VOORBURG GROUP ON SERVICES STATISTICS

14th MEETING, NEW ZEALAND

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THE MEASUREMENT OF ELECTRONIC COMMERCE

SESSION 5

Abstract - The use of electronic commerce as an enabling tool by all sectors of the economy is one of the most important uses being made of ICT goods and services. Statistics on it are being prepared daily, but with inadequate attention to consistency of definition and measurement. The OECD, via its Working Party on Indicators for the Information Society, is trying to address this problem. This paper outlines some of the original thinking of the Working Party and is submitted to the 1999 Voorburg Group Meeting to help in the development of a model survey of the use of ICTs in business.

Bill Pattinson

OECD

1. This paper summarises the thinking to date by the secretariat of the Working Party on the Indicators for the Information Society (WPIIS) on the question of the definition and measurement of e-commerce. The sub-group on e-commerce for WPIIS is working towards the preparation of three discussion papers on the policy needs for e-commerce metrics, the definitions that are currently used for e-commerce and the measurement issues, both past and future. It is submitted to the 1999 Voorburg Group meeting as an input into the debate on the future development of model surveys for the use of ICT goods and services by businesses.

2. Statistical measurement cannot be viewed in isolation from policy uses for data and definitional issues. It is necessary to start with some notion of the uses for e-commerce metrics. The model chosen in this paper is the model presented by Mr Richard Simpson, Industry Canada to the OECD Workshop on E-Commerce held in April 1999. This same model has been carried forward into the recently issued Status Report "Defining and Measuring E-Commerce" prepared for the Paris forum in October 1999 (OECD ref. no. DSTI/ICCP/IIS (99) 4). That model looks at three stages of development of e-commerce - readiness, intensity and impacts - and suggests that these each have different demands for statistical indicators.

3. The definitional aspects of e-commerce also impact the number and type of indicators which might be useful to help user understanding of e-commerce. The paper looks briefly at how e-commerce might be perceived in terms of the infrastructure required, in terms of networks, applications and business processes. This again is the model that has been used in the paper for the E-Commerce forum referred to above.

4. The combination of these two aspects gives an information model from which it is possible to derive a wish list set of indicators that might be appropriate to meet the specified user needs. The paper incorporates such a wish list. A wish list, by itself, is however not a great deal of use. It needs to be tempered with reality in terms of the statistical resources that can be allocated to the task, the respondent load that can be imposed on businesses to complete questionnaires and the general availability of businesses to consistently provide the answers to the questions.

5. The paper also provides a summary document of the indicators that have been compiled by Statistical Agencies to date which helps to point out the areas where work has been undertaken and where greater efforts are required. This table covers the collection of metrics about not only the business enterprise sector, but also the Government and Household sectors. E-commerce is not just restricted to the business sector; the other sectors participate in the overall process as either providers of goods and services or as users of the goods and services and so an economy wide perspective is required.

The Three Stages of Development of E-Commerce

6. The model described in DSTI/ICCP/IIS (99)4 is one, which sets up three different sets of user requirements, depending on the stage of development of implementation of e-commerce. The three stages and a broad statement of their user requirements are shown in the box below.

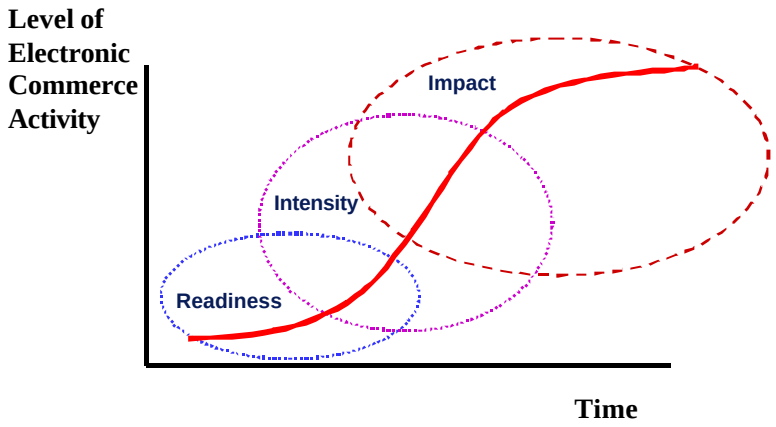
Readiness - measuring the infrastructure in place to allow for e-commerce activities to occur,

Intensity - measuring the extent to which users are utilising e-commerce to undertake their normal business and social processes, and

Impacts - measuring the impact of e-commerce on the economy and society.

7. This model can be depicted graphically as shown below.

Figure 1. Maturity of electronic commerce markets and the need for statistical indicators



8. This diagram serves a purpose to indicate the changing nature of user requirements for information. However, it only provides a rather simple interpretation of a user model.

9. As depicted in the diagram, the information needs cannot be neatly broken into three neat parts - there are considerable overlaps between them. Similar indicators can be used to measure aspects relevant to more than one stage. It is also likely that policy makers may want to know about more than one stage at any one point in time. On some occasions, or in some countries, the user may be interested in the infrastructure in place and the degree of intensity of use of e-commerce. At other times, or at the same time in other countries, the user may want to know about the intensity of use of e-commerce and the impact that e-commerce is having on national economies. On other occasions they may want to know about all of the stages.

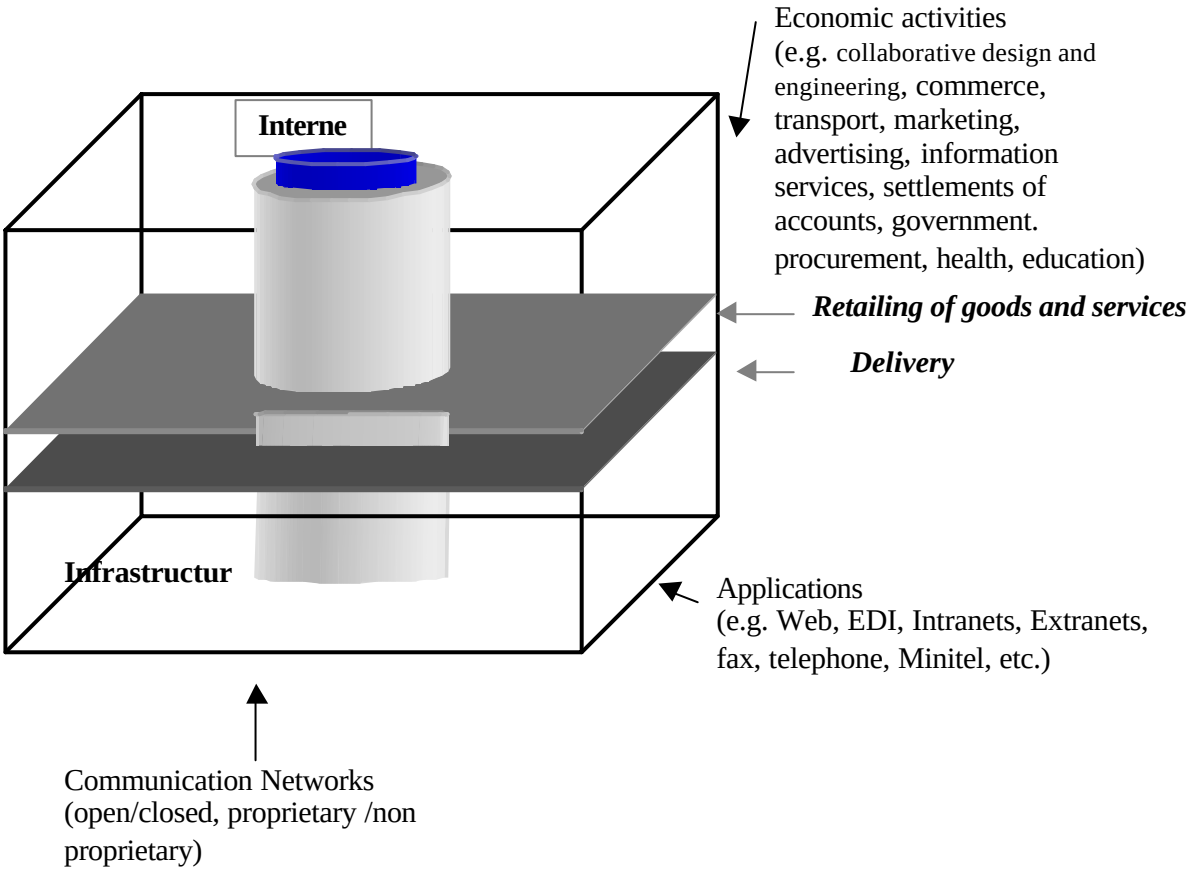
10. The model does not depict any specific institutional sector. But, it is likely that there will be different priorities for information for different institutional sectors in the same country; thus the data model will in fact need to cope with each of the sectors and not just one as depicted in the diagram.

The Scope of E-Commerce

11. Definitional issues complicate the debate about e-commerce. As described in the paper referred to above, there are many definitions in use round the world. There seems to be differences caused by the specification of networks to be included - are they open or closed, proprietary or non-proprietary; there are differences caused by the choice of applications to be included - should we include all Extranets, Intranets, just the world wide web, fax, telephone etc. Aside from this we need to determine which economic activities we wish to include - does it just relate economic transactions where there is some form of ownership change, does it include the delivery of goods or does it include business processes more generally.

12. Below is a diagrammatic representation of this issue. It is repeated from the paper DSTI/ICCP/IIS (99)4 and depicts all e-commerce transactions. The base displays the communication networks and the applications defined as being within scope of the definition of e-commerce; the height displays the various business processes which may be of interest to measure. These business processes can be broken down into two parts - those that involve an economic transaction and those that do not. The former will relate to the many situations in which an economic unit undertakes some form of economic transaction with another economic unit and where there is interest in both the transaction and the transactors (e.g. a firm sells a service to a household customer). The latter will mainly relate to situations where an economic unit is utilising e-commerce to undertake an internal business process and where the number of statistical indicators required is much smaller (e.g. the management of its financial accounts or keeping its staff records up to date). There are user requirements to measure both forms of activity.

Figure 2. A three dimensional representation of e-commerce



Classification by Institutional Sector

13. The area of interest in e-commerce is wider than just the business enterprise sector. Governments in many countries are also looking to provide a lot of their services electronically, both to businesses and to householders. Households are often said to be the key driving influence in the growth in the usage of the Internet and e-commerce today. Thus it is necessary to measure similar electronic activity in the household sector as well. Finally, of course there is tremendous interest in the influence of the overseas sector in these developments, and so there is a need to measure that sector as well. Thus the model needs to cover all sectors of the economy.

Producers, Users, Transactions and Processes

14. As described above, the model that we are trying to represent statistically is not just a simple representation of transactions occurring over some network or other. It is also essential to know about the business processes that are employed by these producers and which ones of these are done electronically. Further, there is a need to know about the characteristics of the producers or providers of these e-commerce transactions and to compare and contrast these with the characteristics of non e-commerce providers.

15. From the user perspective, there is also a need to be able to measure the e-commerce activity, both in terms of business processes and in the purchase or use of electronic services. Again, the characteristics of users are also important in their own right and to be able to compare with non-electronic users.

16. The interest in such events is a dynamic one; not only is it important to know the intensity of use at any point in time, but in the rate of change of that use and the overall impact of that change on business activity and society generally. So the measurement of change and contribution to growth are important indicators which must be generated.

17. The best way of undertaking such a statistical exercise would be to follow each of the transactions separately and then add the results to show the flows between institutional sectors, including the overseas sector. Statistically this would not be feasible, for cost, respondent load and data availability reasons. Hence it is likely that a model ought to be developed in which transactors would be asked to provide aggregate details of all their transactions as both a provider and as a user of e-commerce, and for non-electronic transactions. They would also be asked for data about the business processes that they undertake and the extent to which these have been undertaken using e-commerce techniques.

18. A model such as this would allow the derivation of statistics about both transactors and transaction for each of the institutional sectors both in their role as providers and users of the e-commerce transactions. Such a model readily provides information on the extent to which the transactors themselves are utilising e-commerce and the relationship between electronic and non-electronic commerce; when measured over time, it allows the measurement of change in the extent to which transactors and transactions in institutional sectors are utilising e-commerce.

A Wish List of Indicators

19. On the basis of the above, it is now appropriate to proceed to look at the indicators that might be required for the meeting of these needs. They are shown below, using the Richard Simpson model, bearing in mind the reservations of such an approach referred to earlier. While the interest for this Voorburg group meeting is mainly in the ones relating to businesses, it is useful to consider those as merely a subset of all e-commerce indicators. Thus a complete list is shown below.

Readiness Indicators

20. Readiness indicators will measure the extent to which economic units have access to information and communication technology, to measure the factors which might inhibit use of e-commerce and the perceived benefits that may arise as a result of such use.

1. Extent of Computing Infrastructure

- number and proportion of businesses with computers, numbers of computers available, computing power available - classified by industry, size and region.
- number and proportion of businesses with computers, number of computers available, computing power available - classified by level of Government, function of Government, size and region,
- number and proportion of households with computers, computing power available - classified by household type, household income and region,
- number and proportion of persons with access to computers at home, at work and elswhere.

2. Extent of Telecommunications infrastructure

- number and proportions of businesses with access to the Internet, other Extranets, Intranets, web sites - classified by industry, size and region,
- number and proportion of Government organisations with access to the Internet, other Extranets, Intranets, web sites - classified by level of Government, function of Government, size and region,
- number and proportion of households with access to the Internet and web sites - classified by household type, household income and region.

3. Barriers to use of E-Commerce
- number and proportion of firms concerned about security, quality of service, lack of knowledge, access to information and the like - classified by industry, size of firm and region.
- number and proportion of Government organisations concerned about security, quality of service, lack of knowledge, access to information and the like - classified by level of Government, function of Government, size and region,
- number and proportion of households concerned about security, quality of service, lack of knowledge, access to information and the like - classified by household type, household income and region.

4. Benefits of E-Commerce
- number and proportion of firms that perceive benefits to each of their business processes, and to the firms overall productivity and profitability - classified by industry and size of firm,
- number and proportion of Government organisations that perceive benefits to their business processes - classified by level of Government, type of Government and size,
- number and proportion of households that perceive benefits to their operation - classified by household type, household income and region.

Intensity Indicators

21. Intensity indicators will measure the extent to which economic units utilise e-commerce in all their business processes. For processes involving e-commerce transactions (such as purchases and sales of goods and services), indicators will be required about the transactions themselves and the transactors (both providers and customers). For transactions that can take place both electronically and non-electronically, it will be necessary to measure proportions of total transactions as well. For processes that do not involve transactions, indicators about the extent to which those processes are conducted electronically are required.

22. Indicators are further required about economic units undertaking electronic business processes of any type and the contrasting these with economic units that do not undertake electronic business processes. Thus the indicators ought to be:

5. Use Indicators
- number and proportion of firms undertaking specific electronic business processes - classified by industry, size of firm and region,
- time spent by firms on specific business practices - classified by industry, size of firm and region,
- the proportion of a firm's employees using e-commerce for specific business processes - classified by industry, size of firm and region,
- number and proportion of Government organisations undertaking specific business processes - classified by level of Government, function of Government, size and region,
- time spent by Government organisations on specific business practices - classified by level of Government, function of Government, size and region,
- the proportion of Government organisation's employees using e-commerce for specific business processes - classified by level of Government, function of Government, size and region,
- the number and proportion of households undertaking specific electronic business processes - classified by household type, household income and region,

- time spent by households on specific business practices - classified by household type, household income and region,
- frequency of use by households of specific business practices - classified by household type, household income and region,
- frequency of use by persons of specific business practices - classified by place of access.

6. E-Commerce Transactions
- value and share of transactions undertaken by firms - classified by industry, size of firm and region,
- proportion of these transactions for which payment is made on-line - classified by industry, size of firm and region,
- type of goods purchased/sold - classified by industry, size of firm and region,
- the country of location of the purchaser/seller of the goods and services - classified by industry and size of firm,
- the end use of the goods and services purchased/sold by firms - classified by industry and size of firm.
- the value and share of transactions undertaken by Government organisations - classified by level of Government, function of Government, size and region,
- the proportion of these transactions made on-line - classified by level of Government, function of Government, size and region,
- type of goods purchased/sold - classified by level of Government, function of Government, size and region,
- value and share of transactions undertaken by households - classified by household type, household income and region,
- the proportion of these transactions for which payment is made on-line - classified by household type, household income and region,
- the type of goods purchased - classified by household type, household income and region,
- the country of location of purchases by households - classified by household type, household income and region,

Impacts Indicators

23. These will measure the impact that e-commerce is having on an economic unit's business processes and on its overall economic performance. They should also provide a measure of the substitution effect that is occurring between electronic business processes and other types of process. They should also provide a measure of the impact on specific industries, the firms in those industries and the people employed in them. Finally there will be a specific interest in the impact that electronic transactions are having on more traditional forms of commerce and on the overall impact on economic growth.

Impacts at the Economic Unit Level on Business Practices
- change in the share of specific electronic business practices being undertaken by firms - classified by industry and size of firm,
- change in the share of staff using specific electronic business practices - classified by industry and size of firm,
- reductions in costs achieved from using specific electronic business practices - classified by industry and size of firm,
- increase in income generated from using specific electronic business practices - classified by industry and size of firm,
- increase in profitability and productivity from using specific electronic business practices - classified by industry and size of firm,
- change in employment levels as a result of using selected electronic business practices - classified by industry and size of firm,

- change in the share of specific electronic business practices being undertaken by Government organisations - classified by level of Government, function of Government and size,
- change in the share of staff using specific electronic business practices - classified by level of Government, function of Government and size,
- reductions in costs achieved using specific electronic business practices - classified by level of Government, function of Government and size,
- increase in income generated from using specific electronic business practices - classified by level of Government, function of Government and size,
- change in employment levels as a result of using specific electronic business practices - classified by level of Government, function of Government and size,
- change in the number of different specific electronic business practices being used by households - classified by household type, household income and region,

Impacts at the Economic Unit Level on E-Commerce Transactions
- change in the value and share of e-commerce transactions undertaken by firms - classified by industry, size of firm and region,
- change in the proportion of these transactions for which payment is made on-line - classified by industry, size of firm and region,
- change in the type of goods purchased/sold,
- change in the distribution of the country of location of the purchaser/seller of the goods and services,
- change in the distribution of the end use of the goods and services purchased/sold by firms,
- change in the value and share of e-commerce transactions undertaken by Government organisations - classified by level of Government, function of Government, size and region,
- change in the proportion of these transactions made on-line - classified by level of Government, function of Government, size and region,
- change in the type of goods purchased/sold,
- change in the value and share of transactions undertaken by households - classified by household type, household income and region,
- change in the proportion of these transactions for which payment is made on-line - classified by household type, household income and region,
- change in the type of goods purchased,
- change in the country of location of purchases by households.

Impacts at the Macro Level on Economic Performance
- change in share of e-commerce transactions to total transactions - classified by industry and size of firm,
- change in the share of employment between e-commerce firms and other firms - classified by industry and size of firm,
- change in profitability and productivity between e-commerce firms and other firms - classified by industry and size of firm.

Impacts on Society Generally
- changes in the way that households undertake their normal activities - classified by household type, household income and region,
- changes in the way that persons undertake normal activities, at home, at work, at school and elsewhere - classified by socio economic characteristics of persons.

Statistical Methodology

24. The statistical indicators listed above represent a “shopping list” of indicators that policy makers might like to be able to evaluate e-commerce in their country. It is, of course, extremely unlikely that all of the above would be able to be compiled, for respondent load and cost reasons. It will therefore be

necessary to undertake a priority setting exercise at the national level, to determine the structure of that country's efforts to provide adequate indicators for policy purposes. At the international level it is also necessary to develop a set of indicators which are required for international comparability reasons and which would be most appropriate to include in a model survey of e-commerce or use of ICT.

25. Those priorities can only be worked out when there have been agreements made on the statistical definitions to be employed for the measurement of e-commerce and when a set of priority policy needs have been developed. Hence the OECD has not developed a subset of indicators which might seem to be of the highest priority.

26. What can be done, however, is to look at the statistical methodologies employed up till now in Member countries and the range of indicators that have been developed from those methodologies. These in themselves will give some indication as to the relative priorities as they have been expressed in Member countries.

27. By far the most common way in which countries have gone about developing statistical indicators has been to add questions to other statistical indicator surveys. This practice has been widespread in the compilation of household indicators with Member countries utilising their normal monthly (or similar) interview collections to provide relevant indicators. However, it has also been used in the compilation of some business indicators; for example Statistics Canada asked questions about e-commerce on its 1996 Services Industries survey on Innovative activities and Australia added questions onto its 1996-97 and 1997-98 Business Growth and Performance surveys.

28. The next most common methodology used has been to develop new surveys aimed quite specifically at measuring e-commerce; these have been developed for the business enterprise sector by Statistics Netherlands, Statistics Singapore and the Australian Bureau of Statistics, to name just three. For the Government sector there also has been surveys designed in Australia, Canada and the Netherlands.

29. To date there has been little experimentation by official Statistical Agencies, in using the Internet to measure itself i.e. by utilising counting and classifying technologies available in the internet to measure what is happening there. However a number are looking to experiment with that methodology as a way of overcoming some of the difficult statistical problems that face them using the more traditional way of compiling statistical indicators. These experiments should be watched very closely.

30. The measurement of the Impacts of e-commerce on Member country economies has been almost non-existent to date. Apart from the examples in Canada and Australia referred to earlier, there has been precious little activity. One experiment worth noting is, however, that occurring in USA, where the US Bureau of the Census is examining the feasibility of incorporating questions on retail electronic sales into its normal retail sales collection. This would seem to offer a cheap alternative to measure the move away from existing retail outlets to electronic ones and to measure the impact that e-commerce is having on the overall growth of consumption expenditure in USA. As most countries have some form of retail sales survey, the methodology would seem to be very transportable, if it can be made to work effectively.

Summary of Indicators Compiled to Date

31. The presentation in the Table shown on the next page provides details of the indicators compiled in Member countries at this time. While there appear to be many indicators for some purposes, the user should be aware that while the list implies that particular indicators may be available in more than one country, it is not necessarily true that the resultant indicators are compatible. There could be different definitions being used in different countries or different methodologies being employed, which may result in non-comparable indicators being produced.

32. The list has been provided here to give some indication of the extent of breadth of information available. The user should also be aware that the list does not necessarily imply the priorities for indicators in Member countries - the derivation of particular indicators may on occasions have more to do with the availability of statistical infrastructure than national priorities.

Issues for Discussion

33. While the OECD work has not yet been completed, it is keen to have feedback on the strategy that it is following and which is outlined above. The development of e-commerce metrics is a key component of any model survey on the use of ICT goods and services and hence it is appropriate to debate the issue within this Agenda item.

34. On the basis of the above, the OECD proposes that the model survey on the use of ICT goods and services by businesses:

- ought to include indicators about e-commerce readiness, intensity of use and the impacts,
- should use a broad, or a family of, definition of e-commerce to cover all user requirements for statistical indicators.
- will need to incorporate aspects of infrastructure, defined by the networks being used and the applications involved and the economic activities being undertaken on this infrastructure as part of the definition,
- will need to have a specific focus on Internet transactions, as these seem to be a priority component,
- will need to provide data about the producers and the users of the e-commerce transactions, as well as the transactions themselves.

Bill Pattinson

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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	AUS	AUS, FIN
E- Commerce Intensity	· Number/proportion of economic units **(frequently) using**:			
	- computers	FIN		AUS, US, CAN
	- Internet	FIN		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			
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.