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**Measuring the new economy and adapting to it**

Paper prepared by OECD<sup>1</sup>

**I. Introduction**

1. The purpose of this note is to raise several statistical issues in conjunction with the measurement of the 'new economy'. The note makes no claim to provide a comprehensive picture of possible statistical implications of what remains a rather elusive notion but it will point to a few pertinent issues and, where appropriate, relate them to work undertaken by OECD. In so doing, the note draws on Wyckoff (2001).

2. The OECD began to grapple with the concept of the 'new economy' in 1999, when Ministers asked the organisation to explain an observed divergence in growth trends across Member countries during the 1990s. In particular, Ministers singled out "...*rapid technological innovation, the growing impact of the knowledge society and conditions fostering the start-up and growth of new enterprises*". The ensuing two-year, multi-disciplinary "Growth" project (see <http://www.oecd.org/subject/growth/>) has shown that many existing statistical measures are insufficient for analysing linkages and dynamics that make up the 'new economy'. Some of the challenges but also some of the progress made is reported below.

**II. Dimensions of the 'new economy'**

3. The ministerial mandate mentioned above draws up the main dimensions of what is usually meant by 'new economy'. Three such dimensions are identified here:

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- The first dimension is one of *technology and innovation* that have become more central to the economic process and to the competitiveness of firms and industries. On the whole, processes of innovation and technology cycles have accelerated, and information and communication technologies (ICTs) are both a cause and an effect of this phenomenon. ICTs are general purpose technologies which, thanks to significant drops in prices, are now used across a wide number of industries and have had productivity effects, measured and unmeasured ones. Without doubt, measuring the production, investment, consumption and use of ICT products has raised significant challenges for statisticians, given the rapid quality change that these products have undergone. ICT has also made accurate measurement of service activities more difficult, e.g., due to customisation and new delivery modes enabled by ICT.
- The second dimension is one of *entrepreneurship and market dynamics*. A lot of debate about the 'new economy' has been focused on 'dot com' firms and their role in the stock market. Often, the entire debate about the 'new economy' has been reduced to this phenomenon. This is clearly a foreshortened view. The hype in the stock market has been but one, and partial manifestation of the 'new economy'. Also, as most recent corrections in the stock market have shown, this has not been a lasting phenomenon. But overshooting and contracting financial markets should not distract from the role that entrepreneurship has played in producing and disseminating new technologies. The much-cited innovative cluster of Silicon Valley is the most visible expression of strong innovation dynamics that can emerge from the geographical interaction of young firms, an outward-oriented university system and a set of favourable framework conditions for the financing and growth of start-ups. Few reliable and timely datasets exist about firm dynamics, about the number, activity and geographical location of enterprise births, about their survival, mergers, and deaths.
- The third dimension is one of *globalisation*. Globalisation is about the increasing integration of markets, of the internationalisation of research and development processes, of international investment and the activities of multi-national firms and about the international mobility of highly qualified labour. One factor frequently quoted as having allowed the United States to sustain rapid, non-inflationary growth from sectors that need specialised skills (e.g., in software development) was its ability to attract highly qualified personnel from abroad, especially software engineers from China and India. Tracing the international mobility of high-skilled labour is widely uncharted statistical territory where reliable and comparable data could greatly service analytical and policy needs. But the 'new economy' also poses challenges to well-developed statistical areas such as trade where, for example, e-commerce makes it more difficult to trace trade flows.

### III. DIMENSION 1: SCIENCE, TECHNOLOGY AND THE INFORMATION SOCIETY

#### *Issue 1 - Do ICTs complicate measurement of volume output and productivity?*

4. The answer to *Issue 1* is a nearly unambiguous 'yes' and the reason lies in the problems that statisticians face when dealing with rapid quality change and the emergence of new goods. These problems are not new but arise in a specifically intense form for ICT products. More specific issues include:

5. *Price and volume measures of computers, and communication equipment*. The discussion about the appropriate price and volume measures of computers and hardware has occupied the statistical community for a number of years now. Some statistical offices (United States, Canada, Australia, France, Japan) have employed 'hedonic' techniques to quantify price changes of computers, peripheral equipment and semiconductors. Observed rates of price change for these products have tended to be steep, and even accelerated in the second half of the 1990s. This contrasts with observed price changes in countries that use different approaches towards deflation of hardware and its components and has given rise to discussions about the international comparability of measures of volume output, GDP and productivity. Price

measurement of certain communication equipment and consumer durables can also be problematic. For example, Lequiller (2001) points to the measurement issues regarding mobile phones in France, and many of the points he makes certainly apply equally to other countries.

6. **Initiatives** to address this issue include methodological work carried out by OECD (*Handbook on Price Indices for IT Products*) and by Eurostat (*Handbook on Price and Volume Measures in the National Accounts*); analyses by OECD on the quantitative importance of these effects (Schreyer 2001) and international initiatives to assess the international transferability of hedonic functions (*Hedonic Centre* project by Eurostat, *International Comparison Project* led by Jack Triplett, The Brookings Institution). Related issues of price measurement have also been addressed by the *Ottawa Group on Price Indexes*.

7. **Value and volume measures of output of services with high ICT intensity.** A major challenge for price statisticians and national accountants remains the uncertainty surrounding the available measures of output and value-added in several service industries, in particular financial services, retail and wholesale trade and the health industry. All these activities are major ICT users and their volume output is notoriously difficult to measure – precisely because ICT has added so many qualitative features to the services produced in these industries. Such qualitative features include convenience and speed, or reduced pain in health care output and are difficult to translate into volume measures. As Landefeld and Fraumeni (2000) point out, the largest difficulties in measuring the new economy are probably in consumer spending for these services. Typically, when in-depth and focussed studies are undertaken, price measures are nearly always revised downwards, and volume measures upwards. But progress is partial and slow and some of the most important challenges in ‘new economy’ measurement may lie in accurately assessing the output of the services sector and this is by no means a ‘new’ issue.

8. **Value measures of software.** Whereas hardware and communication equipment expenditure tends to be relatively well measured in current prices, software expenditure measures remain of highly variable quality among OECD countries, even in current prices. This may not be surprising, given that software has only been recognised as an investment good in the 1993 System of National Accounts and some countries have assessed software expenditure for the first time very recently only. Lequiller (2001) is a recent useful reference for the issues involved. OECD started to compile information on country methodology for compiling software expenditure last year, and several key issues soon emerged:

- What is the basic statistical approach towards measuring packaged software: a supply-side approach measuring sales, imports and exports to obtain a data point for domestic sales or a demand side approach based on business investment surveys?
- How does one estimate expenditure for own-account software that firms develop *intra muros*?
- How should customised software be measured and treated in national accounts? And how should the different types of software be deflated?

9. **Measurement of capital services and net (wealth capital) stocks.** All of the aforementioned measurement issues have a direct bearing on current and constant price investment flows and consequently on measures of productive capital, wealth and productivity. Their influence is twofold: they change the shape of capital stocks as traditionally measured but they also put the traditional measurement itself in question. For example, ICT capital goods tend to show significant differences between the time profile of their physical depreciation (wear and tear) and their economic depreciation (loss of value due to ageing). Wear and tear tends to proceed much slower than loss of value in the market place, and this should be reflected in different measures of capital. Similarly, with rapidly changing relative price of ICT capital goods, it is important to identify them as a separate type of asset so as to reflect substitution processes that take place between different types of assets. The more aggregate the available investment data, the less

statisticians will be able to pick up such effects. This can lead to a mis-judgement about the capital services available in production and consequently bias measures of multi-factor productivity.

10. Reliable net capital stock measures and - closely related – measures of consumption of fixed capital are key in discussing the impact of the shortening average service lives of ICT capital goods on the consumption of fixed capital and hence on a pertinent measure for economic well-being, net national product. Only reliable capital measures can provide insight into the effects on real income of the ‘new economy’ and accelerating technical change with its shortening life cycles.

11. *Initiatives.* OECD (under the auspices of the *Canberra City Group on Capital Stock Statistics*) has developed a *Capital Stock Manual*. Links between capital services measures and productivity are also treated at significant length in the *OECD Productivity Manual*. OECD is also undertaking a project to measure capital services across a number of OECD countries with specific identification of ICT capital assets. Measurement issues associated with service activities have been examined for a number of years by the *Voorburg Group on Service Statistics*.

### **Issue 2 - Measuring innovation**

12. The central role of science and technology in the ‘new economy’ suggests a strong place for science and technology data. There is a longstanding tradition of measuring research and development expenditure in OECD countries, and these data remain a vital piece of information. However, traditional methodology to measure R&D expenditure (as laid down in the *OECD Frascati Manual*) has been challenged by developments in recent years, for example by the emergence of R&D performed by services and by co-operative R&D. It is also well known that R&D measures are input-oriented - they capture research efforts, not research outcome. One way to capture research outcome is to trace patenting activity and to construct analytical databases from data available from patenting offices. Patents have their own drawbacks, though, mainly because they miss out on the non-patented outcome of the research and innovation process. Hence, a second and complementary tool to measure the effects of R&D is to conduct innovation surveys. Considering the three dimensions jointly (R&D expenditure, patent activity and innovation outcome) would appear to be the best way to grasp the role of science and technology in economic growth and competition.

13. *Initiatives.* OECD is currently revising its *Frascati Manual* to account for some of the more recent developments in R&D performance. OECD is also building a large database of ‘patent families’ (relating to patents taken out in the United States, the European Union and Japan) that will allow the Secretariat to track patenting activity and to develop methodological guidelines. The OECD has also conducted a meeting on the development of statistical indicators for the biotechnology sector in March, 2000. As a result, OECD has developed an inventory of existing statistical collections in relation to biotechnology activities ([http://www.oecd.org/dsti/sti/prod/wp2000\\_6e.htm](http://www.oecd.org/dsti/sti/prod/wp2000_6e.htm)).

## **IV. DIMENSION 2: ENTREPRENEURSHIP AND FIRM DYNAMICS**

### **Issue 3 - Start-ups, gazelles and small firms – measuring a fast-moving target**

14. *Measuring firm dynamics.* One of the most visible features of the ‘new economy’ has been the emergence of new firms, typically with ICT-related activities. Emergence has often come along with disappearance soon afterwards, reflecting a high rate of firm turnover. Even though the survival probability of start-ups in the new economy may not have always been high, some of the most widely-quoted successful new economy firms were fast growing, young enterprises. However, much evidence of the role of young and growing firms has remained anecdotal and policy makers and analysts have often voiced the need for more systematic and/or more timely information on entry, exit, growth and survival of firms.

Compiling such information is a major undertaking, as it requires longitudinal data bases where individual units (firms or establishments) can be traced over time. Such data sets provide valuable insight into the workings of 'creative destruction' and the heterogeneity of firms. However, compiling and providing such data sets for analysis is a costly enterprise for statistical offices because data need to be specifically prepared for this purpose and issues of confidentiality resolved.

15. **Initiatives.** In the context of its 'Growth' study, OECD has initiated analysis to be carried out in ten countries on firm-level dynamics of growth and productivity. A more systematic effort to compile enterprise demography data has also been launched and will start off with a methodological workshop in November 2001. More broad-based work on the conception of business registers, the main statistical vehicle to trace and sample enterprises, is ongoing in international fora, such as the *Roundtable on Business Survey Frames*, in a joint *UN-ECE/Eurostat Seminar on business registers* (June 2001).

16. **Stock options.** The increasing use of stock options to compensate and attract employees to firms, especially in the high-tech industries, has rendered the measurement of employee compensation more difficult. Although most statisticians would agree that stock options constitute a component of employee compensation, there is clearly an entrepreneurial element attached to compensation via stock options and this implies a further blurring of the borderline between labour and capital income. There are also diverging opinions about the valuation of stock options across countries. One question relates to the point in time when stock options should be valued: at the time of granting, at the time of vesting, at the time of exercising? Added to this are practical concerns about the right price for valuation.

17. **Entrepreneurial income and profits.** Economic developments have rendered the measurement of entrepreneurial income and profits increasingly difficult. As Landefeld and Fraumeni (2000) point out, one of the objectives in the national accounts is to measure operating profits. Reported profits must therefore be adjusted for capital gains and losses and restated to reflect economic depreciation rather than accelerated-tax depreciation or historical cost accounting. Financial innovation and the pressure from stock markets to report strong profits can make the interpretation and adjustment of reported profits difficult.

18. **Initiatives.** The 2000 *OECD National Accounts Expert Meeting* examined the issue of the treatment of stock options in the national accounts. The topic has also been raised and followed up in *Eurostat's* National Accounts Working Party with a view to providing guidance to EU countries.

#### **Issue 4 - The ICT sector: an activity, a set of products or a type of transaction?**

19. **ICT industries and products.** The measurement of the information society is part of nearly every enquiry into the new economy. One aspect of significant interest is indications about the size of the ICT sector. This requires a set of definitions and methodologies to identify economies' ICT sector and to make it internationally comparable. There are at least two different approaches towards defining the ICT sector: in terms of economic activities and in terms of ICT products. Whereas agreement on a definition of the ICT sectors in terms of activities has already been achieved (see below); the product-based definition is still under way. It needs to be built around existing standard commodity classifications. Those relevant for this exercise are the Central Product Classification (used for goods and services of local production) and the Harmonised System (used for data on international trade). While these are both structured classifications, they do not specifically identify ICT goods and services and they require modification before they can be used for measuring ICT sector commodities. More importantly, both classifications are relatively old and do not necessarily identify the new goods and services about which users require information.

20. **Initiatives.** OECD developed an internationally agreed definition of the ICT sector by activity (Working Party on the Indicators of the Information Society - WPIIS). The OECD has subsequently moved

to implement this definition by developing a set of statistical indicators for the sector (available at: [http://www.oecd.org/dsti/sti/it/prod/measuring\\_ict.pdf](http://www.oecd.org/dsti/sti/it/prod/measuring_ict.pdf)). Work on the commodity-related definition is under way and a first proposal for a definition has been planned for April 2001. OECD is also working with the Voorburg Group and Eurostat to develop model surveys of the *use* of ICT goods and services for the business enterprise sector, the government sector and the household sector.

21. **E-commerce.** Much speculation has been around about the current and future importance of electronic commerce. Quantitative indications about the volume of e-commerce transactions are not always well-founded, and sometimes reflect mis-conceptions. Electronic business processes are carried out using ICT technologies and applications. In this respect, the measurement of e-commerce is one component of ICT use and so can be considered in the context of ICT usage surveys. Often, policy makers' needs are however 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 measures different e-commerce segments. These considerations have led to the development of several definitions of e-commerce by OECD.

22. In popular efforts to quantify e-commerce, some basic accounting rules have sometimes been left aside. For example, the amount of sales transactions via the internet has sometimes been compared with GDP, rather than total sales in the economy. For comparisons with GDP, internet transactions must be adjusted to reflect intermediate sales to all firms. Landefeld and Fraumeni (2000) report a downward adjustment of the e-commerce in relation to GDP from 3.5 to 1.8 %, when intermediate transactions are taken into account. Such adjustments, even if approximate, require a minimum set of available data, and full-fledged input-output tables for a more accurate and systematic assessment.

23. **Initiatives.** An *OECD Ad hoc Expert Group* developed several definitions of e-commerce, and then considered a range of indicators based on delegates' own national experience, data availability, and methodological coherence of the data as determined by an OECD survey. As part of the process, it is expected that a good deal will be learned about the extent to which indicators are comparable across countries, or can be modified so that they become comparable.

## V. DIMENSION 3: GLOBALISATION AND THE INTERNATIONAL FLOW OF KNOWLEDGE

### *Issue 5 - Measuring the activities of multinational enterprises*

24. Trade and foreign direct investment remain significant sources of innovative ideas and concepts and may take on greater importance as the complexity of innovation at technological frontiers makes it increasingly difficult for individual firms and countries to engage in innovative activities. High-technology industries have experienced the greatest increase in international trade during the 1990s. Foreign direct investment has grown more rapidly than trade over the past decade (OECD 2000). It plays a particularly large role in diffusing knowledge and ideas in services sectors, where local presence is often a necessity.

25. **Activities of foreign affiliates.** Although there is a long tradition of collecting trade data by detailed product, and although there is data available regarding the flow of foreign direct investment, the data situation becomes much bleaker when one is concerned with measuring the activities of foreign affiliates, i.e., the economic activity resulting from foreign direct investment. This requires data on key economic variables (value-added, employment, compensation etc.) broken down by nationality of ownership of the firm and by industry. Only few countries compile such information for activities associated with inward investment, and even fewer for activities associated with outward investment.

26. **Trade in services.** Measuring the value of services delivered through locally established enterprises and through conventional modes of trade is of significant interest to analysts of trade and investment flows

in the 'new economy' and to trade negotiators. Related is also the measurement of certain categories of service related employment of individuals non-permanently located abroad to the extent that they are covered by trade agreements. Many definitional and measurement questions arise with trade in services and have to be addressed at the international level so as to ensure a minimum level of consistent treatment across countries. In addition, any new initiatives to harmonise statistics in trade in services have to be streamlined with existing standards, in particular those present in the Balance of Payments Statistics.

27. **Initiatives.** OECD has started to compile a *Manual of Economic Globalisation Indicators* that deals with the measurement of activities of foreign affiliates, with measuring the internationalisation of technology, and the globalisation of trade. The manual raises important measurement issues such as how to define a foreign-controlled firm or how to define high-technology trade. A joint effort between OECD, IMF, European Commission, the United Nations and WTO has led to a *Manual on Statistics of International Trade in Services* that was approved by the UN Statistical Commission in March 2001 and that will be published by end-2001. Data work on measuring the flows of *Foreign Direct Investment* and the *Activities of Foreign Affiliates* has been ongoing for a number of years at the OECD.

#### **Issue 6 - Measuring high-skilled labour and its international mobility**

28. **Measuring human capital and knowledge flows.** Human capital is a key policy area in the 'new economy', as it is required for innovation and growth. The measurement of skills, their distribution among different economic activities and the economic effects of the acquisition or absence of certain skills on individuals (e.g., "digital divide") are of significant concern for policy makers.

29. **International mobility of high-skilled labour.** One particular policy area merits special mention in this context. Several OECD Member countries have benefited from the immigration of skilled foreign workers, while others have been affected by a 'brain drain'. Further analysis is needed to examine how the international mobility of highly skilled personnel affects growth and if and how it can be made more than a zero-sum game. Statistical evidence on the international flow of high-skilled persons remains sketchy, however, and does not allow broad based quantitative analysis. Given the policy-relevance of this issue, and the long-term importance of assessing the availability of human capital for OECD economies, the development of relevant data sets stands out as a priority.

30. **Initiatives.** The *OECD Directorate for Education, Labour and Social Affairs* has examined issues of human capital measurement, including educational attainment and knowledge flows. Statistical work is also ongoing to assess the distributions of skills (approximated by types of occupation) by economic activity. Regarding international mobility, OECD organises a workshop for late 2001 that examines issues of migration more broadly, and the aspect of international mobility of high-skilled persons more specifically. The aim is to shed light on the relevant issues and to define the statistical demands arising from the need for analysis.

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