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ICT, THE ECONOMY AND SOCIETY – CHALLENGES OF MEASUREMENT AND ANALYSIS*

Keynote paper

Mr. John Dryden, Organisation for Economic Co-operation and Development (OECD)

* Due to the late submission, this paper could neither be translated nor reproduced and has been posted on Internet as submitted by OECD.

Abstract

The OECD has acted as a forum for the discussion of policies regarding the information society for over 25 years, producing guidelines and recommendations in areas such as privacy of personal information, computer security, cryptography, regulatory reform of communications, and most recently on-line consumer protection, e-government and the taxation of e-commerce. By and large, this work was undertaken without the benefit of statistical measures. But the economic performance of a number of OECD Member countries during the expansion of the 1990s and the subsequent slowdown underscores that the policy challenges being posed by the information society are increasingly economic in nature -- how ICT is affecting productivity, growth rates, inflation, labour markets, etc. This, in turn, has made the need for statistically rigorous data and analysis more urgent. This paper outlines how recent efforts by national statistical offices to improve this situation have allowed researchers to gain new insight into the economic impact associated with ICT and applications like e-commerce, leading to a number of policy recommendations as to how best to exploit the economic potential of these technologies. But it is clear that this work has just begun. The paper ends by outlining important policy issues that require new statistical efforts.

ICT, THE ECONOMY AND SOCIETY – CHALLENGES OF MEASUREMENT AND ANALYSIS

Introduction

1. Systematic efforts to address the policy challenges posed by the information society and information and communication technologies (ICT) began at the OECD in 1982 with the creation of the Committee for Information, Computer and Communications Policy (ICCP). Over the next two decades, this group acted as a forum where OECD's Member countries met to analyse and discuss policy issues, develop recommendations on best practice policies on such matters as liberalisation in the area of telecommunications and to formulate guidelines that would provide some co-ordination and coherence in national policies which are inherently international in nature (see Annex). These efforts were relatively narrow, targeted at updating or modifying existing regulatory frameworks to accommodate the challenges posed by the new technologies. They were largely undertaken without the benefit of any statistical analysis. At this period, statistical work focussed on the supply side for ICT and the data used were drawn mainly from private sector sources. Early attempts to develop comparable information society data from official sources were unsuccessful – in retrospect such efforts by the OECD seem to have been, quite simply, premature.

2. With the emergence of the modern Internet in the mid-1990s, the importance of the information society began to be widely recognised, and soon began to demand the attention of policy makers at the highest level. While attention continued to focus on regulatory issues such as on-line privacy or consumer protection, the importance of ICT as an economic factor garnered greater attention. This can be tracked at the OECD by a series of high-level conferences starting in 1996 and continuing up to the 2003 annual meeting of Ministers at the OECD. As the focus shifted to economic issues, the need for internationally comparable data on the information society became apparent and assumed a high priority. This paper describes the nature of the policy issues being discussed and statistical work undertaken to help address them. It concludes by identifying some challenges that policy makers and statisticians are likely to face in the future.

Measuring the ICT Infrastructure

3. In 1996, Ministers meeting at the OECD endorsed the findings and recommendations of a report on the Global Information Infrastructure / Global Information Society (GII-GIS) which called *inter alia* for competitive safeguards as regards access to network infrastructures. Recognising the need for data to analyse the development and use of the "information highway", Ministers recommended the establishment of a new working party devoted to "... develop[ing] new indicators which identify, assess and monitor the emergence of the GIS." In particular it was noted "the lack of comprehensive and internationally compatible data can be a severe problem in a rapidly changing and increasingly information-based world economy." Moreover, "... a common framework for indicators and standard definitions needs to be developed, tested and shared among OECD countries for better understanding of equipment diffusion and use, communication infrastructures, and services and content. Because most effort has been devoted to the first two, particular attention should be given to the last element."[1]

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1. OECD, 1996, "Global Information Infrastructure and Global Information Society" (GII-GIS) [OCDE/GD(96)93].

4. This group, the Working Party on Indicators for an Information Society (WPIIS), began work in 1997. As a subsidiary body of the ICCP Committee, WPIIS's work has always been very closely tied to policy needs. Methodological work and data collection had to proceed in several areas at different speeds, in a step-by-step, pragmatic fashion.

5. The Working Party, in co-ordination with Eurostat and the Voorburg Group on Service Statistics (a working group of the UN Statistical Commission), focused first on developing an internationally agreed definition of the ICT sector. In 1998, a set of principles was adopted that would provide a conceptual basis to the selection of industries chosen as "ICT" (see box A). These principles were then used to select industrial-activities from UN's International Standard Industrial Classification (ISIC rev 3). Because ISIC rev 3 did not lend itself perfectly to use in the definition and because it was agreed that only whole industries, not parts, should be included in the definition at this time, a number of compromises had to be made. In addition, the definition is limited to those industries that facilitate, by electronic means, the processing, transmission and display of information, and it excludes those industries that create the information, the so-called 'content' industries. The OECD officially approved the activity-based OECD definition for the ICT sector in September 1998.

Box A: OECD definition of the ICT sector

In 1998, the WPIIS adopted a definition of the ICT producing sector based on the class level of ISIC rev 3[1] and the following criteria, for manufacturing and service industries.

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

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

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

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

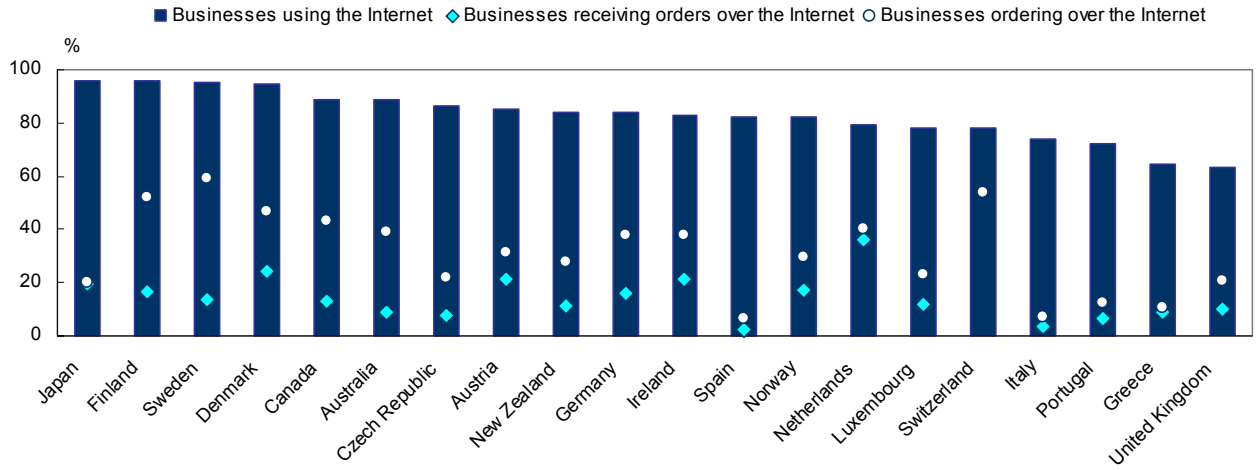
Using these criteria the ICT sector has been defined as the following group of ISIC Rev 3 industries:

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

Services: 5150 – Wholesaling of machinery, equipment and supplies (if possible only the wholesaling of ICT goods should be included); 7123 – Renting of office machinery and equipment (including computers); 6420 – Telecommunications; 72 – Computer and related activities.

6. The second thrust of the work to improve the measurement of ICT has concentrated on developing common methodologies to improve the international comparability of surveys that measure the use of ICT in households, businesses and government. The Nordic countries have led the work in the area of ICT usage in business. As a result of intensive collaboration among the three working groups involved -- the WPIIS, the Voorburg group and Eurostat -- a model questionnaire for measuring ICT usage in businesses was presented in 2000 and currently has five modules including: 1) the use of ICT in general, 2) the use of the Internet, 3) Internet commerce, 4) commerce by other computer mediated networks (e.g. EDI) and 5) barriers to the use of the Internet and ICT in general. The model was pilot tested by Denmark, Finland and Norway with success. In 2001, the WPIIS adopted the model survey and recommended its use as a "core" in country surveys of ICT use by business. Preliminary data show that the business use of the Internet is nearing saturation levels in many countries (Figure 1) but that businesses are much more prone to use the Internet for ordering than they are for receiving orders.

Figure 1: **Proportion of businesses using the Internet for purchases and sales, 2002**[1]
Percentages of businesses with ten or more employees



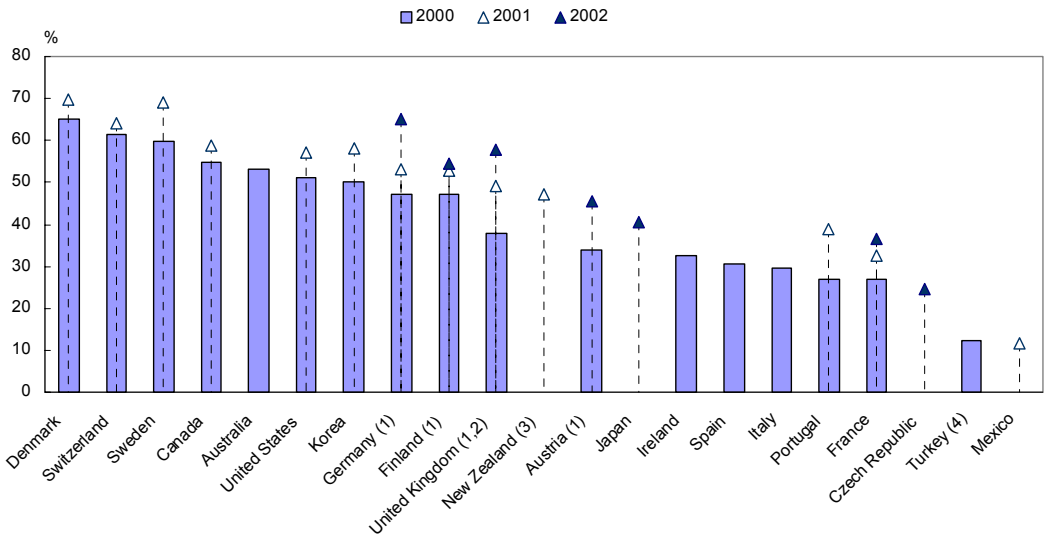
(1) Or latest available year. The results of the Eurostat survey are based on a selection of industries, which changes slightly across countries. Estimates for Japan, Australia, New Zealand, the Netherlands, Canada, Switzerland and the United Kingdom differ slightly from those in other countries, see source for details.
Source: OECD (2003*c*), *Science, Technology and Industry Scoreboard*, Paris.

7. Australia, the Nordic countries and Canada worked closely together on a model survey on ICT usage in the households, launched in 2002. Preliminary data show the households with access to the Internet fall into three groups -- those countries where more than 40 percent of households enjoy access, those where only about a third enjoy such access and those where less than a fifth have access (Figure 2).

8. This initial work on measuring the infrastructure and the use of ICT provided a number of insights that helped to clarify and nuance important policy issues of the day. For example, it showed that while gaps in the access and use of the Internet exist between large and small firms much of this difference could be explained not by size *per se* but by the industrial sector that the firms are operating

in. Some industries that are dominated by small businesses like retail shops and personal care are not immediately oriented towards use of the Internet, like sectors dominated by large firms like finance and insurance. From the household surveys, it appeared that a country's ranking on Internet penetration changed when the unit of focus shifted from the household to individuals having access from any location. Here, instead of being ranked among the top group as they are with household access to the Internet, the United States falls into the second tier behind the Nordic countries and Canada.

Figure 2: **Households with access to a home computer, 2000-02**
Percentage of all households



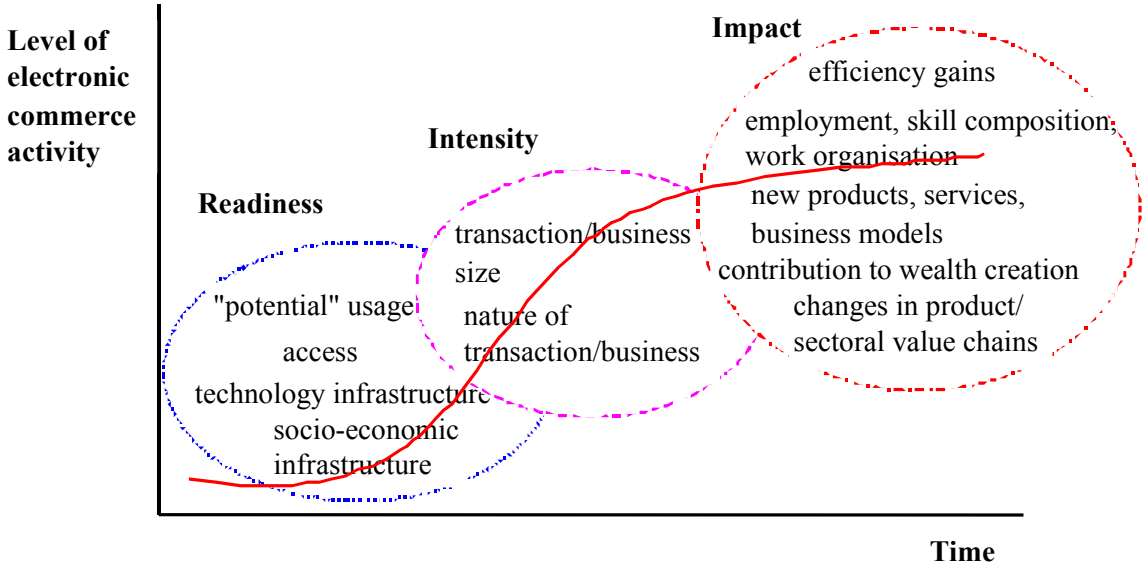
1. For 2002, data from the EU Community Survey on household use of ICT relate to the first quarter. 2. March 2001-April 2002 (fiscal year) instead of 2001. 3. July 2000-June 2001. 4. Households in urban areas only.
Source: OECD, ICT database and Eurostat, Community Survey on ICT usage in households 2002, June 2003.

Definition and measurement of electronic commerce

9. The Ottawa OECD Ministerial on Electronic Commerce in 1998 recommended "work should be undertaken to develop a statistical methodology and apparatus for measuring electronic commerce.". The working party took up the issue amid growing policy and media interest in e-commerce. An Expert Group on Defining and Measuring E-commerce was established, which focused on the three inter-related aspects of this problem: a framework for user needs and priorities, definitions, and statistical measurement.

10. User needs were articulated by a model that sets forth three basic sets of indicators required for policy purposes. They relate to readiness, to intensity and to impacts (Figure 3). It was acknowledged that policy makers' needs are often very broad, as they wish to understand the impact of e-commerce across the economy and over all business processes. On the other hand, they need data at a very fine level that measure different e-commerce segments, as the drivers, technological solutions, impacts and policy implications may be different.

Figure 3. Translating Policy Needs into Indicators for E-commerce



Source: OECD (1999), Defining and Measuring E-Commerce: A Status Report (original Industry Canada).

11. Given the clear need for more than one definition of electronic transactions, the Expert Group therefore developed a narrow one based on electronic commerce restricted to the Internet and broader one that encompasses all computer-mediated networks and thus includes, for example, EDI. These definitions were endorsed in April 2000 and guidelines for their interpretation were developed in 2001.

12. Having established operational definitions of e-commerce and the processes for which indicators might be required, the WPIIS was then able to consider the range of indicators. A list of priority e-commerce indicators was formulated, based on national experiences, data availability and methodological coherence, as well as input from the corresponding policy working party, the Working Party on the Information Economy. These indicators formed the basis of an initial OECD data compilation exercise published in 2002[2]. The initial data collection revealed that in terms of value, e-commerce (business-to-consumer) was still at an early stage (Table 1), although it is clear that many individuals are experimenting (Figure 4) with buying things on-line.

[2] *Measuring the Information Economy 2002* (OECD, 2002)

Table 1. Official estimates of Internet and electronic commerce transactions,[1] 2001 or latest available year

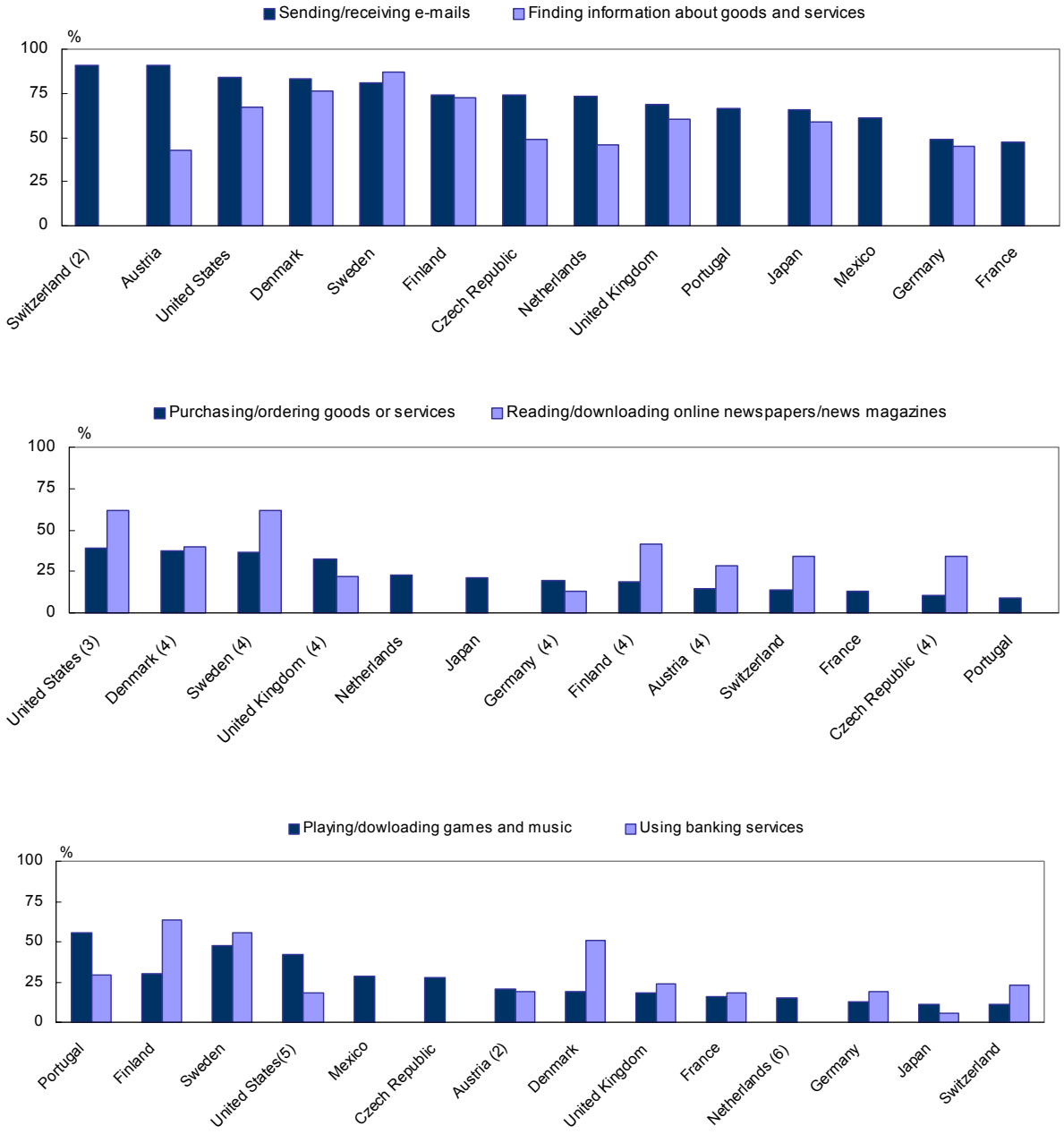
Percentage of total sales or revenues

	Internet commerce, *i.e.* sales over the Internet	Electronic commerce, *i.e.* sales over any kind of computer-mediated network
Broad		
Business sector	**0.5%** Canada **0.7%** Australia (2000-01) **0.3%** New Zealand[2] (2000-01)	
Business sector (excluding financial sector)	**2.0%** Norway **0.7%** Czech Republic **1.0%** Denmark[3] **1.0%** Germany[3] **0.5%** Greece[3] **0.3%** Spain[3] **3.8%** Ireland[3] **0.3%** Italy[3] **0.4%** Luxembourg[3] **2.2%** Austria[3] **1.1%** Finland[3] **2.1%** Sweden[3]	**10.0%** Norway **3.3%** Czech Republic **6.6%** Denmark[3] **4.7%** Germany[3] **0.8%** Greece[3] **2.6%** Spain[3] **15.1%** Ireland[3] **2.6%** Italy[3] **3.4%** Luxembourg[3] **8.2%** Austria[3] **11.5%** Finland[3] **9.5%** Sweden[3]
Retail sector	**0.6%** Canada **0.4%** Australia (2000-01)	**1.50%** (United States, 1st Q 2003) **1.65%** (United States, 4th Q 2002) **1.31%** (United States, 4th Q 2001) **1.17%** (United States, 4th Q 2000)
Narrow		**Broad**

1. For more information on these definitions, see *Measuring the Information Economy*, OECD, 2002, available electronically at www.oecd.org/sti/measuring-infoeconomy.
2. Data for New Zealand exclude electricity, gas and water supply and only cover enterprises with six or more full-time equivalent employees and NZD 30 000 or more in turnover.
3. In European countries, except in Norway, only enterprises with ten or more employees are included. Data for these countries are from the Eurostat Community survey on enterprise use of ICT and exclude NACE activity E (electricity, gas and water supply), NACE activity F (construction) and NACE activity J (financial intermediation).

Source: OECD, ICT database and Eurostat, Community Survey on ICT usage in enterprises 2002, May 2003.

Figure 4. Internet use by type of activity, 2002 or latest available year[1]
Percentage of individuals using the Internet



1. 2001 for France, Mexico, Netherlands, Portugal, Switzerland and the United States. Beginning of 2002 for Austria, Denmark, Finland, Germany, Sweden, the United Kingdom and 2002 for Japan.
2. Only sending e-mails instead of sending and receiving e-mails.
3. Reading/downloading newspapers also includes movies.
4. Purchasing/ordering goods or services excludes shares/financial services.
5. Playing games only instead of downloading games and music.
6. Downloading music only instead of games and music.

Source: OECD, ICT database and Eurostat, Community Survey on ICT usage in households 2002, June 2003.

13. The advent of official estimates of e-commerce had an important impact in terms of tempering the hype that surrounded e-commerce. While e-commerce was growing quickly, it was clear that the official estimates were significantly lower than the data being generated by private market research firms. E-commerce was not a phenomenon that would transform the whole economy in a short period (5 years) of time, and policy makers did not need to make hasty decisions. Some of the issues that seemed paramount in the late 1990s such as concern over the loss of tax revenue as e-commerce led to a hyper-efficient "global" market that sought out the lowest-cost location, perhaps in cyberspace, were not borne out by the data. Market forces reaffirmed the reality of the importance of fundamentals – delivery of products, after sales service, the importance of feel and touch. This said, data revealed that while perhaps not heralding the friction-less economy as predicted by some, e-commerce was a disruptive technology for those sectors where the product was largely intangible or where the activities of intermediaries was important – music, gambling, travel, and the buying and selling of stocks have all been permanently transformed.

New Determinants of Growth?

14. As the information society has developed, the interest has expanded from the micro to the macro and broadened from Ministers of Industry or Science to Ministers of Finance and central bankers. This became evident at the 1999 annual OECD Ministerial meeting. Ministers discussed whether or not new determinants of growth such as ICT could explain an observed divergence in growth trends across Member countries during the 1990s. They asked the OECD to analyse these differences with particular attention to *"…rapid technological innovation, the growing impact of the knowledge society and conditions for fostering the start-up and growth of new enterprises*." In short, is there a "new economy"?

15. Intensive work at the OECD over the next two years explored the question. During this period, the project benefited greatly from work that had been launched earlier in a number of different statistical fields. This included better measurement of quality improvements in products experiencing technological changes such as ICT (hedonic price indices), a manual on productivity measurement and improvement of the OECD's main database for productivity analysis (the STAN or Structural Analysis database) as well as the work on the production and use of ICT and applications like e-commerce.

16. The report to Ministers, *The New Economy: Beyond the Hype,* was delivered in May 2001[3]. The project concluded that no one factor can independently lead to superior growth, but rather it is the interaction of a constellation of events and conditions that led some countries to perform better than others. In this sense, a comprehensive and co-ordinated set of actions is needed to create the right conditions for future change and innovation. That said, many of these factors such as sound monetary and fiscal policy, or well functioning labour markets have been recognised for some time. What was new was that the important role of technology, specifically ICT, was recognised at a macroeconomic level. This conclusion was substantiated in a number of different OECD reports that fed into the study.[4] Thanks to improvements in official data series and methodological work undertaken by

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3 *The New Economy: Beyond the Hype – the OECD Growth Project.* (OECD, 2001)

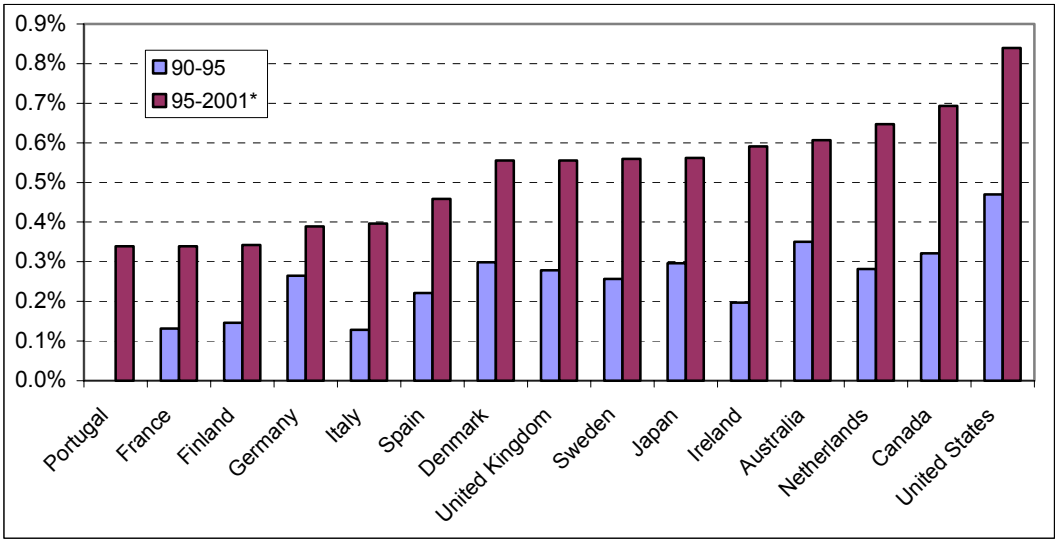
4 . Colecchia, A and P. Schreyer (2001) "The Impact of Information and Communication Technology on Output Growth: Issues and Preliminary Findings" OECD STI Working Papers; Pilat, D and Frank Lee (2001) "Productivity Growth in ICT-Producing and ICT-Using Industries: A Source of Growth

various OECD Working Parties, further work, performed as a follow-up to the Growth Study, was able to analyse the impact of ICT on growth with a relatively high degree of international comparability and begin to unravel differences across countries in the nature of the part of growth attributable to ICT[5].

Measuring the impacts of ICT at the aggregate level

17. The OECD's work distinguished three ways in which the impacts ICT affect economic growth and business performance. **Capital deepening** through investment in ICT is important for economic growth. It establishes the infrastructure for the use of ICT (the ICT networks) and provides productive equipment and software to businesses. ICT investment in OECD countries rose from less than 15% of total non-residential investment in the early 1980s, to between 15% and 30% in 2001. Since investment adds to the capital available to workers it contributes to labour productivity growth. The OECD's estimates show that it typically accounted for between 0.3 and 0.8 percentage points of growth in GDP and labour productivity over the 1995-2001 period (Figure 5). The United States, Australia, the Netherlands and Canada received the largest boost; Japan and United Kingdom a more modest one, and Germany, France and Italy a much smaller one. Investment in software accounted for up to a third of the overall contribution of ICT investment.

Figure 5: **The contribution of investment in ICT capital to GDP growth**
Percentage points contribution to annual average GDP growth, total economy



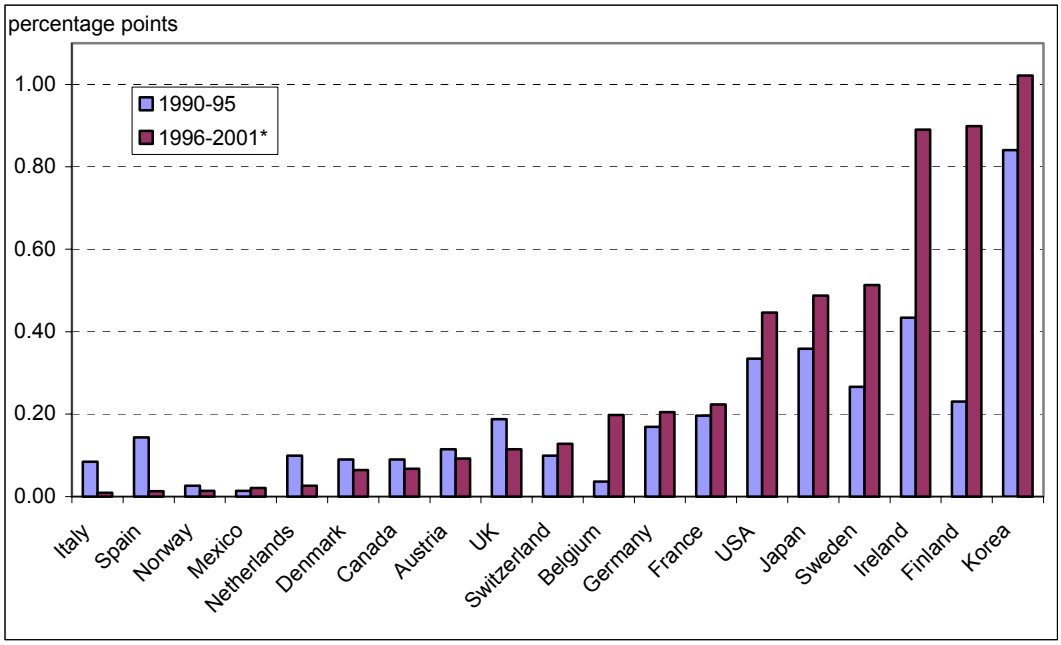
*Or latest available year, *i.e.* 1995-2000 for Denmark, Finland, Ireland, Japan, Netherlands, Portugal and Sweden.
Source: OECD (2003), ICT and Economic Growth: Evidence from OECD Countries, Industries and Firms.

Differentials in the OECD?" OECD STI Working Papers [2001/4], Schreyer, P (2000) "The Contribution of Information and Communication Technology to Output Growth: A Study of the G7 Countries," STI Working Papers [2000/2].

5 The study *ICT and Economic Growth: Evidence from OECD Countries, Industries and Firms* (OECD, 2003) was a principal pillar of the report to the 2003 Meeting of the OECD Council at Ministerial level *Seizing the Benefits of ICT in a Digital Economy* (OECD, 2003)

18. The second important economic impact of ICT is linked to having a sector **producing ICT goods and services** (Figure 6). Having such a sector can be important for growth, since ICT-production has been characterised by rapid technological progress and very strong demand. The sector has therefore grown very fast, making a large contribution to aggregate economic growth, employment and exports. Moreover, having a strong ICT sector may help firms that wish to use the technology, since the close proximity of producing firms might have advantages when developing ICT applications for specific purposes. Having an ICT-producing sector can thus support growth, although OECD work has shown that it is by no means a prerequisite to reaping the benefits of the technology.

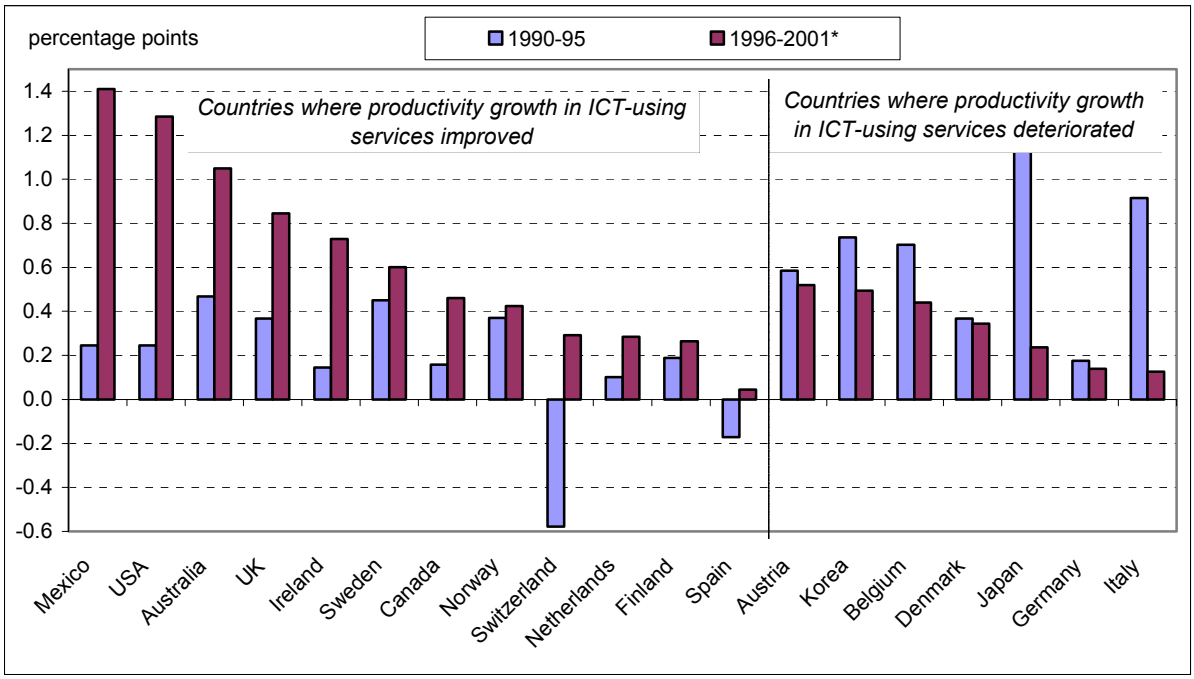
Figure 6: **The contribution of ICT manufacturing to aggregate labour productivity growth**
Contribution to annual average labour productivity growth, percentage points



Note: 1991-95 for Germany; 1992-95 for France and Italy; 1993-95 for Korea; 1996-98 for Sweden, 1996-99 for Korea and Spain; 1996-2000 for Belgium, France, Germany, Ireland, Japan, Mexico, Norway and Switzerland.
Source: OECD, (2003), ICT and Economic Growth: Evidence from OECD Countries, Industries and Firms.

19. The third, and most crucial, impact of ICT that shows up at the aggregate level is the **use of ICT**. Several studies have examined the performance of those sectors of the economy that are intensive users of ICT (Figure 7). Many of these are located in the services sector, e.g. industries such as finance, business services and distribution. In some countries, notably the United States and Australia, there is evidence that those sectors that have invested most in ICT, such as wholesale and retail trade, have experienced an increase in the overall efficiency of using labour and capital, or multi-factor productivity growth. This could be because these sectors have received productivity gains from ICT use over and above the labour productivity gains they received from investment in ICT, for instance because of network effects.

Figure 7: **ICT-using services have experienced stronger productivity growth in some countries**
Contribution of ICT-using services to annual average labour productivity growth, percentage points



Note: ICT-using services include wholesale and retail trade, financial services, insurance and business services.
Source: OECD.

20. The three impacts of ICT noted above all feed through in aggregate productivity performance, though to different extents. For example, productivity growth in the United States, one of the key examples of ICT-driven growth and productivity improvements, has continued to be strong during the recent slowdown. Productivity growth in Australia and Canada, both countries characterised by ICT-intensive growth, was also strong over the recent past. However, such impacts are not visible in all countries, showing that countries have not equally benefited from ICT.

21. The largest economic benefits of ICT are typically observed in countries with high levels of ICT diffusion. OECD data show that the United States, Canada, New Zealand, Australia, the Nordic countries and the Netherlands typically have the highest rates of diffusion of ICT. Many other OECD countries lag in the diffusion of ICT and have scope for greater uptake. But having the equipment or networks is not enough to derive economic benefits. Other factors, such as the regulatory environment, the availability of appropriate skills, the ability to change organisational set-ups, as well as the strength of accompanying innovations in ICT applications, affect the ability of firms to make ICT effective in the workplace and seize the benefits of ICT. Consequently, countries with equal rates of ICT diffusion will not always have similar impacts of ICT on economic performance.

22. This work was among the first to show, for a cross-section of OECD countries, that investment in ICT was associated with growth and productivity gains. The impact of ICT was not exclusively a U.S. phenomenon. Likewise, these gains were not restricted to those economies that enjoyed an ICT producing sector but rather to countries that made active use of ICT as well. Here the productivity gains came predominantly from service industries – many had thought that much of the tertiary sector was incapable of significant productivity gains. Nevertheless, many questions remained unanswered. Foremost among these was why ICT appeared to have a greater impact in some countries than in others. To address this question, it was necessary to look at individual firms and

analyse the interaction of investment in ICT with a host of other factors like the skills of the workers using the ICT, firm reorganisation to exploit fully the potential of ICT and the "co-invention" that occurs as the impact of ICT spreads throughout the firm spurring further innovation.

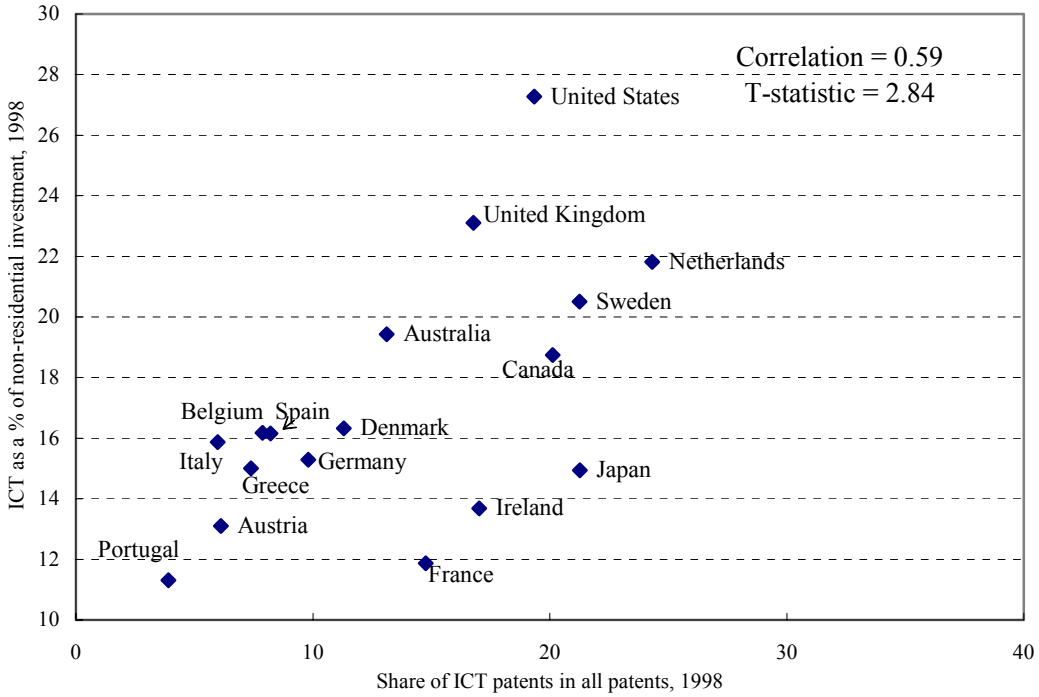
Impacts of ICT at the firm level

23. A consortium of 13 OECD countries was assembled that collectively used micro-level firm data to examine factors influencing the impacts of ICT that cannot be observed at the macro or sectoral level. For example, the role of ICT in helping firms gain market share can only be examined with firm-level data, as can the role of organisational change. In recent years, much progress has been made in developing statistics on the use of various ICT technologies in the economy. In addition, many countries have developed databases that provide detailed and comprehensive data on the performance of individual firms. Combining these two sources of information can help establish a link between firm performance and their use of ICT. Moreover, providing that these databases cover a large proportion of the economy, they can also link the performance of individual firms to that of the economy as a whole.

24. The empirical evidence from such studies, which have now been carried out in many countries, shows that ICT may have several impacts. For example, the effective use of ICT may help firms gain market share at the cost of less productive firms, which could raise overall productivity. In addition, the use of ICT may help firms innovate, e.g. by helping them to expand their product range, customise the services offered, or respond better to client demand. Moreover, ICT may help reduce inefficiency in the use of capital and labour, *e.g.* by reducing inventories. These effects would all lead to higher productivity growth.

25. Firm-level studies also show that the use of ICT is part of a much broader range of changes that help firms to enhance performance. The impacts of ICT are not guaranteed, but depend on complementary investments, *e.g.* in appropriate skills, and on organisational changes, such as new strategies, new business processes and new organisational structures. Firms adopting these practices tend to gain market share and enjoy higher productivity gains than other firms. ICT use by firms is also closely linked to the ability of a company to adjust to changing demand and to innovate. Users of ICT often help make their investments more valuable through their own experimentation and innovation, *e.g.* the introduction of new processes, products and applications. Without this process of "co-invention", which often has a slower pace than technological innovation, the economic impact of ICT would be more limited. Firms that have introduced process innovations in the past are often particularly successful in using ICT. This is particularly important in services, as ICT helps firms in re-inventing business processes and developing new applications (Figure 8).

Figure 8: **ICT investment is accompanied by rapid innovation in ICT**

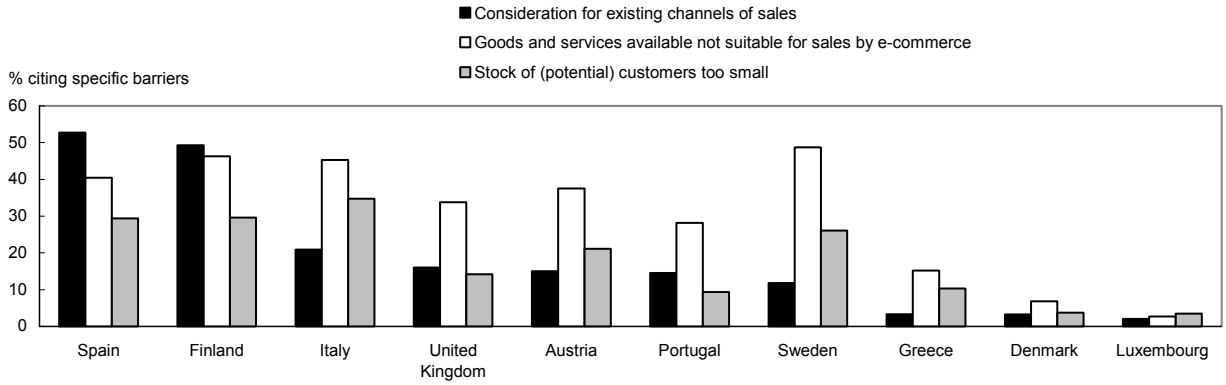


Source: ICT investment from Figure 4; ICT patents from OECD patents database.

26. Firm-level evidence also shows that ICT is no panacea. Firms may well over-invest in ICT, either in an effort to compensate for lack of skills or competitive pressure, or because they lack a clear market strategy. It also takes time to adapt to ICT, *e.g.* in changing organisational set-ups and worker-specific skills. Firms that had adopted network technologies several years previously, notably large firms, are often already able to make the technology work, whereas more recent adopters are still adapting their organisation, management or skills. Evidence for the United Kingdom shows that among the firms that had already adopted ICT technologies in 1995 or earlier, over 50 % purchased through electronic networks in 2000. For firms that only adopted ICT in 2000, less than 20% purchased through electronic networks in 2000.

27. The firm-level evidence also suggests that there are important cross-country differences in firms' use of ICT (Figure 9). For example, new firms in the United States seem to experiment more with ICT and relevant business models than those in other OECD countries; they start at a smaller scale than European firms, but grow much more quickly and get higher returns from their investments in ICT when successful. This may be linked to lower risk aversion in the United States, where its financial system, provides greater opportunities for risk financing to innovative entrepreneurs. Low regulatory burdens may enable U.S. firms to start at a small scale, experiment, test the market and their business model, and, if successful, expand rapidly. Moreover, if they do not succeed, the costs of failure are relatively limited. In contrast, firms in other OECD countries are often faced with high entry and exit costs. In a period of rapid technological change, greater scope for experimentation may enable new ideas and innovation to emerge more rapidly, leading to faster technology diffusion.

Figure 9: **Market conditions affect Internet commerce for businesses**
Percentage of businesses using a computer with ten or more employees citing specific barriers, 2000



Source: OECD (2002), *Measuring the Information Economy*, based on Eurostat data.

Policies to seize the benefits from ICT

28. What does the empirical evidence on the economic impacts of ICT imply for policy? The most important implication concerns the business environment. Governments should reduce unnecessary costs and regulatory burdens on firms to create a business environment that promotes productive investment. This involves policies that enable firms to undertake organisational changes, that strengthen education and training systems, that encourage good management practices, and that foster innovation, *e.g.* in new applications. Moreover, policy should foster market conditions that reward the successful adoption of ICT; competition is the key in selecting firms that are able to seize the benefits of ICT and in making them flourish and grow. Policies to foster growth in services are important too, as ICT offers a new potential for growth in the service sector, providing that regulations that stifle change are adjusted or removed. Moreover, competition needs to be strengthened. Competition not only helps lower the costs of ICT products and services, which fosters diffusion, it also strengthens pressures on firms to improve performance and change conservative attitudes.

Continuing challenges and new opportunities

29. As is common with work that tries to empirically pin down the role of new factors in growth such as ICT, it generates more policy-related questions. Among these are why did the growth surge suddenly occur in the U.S. from 1995? Has the long-term rate of economic growth been increased? Why did it not occur in other countries that invested heavily in ICT as well? Statistically, many of the challenges posed have in fact existed for some time and they are not only methodological in nature. In terms of new topics, as the information society matures our ability to measure it must advance beyond statistics that show readiness (the infrastructure, PC penetration, schools on-line) to the intensity and nature of use (time spent on-line, composition of traffic, value of e-commerce) and the impact of this technology on the economy and society (productivity, changing demand on skills, business / work organisation). Already many OECD surveys of ICT use by businesses indicate that ICT use is near to saturation, rendering such questions less useful. On the other hand, we have a poor understanding of the effects that ICT has had on the output of the service industries such as retail trade, transportation and health, where measurement of real output and productivity was far from perfect even before the widespread adoption of ICT.

30. Previous work on e-commerce revealed that the use of ICT by businesses goes far beyond business-to-business or business-to-consumer transactions but rather that most important impacts may involve non-market activities within firms that reorganise important activities as ICT permeates the enterprise. For this reason, the OECD has initiated work to define and measure e-business activities such as inventory management and customer interaction so as to better understand the use of ICT and its impact.

31. An important challenge that has not yet been adequately addressed by the OECD is to measure the impact of ICT beyond the economy and into society and culture. For example, developments such as peer-to-peer instant messaging and file transfers are having a large impact on how we communicate and share information, effectively redefining what we consider our community and, when sharing music and video, posing challenges to intellectual property rights protection. This entails a need to expand the focus on the Internet from the web to these new tools and understand better the role of old tools like e-mail that remains the "killer app" of the Internet.

32. Likewise, the impact of ICT as it changes the way citizens and governments interact needs to be explored, both in terms of the efficiency gains it can provide to government services but also in terms of government accountability, responsiveness and intrusiveness. It is clear that ICT is a powerful force that can empower people to communicate freely and it demands a transparency and openness that goes beyond the degree that some governments are currently comfortable with. But the advent of ICT and the Internet more specifically means that information flows faster, creating pressure for government systems that can react accordingly and which may entail decentralisation of decision-making. Evaluating the need for this change and how it can be best implemented will require some new measurement tools.

33. Another area where measurement of the impact of ICT needs further development is that of human capital, skills and labour markets. ICT is at the root of the evolution of OECD economies towards "knowledge-based economies" that require the use of many abstract, analytical skills as opposed to manual dexterity. To some degree this facet of the information society is at the root of the digital divide, but we still have a very imperfect idea of what we mean by being computer literate. The identification and common understanding of what we mean by IT skills is a prerequisite to tracking their supply, demand and flow.

34. This list of challenges that we need to address may seem daunting, but in fact progress has already been made in many of these areas. Earlier challenges such as measuring e-commerce or surveying the use of ICT in businesses have been addressed in a rigorous and timely manner. A good part of this success is due to the sharing of ideas, techniques, successes and failures between countries. The OECD can contribute to this exchange by drawing together its methodological "best practices" that have been developed in recent years and make them easily available so that other countries just embarking on this work can benefit from the learning curve built by others.

35. The "information economy" characterised by the production, diffusion and use of ICT and their contribution to economic activity and trade is one aspect of the "knowledge-based economy" -- incorporating investment in knowledge more generally, human resources, research and innovation, technology and knowledge-intensive industries. Here, too, statistical challenges are not lacking in the need to underpin policy analysis with timely internationally-comparable data. The OECD regularly publishes statistical compendia that focus on the key policy questions of the day.[6]

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6 *OECD Science, Technology and Industry Scoreboard 2003* (OECD, 2003).

36. The OECD will further develop the framework of indicators for information society in preparation for the second phase of the World Summit on the Information Society that will take place in Tunis in November 2005. Based on our experience in using this data to undertake analysis and to inform policy makers, the OECD stands ready to contribute to the formulation of a set of core, reference indicators that should guide data collection. Lastly, the OECD will continue to act as a forum where Member countries and observers can meet to exchange ideas, identify best practices and formulate recommended standard methodologies. This work can be made available to a wider range of countries through a variety of means including our own outreach efforts, and effective partnering with other organisations such as those of the UN family. Indeed, an invaluable role the OECD can play is that of a broker that brings together countries that would like to develop indicators of the information society to share the experience of those countries that have hands-on, proven expertise in this area.

Annex. OECD Information Society Policy Guidelines

OECD Guidelines on the Protection of Privacy and Transborder Flows of Personal Data (1980)	The Guidelines define basic principles for the protection of privacy and personal data in the context of automated processing of personal data..
OECD Guidelines for the Security of Information Systems and Networks (1992, revised in 2002)	The Guidelines define basic principles for the protection of the availability, integrity, and confidentiality of information systems. Key principles include: accountability, awareness, ethics, multi-disciplinarity, proportionality, integration, timeliness, reassessment, and democracy.
OECD Council Recommendation on Global Information Infrastructure/Global Information Society (1997) www.oecd.org/dsti/iccp/gii-gis.htm	The report provides recommendations regarding access to infrastructures, the competitive safeguards required, as well as applications and services provided on networks (electronic commerce) and related issues such as intellectual property rights, transaction safeguards, and multimedia content.
OECD Guidelines for Cryptography Policy (1997)	These guidelines provide internationally comparable criteria for encryption of computerised information for safeguarding electronic transactions, communications, and data storage.
Taxation Framework Conditions (1998)	Agreement that the taxation principles that guide governments in relation to conventional commerce should also guide them in relation to electronic commerce.
OECD Guidelines for Consumer Protection in the Context of Electronic Commerce (1999)	These are guidelines to: 1) control fraudulent and misleading commercial conduct; 2) resolve disputes and establish redress mechanisms; and 3) ensure on-line consumer privacy.

Source: OECD.