ For ordering or inventory control ☐ For accounting functions ☐ For production or service operations ☐ Other internal or external computer system/s (please specify)..... ☐ Your system/s for placing orders via computer networks were not linked automatically to any of the above ☐		An automatic link exists if information captured in one system triggers an update in another system or is available in real time in other systems. For instance, paying suppliers.

Notes to the questions

- 1 Where there is no 'Go to' direction, the skip is to the next question.
- 2 This is a filter question only. Its purpose is to allow businesses which do not use networks to go to the last section of the questionnaire.
- 3 There is contradictory evidence from EC countries regarding the usefulness of this question for policy purposes and its statistical reliability. At least some European countries find that respondents have difficulty with the question. It has therefore been presented as non-core in the model questionnaire.
- 4 The main aim of this question is to enable estimation of the proportion of businesses with broadband access. Possible country variations are: rename categories where local terms differ (for instance, the term 'DSL' is not used much in some countries); remove categories where items are not feasible; add or split categories according to technologies available and country data requirements. Care should be taken when adding or splitting categories that statistical bias is not introduced. This could occur if the provision of alternative categories affects response thereby leading to loss of comparability with other countries' data. Note also the comments against the categories 'Other narrowband' and 'Other broadband'. An earlier draft included a split of the broadband categories based on maximum contractual download speed (equivalent to advertised speed). That split was removed because of concerns about respondent knowledge and because it is considered that any cut-off chosen will be obsolete in a relatively short time. Individual countries may wish to include such a split, with a possible model being based on questions included by Eurostat on its 2006 model questionnaire.
- 5 This 'other' item would not appear on questionnaires countries should add appropriate category/ies based on services available. In particular, there is anecdotal evidence that the term 'broadband' may not be well understood in all countries.
- 6 This response category is non-core because it is relatively untested in member country official surveys.
- 7 This question is non-core because it is relatively untested in member country official surveys.
- 8 Countries can also ask the question as ranges or absolute values as long as an estimated total value can be calculated for each business.
- 9 This question is non-core because three of its components are either relatively untested in member countries (types of products and how orders were received) or are believed to be difficult statistically (location of customers). Countries may prefer to ask each component of the question as a separate question. Other issues relevant to this question include the statistical reliability of disaggregated data. An alternative to percentage splits is to ask for absolute values. The component 'type of customers' is known to be fairly stable so could be asked every second year rather than annually.
- 10 Categories and order are based on analysis of responses from Australia, Canada and Eurostat. Possible country variations are to add or split categories according to country data requirements. Note that responses to barriers and benefits questions tend to be fairly stable over time therefore they may be rotated in and out of an annual collection.
- 11 Categories have been revised and ordered based on data from Canada (Internet commerce), Australia (Internet selling) and Eurostat (Internet selling – both sellers and non-sellers). Note that this question is asked of both sellers and non-sellers though countries may prefer to ask the question separately of sellers (as a limitations question) and non-sellers (as a barriers question). Possible country variations are to add or split categories according to country data requirements. It is possible to ask barriers questions in a variety of ways. They include asking for all reasons, asking respondents to rate the importance of each reason or asking for the main plus a secondary reason, or the main reason only. The approach taken here is probably one of the least burdensome presentations. Where countries use a different approach to the collection of these data, for the purposes of international comparability, data should be tabulated to show the main reason most commonly reported or the reason most commonly selected as the most important reason. Note that responses to barriers and benefits questions tend to be fairly stable therefore they can be rotated in and out of an annual collection.
- 12 This is a new item designed to capture interoperability as a barrier. It is non-core because it is untested.
- 13 This would be a valid response for businesses which are already selling over the Internet.
- 14 This would be a valid response for businesses which are not currently selling over the Internet but are planning to do so.
- 15 This question offers the potential to cross-classify categories and produce useful information on e-business and trust functions on a business' Web site. For instance, cross classifying whether a site collects information against privacy characteristics or cross-classifying an online order facility against security characteristics. Possible country variations are to add or split categories according to country data requirements.
- 16 Questions relating to government units in demand surveys are complicated because respondents do not have a common idea of what constitutes a government organisation (this is exacerbated when results are compared across countries). The question has been made non-core because of these statistical difficulties. WPIS delegates have generally supported use of the SNA definition of government units so that has been specified in this question. The SNA93 definition includes government organisations at local, regional and national level and may be found here: <http://unstats.un.org/unsd/sna1993/glossform.asp?getitem=219>. Countries should tailor this question to best convey the SNA concept of a government organisation.
- 17 This question is experimental and has not been asked in this form by NSOs. It is therefore non-core. It is partly based on a question tested by Statistics Canada but additional response categories have been added.
- 18 This section is currently limited to links between e-commerce and other systems. In the future, it could include questions about links between other business systems such as other (non e-commerce) purchases and sales, logistics etc.
- 19 A business should respond positively if it answered yes to any of the e-commerce purchasing or selling questions (9, 10, 19 or 20).
- 20 Interested countries can ask the linkages questions separately for Internet and non-Internet purchasing and selling.
- 21 The date would usually be the end of the reference period. To simplify the question, the date used could be that of the last pay date in the reference period.

ANNEX 4

EUROSTAT MODEL QUESTIONNAIRE ON ICT USAGE AND E-COMMERCE IN ENTERPRISES (2008) - VERSION 3.3

The Eurostat model for a Community Survey on ICT Usage and e-Commerce in Enterprises includes a module that surveys a different topic every year. Thus, in 2007, a supplementary module investigated E-skills - ICT competence in the enterprise unit and the demand for ICT skills. In 2008, module G surveyed the perceived benefits of ICT, while the draft questionnaire for 2009 will feature a module on the use of radio frequency identification (RFID) technologies.¹

COMMUNITY SURVEY ON ICT USAGE AND E-COMMERCE IN ENTERPRISES 2008 General outline of the survey

Sampling unit: Enterprise.

Scope / Target Population: **Economic activity:**
Enterprises classified in the following categories of NACE-Rev.1:

- Section D – “Manufacturing”;
- Section F – “Construction”;
- Section G – “Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods”;
- Groups 55.1 and 55.2 – “Hotels” and “Camping sites and other provision of short-stay accommodation”;
- Section I – “Transport, storage and communication”;
- Section K – “Real estate, renting and business activities”;
- Groups 92.1 and 92.2 – “Motion picture and video activities” and “Radio and television activities”.

Only for modules A to E and G and X (X1, X2 and X5):

- Classes 65.12, 65.22; 66 except 66.02 – “Banking, financial leasing and insurance”.

Optional:

- Section E – “Electricity, gas and water supply”;
- Groups from 55.3 to 55.5 inclusive;
- Groups from 92.3 to 92.7 inclusive; and
- Division 93 – “Other service activities”.

Only for modules A to E and G and X (X1, X2 and X5):

- Classes 67.12, 67.13, 67.2 – “Activities auxiliary to financial intermediation, except administration of financial markets”.

Enterprise size:
Enterprises with 10 or more persons employed;
Optional: enterprises with number of persons employed between 1 and 9.

Geographic scope:
Enterprises located in any part of the territory of the Country.

Reference period: Year 2007 for the % of sales/orders data and where specified.
January 2008 for the other data.

Survey period: First quarter 2008.

¹ The recent Eurostat model questionnaires for ICT surveys in enterprises are available at:
http://circa.europa.eu/Public/irc/dsis/emisannexes/library?l=/data_-_database/theme_3_-_popul/isoc/householdsindiv&vm=detailed&sb=Title.

Questionnaire: The layout of the national questionnaire should be defined by the country. However, countries should follow the order of the list of variable enclosed, if possible. The background information (Module X) should be placed at the end of the questionnaire. This information can be obtained in 3 different ways: from national registers, from Structural Business Statistics or collected directly with the ICT usage survey. Every effort should be made to obtain them from the most recent SBS survey. Countries can include additional questions.

Note on the use of “Don’t know” response categories:

In general “Don’t know” response categories are not recommended as it is considered that such an answer would provide the same information as a blank one. Even if the respondent doesn’t have the information, it should be possible to gather it from records or from someone else in the enterprise. However, there are a few exceptions in which cases a “Don’t know” response category is used in the model questionnaire.

Target respondent: A decision maker with major responsibility for IT-related issues in the enterprise (the IT manager or a senior professional in the IT department). In smaller enterprises, the respondent may be someone at the level of managing director or the owner. In any case the respondent should not be someone with responsibilities only in accounting.

Sample size, stratification: The sampling design and the resulting sample size should be appropriate for obtaining accurate, reliable and representative results on the variables and items in the model questionnaire.

This objective should be achieved for the overall proportions as well as for the proportions for the different breakdowns of the population defined below: NACE, size class and geographic. NACE breakdown and enterprise size class breakdown are not required to be cross-tabulated.

This requirement aims at ensuring the collection of a complete dataset – without empty, confidential or unreliable cells - for these indicators.

NACE breakdown: (To be applied to: all variables; enterprises with 10 or more persons employed; whole territory of the Country.)

Data should be broken down by the following NACE aggregates:

- 1 DA+DB+DC+DD+DE
- 2 DF+DG+DH
- 3 DI+DJ
- 4 DK+DL+DM+DN
- 5 45
- 6 50
- 7 51
- 8 52
- 9 55.1+55.2
- 10 60+61+62+63
- 11 64
- 12 72
- 13 70+71+73+74
- 14 92.1+92.2

Only for modules A to G and X (X1, X2 and X5):

- F1 65.12+65.22
F2 66.01+66.03

Optional:

- 17 22
- 18 40+41
- 19 55.3+55.4+55.5
- 20 92.3 to 92.7
- 21 93

Only for modules A to G and X (X1, X2 and X5):

- F3 67.12+67.13+67.2

Size class breakdown: (To be applied to: all variables; aggregate of all mandatory NACE aggregates [1 to 14 defined above]; whole territory of the Country.)

Data should be broken down by the following size classes of the number of persons employed:

- 1 10 or more
- 2 10 - 49 (small enterprises)
- 3 50 - 249 (medium enterprises)
- 4 250 or more (large enterprises)

Optional:

- 5 1-4
- 6 5-9

Geographic breakdown: (To be applied to: all variables; aggregate of all mandatory NACE aggregates [1 to 14 defined above]; enterprises with 10 or more and less than 250 persons employed [small and medium enterprises as defined above].)

Data should be broken down by the following regional groups:

- 1 convergence regions (ex-objective 1 regions)
- 2 non-convergence regions (ex-non-objective 1 regions)

Note: See glossary for the list of convergence regions in each country.

Weighting of results:

Results should in general be weighted by number of enterprises.

Turnover/Purchases weighting should be also used for turnover/orders related questions (Turnover: H4, H3, H4; Purchases: H8, H9: if possible purchases weighting, otherwise turnover weighting).

Weighting by the Number of Persons Employed should be also applied for questions A2, B2 and for % using the Internet, % using broadband, % using xDSL, % using a website or homepage, % purchasing via the Internet, % receiving orders via the Internet, % receiving orders via the Internet or other computer mediated networks.

Treatment of non-response/'Do not know':

Unit non-response:

The non-respondent units should be assumed to resemble those who have responded to the survey and be treated as non-selected units. For this, the weighting or the grossing up factors should be adjusted: the design weight N_h / n_h is replaced by N_h / m_h where N_h is the size of stratum h , n_h is the sample size in stratum h and m_h is the number of respondents in stratum h .

Item non-response:

Logical corrections should be made, when information can be deduced from other variables, and priority given to further contacts with enterprises to collect the missing information.

For the categorical variables (e.g. the YES/NO questions), respondents with item non response or 'do not know' should not be imputed with values from respondents who answered the question.

Numerical variables shouldn't also be imputed with the exception of H4 (breakdown of e-commerce sales by origin of client) and H9 (breakdown of e-commerce purchases by destination). The imputation of these two variables should take into account, at least, the breakdowns by size class and NACE in the tabulated results.

Tabulation of results:

For the categorical variables, estimates should be made for the total number of enterprises for each response category, broken down by the NACE categories and size classes specified above.

For the quantitative variables (turnover, purchases and number of persons employed), when collected in absolute or percentage terms (and not in percentage classes), estimates should be made for the total values in absolute terms, broken down by the NACE categories and size classes specified above.

Data transmission:

Results are to be sent to Eurostat following the transmission format described in another Eurostat document.

COMMUNITY SURVEY ON ICT USAGE AND E-COMMERCE IN ENTERPRISES 2008

Model Questionnaire (Version 3.3 of 16 April 2007)

(Questions relating to the i2010 Benchmarking Indicators are marked with an asterisk *)

Module A: Use of computers and computer networks		
A1. Did your enterprise use computers, in January 2008? (Filter question)	Yes ☐	No ☐ → Go to X1
A2. How many persons employed used computers at least once a week, in January 2008? - <i>Optional</i> If you can't provide this value, Please indicate an estimate of the percentage of the number of persons employed used computers at least once a week, in January 2008. - <i>Optional</i>	(Number) %	
A3.* Was your enterprise using an internal computer network (e.g. LAN - Local Area Network) in January 2008? (Filter question)	Yes ☐	No ☐ → Go to A5
A4.* Did your enterprise use wireless access within its internal computer network (e.g. wireless LAN), in January 2008?	Yes ☐	No ☐
A5. Did your enterprise have in use an internal home page (Intranet), in January 2008? (Filter question)	Yes ☐	No ☐ → Go to A7
A6. In January 2008, was your enterprise using such systems for sharing the following information? <i>Optional</i>	Yes	No
a) The general policy or strategy of the enterprise	☐	☐
b) Internal company newsletters or daily news	☐	☐
c) Day-to-day / working documents (e.g. for meeting)	☐	☐
d) Manuals, guides or training material	☐	☐
e) Product or services catalogues	☐	☐
A7. In January 2008, did your enterprise use dedicated applications for employees to access human resources services (e.g. see open job positions, request annual leave, view or download payslips, or other services)?	Yes ☐	No ☐
A8.* In January 2008, did your enterprise have an extranet (a website or an extension of the Intranet with access restricted to business partners)?	Yes ☐	No ☐
A9.* Did your enterprise have in use, in January 2008, third party free or open source operating systems, such as Linux? (i.e. with its source code available, no copyright cost, and the possibility to modify and/or (re)distribute it)	Yes ☐	No ☐
Module B: Access and use of Internet (Scope: enterprises with Computers)		
B1. Did your enterprise have access to Internet, in January 2008? (Filter question)	Yes ☐	No ☐ → Go to C1
B2.* How many persons employed used computers connected to the World Wide Web at least once a week, in January 2008? If you can't provide this value, Please indicate an estimate of the percentage of the number of persons employed used computers connected to the World Wide Web at least once a week, in January 2008.	(Number) %	

B3.* Did your enterprise have the following types of external connection to the Internet, in January 2008?		
	Yes	No
a) Traditional Modem (dial-up access over normal telephone line) or ISDN connection	☐	☐
b) DSL (xDSL, ADSL, SDSL etc) connection	☐	☐
c) Other fixed internet connection (e.g. cable, leased line (e.g. E1 or E3 at level 1 and ATM at level 2), Frame Relay, Metro-Ethernet, PLC - Powerline communication, etc.)	☐	☐
d) Mobile connection (e.g. analogue mobile phone, GSM, GPRS, UMTS, EDGE, CDMA2000 1xEVDO)	☐	☐
B4. Did your enterprise use the Internet for the following purposes, in January 2008?		
(as consumer of Internet services)	Yes	No
a) Banking and financial services	☐	☐
b) Training and education	☐	☐
B5.* Did your enterprise use the Internet for interaction with public authorities, during 2007? (Filter question)	Yes ☐	No ☐ → Go to B7
B6.* Did your enterprise interact with public authorities in the following ways, during 2007?		
	Yes	No
a) For obtaining information	☐	☐
b) For obtaining forms, e.g. tax forms	☐	☐
c) For returning filled in forms, e.g. provision of statistical information to public authorities	☐	☐
d) For treating an administrative procedure (e.g. declaration, registration, authorization request) completely electronically without the need for additional paper work (including payment if required)	☐	☐
d) For submitting a proposal in an electronic tender system (e-procurement) (in the system itself and not by email)	☐	☐
B7. Did your enterprise have a Website or Home Page, in January 2008? (Filter question)	Yes ☐	No ☐ → Go to B9
B8. Did the Web Site provide the following facilities for your enterprise, in January 2008?		
	Yes	No
a) Product catalogues or price lists	☐	☐
b) Possibility for visitors to customize or design the products	☐	☐
c) Online ordering or reservation or booking, e.g. shopping cart	☐	☐
d) Online payment	☐	☐
e) Personalised content in the website for regular/repeated visitors	☐	☐
f) Advertisement of open job positions or online job application	☐	☐
B9.* Was your enterprise, in January 2008, using a digital signature in any message sent, i.e. using encryption methods that assure the authenticity and integrity of the message (uniquely linked to and capable of identifying the signatory and where any subsequent change to the message is detectable)?	Yes ☐	No ☐

Module C: Automated Data Exchange (Scope: enterprises with Computers)				
Automated data exchange between the enterprise and other ICT systems outside the enterprise means: – exchange of messages (e.g. orders, invoices, payment transactions or description of goods) – via the internet or other computer networks – in an agreed format which allows its automatic processing (e.g. XML, EDIFACT etc.) – without the individual message being manually typed.				
C1.*	In January 2008, was your enterprise using such automated data exchange? (Filter question)	Yes ☐	No ☐ → Go to C4	
C2.*	Was automated data exchange used for the following purposes?			
		Yes	No	
	a) Sending orders to suppliers	☐	☐	
	b) Receiving e-invoices	☐	☐	
	c) Receiving orders from customers	☐	☐	
	d) Sending e-invoices	☐	☐	
	e) Sending or receiving product information (e.g. catalogues, price lists, etc.)	☐	☐	
	f) Sending or receiving transport documents (e.g. consignment notes)	☐	☐	
	g) Sending payment instructions to financial institutions	☐	☐	
	h) Sending or receiving data to/from public authorities (e.g. tax returns, statistical data, [national examples], etc.)	☐	☐	
C3.	Were the following formats used for the automated data exchange? <i>Optional</i>			
		Yes	No	
	a) EDIFACT or similar standards (e.g. EANCOM, ANSI X12)	☐	☐	
	b) XML based standards, for example ebXML, RosettaNet, UBL, papiNET	☐	☐	
	c) Proprietary standards agreed between you and other organisations	☐	☐	
Go to question D1				
C4.	Were the following issues reasons for the enterprise not to use automated data exchange? <i>Optional</i>			
		Yes	No	Don't know
	a) No interest in using it, because it isn't relevant for the business	☐	☐	☐
	b) Lack of expertise in-house for its implementation	☐	☐	☐
	c) Return on the investment too low or not clear	☐	☐	☐
	d) Lack of appropriate software for the specific sector/size of the enterprise	☐	☐	☐
	e) Difficulty with agreeing common standards with business partners	☐	☐	☐
	f) Uncertainty of the legal status of the messages exchanged	☐	☐	☐

Module D: Sharing electronically information on the Supply Chain Management (Scope: enterprises with Computers)		
Sharing electronically information on the supply chain management means: – exchanging all types of information with suppliers and/or customers in order to coordinate the availability and delivery of products or services to the final consumer; – including information on demand forecasts, inventories, production, distribution or product development; – via computer networks, not only the Internet but also other connections between computers of different enterprises. – it can be from you to your suppliers/customers or the other way around. This information may be exchanged via websites or via automated data exchange (recall definition in module C), but it excludes normal e-mail messages manually written.		
D1. In January 2008, was your enterprise regularly sharing electronically information on the supply chain management with your suppliers or customers? (Filter question)	Yes ☐	No ☐ → Go to E1
D2. Was your enterprise regularly sharing electronically the following information with its <u>suppliers</u>, in January 2008?		
	Yes	No
a) Inventory levels, production plans or demand forecasts	☐	☐
<i>Optionally, the 3 items may be collected separately:</i>		
a1) Demand forecasts	☐	☐
a2) Inventory levels	☐	☐
a3) Production plans	☐	☐
b) Progress of deliveries (i.e. distribution of raw materials or finished products)	☐	☐
D3. Was your enterprise regularly sharing electronically the following information with its <u>customers</u>, in January 2008?		
	Yes	No
a) Inventory levels, production plans or demand forecasts	☐	☐
<i>Optionally, the 3 items may be collected separately:</i>		
a1) Demand forecasts	☐	☐
a2) Inventory levels	☐	☐
a3) Production plans	☐	☐
b) Progress of deliveries (i.e. distribution of raw materials or finished products)	☐	☐
D4. Were the following methods used for the electronic exchange of this information, in January 2008?		
	Yes	No
a) Websites (yours, those of your business partners or web portals)	☐	☐
b) Automated data exchange (XML, EDIFACT, etc.)	☐	☐

Module E: Automatic share of information within the enterprise (Scope: enterprises with Computers)			
Sharing information electronically and automatically between different functions of the enterprise means any of the following: – Using one single software application to support the different functions of the enterprise; – Data linking between the software applications that support the different functions of the enterprise – Using a common database or data warehouse accessed by the software applications that support the different functions of the enterprise; – Automated data exchange between different software systems (recall definition in module C);			
E1.*	In January 2008, when your enterprise received a sales order (either electronically or not), was the relevant information about it shared electronically and automatically with the software used for the following functions?	Yes	No
	a) Your management of inventory levels	☐	☐
	b) Your accounting	☐	☐
	c) Your production or services management	☐	☐
	d) Your distribution management	☐	☐
E2.*	In January 2008, when your enterprise sent a purchase order (either electronically or not), was the relevant information about it shared electronically and automatically with the software used for the following functions?	Yes	No
	a) Your management of inventory levels	☐	☐
	b) Your accounting	☐	☐
E3*	In January 2008, did your enterprise have in use an ERP software package to share information on sales and/or purchases with other internal functional areas (for example, finance, planning, marketing, etc.)?	Yes ☐	No ☐ Don't know ☐
E4.*	In January 2008, did your enterprise have in use any software application for managing information about clients (so called CRM) that allows it to:	Yes	No
	a) Capture, store and make available to other business functions the information about its clients?	☐	☐
	b) Make analysis of the information about clients for marketing purposes (setting prices, make sales promotion, choose distribution channels, etc.)?	☐	☐
Module F: e-Commerce via Internet (Scope: enterprises with Computers)			
e-Commerce means: - the placement of orders, where an order is a commitment to purchase goods or services, - via computer networks, not only the Internet but also other connections between computers of different enterprises, - where payment and delivery does not have necessarily to be done via computer networks. e-Commerce may be done via websites or via automated data exchange between enterprises, but it excludes normal e-mail messages that are written individually by hand.			
Orders received via computer networks (Sales)			
F1.*	Did your enterprise receive orders for products or services via computer networks (excluding manually typed e-mails), during 2007? (Filter question)	Yes ☐	No ☐ → Go to F5

F2.* Please state the value of the turnover resulted from orders received electronically (in monetary terms, excluding VAT), in 2007. If you can't provide this value, Please indicate an estimate of the percentage of the total turnover resulted from orders received electronically, in 2007.	(National Currency) %																								
F3.* Please indicate what percentage represented orders received via each one of the following ways, out of total turnover, in 2007. <i>Optional</i> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">a) via a website</td> </tr> <tr> <td style="padding: 5px;">b) via automated data exchange (XML, EDIFACT, etc.) over the internet</td> </tr> <tr> <td style="padding: 5px;">c) via automated data exchange (XML, EDIFACT, etc.) over other computer networks</td> </tr> </table>	a) via a website	b) via automated data exchange (XML, EDIFACT, etc.) over the internet	c) via automated data exchange (XML, EDIFACT, etc.) over other computer networks	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="margin-left: 5px;">%</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="margin-left: 5px;">%</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="border: 1px solid black; width: 20px; height: 20px; margin-right: 5px;"></td> <td style="margin-left: 5px;">%</td> </tr> </table>					%					%					%						
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				%																					
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F4.* Was your enterprise using a secure protocol, such as SSL and TLS, for the reception of orders via Internet, in January 2008?	Yes ☐ No ☐																								
Orders received via computer networks (Purchases)																									
F5.* Did your enterprise send orders for products or services via computer networks, during 2007 (excluding manually typed e-mails)? (Filter question)	Yes ☐ No ☐ → Go to G1																								
F6.* Please indicate for 2007 the percentage of orders that were sent electronically in relation to the total purchases' value (in monetary terms, excluding VAT). <i>Alternative Question:</i>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Less than 1%</td> <td style="text-align: right; padding: 5px;">☐</td> </tr> <tr> <td style="padding: 5px;">1% or more and less than 5%</td> <td style="text-align: right; padding: 5px;">☐</td> </tr> <tr> <td style="padding: 5px;">5% or more and less than 10%</td> <td style="text-align: right; padding: 5px;">☐</td> </tr> <tr> <td style="padding: 5px;">10% or more and less than 25%</td> <td style="text-align: right; padding: 5px;">☐</td> </tr> <tr> <td style="padding: 5px;">25% or more</td> <td style="text-align: right; padding: 5px;">☐</td> </tr> </table>	Less than 1%	☐	1% or more and less than 5%	☐	5% or more and less than 10%	☐	10% or more and less than 25%	☐	25% or more	☐														
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Module G: Perceived benefits of the use of ICT (Scope: enterprises with Computers)																									
The implementation of an ICT project refers to the introduction of a new or updated ICT (e.g. a new/updated software application or a new/updated hardware) or a change in the use of an existing ICT. Examples of ICT projects are: a new or a restructured website, a new internal homepage, the starting of using automated data exchange or the starting of receiving orders via computer networks.																									
G1. In January 2008, to what degree have ICT projects implemented in the last 2 years caused improvements in the following areas, compared to the previous task handling? <i>If your enterprise has not had any ICT projects, please tick all boxes 'not applicable'.</i> <i>Optional</i> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">a) Your management of inventory levels</td> </tr> <tr> <td style="padding: 5px;">b) Your accounting</td> </tr> <tr> <td style="padding: 5px;">c) Your production or services management</td> </tr> <tr> <td style="padding: 5px;">d) Your distribution management</td> </tr> </table>	a) Your management of inventory levels	b) Your accounting	c) Your production or services management	d) Your distribution management	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th style="padding: 5px;">Minor/None</th> <th style="padding: 5px;">Moderate</th> <th style="padding: 5px;">Significant</th> <th style="padding: 5px;">Don't know / Not applicable</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> </tr> <tr> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> </tr> <tr> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> </tr> <tr> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> <td style="padding: 5px;">☐</td> </tr> </tbody> </table>	Minor/None	Moderate	Significant	Don't know / Not applicable	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
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Module X: Background information	
(X1-X5) available in some countries from SBS and thus not to be included; latest available information should be provided	
X1. Main economic activity of the enterprise, during 2007	
X2. Average number of persons employed, during 2007	
X3. Total purchases of goods and services (in value terms, excluding VAT), for 2007	
X4. Total turnover (in value terms, excluding VAT), for 2007	
X5. Location (Convergence/ non-Convergence region), in 2007	

COMMUNITY SURVEY ON ICT USAGE AND E-COMMERCE IN ENTERPRISES

2008

Glossary

ERP

Enterprise Resource Planning (ERP) consists of one or of a set of software applications that integrate information and processes across the several business functions of the enterprise. Typically ERP integrates planning, procurement, sales, marketing, customer relationship, finance and human resources.

ERP software can be customised or package software. These latter are single-vendor, enterprise wide, software packages, but they are built in a modular way allowing enterprises to customise the system to their specific activity implementing only some of those modules.

ERP systems typically have the following characteristics:

1. are designed for client server environment (traditional or web-based);
2. integrate the majority of a business's processes;
3. process a large majority of an organization's transactions;
4. use enterprise-wide database that stores each piece of data only once;
5. allow access to the data in real time.

CRM

Customer Relationship Management (CRM) is a management methodology which places the customer at the centre of the business activity, based in an intensive use of information technologies to collect, integrate, process and analyse information related to the customers. One can distinguish between:

1. Operational CRM – Integration of the front office business processes that are in contact with the customer.
2. Analytical CRM – Analysis, through data mining, of the information available in the enterprise on its customers. This aims to gather in depth knowledge of the customer and how to answer to its needs.

e-Invoice

An e-invoice is an invoice where all data is in digital format and it can be processed automatically. A distinctive feature of an e-invoice is automation. E-invoice will be transferred automatically in inter-company invoicing from the invoice issuer's or service provider's system directly into the recipient's financial or other application.

The transmission protocol might be XML, EDI or other similar format.

e-Signature

An e-signature is some kind of electronic information attached to or associated with a contract or another message used as the legal equivalent to a written signature. Electronic signature is often used to mean either a signature imputed to a text via one or more of several electronic means, or cryptographic means to add non-repudiation and message integrity features to a document. Digital signature usually refers specifically to a cryptographic signature, either on a document, or on a lower-level data structure.

For either of them to be considered a signature they must have a legal value, otherwise they are just a piece of communication. Some web pages and software EULAs claim that various electronic actions are legally binding signatures, and so are an instance of electronic signature. For example, a web page might announce that, by accessing the site at all, you have agreed to a certain set of terms and conditions.

The legal status of such claims is uncertain.

An electronic signature can also be a digital signature if it uses cryptographic methods to assure both message integrity and authenticity. Because of the use of message integrity mechanisms, any changes to a digitally signed document will be readily detectable if tested for, and the attached signature cannot be taken as valid.

It is important to understand the cryptographic signatures are much more than an error checking technique akin to checksum algorithms, or even high reliability error

detection and correction algorithms such as Reed- Solomon. These can offer no assurance that the text has not been tampered with, as all can be regenerated as needed by a tamperer. In addition, no message integrity protocols include error correction, for to do so would destroy the tampering detection feature.

Popular electronic signature standards include the OpenPGP standard supported by PGP and GnuPG, and some of the S/MIME standards (available in Microsoft Outlook). All current cryptographic digital signature schemes require that the recipient have a way to obtain the sender's public key with assurances of some kind that the public key and sender identity belong together, and message integrity measures (also digital signatures) which assure that neither the attestation nor the value of the public key can be surreptitiously changed. A secure channel is not required.

A digitally signed text may also be encrypted for protection during transmission, but this is not required when the digital signature has been properly carried out. Confidentiality requirements will be the guiding consideration.

SSL / TLS

Secure Sockets Layer (SSL) and Transport Layer Security (TLS) are cryptographic protocols which provide secure communications on the Internet. SSL provides endpoint authentication and communications privacy over the Internet using cryptography. In typical use, only the server is authenticated (i.e. its identity is ensured) while the client remains unauthenticated; mutual authentication requires PKI deployment to clients. The protocols allow client/server applications to communicate in a way designed to prevent eavesdropping, tampering, and message forgery.

Free / Open Source

Open source software refers to computer software under an open source license. An open-source license is a copyright license for computer software that makes the source code available under terms that allow for modification and redistribution without having to pay the original author. Such licenses may have additional restrictions such as a requirement to preserve the name of the authors and the copyright statement within the code.

Related to the Open Source Definition is the Free Software definition by the Free Software Foundation, which attempts to capture what is required for a program license to qualify as being free-libre software. In practice, licenses meet the open source definition almost always also meet the Free software definition. All licenses reported to meet the free software definition as of 2005 also meet the open source definition.

Digital products or services

Goods/services that can be ordered and delivered directly to a computer over the Internet, e.g. music, videos, games, computer software, online newspapers, consulting services, etc.

DSL (Digital Subscriber Line)

A high-bandwidth (broadband), local loop technology to carry data at high speeds over traditional (copper) telephone lines.

xDSL, ADSL etc.

DSL technologies designed to increase bandwidth over standard copper telephone wires; includes ADSL (Asymmetric Digital Subscriber Line) etc.

Electronic commerce (e-commerce)

Transactions conducted over Internet Protocol-based networks and over other computer-mediated networks. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off-line. Orders received via telephone, facsimile, or manually typed e-mails are not counted as electronic commerce.

E-mail

Electronic transmission of messages, including text and attachments, from one computer to another located within or outside of the organisation. This includes electronic mail by Internet or other computer networks.

Extranet^(Changed)

A closed network that uses Internet protocols to securely share enterprise's information with suppliers, vendors, customers or other businesses partners. It can take the form of a secure extension of an Intranet that allows external users to access some parts of the enterprise's Intranet. It can also be a private part of the enterprise's website, where business partners can navigate after being authenticated in a login page.

ISDN	Integrated Services Digital Network.
Internal computer network^(New)	An internal computer network is a group of at least two computers connected together using a telecommunication system for the purpose of communicating and sharing resources within an enterprise. It typically connects personal computers, workstations, printers, servers, and other devices. It is used usually for internal file exchange between connected users; intra business communications (internal e-mail, internal web based interface etc), shared access to devices (printers etc) and other applications (databases) or for joint business processes.
LAN (Local Area Network)	A network for communication between computers confined to a single building or in closely located group of buildings, permitting users to exchange data, share a common printer or master a common computer, etc.
Wireless access^(New)	The use of wireless technologies such as radio-frequency, infrared, microwave, or other types of electromagnetic or acoustic waves, for the last internal link between users devices (such as computers, printers, etc) and a LAN backbone line(s) within the enterprise's working premises. It includes mainly Wi-fi and Bluetooth technologies.
Internet	Relates to Internet Protocol based networks: www, Extranet over the Internet, EDI over the Internet, Internet-enabled mobile phones.
Intranet	An internal company communications network using Internet protocol allowing communications within an organisation.
Modem	Device that modulates outgoing digital signals from a computer or other digital device to analogue signals for a conventional copper twisted pair telephone line and demodulates the incoming analogue signal and converts it to a digital signal for the digital device.
Website	Location on the World Wide Web identified by a Web address. Collection of Web files on a particular subject that includes a beginning file called a home page. Information is encoded with specific languages (Hypertext mark-up language (HTML), XML, Java) readable with a Web browser, like Netscape's Navigator or Microsoft's Internet Explorer.
xDSL	Digital Subscriber Line. DSL technologies are designed to increase bandwidth available over standard copper telephone wires. Includes IDSL, HDSL, SDSL, ADSL, RADSL, VDSL, DSL-Lite.
Convergence regions	In 2007 the list of objective 1 regions (valid until end 2006) is substituted by the new list of convergence regions eligible for funding from the Structural Funds. Structural Funds promote the development and structural adjustment of regions whose development is lagging behind. It defines convergence regions as those where average per capita GDP is below 75% of the European Union average. Countries composed entirely of Convergence regions: Bulgaria Estonia (the whole country counts as one single region at NUTS2) Ireland (Southern and Eastern under transitional support) Latvia (the whole country counts as one single region at NUTS2) Lithuania (the whole country counts as one single region at NUTS2) Malta (the whole country counts as one single region at NUTS2) Poland Romania Slovenia (the whole country counts as one single region at NUTS2) Countries partially composed of Convergence regions: Belgium: Hainaut Czech Republic: Střední Čechy, Jihozápad, Severozápad,

ANNEX 5

ESTIMATION OF A PROPORTION UNDER DIFFERENT SAMPLING SCHEMES

Many indicators are expressed as percentages or proportions of businesses satisfying a certain condition: using computers, using the Internet, having a website, etc. In statistical terminology, these indicators are estimates of a population proportion, defined as:

$$p = \frac{A}{N} \quad (1)$$

where N is the number of businesses (units) in the population, and A is the number of businesses satisfying the given condition.

Different estimates for p are possible and the choice should be based on the design of the sample from which data are collected. Usually, statistical investigations will be designed to collect data from a sample of businesses and not from the total population. The target population will usually be segmented into *strata*, defined by economic activity and size (and possibly geographical variables, such as head office location). Different sampling methods will yield different *sampling errors* (with respect to the 'true' proportion p).

Every sampling method assigns unit *weights* that reflect the number of population units represented by each sample unit. For an exhaustive survey (census) or stratum, weights are equal to one.

The total number of firms (size of the target population or in-scope businesses) may be known (by the Statistical Business Register) or is estimated.

CASE 1. Simple random sampling without replacement (SRSWOR) of a non-stratified population

In this case, n businesses out of N have been randomly selected with equal probability and without replacement (that is, a business cannot be selected twice to be interviewed). The sample weight is equal to $w=N/n$, that is, the sample is "grossed up" in proportion to the population size. The indicator may be calculated as the *sample proportion*:

$$\hat{p} = \frac{\sum_{i=1}^n w_i a_i}{\sum_{i=1}^n w_i} = \frac{\sum_{i=1}^n (N/n) a_i}{\sum_{i=1}^n (N/n)} = \frac{(N/n) \sum_{i=1}^n a_i}{N} = \frac{\sum_{i=1}^n a_i}{n} \quad (2)$$

where a_i is a dichotomous variable that is 0 if the answer is "No" and 1 if "Yes".

An unbiased estimate of the variance of the sample proportion is given by

$$\hat{V}(\hat{p}) = \frac{N-n}{N} \frac{\hat{p}(1-\hat{p})}{n-1} \quad (3)$$

and therefore its standard error can be estimated by:

$$SE(\hat{p}) = \sqrt{\frac{N-n}{N} \frac{\hat{p}(1-\hat{p})}{n-1}} \quad (4)$$

Now, if N is much larger than n , that is to say the sampling fraction n/N is low, the estimated standard error given by (4) can be approximated by a simpler expression:

$$SE(\hat{p}) \cong \sqrt{\frac{\hat{p}(1-\hat{p})}{n}} \quad (5)$$

Note that an alternative approximation is given by dividing by $n-1$ instead of by n .

A sampling fraction of 10 per cent or less is a requirement for using expression (5).

CASE 2. Stratified random sampling

In stratified random sampling, the population is broken down into strata that are expected to be more homogeneous than the whole population with respect to the variable of interest. Every population unit must belong to one and only one stratum. Sample selection is done independently in each stratum, which will have a sampling fraction determined by factors such as stratum size, variability and significance.

Let L be the number of strata and let N_h and n_h be the population and sample size respectively, in stratum h ($h=1, 2, \dots, L$).

An unbiased estimate of $p = \frac{A}{N}$ is:

$$\hat{p} = \frac{\sum_{h=1}^L \frac{N_h}{n_h} \sum_{i=1}^{n_h} a_{hi}}{N} = \sum_{h=1}^L \frac{N_h}{N} \hat{p}_h \quad (6)$$

where a_{hi} is a dichotomous variable that is 0 if the answer is "No" and 1 if "Yes"; and $\hat{p}_h$ is an estimate of the proportion p_h in stratum h , analogous to expression (2). It can be seen that the weight assigned to each unit in stratum h is $w_h = \frac{N_h}{n_h}$.

As sampling is independent between strata, and the estimate is a weighted sum of estimates, the sampling variance can be calculated as a weighted sum of variances.

The estimate of the standard error of $\hat{p}$ is:

$$SE(\hat{p}) = \sqrt{\sum_{h=1}^L \left(\frac{N_h}{N} \right)^2 \hat{V}(\hat{p}_h)} \quad (7)$$

where $V(\hat{p}_h)$ is the estimated variance of $\hat{p}_h$ in stratum h , and can be calculated as the square of expression (4) or (5), according to the size of the sampling fraction in each stratum.

CASE 2a. Stratified random sampling with one or several strata exhaustively investigated

One or more strata (for example, those containing large businesses) may be exhaustively sampled (that is, all units are selected). For those strata, there is no sampling error, and overall estimates of standard error need to take this into account.

For simplicity, it can be supposed that just one stratum, the first, is exhaustively investigated. The general case is an easy extension of this.

An estimate of p is:

$$\hat{p} = \frac{\sum_{i=1}^{N_1} a_{1i} + \sum_{h=2}^L \frac{N_h}{n_h} \sum_{i=1}^{n_h} a_{hi}}{N} = \frac{N_1}{N} p_1 + \sum_{h=2}^L \frac{N_h}{N} \hat{p}_h \quad (8)$$

and an estimate of the standard error is:

$$SE(\hat{p}) = \sqrt{\sum_{h=2}^L \left(\frac{N_h}{N} \right)^2 \hat{V}(\hat{p}_h)} \quad (9)$$

Note that the true proportion of stratum 1 is included in expression (8), but stratum 1 is omitted from expression (9).

In this case, the weight for any unit in stratum h is $w_h = \frac{N_h}{n_h}$, if $h \neq 1$, and $w_1 = 1$.

CASE 3. Ratio estimates with simple random sampling

Ratio estimates of a proportion can appear when the denominator of a proportion is not known and must be estimated from the sample. For example, the proportion of employees that have Internet access out of the total number of employees; or the ratio of the number of businesses that sell by Internet to the number of businesses that have Internet access.

For unit i , let y_i and x_i be the values of the characteristics that must be compared. For example, y_i could be the number of employees that have Internet access and x_i the total number of employees (or, for the second example, y_i is 1 if it sells by Internet, and 0 otherwise; and x_i is 1 if it has Internet access, and 0 otherwise). Thus, we are interested in estimating the following indicator:

$$p = \frac{Y}{X} = \frac{\sum_{i=1}^N y_i}{\sum_{i=1}^N x_i} \quad (10)$$

A natural estimate of p (let us call it $\hat{r}$ to indicate that it is a ratio) is the sample version of expression (10), that is to say, weighting all units with the same weights, $\frac{N}{n}$:

$$\hat{r} = \frac{\hat{Y}}{\hat{X}} = \frac{\frac{N}{n} \sum_{i=1}^n y_i}{\frac{N}{n} \sum_{i=1}^n x_i} = \frac{\sum_{i=1}^n y_i}{\sum_{i=1}^n x_i} \quad (11)$$

This estimate is not unbiased, but, for most of the population, the bias will not be important if the sample size is reasonably large (usually, 20 or more units).

There is no unbiased estimate with a closed form of the standard error, but an expression that can be successfully used as an approximation is:

$$SE(\hat{r}) \cong \frac{1}{\bar{x}} \sqrt{\frac{N-n}{Nn} \frac{\sum_{i=1}^n (y_i - \hat{r}x_i)^2}{n-1}} \quad (12)$$

Where $\bar{x}$ is the sample average of characteristic x, that is,

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n} \quad (13)$$

CASE 4. Ratio estimates with stratified random sampling

With stratified random sampling, ratio estimates can be used if an estimate of a proportion of unknown denominator is desired. In this appendix, only the "combined ratio estimate" will be dealt with.

Following the same notation as above, we are interested in estimating the following indicator:

$$r = \frac{\sum_{h=1}^L \sum_{i=1}^{N_h} y_{hi}}{\sum_{h=1}^L \sum_{i=1}^{N_h} x_{hi}} \quad (14)$$

An estimate of the ratio will be:

$$\hat{r} = \frac{\sum_{h=1}^L \frac{N_h}{n_h} \sum_{i=1}^{n_h} y_{hi}}{\sum_{h=1}^L \frac{N_h}{n_h} \sum_{i=1}^{n_h} x_{hi}} \quad (15)$$

As estimate of the standard error of $\hat{r}$ the following expression can be used:

$$SE(\hat{r}) \cong \frac{1}{\hat{X}} \sqrt{\sum_{h=1}^L \frac{N_h(N_h - n_h)}{n_h} \sum_{i=1}^{n_h} \frac{(y_{hi} - \hat{r}x_{hi})^2}{n_h - 1}} \quad (16)$$

where $\hat{X}$ is the population total estimate.

ANNEX 6

IMPUTATION OF MISSING DATA IN ICT SURVEYS

If re-contacting the interviewed business is out of scope for cost or time reasons, item non-response can be treated by mathematical techniques for data imputation. **Imputation** consists of assigning a plausible value to a question for which the selected unit has not provided a response, or to a question whose answer is logically or arithmetically inconsistent with answers in the rest of the questionnaire.

When the answer to different questions is inconsistent, the problem of deciding which one is incorrect may be very difficult. Usually, a hierarchy among questions, or blocks of questions, is established, so that answers to some of them are considered 'dominant'.

Example:

Suppose the following two questions and responses are found in a questionnaire:

A) Did your business have a website/home page, during January 200X?

Yes ☐

No ☒

B) Did your website/homepage provide any of the following facilities, during January 200X?

a) Marketing the business' products ☒

b) Facilitating access to product catalogues and price lists ☒

c) Providing after sales support ☐

Clearly, responses to questions A and B are inconsistent. However, it is more likely that the respondent made a mistake in question A) than in question B), because he or she was able to specify two web facilities. The most plausible conclusion is that his or her business had a website or home page, and therefore that question A) should be imputed as 'Yes'.

It is important to recall that imputation does not intend to establish a 'true' answer, but to assign a value for a missing answer that is consistent with the rest of the questionnaire. Frequently used methods for data imputation in business surveys are: deterministic imputation, 'hot deck' and 'cold deck' techniques. The choice among them should be in accordance with the current practice for other business surveys in the statistical office, so these should be reviewed before selecting one method for surveys of ICT use.

Deterministic imputation

Deterministic imputation of missing data consists of assigning a valid answer by means of the application of fixed rules that relate questions' values to each other. Under the same conditions, the mechanism will always generate the same imputed value.

Example:

A simple deterministic rule to assign a missing number of employees who use email is to assign the value of the number of employees who have access to the Internet, if the business uses email and 0 otherwise.

Hot deck imputation

For each business with item non-response, the hot deck procedure searches a set of businesses with similar characteristics, called 'donors', that have responded to the item. The method consists of randomly selecting one of the donors, and assigning the answer of the chosen donor to the business with item non-response.

Example:

The following table shows some raw data from a survey on ICT use by businesses. Each row (register) represents a different business, and characteristics of the businesses are shown in the columns. 'Missing' means item non-response. An imputed value for presence of a website for business 6 is sought.

Assume that two businesses are defined as 'similar' if they have the same level of Internet use (that is, they both used or did not use the Internet) and if their main activity is the same at the 3-digit level of ISIC. According to these criteria, in the example, business #6 is similar only to businesses #1, #2 and #5. Thus, businesses #1, #2 and #5 are donors for business #6, and one of them is randomly selected. If #1 is drawn, the value to the question 'Presence of a website' for business #1 will be imputed to business #6 (that is, 'Yes'). If #2 or #5 are drawn, 'No' will be imputed to business #6.

Business ID	Internet access	ISIC code of main activity	Presence of a website	% of employees with Internet access
#1	Yes	ABCD	Yes	10%
#2	Yes	ABCD	No	15%
#3	No	ABCD	No	0%
#4	Yes	ABXY	No	25%
#5	Yes	ABCD	No	20%
#6	Yes	ABCD	Missing	Missing

It is worth noting that if each donor has the same probability of being selected, then the relative frequencies of the imputed values will tend to replicate those of the valid values.

The hot deck procedure is one of the most frequently used methods of imputation and its main operational problem is how to delimit the set of donors, i.e. which variables determine that two units are 'similar'. A very restrictive rule will produce few donors (or none). The variables *size* and *economic activity* should generally be used to define similarity. Additionally, basic ICT variables such as the *use of computer*, *use of Internet* and *presence of website* should be used to identify donors where the missing answer relates to those variables (e.g. refer to the relationship in the example above where use, or not use, of Internet is used as a criterion for a donor).

This procedure tends to reduce the variance of the responses since by its own operational mechanism (replication of answers), it makes the sample more homogeneous. The bias towards homogeneity may be balanced by its simplicity.

Cold deck imputation

The cold deck procedure is similar to hot deck imputation, except that the donors are not actual survey responses, but are logical combinations of responses that are constructed (often based on experiences learnt from past surveys). The problems of this method include those of the hot deck method but it also requires some information on which the construction of a donor table is based. Such information may not be available for those developing economies that are measuring ICT for the first time.

Other imputation techniques

Other imputation methods are mean (for quantitative variables) or modal (for qualitative variables) value imputation. The method consists of imputing the mean or the modal (i.e. most frequent) value of the set of donors.

Example:

Using raw data from the example above, and considering the same definition of similarity, the imputed value of *percentage of employees with Internet access* of business #6, would be 15% = $(10\% + 15\% + 20\%) / 3$ (the simple mean of the value for donors #1, #2 and #5).

In the example, if business 6 had responded that 10 per cent of its *employees used computers*, an imputed value of 15 per cent for the *percentage of employees with Internet access* could be considered contradictory.

A problem common to all imputation methods is in ensuring logical and arithmetic coherence of imputed values with other responses in the same questionnaire. For instance, the imputed value may be inconsistent with the response to another question. To avoid this situation, a check for validity can be made after each imputation, selecting another donor if necessary.

Another method of imputation is to assign the answer given by the same unit in a previous survey (historical imputation). The same principle can be applied to unit non-response. This technique would more frequently be applied to large businesses, because they are more likely to be in successive surveys.

ANNEX 7

OECD LIST OF ICT GOODS (2003)

HS 2002	HS 1996	Telecommunications equipment	Notes
851711	851711	Line telephone sets with cordless handsets	
851719	851719	Other telephone sets, video phones	
851721	851721	Facsimile machines	
851722	851722	Teleprinters	
851730	851730	Telephonic or telegraphic switching apparatus	
851750	851750	Other apparatus, for carrier-current line systems or for digital line systems	
851780	851780	Other electrical apparatus for line telephony or line telegraphy	
851790	851790	Parts for other electrical apparatus for line telephony or line telegraphy	
852020	852020	Telephone answering machines	
852510	852510	Transmission apparatus for radio-telephony, radio-telegraphy, radio-broadcasting or television not incorporating reception apparatus	
852520	852520	Transmission apparatus for radio-telephony, radio-telegraphy, radio-broadcasting or television incorporating reception apparatus	
852530	852530	Television cameras	
852610	852610	Radar apparatus	
852790	852790	Reception apparatus for radio-telephony, radio-telegraphy or radio-broadcasting, whether or not combined, in the same housing, with sound recording or reproducing apparatus or a clock, n.e.s	
852910	852910	Aerials and aerial reflectors of all kinds; parts suitable for use therewith	
853110	853110	Burglar or fire alarms and similar apparatus	(1)
854420	854420	Co-axial cable and other co-axial electric conductors	
854470	854470	Optical fibre cables	
		Computer and related equipment	
847110	847110	Analogue or hybrid automatic data processing machines	
847130	847130	Portable digital automatic data processing machines, weighing not more than 10 kg, consisting of at least a central processing unit, a keyboard and a display	
847141	847141	Digital automatic data processing machines comprising in the same housing at least a central processing unit and an input and output unit, whether or not combined	
847149	847149	Other digital automatic data processing machines, presented in the form of systems	
847150	847150	Digital processing units other than those of subheadings 8471.41 and 8471.49, whether or not containing in the same housing one or two of the following types of unit : storage units, input units, output units	
847160	847160	Automatic data processing machines, input or output units, whether or not containing storage units in the same housing	
847170	847170	Automatic data processing machines, storage units	
847180	847180	Other units of automatic data processing machines	
847190	847190	Magnetic or optical readers, machines for transcribing data onto data media in coded form and machines for processing such data, not elsewhere specified or included	
847330	847330	Parts and accessories of the machines of heading No. 84.71	

HS 2002	HS 1996	Electronic components	Notes
850431	850431	Electrical transformers having a power handling capacity not exceeding 1 kVA	(1)
850450	850450	Inductors	(1)
850490	850490	Parts of: electrical transformers, static converters (for example, rectifiers) and inductors	(1)
852330	852330	Cards incorporating a magnetic stripe, unrecorded	(1)
852460	852460	Cards incorporating a magnetic stripe, recorded	(1)
852990	852990	Parts suitable for use solely or principally with the apparatus of headings Nos. 85.25 to 85.28 except aerials and aerials reflectors	
853221	853221	Capacitors, fixed, tantalum having a reactive power handling capacity of less than 0.5 kvar	
853224	853224	Capacitors, fixed, ceramic dielectric, multilayer having a reactive power handling capacity of less than 0.5 kvar	
853230	853230	Variable or adjustable (pre-set) capacitors	
853310	853310	Fixed carbon resistors, composition or film types	
853321	853321	Electrical resistors, fixed, (including rheostats and potentiometers), other than heating resistors, for a power handling capacity $\leq$ 20 W	
853329	853329	Electrical resistors, fixed, (including rheostats and potentiometers), other than heating resistors, n.e.s.	
853331	853331	Wirewound variable resistors, for a power handling capacity $\leq$ 20 W	
853339	853339	Resistors, wirewound, variable, n.e.s.	
853340	853340	Other variable resistors, including rheostats and potentiometers	
853390	853390	Parts for electrical resistors (including rheostats and potentiometers), other than heating resistors	
853400	853400	Printed circuits	
854011	854011	Cathode-ray television picture tubes, including video monitor tubes, colour	
854012	854012	Cathode-ray television picture tubes, including video monitor tubes, black and white or other monochrome	
854020	854020	Television camera tubes; image converters and intensifiers; other photo-cathode tubes	
854040	854040	Data/graphic display tubes, colour, with a phosphor dot screen pitch smaller than 0.4 mm	
854050	854050	Data/graphic display tubes, black and white or other monochrome	
854060	854060	Other cathode-ray tubes	
854071	854071	Microwave tubes, magnetrons, excluding grid-controlled tubes	
854072	854072	Microwave tubes – klystrons, excluding grid-controlled tubes	
854079	854079	Microwave tubes, other, excluding grid-controlled tubes	
854081	854081	Receiver or amplifier valves and tubes	
854089	854089	Valve and tubes, n.e.s.	
854091	854091	Parts of cathode-ray tubes	
854099	854099	Parts of thermionic or photo-cathode, valve and tubes, other than cathode-ray tubes	
854110	854110	Diodes, other than photosensitive or light emitting diodes	
854121	854121	Transistors, other than photosensitive, dissipation rate $<$ 1 W	
854129	854129	Transistors, other than photosensitive transistors, n.e.s.	
854130	854130	Thyristors, diacs and triacs, other than photosensitive devices	
854140	854140	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes	
854150	854150	Other semiconductor devices	
854160	854160	Mounted piezo-electric crystals	
854190	854190	Parts for semiconductor devices	
854210	854212	Cards incorporating electronic integrated circuits ('smart' cards)	(2)
854221	854213-19	Digital monolithic integrated circuits	(2)
854229	854230	Other monolithic integrated circuits	(2)
854260	854240	Hybrid integrated circuits	(2)
854270	854250	Electronic microassemblies	(2)
854290	854290	Parts for electronic integrated circuits and microassemblies	

HS 2002	HS 1996	Audio and video equipment	Notes
851810	851810	Microphones and stands therefor	
851821	851821	Single loudspeakers, mounted in their enclosures	
851822	851822	Multiple loudspeakers, mounted in the same enclosure	
851829	851829	Other loudspeakers, n.e.s	
851830	851830	Headphones and earphones, whether or not combined with a microphone, and sets consisting of a microphone and one or more loudspeakers	
851840	851840	Audio-frequency electric amplifiers	
851850	851850	Electric sound amplifier sets	
851890	851890	Parts of microphones, loudspeakers, headphones, earphones, combined microphone/ loudspeaker sets, audio-frequency electric amplifiers and electric sound amplifier sets	
851910	851910	Coin- or disc-operated record-players	
851921	851921	Record-players, without loudspeaker	
851929	851929	Record-players, n.e.s.	
851931	851931	Turntables with automatic record changing mechanism	
851939	851939	Turntables, n.e.s.	
851940	851940	Transcribing machines	
851992	851992	Pocket-size cassette-players	
851993	851993	Other sound reproducing apparatus, cassette-type	
851999	851999	Sound reproducing apparatus, not incorporating a sound recording device, n.e.s.	
852010	852010	Dictating machines not capable of operating without an external source of power	
852032	852032	Other magnetic tape recorders incorporating sound reproducing apparatus, Digital audio type	
852033	852033	Other magnetic tape recorders incorporating sound reproducing apparatus, cassette-type	
852039	852039	Other magnetic tape recorders incorporating sound reproducing apparatus	
852090	852090	Magnetic tape recorders and other sound recording apparatus, whether or not incorporating a sound reproducing device, n.e.s.	
852110	852110	Video recording or reproducing apparatus, whether or not incorporating a video tuner – magnetic tape-type	
852190	852190	Video recording or reproducing apparatus, whether or not incorporating a video tuner – other type	
852210	852210	Parts and accessories suitable for use solely or principally with the apparatus of headings Nos. 85.19 to 85.21 – pick-up cartridges	
852290	852290	Parts and accessories suitable for use solely or principally with the apparatus of headings Nos. 85.19 to 85.21 – other	
852311	852311	Magnetic tapes, unrecorded, width ≤ 4 mm (1/6 in.)	(1)
852312	852312	Magnetic tapes, unrecorded, width > 4 mm (1/6 in.) but ≤ 6.5 mm (1/4 in.)	(1)
852313	852313	Magnetic tapes, unrecorded, width > 6.5 mm (1/4 in.)	(1)
852320	852320	Magnetic discs, unrecorded	(1)
852390	852390	Other prepared unrecorded media for sound recording or similar recording of other phenomena, other than products of Chapter 37	(1)
852540	852540	Still image video cameras and other video camera recorders, digital cameras	
852712	852712	Pocket-size radio cassette-players capable of operating without an external source of power	
852713	852713	Radio-broadcast receivers, capable of operating without an external source of power, combined with sound recording or reproducing apparatus	
852719	852719	Other radio-broadcast receivers, capable of operating without an external source of power, not combined with sound recording or reproducing apparatus	
852721	852721	Radio-broadcast receivers with sound recording or reproducing apparatus, for motor vehicles, requiring external source of power	
852729	852729	Other radio-broadcast receivers for motor vehicles, not combined with sound recording or reproducing apparatus	
852731	852731	Other radio-broadcast receivers, including apparatus capable of receiving also radio-telephony or radio-telegraphy, combined with sound recording or reproducing apparatus	
852732	852732	Other radio-broadcast receivers, including apparatus capable of receiving also radio-telephony or radio-telegraphy, not combined with sound recording or reproducing apparatus but combined with a clock	

HS 2002	HS 1996	Audio and video equipment (continued)	Notes
852739	852739	Other radio-broadcast receivers, including apparatus capable of receiving radio-telephony or radio-telegraphy, n.e.s.	
852812	852812	Reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus, colour	
852813	852813	Reception apparatus for television, whether or not incorporating radio-broadcast receivers or sound or video recording or reproducing apparatus, black and white or other monochrome	
852821	852821	Video monitors, colour	
852822	852822	Video monitors, black and white or other monochrome	
852830	852830	Video projectors	
		Other ICT goods	
846911	846911	Word-processing machines	
847010	847010	Electronic calculators capable of operation without an external source of electric power and pocket-size data recording, reproducing and displaying machines with calculating functions	
847021	847021	Other electronic calculating machines incorporating a printing device	
847029	847029	Other electronic calculating machines	
847040	847040	Accounting machines	
847050	847050	Cash registers	
847310	847310	Parts and accessories (other than covers, carrying cases and the like) suitable for use solely or principally with machines of heading No. 84.69	
847321	847321	Parts and accessories of the electronic calculating machines of subheading No. 8470.10, 8470.21 or 8470.29	
847350	847350	Parts and accessories equally suitable for use with machines of two or more of the headings Nos. 84.69 to 84.72	
852691	852691	Radio navigational aid apparatus	
852692	852692	Radio remote control apparatus	
901041	901041	Apparatus for the projection or drawing of circuit patterns on sensitised semiconductor materials – direct write-on-wafer apparatus	(1)
901042	901042	Apparatus for the projection or drawing of circuit patterns on sensitised semiconductor materials – step and repeat aligners	(1)
901049	901049	Apparatus for the projection or drawing of circuit patterns on sensitised semiconductor materials – other	(1)
901410	901410	Direction finding compasses	
901420	901420	Instruments and appliances for aeronautical or space navigation (other than compasses)	
901480	901480	Other navigational instruments and appliances	
901490	901490	Parts and accessories of direction finding compasses, other navigational instruments and appliances	
901540	901540	Photogrammetrical surveying instruments and appliances	
901580	901580	Other surveying instruments and appliances	
901811	901811	Electro-cardiographs	(1)
901812	901812	Ultrasonic scanning apparatus	(1)
901813	901813	Magnetic resonance imaging apparatus	(1)
901814	901814	Scintigraphic apparatus	(1)
901819	901819	Other electro-diagnostic apparatus (including apparatus for functional exploratory examination or for checking physiological parameters)	(1)
902212	902212	Computed tomography apparatus	(1)
902213	902213	Other apparatus based on the use of X-rays, for dental uses	(1)
902214	902214	Other apparatus based on the use of X-rays, for medical, surgical or veterinary uses	(1)
902219	902219	Other apparatus based on the use of X-rays, for other uses	(1)
902410	902410	Machines and appliances for testing the hardness, strength, compressibility, elasticity or other mechanical properties of materials, metals	
902480	902480	Other machines and appliances for testing the hardness, strength, compressibility, elasticity or other mechanical properties of materials	
902490	902490	Parts and accessories for machines and appliances for testing the hardness, strength, compressibility, elasticity or other mechanical properties of materials	

HS 2002	HS 1996	Other ICT goods (continued)	Notes
902620	902620	Instruments and apparatus for measuring or checking the pressure of liquids or gases, excluding instruments and apparatus of heading Nos. 9014, 9015, 9028 or 9032	
902710	902710	Instruments and apparatus for physical or chemical analysis, gas or smoke analysis apparatus	
902730	902730	Spectrometers, spectrophotometers and spectrographs using optical radiations (UV, visible, IR)	
902740	902740	Instruments and apparatus for measuring or checking quantities of heat, sound or light, exposure meters	
902750	902750	Other instruments and apparatus using optical radiations (UV, visible, IR)	
902780	902780	Other instruments and apparatus for physical or chemical analysis	
902810	902810	Gas meters	
902820	902820	Liquid meters	
902830	902830	Electricity meters	
902890	902890	Parts for gas, liquid or electricity supply or production meters, including calibrating meters therefor	
902910	902910	Revolution counters, production counters, taximeters, mileometers, pedometers and the like	
902920	902920	Speed indicators and tachometers; stroboscopes	
902990	902990	Parts and accessories for revolution counters, production counters, taximeters, mileometers, pedometers and the like; speed indicators and tachometers, other than those of heading No. 90.14 or 90.15; stroboscopes	
903010	903010	Instruments and apparatus for measuring or detecting ionising radiations	
903020	903020	Cathode-ray oscilloscopes and cathode-ray oscillographs	
903031	903031	Multimeters without a recording device	
903039	903039	Other instruments and apparatus for measuring or checking voltage, current, etc. without a recording device	
903040	903040	Other instruments and apparatus, specially designed for telecommunications (for example, cross-talk meters, gain measuring instruments, distortion factor meters, psophometers)	
903082	903082	Other instruments for measuring or checking semiconductor wafers or devices	
903083	903083	Other instruments for measuring or checking semiconductor wafers or devices with a recording device	
903110	903110	Measuring or checking instruments, appliances and machines n.e.s, machines for balancing mechanical parts	
903120	903120	Measuring or checking instruments, appliances and machines n.e.s, test benches	
903130	903130	Measuring or checking instruments, appliances and machines n.e.s, profile projectors	
903141	903141	Other optical instruments and appliances, for inspecting semiconductor wafers or devices or for inspecting photomasks or reticles used in manufacturing semiconductor devices	
903180	903180	Other measuring or checking instruments, appliances and machines, n.e.s.	
903190	903190	Parts and accessories for measuring or checking instruments, appliances and machines, n.e.s.	
903210	903210	Thermostats	
903220	903220	Manostats	
903289	903289	Other automatic regulating or controlling instruments and apparatus, n.e.s.	
903290	903290	Parts and accessories for automatic regulating or controlling instruments and apparatus	

Source: OECD, 2005.

Notes

Titles are according to the 2002 Harmonized System. Some have been changed slightly in the interests of clarity and space

- (1) Industry of origin not in the OECD ICT sector (2002).
- (2) HS 1996 and HS 2002 codes differ. Titles are according to the 2002 Harmonized System. Some have been changed slightly in the interests of clarity and space

ANNEX 8

OECD LIST OF ICT GOODS (2008)

Extracted from the list of ICT products (OECD 2008).

CPC Ver. 2 sub-class	ISIC Rev. 4 class	Product description (CPC sub-class title)
Computers and peripheral equipment		
45142	2620	Point-of-sale terminals, ATMs and similar machines
45221	2620	Portable automatic data processing machines weighing not more than 10 kg, such as laptop and notebook computers
45222	2620	Personal digital assistants and similar computers
45230	2620	Automatic data processing machines, comprising in the same housing at least a central processing unit and an input and output unit, whether or not combined
45240	2620	Automatic data processing machines presented in the form of systems
45250	2620	Other automatic data processing machines whether or not containing in the same housing one or two of the following types of units: storage units, input units, output units
45261	2620	Input peripherals (keyboard, joystick, mouse etc.)
45262	2620	Scanners (except combination of printer, scanner, copier and/or fax)
45263	2620	Inkjet printers used with data processing machines
45264	2620	Laser printers used with data processing machines
45265	2620	Other printers used with data processing machines
45266	2620	Units performing two or more of the following functions: printing, scanning, copying, faxing
45269	2620	Other input or output peripheral devices
45271	2620	Fixed media storage units
45272	2620	Removable media storage units
45289	2620	Other units of automatic data processing machines
45290	2620	Parts and accessories of computing machines
47315	2620	Monitors and projectors, principally used in an automatic data processing system
47550	2620	Solid-state non-volatile storage devices
Communication equipment		
46921	2630	Burglar or fire alarms and similar apparatus
47211	2630	Transmission apparatus incorporating reception apparatus
47212	2630	Transmission apparatus not incorporating reception apparatus
47213	2630	Television cameras
47221	2630	Line telephone sets with cordless handsets
47222	2630	Telephones for cellular networks or for other wireless networks
47223	2610, 2630	Other telephone sets and apparatus for transmission or reception of voice, images or other data, including apparatus for communication in a wired or wireless network (such as a local or wide area network)
47401	2630	Parts for the goods of subclasses 47221 to 47223
Consumer electronic equipment		
38581	2640	Video game consoles
47214	2640	Video camera recorders
47215	2670	Digital cameras

47311	2640	Radio broadcast receivers (except of a kind used in motor vehicles), whether or not combined with sound recording or reproducing apparatus or a clock
47312	2640	Radio broadcast receivers not capable of operating without an external source of power, of a kind used in motor vehicles
47313	2640	Television receivers, whether or not combined with radio-broadcast receivers or sound or video recording or reproducing apparatus
47314	2640	Monitors and projectors, not incorporating television reception apparatus and not principally used in an automatic data processing system
47321	2640	Sound recording or reproducing apparatus
47323	2640	Video recording or reproducing apparatus
47330	2640	Microphones and stands therefor; loudspeakers; headphones, earphones and combined microphone/speaker sets; audio-frequency electric amplifiers; electric sound amplifier sets
47402	2640	Parts for the goods of subclasses 47321, 47323 and 47330
Miscellaneous ICT components and goods		
45281	2610	Sound, video, network and similar cards for automatic data processing machines
47130	2610	Printed circuits
47140	2610	Thermionic, cold cathode or photo-cathode valves and tubes (including cathode ray tubes)
47150	2610	Diodes, transistors and similar semi-conductor devices; photosensitive semi-conductor devices; light emitting diodes; mounted piezo-electric crystals
47160	2610	Electronic integrated circuits
47173	2610	Parts for the goods of subclasses 47140 to 47160
47403	2630, 2640, 2651	Parts for the goods of subclasses 47211 to 47213, 47311 to 47315 and 48220
47530	2680	Magnetic media, not recorded, except cards with a magnetic stripe
47540	2680	Optical media, not recorded
47590	3290	Other recording media, including matrices and masters for the production of disks
47910	2680	Cards with a magnetic stripe
47920	2610	"Smart cards"
48315	2670	Liquid crystal devices n.e.c.; lasers, except laser diodes; other optical appliances and instruments n.e.c.
48354	2670	Parts and accessories for the goods of subclass 48315

Source: OECD, 2008.

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