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OECD WORK ON ICT AND BUSINESS PERFORMANCE - THE ROLE OF DATA LINKING

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Background

1. Firm-level data are a rich source of information for policy analysis, as they can provide insights that can not be derived from macro-economic or sectoral data. For example, the role of firm creation and destruction in productivity growth, or the role of organisational change in ICT-related productivity changes can only be examined with firm-level data. Firm-level studies contribute to a better understanding of the drivers of economic performance, and thus to better policy making. One area that seems particularly fruitful for further analysis with firm-level data is the impact of information and communications technology (ICT) on the economy. Some of the OECD's recent work on economic growth has already examined the role of ICT at the macro-economic level as well as the role of the ICT-producing sector and ICT-using industries (Colecchia and Schreyer, 2001; Pilat and Lee, 2001; Van Ark, 2001). Many insights have been gained, but the work has also led to new questions. Further analysis is required to inform the policy debate, since ICT is recognised as an important driver of growth and as an important catalyst of changes in the business sector.

2. A request for further work on ICT and business performance was recently made by the US Secretary of Commerce, Mr. Evans, to the OECD Secretary-General. This request noted that firm-level data would be highly relevant for further analytical and policy-relevant work. Depending on the data that are available in different countries, work on ICT and business performance could address a wide range of policy-relevant questions. Some examples of questions that could be addressed are the following:

- How does ICT affect productivity and growth at the firm level? What other factors (*e.g.* skills, organisational change) enable ICT to improve business performance?

- What has the largest impacts on business performance? The adoption of ICT technology (*e.g.* computer networks), their integration across the value chain through software, or new ways of doing business (electronic commerce)? Or is it a combination of these?

- How does ICT, including electronic commerce, affect the ability of firms to respond to changing demand patterns? Does ICT affect product and process innovation at the firm level?

- What characterises firms that benefit most from ICT? Are new firms more likely to benefit? Does the impact of ICT vary across industries? How important is the size of firms?

- What determines the decision of firms to adopt ICT? What are the main (perceived and actual) barriers to ICT adoption? How and why do these barriers differ across countries?

3. These questions are only examples of issues that could be addressed, and will be refined over time. Nevertheless, they suggest that the work could help address important policy issues. For example:

- ICT appears to have a greater impact on the performance of new firms than on old firms. This suggests that policies to enhance business creation are important to derive benefits from ICT.

- Analysis of the characteristics of firms that benefit most from ICT and the conditions under which ICT is effective in enhancing business performance can help identify the barriers, enabling factors and policies that should be addressed by policy makers. Examples include skills, access to ICT networks, lack of competition, or the security of ICT networks.

- Analysis of changes in business processes and the interaction between firms and customers can help identify new challenges for policy and for statistical measurement. For example, the emergence of new products and services and increased customisation make it more difficult to measure productivity in services sectors.

The OECD work

4. Following the request by the United States, OECD has started a project on ICT and business performance. At an OECD meeting in November 2001, experts from several OECD countries agreed to examine the impact of ICT on productivity and business performance, using firm-level data. This group currently includes experts from the United States, Japan, Germany, France, Italy, United Kingdom, Canada, Australia, Netherlands, Sweden, Switzerland, Denmark and Finland (Box). Given the statistical nature of the work, the project involves close co-operation between OECD's Working Party on Indicators for the Information Society (WPIIS) and OECD's Statistical Working Party of the Committee on Industry and Business Environment (SWIC).

Box: **Participants in the OECD firm-level project on ICT and business performance**

The study is being conducted by the OECD Directorate for Science, Technology and Industry in co-operation with experts from 13 Member countries:

Australia: Dean Parham (Productivity Commission) and Sheridan Roberts (Australian Bureau of Statistics)

Canada: John Baldwin (Statistics Canada)

Denmark: Peter Bøegh Nielsen (Statistics Denmark)

Finland: Petri Rouvinen (ETLA - Research Institute of the Finnish Economy) and Mika Maliranta (ETLA and Statistics Finland)

France: Thomas Heckel (INSEE)

Germany: Thomas Hempell (ZEW Centre for European Economic Research)

Italy: Carlo Milana (ISAE - Institute of Studies for Economic Planning), Fabiola Riccardini and Alessandro Zeli (ISTAT)

Japan: Kazuyuki Motohashi (Ministry of Economy, Trade and Industry and Hitosubashi University)

Netherlands: Eric Bartelsman (Free University of Amsterdam), George van Leeuwen and Henry van der Wiel (CPB Netherlands Bureau of Economic Policy Analysis)

Sweden: Anders Wiberg (IPTS - Swedish Institute for Growth Policy Studies) and Anders Hintze (Statistics Sweden)

Switzerland: Maja Huber (Swiss Federal Statistical Office) and Heinz Hollenstein (KOF - Institute for Business Cycle Research)

United Kingdom: Tony Clayton (Office for National Statistics) and Jonathan Haskel (University of London)

United States: B.K. Atrostic and Ron Jarmin (Center for Economic Studies, US Bureau of the Census) and Patricia Buckley (US Department of Commerce)

OECD: Dirk Pilat and Alessandra Colecchia (Economic Analysis and Statistics Division)

The data

5. The potential for the OECD project has evolved from the recent development of linked databases in many countries (see Annex Table 1), as well as the greater international comparability of statistics, *e.g.* the availability of e-commerce and innovation surveys in most countries of the European Union. Most of the early work with firm-level data on ICT and business performance, and a considerable amount of work by academic researchers, was based on private data and on special surveys of a sample of firms. Work with private sources has helped generate interest in this area of analysis and has given an important impetus to the development of official statistics on ICT. However, work with private data suffers from a number of methodological drawbacks. First, the representativity of the sample of firms is often not known, which may imply that the results of such studies are biased. Second, the quality of the data is not always known, since the data do not necessarily confirm with accepted statistical conventions and definitions.

6. Over the past decade, the analysis in this area has benefited from the establishment of longitudinal databases in statistical offices. These databases cover much larger and statistically representative samples than private data, which is important given the enormous heterogeneity in plant and/or firm performance (Bartelsman and Doms, 2000). They also allow firms to be tracked over time and can be linked to many surveys and data sources. Among the first of these databases was the Longitudinal Research Database of the Center of Economic Studies (CES) at the US Bureau of the Census (McGuckin and Pascoe, 1988). Since then, several other countries have also established longitudinal databases and centres for analytical studies with these data. Examples include Canada, Finland, France, the Netherlands and the United Kingdom. The data integrated in these longitudinal databases differ somewhat between countries, since the underlying sources are not the same. However, many of the basic elements of these databases are common. The basic source for productivity-related analysis in most countries is typically a production survey or census, such as the US Annual Survey of Manufactures. These data typically cover the manufacturing sector, but longitudinal databases increasingly also cover the service sector.

7. In recent years, statistical offices and researchers working with these data have increasingly become involved in analytical work on ICT's contribution to economic performance and productivity. The first of these studies typically used technology use surveys, such as the Survey of Manufacturing Technology in the Netherlands or the United States, and the Survey of Advanced Technology in Canada. Other studies used data on IT investment derived from production or investment surveys. In recent years, more data on ICT have become available, e.g. from surveys of ICT use and e-commerce undertaken in many OECD countries. Moreover, innovation surveys, such as the Community Innovation Survey, often include some survey questions on computer use that can, in principle, be used for empirical analysis. Finally, several countries have other special surveys that touch on aspects of ICT use by firms. In principle, such surveys can also be used for more detailed analysis. More detail is available on the specific sources in each country is shown in Annex Table 1. Some examples of recent studies are shown in the references.

Progress thus far

8. A first meeting of the expert group in April 2002 highlighted the relevance of large-scale firm-level studies based on data linking. In presenting their work, countries described the databases and methodologies they are using, the main questions that are being addressed in the different studies, the scope for co-operation/comparison with other countries, the main statistical challenges, and the preliminary results of the work. The meeting showed that much work on ICT and business performance is currently underway, with a wide range of data and approaches being used in different countries. This is partly because statistical sources show considerable variety and partly because this area of work is still relatively new in most countries. The current variation is useful, as it highlights the advantages and drawbacks of different methods and allows the same questions to be examined through a variety of approaches.

9. The discussion during the meeting also showed that the possibilities for comparative research between two or more countries are increasing. Some topics are being (or will be addressed providing sufficient funding is available) addressed in several countries. For example, almost all countries will examine the link between the use of ICT and productivity. But other important topics will also be the subject of research in several member countries, possibly allowing co-operation and sharing of experiences. Such areas include: the impact of e-commerce on business performance; the link between ICT and innovation within firms; the role of computer networks; the role of skills and labour force characteristics; the impact of organisational change and business practices; and the role of R&D. In several countries, even more complex links will be investigated.

10. While the discussion showed that it was still difficult to engage in large-scale international comparisons, it was considered feasible to engage in smaller comparative studies, involving two, three or possibly more countries. OECD was asked to play an active role in brokering potential comparative and co-operative research, by examining the available data and methods used in each country in greater detail. All countries involved indicated that they would provide the OECD Secretariat with greater detail on their data and the variables available (if they had not done so already), allowing the brokering to be pursued at short notice. The results of this work will be discussed in August 2002.

11. The April meeting re-iterated that a distinction should be made between short-term and long-term objectives of this work. In the short term, OECD will prepare a policy-relevant report on ICT and business performance. This report will be drafted on the basis of OECD's own macro-, sectoral and statistical work, but will also draw on the ongoing firm-level work in the countries involved in the project. This report will be ready for the OECD Ministerial meeting of May 2003. This may be too soon for most comparative studies that might be undertaken in response to OECD's brokering efforts. However, it is intended that the work will continue after the OECD Ministerial meeting in 2003, as ICT will likely continue to be an important driver of growth in the years to come. In the medium term, it should be possible to engage in more comparative analysis, while enabling the work to feed back into statistical and analytical work at both OECD and the national level. This longer-term objective fits into OECD's role as a forum for discussion and sharing of best practices, which was highlighted in the discussions of the expert group.

Timetable and projected outputs

12. The work continues and progress will be discussed at two other expert meetings in 2002 (one to be held the last week of August, linked to the meeting of the International Association of Official Statisticians in London, and one to be held on the 9th of December, prior to the meeting of the Statistical Working Party). OECD is also preparing a publication on "Measuring the Information Economy", that will summarise the latest official data on ICT use and supply in OECD countries. The entire project aims for a report for the 2003 Ministerial meeting, which will present the analytical and policy-relevant findings. Preliminary findings will be discussed at relevant OECD committee meetings this autumn and a full draft report at meetings in the spring of 2003.

13. The work should also allow some feedback on statistics, e.g. the relevance and applicability of these statistics, such as surveys on ICT use by businesses and surveys of electronic commerce. This would enable countries to adjust their surveys where needed. It is also likely that the project will demonstrate the importance of data linking for analytical and policy-relevant work. Statistical offices might therefore wish to consider the potential for linking databases when designing new statistical surveys. Common firm identifiers and sample frames are important in this respect. Databases that allow individual firms to be tracked over time are also of great importance. They provide crucial insights in firm creation and destruction, and in the changing fortunes of firms, as well as the factors which influence firm dynamics.

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Annex Table 1: Key databases for firm-level statistical analysis on ICT and business performance

Country	Longitudinal databases	Production, employment	Technology use surveys	Innovation surveys	Research and Development	Other sources on ICT use	Electronic Commerce	Other surveys used
Australia	Business Longitudinal Survey, 1994-95 - 1997-98	Economic Activity Survey				Survey on business use of ICT, 1997-2001		
Canada	Longitudinal Manufactures Research File; Longitudinal Employment Analysis Programme	Annual Survey of Manufactures	Survey of Innov. & Advanced Technology 1993; 1998 SAT	1996/1999 Survey of Innovation				
Denmark		1995-99 enterprise statistics; 1995-1999 account statistics				1998 survey on enterprise use of ICT		Database for labour market research (IDA)
Finland	Longitudinal Data on Plants in Manufacturing	Annual Industrial Statistics, Business Register on Plants		Community Innovation Surveys	R&D surveys		E-commerce surveys	Employee Statistics
France		Annual Survey of Enterprises (EAE); BRN employer file; SUSE firm accounts		Community Innovation Surveys (CIS)	R&D surveys	Survey Organisational Change and Informatisation (COI)		Annual Social Declarations (DADS); Employment Structure Survey
Germany (ZEW)		Service sector business survey		Mannheim Innovation Panel		Survey on ICT use and skill shortages	ZEW CATI Survey for 2000	
Italy		Survey on economic & financial accounts			R&D assets from enterprise account	ICT assets & investment from enterprise accounts	E-commerce survey	
Japan		Basic Survey on Business Structure and Activities			R&D survey	Basic Survey on Business Structure and Activities (BSBSA)	E-commerce survey	Survey of IT workplaces (SITW)
Netherlands	Microlab data CBS (CEREM)	Production Survey, 1978-1999	Automation Survey, 1987-97	CIS 1994-96, 1996-98, 2000	Quadrennial, from 1985 onwards	Investment in fixed assets, 1993-99		
Switzerland			Advanced Manufacturing Survey, 1998	Innovation Survey, every 3rd year since 1990			2002 survey on ICT & E-commerce	2000 survey on ICT and organisational change
United Kingdom	ONS business data bank/ Annual respondents databank (ARD)	Annual Business Inquiry 1998-2001		CIS 1997 and 2000	R&D surveys 2000-2001	ICT capital expenditure, E-commerce and software spending from ABI supplement	E-commerce surveys 2000-2001	Workplace Industrial Relations Survey
United States	Longitudinal Research Database, Longitudinal Business Database	Census/ Survey of Manufactures; SSEL Economic Census	Survey of Manufacturing Technology, 1988, 1991, 1993		National Science Foundation R&D Surveys	Computer spending from ASM; Business expenditure survey, computer network use from ASM supplement		EQW National Employer Survey