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DEFINING AND MEASURING E-COMMERCE: A STATUS REPORT

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FOREWORD

This report was prepared as a background document for the OECD Forum on Electronic Commerce to be held in Paris on 12-13 October 1999.

The OECD Working Party on Indicators for the Information Society (WPIIS) created at its April 1999 meeting an Expert Group on "Defining and Measuring Electronic Commerce". The report presents the Expert Group's *work in progress* to develop a framework for measurement priorities for electronic commerce.

As recommended by the Working Party on Indicators for the Information Society, the ICCP Committee has agreed to the declassification of this paper through a written procedure. This final version incorporates comments by Member countries.

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I. Introduction

Electronic commerce has the potential to radically alter some economic activities and the surrounding social environment. These changes require new frameworks for conducting business and pose new challenges to policy makers. To better understand the importance, interaction and nature of these policy challenges, it is necessary to track the developments of this very dynamic medium and the impact it is having on our economy and society[1].

Reliable and internationally comparable statistics that measure the level, growth and composition of electronic commerce are lacking, as is a consistent definition of electronic commerce. Determining the economic and social impacts of e-commerce is also in large measure a question of monitoring and measuring change in the marketplace, the generation of new product and business models, the need for new skills and news ways to organise work. But obtaining measurements of this kind presents a real challenge. "Initiate work on defining and measuring electronic commerce" is one of the seven points in the OECD e-commerce action plan endorsed by Ministers at last year's conference on Electronic commerce (Ottawa, October 1998)[2].

Following an OECD Workshop (21 April 1999) which brought together the expertise of business, policy makers, researchers and statisticians to discuss issues of definition and measurement of e-commerce, the OECD Working Party on Indicators for the Information Society (WPIIS) decided at its April 1999 meeting to create an Expert Group on "Defining and Measuring E-commerce". The Expert group mandate is to "compile definitions of electronic commerce which are policy relevant and statistically feasible." Fourteen countries and Eurostat are participating in the Expert Group, and Singapore is participating as an Observer[3]. In developing definitions and measures of electronic commerce the Expert Group should be "fully aware of the policy needs for indicators and data in the domain of electronic commerce".

The WPIIS Expert Group is working in close collaboration with another ICCP related group, the Working Party on the Information Economy (WPIE), as well as with policy makers and experts from businesses and research institutes[4]. Initial building blocks of this multifaceted work are (1) the development of a set of e-commerce definitions for the purpose of statistical measurement across countries, (2) the translation of policy needs into a set of comparable e-commerce metrics, and (3) the development of concrete proposals to use and adapt existing statistical instruments to collect data and develop such metrics.

The Expert Group's first steps were to develop three draft papers in parallel. The draft background paper on definitions summarises the range of definitions of electronic commerce in use in Member countries, and the variety of different purposes for which measures are wanted. It solicits additional views on electronic commerce that can be used for measurement purposes, and will develop a synthesis or convergence of definitions in its next version.[5] A draft paper on methodology will review those measures of electronic commerce that have been collected, and assess the statistical soundness of methodologies currently available for measuring the definitions proposed in the draft definition paper.

A third draft paper will develop a framework of measurement priorities for electronic commerce based on national accounts. While electronic commerce is of interest in its own right, interest is at least as great about the ways that it may affect the economy as a whole, specific industries and sectors, and the firms that do, and do not, participate in it. These effects include changes in the factors or inputs that enter

businesses' production processes, changes in their production, revenue and distribution models, and in the nature of the marketplace. National accounting and other economic principles provide the current framework for measuring these characteristics in the economy generally. They also provide a framework for measuring the effects of electronic commerce, determining where there are gaps in current statistical collections, and guiding the development of new measures.

Developing measures of electronic commerce clearly will require statistical agencies to address a number of technical challenges. Still, existing measurement frameworks can offer some answers and guidance. For example, the general principles underlying national accounts and input-output matrices, and theories of productivity, can be adapted to address measurement issues in electronic commerce. These principles have been adapted in the recent past to develop measures of the quality of the outputs of technologically complex products such as computers and related equipment, and are being used to guide the development of measures of outputs and prices in the services sector. While measures of the impact of electronic commerce are not available off the shelf, developing an appropriate system can begin by adapting and building on existing measurement systems and frameworks.

This report presents OECD *work in progress* to develop a framework for measurement priorities for electronic commerce. Section II discusses policy needs for e-commerce metrics as they emerged from the discussion at the OECD "Workshop on Defining and Measuring E-commerce". Section III surveys existing e-commerce definitions and starts building a conceptual framework to develop a set of definitions. Section IV looks at e-commerce measurement challenges and surveys existing public statistical efforts to develop e-commerce indicators. Finally, section V presents some concluding remarks and challenges ahead.

II. Policy needs for e-commerce metrics

To focus the policy debate, statistics that measure the level, growth and composition of e-commerce are badly needed[6]. This knowledge requirement is fuelling the growth of "e-consultants" providing all kinds of "e-estimates" that cannot be easily compared, as well as generating innovative approaches to using the Internet in order to measure itself[7]. The problem for both research firms and government statistical agencies is to develop analytical methods that can make sense of the huge quantity of data it is now possible to obtain about the Internet and e-commerce applications.

The OECD Workshop on "Defining and Measuring E-commerce" produced an open and productive discussion on a variety of issues[8]. The methods and potential value to policy makers of e-commerce data analysis by commercial research firms were discussed. It was acknowledged that public and private sector knowledge requirements were not always the same, but that they could intersect in some cases. Governments too can require short-term information for policy purposes, but national statistical agencies are not as a rule oriented to providing this information. Statistical surveys, though, are very rich instruments that can be used to measure not only e-commerce transactions or e-commerce usage but also broader e-commerce definitions and impacts. The general feeling expressed by Workshop participants was that principles would have to be established for the expansion of statistical regimes in a policy context.

Policy questions should guide the setting of e-commerce definitions in terms of what needs to be measured in what way and by whom. Hence to guide statistical agencies' measurement of e-commerce there is a need to:

(1) Identify governments' policy priorities

(2) Translate policy concerns into research needs

(3) Develop a framework to guide research in the measurement area

This section looks at policy needs for e-commerce metrics in terms of the development of both e-commerce definitions and indicators.

II.1 What do we want to measure?

The discussion at the Workshop underlined the importance of social as well as economic indicators in an e-commerce measurement framework. Important social indicators relevant to e-commerce range from skills and education, to patterns of interaction in the marketplace, the household and the workplace. Especially in the interventions from industry and from market research firms, it was clear that there is a need to link economic indicators to social indicators.

There were indications throughout the Workshop that the knowledge requirements of policy makers and industry have converged in the key respect that both communities need to know what is *not* occurring as well as what is occurring. This information is vital for strategic planning in either arena. To summarise there is need for:

- E-commerce statistics that are internationally comparable, and therefore based on a common set of definitions and a common measurement framework for e-commerce.

- E-commerce metrics and sectoral analysis that capture not only the size and growth of e-commerce, but also fundamental changes in the economy, such as the emergence of new business models, changes in the business and public value added chain, different degrees of e-commerce diffusion across society, sectors, countries.

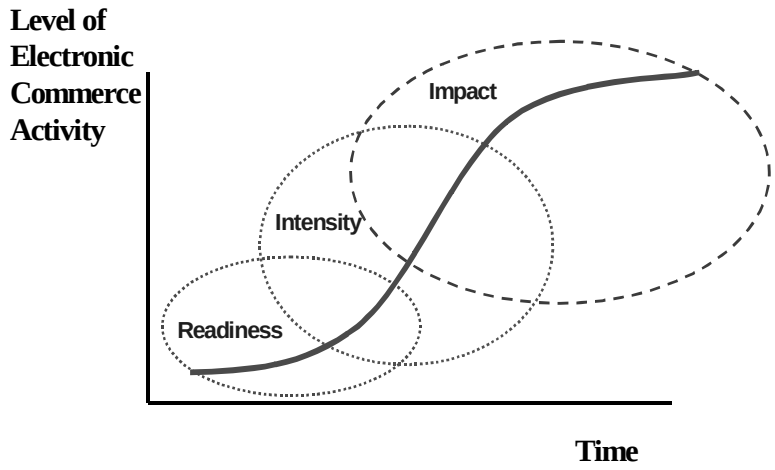
A very useful representation of needs for e-commerce metrics as related to the three areas of the S-shaped path for the diffusion of new technologies is presented in Figure 1[9]. The idea is that there is a life cycle for research needs which follows the pattern of growth of e-commerce markets: at an initial stage there is need for information on the enabling factors and barriers to e-commerce; at a more mature stage one should look for the intensity of e-commerce use to enable policy makers to address imbalances; at a later stage one would be able to measure the impact of e-commerce on the economy and society. The three broad areas for indicators are:

1. **E-commerce readiness** - Included here are issues of preparing the technical, commercial and social infrastructures that are necessary to support e-commerce. It is essential for each country to be able to construct a statistical picture of the state of readiness of each infrastructure element to engage with e-commerce.

2. **E-commerce intensity** - These issues relate to the state of e-commerce application. The statistical requirement is to profile who is exploiting e-commerce possibilities and who is not, and to identify leading sectors and applications.

3. **E-commerce impact** - These issues relate to additionality (i.e. e-commerce goes beyond substitution effects and creates new value added) and multiplier effects. Statistics are needed to evaluate whether and to what extent e-commerce makes some kind of difference in terms of efficiency and/or the creation of new sources of wealth.

Figure 1. Maturity of electronic commerce markets and need for indicators: the S-curve



Source: Industry Canada, presented at the OECD Workshop on *Defining and Measuring E-commerce* (April 1999).

It is clear that the knowledge requirement in the electronic marketplace concerns far more than growth in transactions. When e-commerce markets reach a certain maturity, and differences in e-commerce uptake level out there will be less concern about growth in e-commerce, and more concern about the wealth-creation potential of e-commerce. At that stage it is far more important to have knowledge of the "qualities" of the transactions in terms of who transacts with whom under what conditions, the evolution of products and services, value-chain and supply-chain dynamics, market and industry structure, industrial organisation and management.

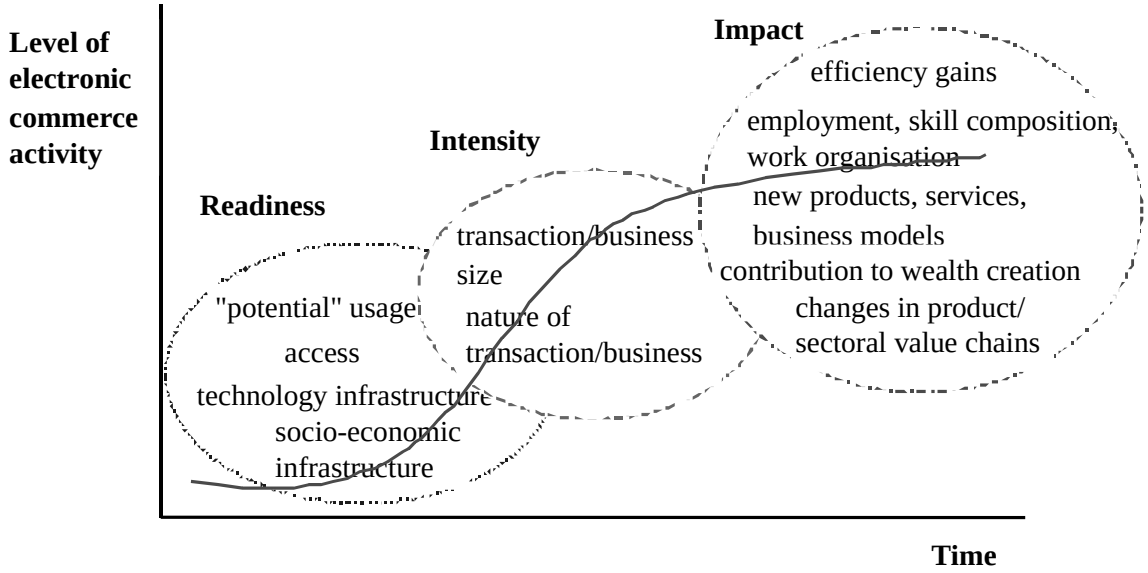
II.2 What are the e-commerce indicators one might want to collect on an internationally comparable basis?

In order to develop a framework to guide research in the e-commerce measurement area it is necessary to translate policy concerns into a set of e-commerce indicators. There are several efforts in this direction which are ongoing on a national basis. Data requirements cover both supply and demand aspects of e-commerce and Figure 2 links the need for indicators on e-commerce readiness, intensity and impact with the type of information one would need to collect across the whole spectrum of actors in the electronic marketplace (consumers, businesses, government).

The degree of e-commerce readiness should encompass indicators that reflect the country's socio-economic and technological infrastructure and usage. Particularly important are indicators that express the potential for e-commerce readiness, i.e. the propensity of individuals or businesses or governments to transact or more generally to carry out businesses electronically (e.g. indicators of credit card use, indicators of the barriers or the perceived benefits to e-commerce). The e-intensity indicators would give information on the size, growth and nature of the electronic commerce transactions/business. It

is important to know for what component of a transaction e-commerce is used (e.g. information gathering, sale, purchase, payment) or in what business function; who are the actors involved in the transaction/business and what are their socio-demographic characteristics; what are the products and services involved, whether the transaction is domestic, international, urban or rural. The impact indicators would focus on the additionality and multiplier effects of e-commerce, the impacts on production processes and business models, on the workplace and more generally on society.

Figure 2. Translating policy needs into research priorities



Source: OECD.

III. Defining e-commerce

The measurement of electronic commerce would clearly benefit from the adoption of a set of definitions that would provide some consistency across studies and a reference point for the collection of data. Work to develop a definition should be undertaken at the national and international level in consultation with businesses, researchers, policy makers and statisticians. Because of inherent differences in policy interests and feasibility of definitions, a framework for defining various aspects of electronic commerce for different purposes may be the most practical. That is, one could aim at developing a set of definitions (with well-defined inclusions and exclusions) that could be used for different purposes in a consistent way[10].

III.1 No shortage of definitions

Definitions of electronic commerce given by various sources differ significantly. Some include all financial and commercial transactions that take place electronically, including electronic data interchange (EDI), electronic funds transfers (EFT), and all credit/debit card activity. Others limit electronic commerce to retail sales to consumers for which the transaction and payment take place on open

networks like the Internet. The first type refers to forms of electronic commerce that have existed for decades and result in trillions of dollars worth of activity every day. The second type has existed for a few years and is not yet very large.

Some definitions are best suited for statistical measurement because they include a list of items that fit within the boundaries of existing statistical classifications; some are best suited to address certain policy concerns. Not only it is possible to construct a typology of definitions, but also to have a typology of views. Some academics give a very broad definition that includes all those communication applications that support commercial activities. Their focus is on electronic commerce as a strategy or business model, rather then on e-commerce as an application or technology. Private research companies, the "e-consultants", usually cover both the broader definition focused on business processes or focus on Internet commerce, distinguishing between business-to-business and business-to-consumer Internet commerce. But also in the case of Internet commerce various definitions can be found, according to what part of the Internet transaction is included. Finally, definitions given by the same organisation change over time. This points to the fact that an e-commerce definition is necessarily dynamic and varies with the objective one wants to measure.

The business or industry definition can be broader or narrower and the terms used are usually e-business for the former and e-commerce for the latter. Key to the narrower definition is the transactional aspect. A survey of business views on the definition of e-commerce conducted on behalf of Statistics Canada also distinguishes between e-business and e-commerce. According to the findings of the survey *"the notion of transactions, computer-mediation, channels and trigger events were found to be key concepts in defining e-commerce"*[11]. Also, industry perception of what are the relevant computer-mediated channels or electronic commerce networks on which e-business or e-commerce takes place differ across sectors, hence a definition should clearly specify on what type of networks or applications e-commerce occurs.

Public statistical offices are now starting to develop e-commerce-related surveys. The definition used by statisticians is inevitably more focused and narrow (since it has to be directly measurable). Because statistical offices aim at collecting data on the use of certain technologies/applications (e.g. the Internet, EDI, e-mail, etc.) and electronic processes (e.g. electronic stock monitoring, electronic transactions, electronic ordering or purchasing, etc.), in most cases there is not even the need for a comprehensive definition. For example most of the surveys are now focusing on Internet commerce. Statistical surveys are very rich instruments that can be used to measure not only e-commerce transactions or e-commerce usage but also broader definitions and impacts. Broader definitions of e-commerce can be implemented statistically as long as those definitions are detailed enough (e.g. they disaggregate the transaction in various components, they disaggregate the networks and applications on which e-commerce occurs, etc.).

Policy makers' definitions of e-commerce are often very broad in order to capture the impacts of e-commerce, cover all segments of transactions and all actors in the economy. But policy makers also need narrower definitions to respond to specific policy concerns. For example, there is need for measuring the development of different e-commerce segments since drivers, technological solutions, impacts and policy implications of business-to-business (b-to-b) and business-to-consumer (b-to-c) e-commerce are different. Also, when looking at the economic impacts of e-commerce, policy makers may be interested in the huge potential and dynamics associated with the Internet and its open, non-proprietary protocol[12]. What is needed in a policy context is a set of definitions of e-commerce that capture both its size and its impacts, and that are measurable across countries.

III.2 Building a framework

With e-commerce, like with any definition of crosscutting activities, it is difficult to make sharp distinctions. As reviewed in the preceding section, the term "e-commerce", regardless of the word "commerce" built into it, has been attributed so many different meanings by different actors that the term cannot be used in a neutral way. For the purpose of this section the term "*e-commerce*" (in italics) will be used as a generic term. The purpose is to show that, in fact, most of the existing e-commerce definitions differ with respect to: (a) the activities or type of transactions included in the definition, and (b) the communication infrastructure on which these activities/transactions are carried on. The range of activities/transactions included in an *e-commerce* definition can be wider (e.g. include most of the different layers of economic activity such as collaborative design and engineering, commerce, transport, marketing, advertising, information services, settlements of accounts, government procurement, health, education, etc.) or narrower (e.g. only retailing or delivery occurring electronically). The communication infrastructure, in turn, will be defined by two dimensions: applications and networks. It refers to all the possible applications (e.g. the Web, Electronic Data Interchange, Minitel, etc.) running over all the possible communication networks (e.g. open, closed, prorietary or non-proprietary networks).

Thus, existing *e-commerce* definitions can be seen as differing because of three key elements: (1) activities/transactions, (2) applications, (3) communication networks. For example some definitions refer to only one activity (e.g. retailing or delivery occurring electronically), or to one activity occurring over a specific network (e.g. retailing occurring over open networks, or TCP/IP based networks), or, more narrowly, to one activity occurring over a particular application (e.g. Web or Internet retailing). In practice, by taking into account what type of activity over which network, one can think of different types of *e-commerce* definition. This also underlines that *e-commerce* is more than a technology or application, rather it denotes the application of information and communication technologies to the entire value chain of business processes conducted electronically.

The interaction between "technology" and "business process" (or business activity) is key to understanding the impact that *e-commerce* is having on the nature of economic transactions, and in turn on the economy. At least one definition of *e-commerce* should reflect the issue of transformation of economic activities, or else *e-commerce* would simply be the application of new information technologies to the commerce sector; also a definition should focus on certain technologies, otherwise *e-commerce* would not be different from electronic transactions that have existed for years, such as transactions carried out by fax, telephone, EDI etc. and would not justify the recent attention given to it by policy makers. It is the pervasiveness of electronic commerce all along the transactional structure, across the whole range of economic activities, and across the range of different economic actors that make it a unique application.

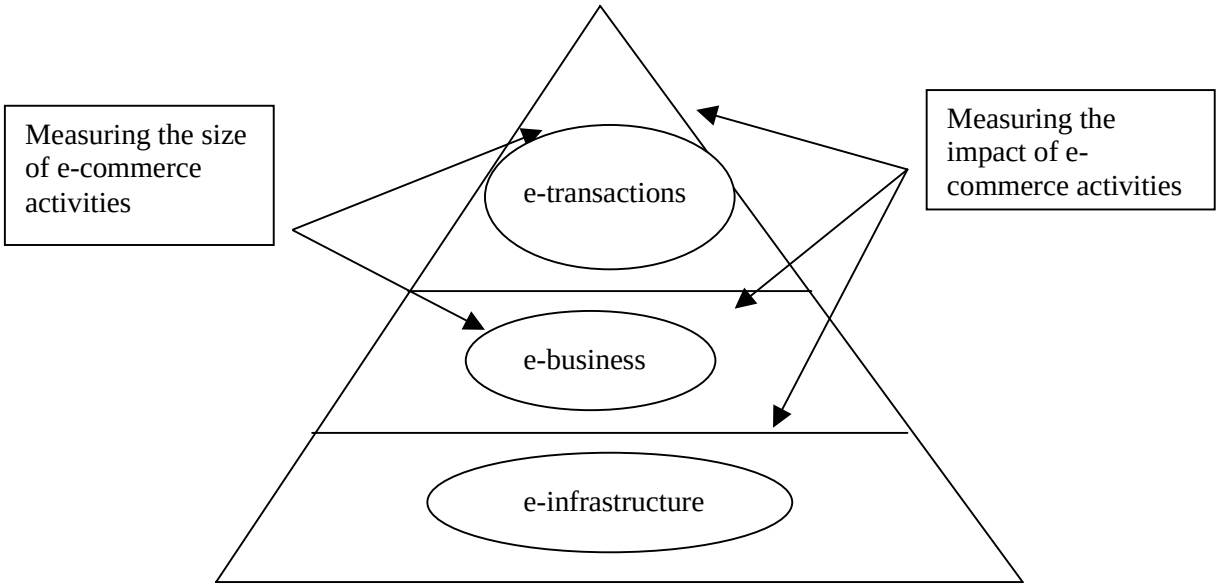
In order to identify a certain set of *e-commerce* definitions one should start by asking at least three types of questions: (1) why we want to measure; (2) what do we want to measure and (3) what can we measure. The development of e-commerce definitions is thus strictly linked to the measurement issues reviewed in section IV.

Why do we want to measure? As argued in section II, policy makers are mainly interested in the measurement of the economic and social impacts of e-commerce. In this respect they need to use broader definitions in order to capture fundamental changes in the economy driven by e-commerce. Also, the reason for the recent interest of policy makers in e-commerce lies in the emergence of open, non-proprietary networks such as the Internet that are seen as a catalyst for driving business over networks. In the set of definitions of e-commerce one might include also more narrow definitions focused on business or transactions occurring over particular networks such as the Internet (and e.g. use terms such as "*I-commerce*" in order to distinguish it from other forms of e-commerce)[13].

What do we want to measure? Suppose the objective is to measure the size of *e-commerce* as an activity. In that case one might want to develop at least two definitions, a broader one reflecting the *e-commerce* business activity and a narrower one capturing *e-commerce* transactions. If instead one is interested in measuring the impact of *e-commerce* one might want to have an even broader set of definitions, basically related to the concept of an "e-sector". In this case one might include in the definition the underlying infrastructure to carry out "e-commerce activities" or "e-commerce transactions". The key is, though, that there is need to know what is *not* occurring as well as what is occurring and why. Also, it is necessary to measure the size and impacts of e-commerce transactions or activities in relation to non e-commerce transactions/activities. What we are interested in is the measurement of the relative size or the relative impacts of e-commerce (see Figure 3).

What can we measure? To different kinds of definitions correspond different degrees of measurability. Even in the case of the narrowest types of definition, e.g. those based on transactions, one should decide what components (e.g. information gathering, ordering method, payment method), carried out over which medium (Internet, Extranet, EDI, phone, fax, e-mail, etc.)[14], are included in the definition. Some of the characteristics that we want to measure, such as the volume and value of sales conducted over the Internet, are extensions of information that countries generally collect. Other characteristics, such as changes in the speed or quality of these transactions or the nature of business models and supply chains, present greater measurement challenges.

Figure 3. Measuring e-commerce size or its impact in relation to overall transactions/activities



Source: OECD.

IV. Measuring e-commerce

Due to the rapid growth in e-commerce, Member countries have responded to the information needed by policy makers in a less structured way than they might have wished; their responses have varied depending on the statistical infrastructure available in those countries. Because there have been no

international statistical frameworks or definitions to follow, the indicators that have been produced to date are not necessarily comparable.

These increased information requirements will also raise timeliness, availability and burden issues to statistical agencies. In developing their responses to these information needs, statistical agencies have to take into account whether the desired data are indeed available from statistical units, and consider the burden that collecting them places on those units. Transactions data alone will generally not suffice to measure the impact of e-commerce on the economy and society.

IV.1 Ongoing efforts in public statistical offices

Readiness. The first area for which indicators are required is measuring the readiness of economies for e-commerce. Readiness measures have received the greatest statistical attention so far. The indicators that have been developed have basically been of two types: the first relates to the telecommunications infrastructure available in a country; the second relates to the skills and training of the population using the infrastructure.

Indicators about the telecommunications infrastructure have been compiled by a number of countries, and generally from a variety of sources. Statistical Agencies often survey the telecommunications industry to measure its size, structure and financial performance. A number of surveys, such as the one conducted annually by Statistics Canada, also allow for the compilation of a range of indicators about the growth of telecommunications services in those countries. In other countries, there are often only a small number of telecommunications service companies in operation. In these cases it is often difficult for Statistical Agencies to compile statistics, as the data are commercially confidential. In a lot of cases reliance has to be placed on official reports emanating from the major provider. Since the growth of the Internet, there have also been a number of collections undertaken within Member countries that provide some information on the number of and services provided by Internet Service Providers. Typically these surveys have been hard to conduct because of difficulties in obtaining accurate and up-to-date lists of such companies. They often have very short life spans and can be quickly involved in business restructures, which makes statistical measurement much more difficult.

With respect to indicators about the general population and the skills that are required for e-commerce, there are typically two data sources. The first relates to collections such as Censuses of Population, which are conducted at regular but infrequent intervals in many countries; these provide some indicators, but the time lag for which they are available limits their usefulness. Some other countries have social systems which provide regular information about the skills of the population and in which industries they are being used. In these countries there clearly are more indicators available. In other cases countries have been able to get some measures of the skills of the workforce, in respect of Information and Communication Technologies (ICTs), by asking questions in specific surveys measuring the use of ICTs in industry. The skill level of the population able to use ICTs and especially Internet applications has also been measured in surveys aimed at measuring the use of these technologies in households.

Intensity. As the information needs move from the readiness issues towards the intensity phase, there is a requirement for many more indicators about the use of ICT in the business, government and household sectors. Within this field, the priorities for data collection have been mainly in the areas of the business enterprise and the household sectors. In terms of the business enterprise sector, the most common way in which countries have responded has been by the development of special surveys that measure the use of a range of information and communication technologies. These surveys have generally taken a broad, almost economy wide, approach although it has been rare for data to be collected about the Agriculture sector. These surveys generally have measured the technological infrastructure in place and

the usage of those technologies. In most of these surveys, there has been particular emphasis placed on the Internet.

In terms of the household sector, many countries have developed surveys as part of their standard household surveys programmes. The number of indicators varies widely across countries depending on the amount of interviewing time it has been possible to devote to measuring this phenomenon. The surveys generally measure the extent to which people and households are using ICTs and more generally look at the issues of the barriers to future use and the benefits being obtained from current use. These surveys have tended to concentrate on the use of computers and the Internet, but in some cases have gone more extensively into other technologies being used by people and households. Because the surveys tend to be conducted as supplements to existing surveys, it is possible to have access to socio-demographic characteristics that might not normally be available.

As far as measuring the value of electronic sales is concerned, the vehicle has not proven to be very reliable due to the small number of people, households and businesses that generally undertake such transactions. Most countries have found it only possible to undertake such collections on an annual or less frequent basis although in Australia data is collected every quarter. However, some of the statistics derived about changes between successive quarters are very susceptible to high sampling errors. Another strategy being tested in the United States is to add questions on the proportion of sales made over the Internet to their monthly retail sales surveys for the last quarter of 1999. The data will be analyzed for their reliability and usefulness before further collection and release plans are announced. This strategy has the potential to be an extremely cost effective way of quickly developing one indicator of e-commerce sales, even if only for a narrow definition of e-commerce.

In terms of the Government sector, there have been only a few cases where statistics have been compiled, reflecting the generally lower priority being given to such transactions by policy makers. In those cases where surveys have been run, they have generally concentrated on measuring the extent to which Government Agencies have access to the infrastructure and make some measures of the rate at which the Internet, in particular, is being used.

Impacts. Statistical measurement of the impacts of e-commerce has so far received least attention. The two examples of measurement of impacts that have been undertaken so far by Statistical Agencies are in the survey of Innovation in the Services sector conducted by Statistics Canada (1996) and the Survey of Business Growth and Performance by the Australian Bureau of Statistics (1996-97 and 1997-98). In the first case, Statistics Canada added a number of questions to its Innovation survey, aiming at measuring the impacts of e-commerce on business processes, using qualitative questions. In the latter case the Australian Bureau of Statistics added questions on the use of the Internet to its longitudinal survey of businesses. This allows deriving measures of the impacts of Internet use on the financial performance of businesses.

Table 1 provides some examples of indicators developed by statistical agencies. The next step will be to collect more information on Member countries' initiatives and complete an inventory on a more detailed basis.

IV.2 Challenges in measuring

Member countries have done considerable work in developing measures of readiness for e-commerce, but, as inspection of Table 1 shows, have done relatively little work on developing measures of either the size of e-commerce or its impacts. In part, this reflects the embryonic nature of electronic commerce markets in most Member countries, with few, if any, countries where e-commerce impacts can

be fully detected. It also reflects the fact that measuring the impact of electronic commerce presents relatively more challenges than measuring either readiness or intensity. However, it is the potential social and economic impacts of electronic commerce that generate the greatest needs for information. Providing the information needed to assess these impacts will require countries to extend and expand their current data collections. In doing so, they are likely to encounter technical and conceptual challenges.

Many of the challenges in measuring the impact of electronic commerce are technical issues reflecting the typical structure of government data collection programmes. Illustrative examples of these challenges include:

- Relatively few businesses or households are currently engaged in electronic commerce, so the absolute number of them appearing in samples of businesses or households is likely to be small.

- Some key industries consist of a small number of businesses, making it difficult to publish statistics that do not disclose confidential information.

- Businesses enter and exit electronic commerce activities, and change the nature of those activities, relatively quickly compared to the rate that governments can update the business registers from which they draw their samples.

- Many electronic commerce transactions of interest occur within, as well as between, businesses, but data collection programmes typically focus on transactions between businesses.

- Electronic commerce transactions do not necessarily involve financial transactions, so sources other than financial transactions must be surveyed.

Some of these technical challenges reflect the newness of electronic commerce, and the relatively rapid pace of change within this activity. Other technical challenges arise because the collection programmes of statistical agencies typically focus on transactions rather than on processes, and because the processes involved are complex. Measuring the impacts of electronic commerce requires baseline measures of business processes – not just the amounts of inputs businesses purchase, but also the processes they use to purchase them; not just the amounts of products businesses produce but also the processes they use to transform the inputs into products, and the processes they use to sell them – against which the differences between standard and electronic commerce processes can be assessed. Such measures will require collecting all of this baseline information within a business. In many Member countries, ways to measure both the baseline process and the effects of electronic commerce generally would need to be developed. Yet another technical challenge is achieving a degree of international comparability while also developing measures consistent with each country's statistical system.

Some of the measurement challenges are conceptual ones. Defining and measuring what an electronic commerce process produces -- for example, inventory, monitoring and replenishment, constant tracking of shipments, or the delivery of digitised media -- can be difficult. But these measurement challenges mostly are neither new nor unique to electronic commerce. They are extensions of or variations on existing conceptual challenges in measuring activities in the services sector. Such activities are important in their own right, and the process of tackling their measurement challenges is underway. The interest in measuring the impacts of electronic commerce highlights why it is important to continue systematically addressing this set of measurement challenges.

Table 1. Indicators collected across countries

Indicator	Description	BUSINESS	GOVERNMENT	HOUSEHOLD
E-Commerce readiness	· Number of telecoms carriers	ALL	ALL	not app
	. Number of ISPs	AUS	not app	not app
	. Number of telephone fixed access lines	ALL*	ALL*	ALL*
	. Number of digital fixed access lines	ALL*	ALL*	ALL*
	· Number of mobile telephone subscribers	ALL*	ALL*	ALL*
	· Number and proportion of persons with:			
	- computer skills	AUS, NLD, DNK, SWE, NOR	AUS	
	- experience in using computers			AUS, FIN, FRA
	· Number and proportion of economic units **with**:			
	- computers	AUS, NLD, SWE, DNK, FIN, FRA (manuf.), ITA(SME's)	AUS	AUS, CAN, FIN, FRA, KOR, NLD, NOR, USA, JPN, SWE, ITA, DNK
	- modems	FIN, ITA (SME's)		AUS, CAN, FIN, NOR
	- Internet access	AUS, NLD, FIN, DNK, SWE, FRA (manuf.)	AUS	AUS, CAN, FRA, FIN, NOR, US, SWE, USA, ITA, DNK
	- Other extranets	AUS, FIN, DNK	AUS	not app
	- Intranets	AUS, FIN, DNK	AUS	not app
	- Web-sites	AUS	AUS	not app
	- digital TV	not app	not app	AUS
	- other peripheral computer equipment			AUS, FIN, FRA
	. Benefits of e-commerce	AUS, NLD	AUS	
	. Barriers to e-commerce	AUS, FIN, NLD, DNK	AUS	AUS, FIN
E- Commerce Intensity	· Number/proportion of economic units **(frequently) using**:			
	- computers	FIN, DNK		AUS, US, CAN
	- Internet	FIN, DNK		AUS, US, CAN
	· Time spent by economic units using:			
	- computers			AUS
	- Internet			AUS
	· **Frequency of use** by economic units on:			
	- computers			AUS, FIN, FRA, KOR, NOR, SWE
	- Internet			AUS, FIN, KOR, NOR, SWE, CAN
	· Number/proportion of persons in economic units **frequently** using:			
	- computers	AUS, DNK, SWE, FIN	AUS	AUS, FIN
	- Internet	AUS, DNK, SWE, FIN	AUS	FIN
	. Number/proportion of economic units expecting to use:			
	- computers	FIN, DNK		AUS, CAN, FIN, DNK
	- Internet	AUS, FIN, DNK	AUS	AUS, CAN, FIN, DNK
	. Number/proportion intending to set up Web-sites	AUS, CAN(manuf), SWE	AUS	not app
	Internet transactions			
	- Type of transaction	AUS, FIN, NLD, CAN(manuf.), DNK	AUS	
	- Value of sales/purchases	AUS		AUS, US, FIN
	- Value/proportion of sales/purchases	AUS		AUS
	- End use of transaction			
	- Location of transactor			
	- Number/proportion of economic units making transactions:			
	- sales	AUS, DNK, FIN, NLD	AUS	not app
	- purchases	AUS, DNK, FIN, NLD	AUS	AUS, USA
	. Share of transactions made electronically			
	- sales			
	- purchases			

Table 1. *(continued)* Indicators collected across countries

Indicator	Description	BUSINESS	GOVERNMENT	HOUSEHOLD
E-Commerce Impacts	. Proportion of economic units			
	- satisfied with the results of e-commerce	CAN		
	- where customer service issues have been impacted	CAN		
	. Expenditure on e-commerce	CAN		
	. Effects on performance	AUS		
	* = Residential/Business split available for some countries.			

Source: OECD.

Developing measures of electronic commerce clearly will require statistical agencies to address a number of challenges. Still, existing measurement frameworks can offer some answers and guidance. For example, the general principles underlying national accounts and input-output matrices, and theories of productivity, can be adapted to address measurement issues in electronic commerce. These underlying principles have been adapted in the recent past to develop measures of the quality of the outputs of technologically complex products such as computers and related equipment, and are being used to guide the development of measures of outputs and prices in the services sector. While measures of the impact of electronic commerce are not available off the shelf, developing an appropriate system can begin by adapting and building on existing measurement systems and frameworks.

V. Concluding remarks: the challenges ahead

E-commerce is more than a technology, it is a business model built around the application of information and communication technologies to any aspect of the value chain for products and services. Determining the size and impacts of e-commerce requires the development of indicators that, while responding to policy needs, capture the key elements and processes that are common to a representative range of operational e-commerce models in the OECD countries. A statistical definition of e-commerce will be based on a set of definitions that refer specifically to these policy needs, key elements and processes.

It is clear that there are several major challenges to face in the development of this work, and that such challenges are linked to the interest that policy makers have not merely in e-commerce "numbers" but in e-commerce "relative and internationally comparable numbers" and in the broader impacts of e-commerce on the economy. In conclusion there is need to:

– Develop a set of definitions that takes into consideration not only the transactional aspects of e-commerce but also the need for evaluating its broader economic impacts.

– Develop e-commerce metrics and sectoral analysis that capture not only the size and growth of e-commerce, but also fundamental changes in the economy, such as the emergence of new business models, changes in the business and public value added chain, different degrees of e-commerce diffusion across society, sectors, countries.

– Develop internationally comparable e-commerce metrics that can be used to analyse the comparative advantages and disadvantages that might exist in different countries when exploiting the potential of e-commerce.

– Develop new indicators that better reflect the nature of the electronic *marketplace*, i.e. indicators that concern all dynamic aspects of market creation, structure, participation and interaction among actors. For example some attention should be given to (a) developing indicators of the migration of e-commerce applications from closed to open networks; (b) developing indicators that capture the interactions among the various actors in the electronic marketplace; (c) trying to link economic to social indicators.

– Capture the broader impacts of e-commerce on the economy by improving the measurement of key components of productivity -- inputs, outputs, and associated prices -- at the level of the individual businesses, sectors, as well as at the macroeconomic level.

– Setting priorities for measurement. The limited resources of statistical organisations mean that the measurement effort must proceed in stages. Some proposed measures can be collected with relatively straightforward changes to current survey questionnaires. Collecting other measures may require more development. Questions and entire survey vehicles may need to be developed, or be relatively costly to implement. Time also matters because electronic commerce is a rapidly evolving and spreading phenomenon. It requires measurement frameworks and collection systems that are flexible enough to keep up with its changes, and to meet differing and evolving user needs.

V.1. Next steps

The WPIIS Expert Group on electronic commerce will continue its work throughout the coming months. Three background papers (summarising definitions and measures of electronic commerce in use to date, assessing lessons learned from those using these measures and definitions, and proposing an initial framework for measurement priorities) are being completed and constitute a basis to stimulate the discussion. The drafts will be circulated for comments to members of the Expert Group. Members of the Expert Group will in turn seek comments from stakeholders in their countries, including policy makers, researchers, business, and statistical agencies.

Comments and feedback are also sought through informal and formal opportunities for discussion, with other OECD groups such as the ICCP Committee's Working Party on the Information Economy and other OECD Directorates. Opportunity to discuss this ongoing work is also given in other fora such as a workshop on defining and measuring electronic commerce sponsored by the Brookings Institution in Washington, D.C.,[15] and the ISI Cutting Edge Conference 1999 on "The Measurement of Electronic Commerce" in Singapore[16]. Based on comments received on the draft papers and presentations, and on relevant materials received, the Expert Group will prepare a draft report on defining and measuring electronic commerce. That draft report will be presented to the WPIIS at its next meeting in April 2000.

NOTES

[1] OECD (1998), "The Economic and Social Impact of E-commerce. Preliminary Findings and Research Agenda".

[2] The other action points that were endorsed were: work to develop Guidelines for Consumer Protection in the context of electronic commerce within 1999; develop practical guidance for the implementation of the 1980 OECD Privacy guidelines in an online environment, based on national experiences; discuss the emerging technologies and business models for authentication and certification; extend the analytical work at the OECD examining the economic and social impacts of electronic commerce, and applications in government, particularly education; continue work on examining the policy implications of changing information and communication networks, including technological convergence, enhancing access to infrastructures and study policy requirements to complete the liberalisation of the underlying telecommunications infrastructure; set up specific technical advisory groups with business and non-member countries to address taxation issues.

[3] The terms of reference for this group can be found in document: DSTI/ICCP(99)7.

[4] The Expert Group's focus is on the measurement of the size and economic impacts of electronic commerce activities. Other important issues such as telecommunications and trade policies are being dealt with in other OECD committees and working parties.

[5] "Defining E-Commerce: Background Paper and Issues for Discussion", preliminary draft, 18 August, 1999.

[6] OECD (1998), "The Economic and Social Impact of E-commerce. Preliminary Findings and Research Agenda".

[7] Because the Internet architecture is highly transparent (unlike the public telecommunication architecture), and because e-commerce generates large amounts of transaction-related information that can be captured and processed immediately, many new technical solutions to data gathering are being developed.

[8] Paris, 21 April 1999. The documentation relative to the Workshop can be found at http://www.oecd.org/dsti/sti/it/ec/act/agenda_Ecworkshop.htm.

[9] Presentation given by Richard Simpson, Industry Canada, at the OECD Workshop, http://www.oecd.org/dsti/sti/it/ec/act/agenda_Ecworkshop.htm.

[10] OECD (1998), "The Economic and Social Impact of E-commerce. Preliminary Findings and Research Agenda".

[11] Statistics Canada (1999), "A reality check to defining eCommerce". A report prepared by CGI for Statistics Canada.

[12] While the impacts of earlier forms of electronic commerce have presumably already been felt, the role of open standards as a catalyst for driving business over networks has driven the recent interest of policy makers for e-commerce.

[13] For example the 1999 White Paper “Communications in Japan" (Ministry of Posts and Telecommunications) developed a set of nested definitions focused on the Internet.

[14] Even if one restricts oneself to the narrowest definition, i.e. transactions occurring over the Internet, there can be significant differences in the definitions used. For example the elements included in the Internet-commerce sales statistics of the private research companies that size B2B Internet-commerce might be different. When Forrester Research sizes B2B I-commerce sales, it refers to “trade of goods and services in which the final order is placed over the Internet”. IDC estimates, instead, include transactions that have been originated over the Internet in terms of information gathering, regardless of whether the order is finally placed over the Internet or the phone/fax.

[15] The Workshop, held in late September 1999, is part of the Brookings series of workshops on measuring output and productivity in the services sector.

[16] 6-8 December 1999, Singapore. http://www.singstat.gov.sg/EC/echome.html