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ICT Statistics at the New Millennium – Developing Official Statistics – Measuring the Diffusion of ICT and its Impacts

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1. Introduction

Over the past few years, compilers of statistics the world over have been forced to realise that the descriptive systems used in statistics are not keeping up with the pace of social and economic change. The internationalisation of economies, globalisation, the rapid advance of the new technology, changes in production structures, business reorganisation and so forth all place increasing pressure on the national statistical systems. As the importance of the intangible economy grows, the foundation of the traditional compiling of statistics, based on readily identifiable and measurable parameters, is being eroded.

The more complex economic phenomena and linkages become, the greater and more specific will be the needs of the users of statistics. The potential of statistical organisations to respond to these new challenges varies from one country to another. The countries with the most sophisticated statistical systems are currently making a concerted effort to find new statistical standards that would be more appropriate than those currently in use to describe the information society. At the same time, however, many countries are still struggling to establish statistics for the services sector or to develop labour force surveys.

Section 2 gives a short and very rough overview of the ongoing work in the field of statistics relating to the development of information and communication technology (ICT) and its impacts on the economies and on the society as a whole. Section 3 introduces three slightly different approaches with different emphasis on describing the emergence and diffusion of ICT and the respective economic and social change. These are termed as the indicators approach, the new economy approach and the intellectual capital approach. Section 4 discusses the basic requirements for the establishment of a new statistical system, as well as the present obstacles and problems of this work. Finally, some remarks are presented regarding further statistical co-operation in this field.

2. Reactions to growing information needs

The discussion about the development of the information society and its future prospects has been ongoing among politicians, researchers and statisticians all over the world for quite a long while. Information society is usually understood as a society that makes extensive use of information networks and information technology, produces large quantities of information and communication goods and services, and has diversified content industry. Common strategies and political and economic programmes on the information economy and information society have been formulated both at the national level and within international organisations and the European Union. The interest in the information society and the inclination towards understanding the regularities of the development as well as its cause and effect relationship have created growing pressure on the statistical offices to develop statistics and indicators relating to this development. International comparisons are becoming increasingly important and benchmarking ICT performance against other countries is seen as a key issue in an information society characterised by increasing globalisation.

The development of the statistics on ICT and its impacts is well in progress in all those organisations and countries where the public debate is lively and well formulated programmes and policies of the information society or the ICT development have been established. The following short summary of the development of ICT statistics is focused on the work carried out within the European Union, the OECD, the Voorburg Group and the Nordic Countries. Even though each of these has concentrated on some specific work areas, there has been much co-operation as well as several joint projects and meetings between these organisations and the individual countries in the development of concepts, classifications, new surveys and other statistical tools. It is also worth noting that the intensive and innovative work done by many statistical offices the globe around is of the crucial importance and has a decisive impact on the work on the international level.

Official statistics, however, no longer have a monopoly over statistical information production. This is especially true in the field of ICT statistics where there is a huge demand for rapid IT market information. Some remarks on commercial statistics production are presented at the end of this Section.

2.1. The focus of the European Union: eEurope

The EU Commission initiated the eEurope programme in December 1999. The aim is to guarantee that the EU would benefit from the advantages of digital technology and that the emerging information society would be of use to all European citizens.

In March 2000, the Lisbon European Council made an ambitious decision according to which Europe will become the most competitive and dynamic economy of the world. The politicians stated that Europe has to take advantage of the opportunities relating to the emergence of the New Economy and especially to the Internet. In June 2000, the Porto Summit accepted the broad eEurope Action Plan to be implemented by the end of 2002.

Originally, the eEurope initiative listed ten different topics where European-wide actions could create specific value added. These actions are usually grouped around three key objectives as follows:

1. Cheaper, faster and more secure Internet
a) Cheaper and faster Internet connections;
b) Faster Internet for researchers and students;
c) Secure networks and smart cards.

2. Investing in people and skills
a) European youth into the digital age;
b) Working in the knowledge-based economy;
c) Participation for all in the knowledge-based economy.

3. Stimulating the use of the Internet
a) Accelerating e-commerce;
b) Government on-line;
c) Health on-line;
d) Digital content for global networks;
e) Intelligent transport systems.

The objectives included in the eEurope Action Plan are to be attained with three main measures:

- Speeding up the creation of the appropriate juridical environment;
- Supporting the development of the infrastructure and new services all over Europe;
- Applying open co-ordination and benchmarking analyses in order to guarantee the efficiency

and effectiveness of the measures.

In order to monitor the implementation of the eEurope Action Plan in the Member States, 23 key indicators, all quantitative by nature, have been defined. The statistical indicators are to be produced regularly at least once a year. Examples of these indicators are as follows:

- Percentage of the population using the Internet regularly;
- Percentage of households connected to the Internet;
- Number of secure servers per million inhabitants;
- Number of computers per 100 students in primary, secondary and tertiary education;
- Percentage of workforce with basic IT training;
- Percentage of workforce involved in teleworking;
- Percentage of firms buying and selling via the Internet.

For the moment, there are several existing statistics describing production and trade of ICT goods and services, development of the main ICT sector enterprises and some barometer type surveys on the penetration and use of ICT. Some data on ICT equipment and the Internet are coming from other international organisations such as the ITU (the International Telecommunication Union) and the EITO (the European Information Technology Observatory). There are also many data gaps that need urgent attention. At the moment, Eurostat (the Statistical Office of the European Communities) together with the Member States' statistical offices is preparing a new strategic plan for developing information society statistics in the near future. Within the European statistical system, many of the most urgent needs for new statistical indicators are related to the monitoring process of the eEurope initiative.

Parallel to the preparation of the plan, there are also new and concrete statistical surveys in progress in Europe. Most of the EU Member States participate in a project on measuring the use of the Internet and the volume of e-commerce in enterprises. The first results of this survey should be available during this autumn.

2.2. OECD activities

Within the OECD (the Organisation for Economic Co-operation and Development), the development of Information Society Statistics started as early as the beginning of the 1980s. The first gurus of the information society theory, namely Alvin Toffler, Yoneji Masuda and John Naisbitt had already published their revolutionary visions of the future. At that time, the ICCP Committee (Committee for Information, Computers and Communication Policy) first developed the idea that comparable statistics and statistical indicators are needed in order to monitor the development of information technology and its dissemination and applications. As a result, the Committee established an Ad Hoc Working Group for statistics on information society. The biggest problems in the work of this Group were related to the definition of the information sector and the related classifications. As the ICCP Committee thought that the work of the Group advanced too slowly and as only a few countries were willing or able to answer to the OECD's new questionnaires on information sector development, it was decided to discontinue the Group at the end of the decade. In retrospect, one can only say that the time was not yet ripe for the development of these statistics. This first attempt was not, however, totally useless. On the contrary, the countries that were mostly involved in this work at that time have the best ICT statistics today.

In 1997, the OECD decided to re-start its work on the development of information society statistics and convened the first meeting of the Statistical Panel (the ICCP Statistical Panel on GII-GIS). In 1998, the Panel was transformed into a permanent working party (WPIIS, Working Party on Indicators for the Information Society). From the very beginning, the WPIIS considered the lack of basic, commonly accepted statistical definitions on the scope of these new statistics as the most urgent development needs. Consequently, the WPIIS centred its work on classifications. As a result, the activity-based OECD definition of the ICT sector was accepted in 1998. This definition is limited to the 4-digit level of the ISIC

Rev. 3. According to this definition, the ICT sector is limited to those industries that facilitate, by electronic means, the processing, transmission and display of information. The information producing activities, so-called content industries, are not included.

Since 1998, the OECD has also developed and published a set of statistical indicators for the ICT sector. These interesting indicators are mainly based on data from the various existing OECD data sources. Among these indicators are statistics on employment, value added, research and development expenditure and international trade in the ICT sector. On the basis of these basic statistics the OECD developed some measures on the relative importance of the ICT sector in the OECD Member Countries. These OECD statistics can be seen as extremely good examples of producing new information by combining old statistical data sources, of meaningful regrouping of the activities and of innovative ways of thinking.

The OECD also works on identifying ICT goods and services. In addition to this, the OECD has carried out methodological work in the field of e-commerce and as a result, it has defined a set of indicators related to e-commerce. The organisation has also made a pioneering work in the field of measurement the impacts of ICT on productivity and economic growth.

2.3. The Voorburg Group's main interests

The Voorburg Group on services statistics meets annually. The Group was created in 1986 and it is one of the oldest so-called City Groups. It is an informal forum for exchange of views on services statistics development and related basic statistical tools.

Information society statistics were for the first time on the Group's agenda at their Sydney meeting in 1994. At that meeting, the Australian Bureau of Statistics presented a paper on the definition of the IT sector and on the measurement of IT use. Since 1998, issues related to the information society statistics have formed a permanent item on the Group's agenda. Special attention has been paid to the development of a model questionnaire regarding the ICT use of businesses. The Voorburg Group has also made a valuable contribution to the development of the ICT activity and product classifications.

2.4. Nordic co-operation perspective: international comparability is possible

The statistical co-operation of the five Nordic Countries – Denmark, Finland, Iceland, Norway and Sweden – has a long history. During the recent years, the statistical agencies of the Nordic Countries have had a number of joint efforts concerning information society statistics and the related basic statistical tools. They have also made joint contributions to the international development work. The focus of the work has been on developing and testing the measurement of ICT use in enterprises.

The first two joint publications were published in 1998. The first volume consisted methodological issues related to the new business surveys (*Guidelines for measuring use of information and communication technology (ICT) in enterprises – a first step towards harmonised Nordic surveys*). A comparative study on the ICT sector in the Nordic countries was published as the second volume. This study includes statistics on employment, enterprise structure and concentration in the ICT sector as well as economic information on turnover, value added and wages and salaries of ICT businesses. The publication (*The Information and Communication Technology Sector in the Nordic Countries - a first statistical description)* also contains statistics on gender, age and educational structure of the persons employed in the Nordic ICT sector. The ICT sector was defined according to the OECD WPIIS agreement. The updated figures on the ICT sector in the Nordic countries were published last December.

The common Nordic approach to measuring ICT use in enterprises was first tested in Denmark and Finland with a questionnaire-based survey of enterprises. A Danish-Finnish publication (*Use of ICT in Danish and Finnish Enterprises 1999*) was published in early 2000. Later on Norway and Sweden also carried out similar surveys and the second publication (*Use of ICT in Nordic enterprises)* was published in

January 2001. The Nordic experience suggests that the comparability of survey results between the countries can be achieved and these kinds of benchmarking studies are highly welcome to national users.

2.5. Commercial ICT statistics

Commercial companies mainly focus on collecting information for which their clients are willing to pay. It is evident that companies will only be interested in acquiring information of which they can make use. Due to the need for international benchmarking, there is a growing demand for statistics and indices describing the competitiveness and diffusion of ICT as well as the development of the IT market (e.g. IDC/World Times Information Society Index). These indicators, mainly produced by private research companies, have one common special feature: the main focus is on future developments and expectations instead of quantitative figures of the past or present situation.

A number of consulting groups have published estimates on e-commerce transactions. These vary widely, due to diverse definitions and scope. It is difficult to reconcile their estimates, since transaction values are based on surveys for which the questions and answers are not usually made available to the public, sample sizes vary considerably and little information is available on the respondents. The following table was originally published by the OECD:

The consultant estimates of world-wide e-commerce, US$ billion

	1999	2003
e-Marketer	98.4	1,244
IDC	111.4	1,317
ActivMedia	95.0	1,324
Forrester Low	70.0	1,800
Forrester High	170.0	3,200
Boston Consulting Group	1,000.0	4,600

This kind of statistical information may be of some use to market operators, but from the viewpoint of official statistics it is quite useless.

3. Three approaches to the measurement of changes in society

Information and communication technologies are already part of our everyday life. Information technology is integrated into various kinds of production and consumer goods. ICT has already had a profound influence on the whole society – on work, education and commerce. Huge changes are perceivable in the nature of business and in rapid shifts in industries. New organisational forms have emerged. It is not only a question of virtual trading floors but the effect of ICT on conventional industrial sectors has also been considerable. The use of ICT is expected to exert a major impact on the profitability, productivity and employment levels of businesses and it is generally considered to be a critical factor contributing to national performance on both micro and macro economic level. The impact of information and communication technology is not easy to separate from other changes in society, however, and networking or outsourcing on the country level cannot be monitored separately from globalisation and internationalisation.

Changes in the economy and society always mean changes in statistics. But what kinds of changes are needed due to the rapid development of ICT and what statistics they concern are difficult questions to answer. When researchers and statisticians talk about the role and impacts of ICT on the economy and society as a whole, they emphasise different factors and also use different names for this era, such as information society, virtual society, intangible economy, knowledge-based economy, networked economy, new economy, ICT economy, Internet economy, digital economy and high tech economy. Because the

definition of this changing economy/society remains somewhat unclear, the scope of the statistics to be developed is also indefinable to some extent. It is clear that the statistics as a subject of revision or development vary according to the selected viewpoints.

There are good reasons to say that due to the development and rapid diffusion of ICT, hardly any statistics can keep their relevance without sizeable changes. At the same time, new statistics are needed as well. As an attempt to structure the different needs for developing statistics and in order to show how comprehensive the development needs are, the following three approaches are presented below: the indicators approach, the new economy approach and the intellectual capital approach. Needless to say, this presentation does not rely on any real scientific theory or statistical framework.

3.1. Indicators approach: focus on ICT itself and its overall impacts

The first national Information Society Strategy in Finland was drawn up in 1994 with a focus on technology and the economy. The second one, from 1997, centred on people and the survival of the human being in the fast changing environment. Raising the quality of life, supporting sustainable development – they are considered as crucial targets as well as the balance in society.

Keen to monitor the progress, the Government charged Statistics Finland with the responsibility of providing reports at regular intervals and of conducting occasional studies on the Programme's impacts in society. Examples are provided by a series of statistical reports under the heading, *On the Road to the Finnish Information Society* and by a research project entitled *Finns and the Future Information Society*.

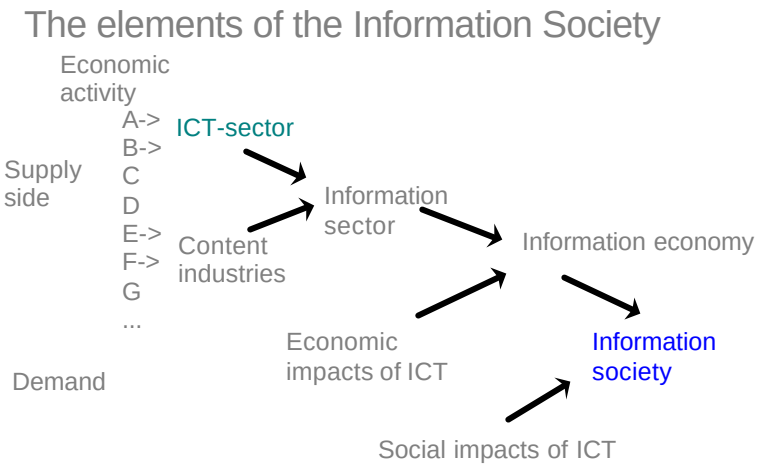
Because of lack of any common theoretical framework for these statistics, the starting point for the development of the Finnish information sector statistics was the so-called indicators approach. The aim was to use many different types of indicators to illustrate the production, use, diffusion, infrastructure, labour force and so forth related to the development of ICT.

The first set of statistics was published in 1997 and the second in 1999. The third one will be published this autumn. The publications and the corresponding indicator database include statistical information and indicators relating to the following areas:

- Technical infrastructure, networks and penetration rates;
- Applications and services;
- Educational indicators and indicators on entry into the labour market;
- Structure of the ICT sector, production and foreign trade of ICT products, R&D;
- Employment structures in the ICT sector;
- Use of ICT in business and at work;
- The information society and private homes; use of ICT, time use patterns.

It is evident that the set of indicators will not remain constant over time. As the basic statistics develop, new indicators will be calculated. In addition to the economic measures, more attention should be given to the sphere of social relations in the future. Interest on the social impacts of the ICT diffusion is becoming more and more important. Much has already been written about the digital divide, which refers to the risks of the digital economy accentuating the gulf between the 'haves' and 'have-nots' within and between our societies.

The discussion on the appropriate set of information economy/society indicators continues on the European level as well. As was said earlier, the EU is developing a set of indicators related to eEurope and the OECD has developed a list of indicators on e-commerce. The Nordic expert group has also presented its own view on the basic elements of the information society:



3.2. New economy approach: a challenge to economic statistics

The discussion about the emergence of the New Economy led the economists to lay more emphasis on the research on economic growth and productivity. Usually the New Economy is defined as an economy with sustained, non-inflatory economic growth and with high level of employment. This phenomenon has emerged at the same time as the rapid development and dissemination of ICT in all sectors of the society. While researchers and politicians are interested to know more about the links between ICT and economic development, they look more carefully at statistics and statistical indicators on national accounts, labour market, productivity, measurement of real output, price indices, various business statistics, and so on. During this work researchers have realised that many of the traditional macro economic statistics are losing their relevance due to the rapid changes caused by ICT. The recognised needs for revisions are connected to both the statistical methods and the basic concepts and classifications.

Many of the signs relating to the New Economy are visible. The economic growth has accelerated at the same time as the inflation rate has remained low. The structural changes in the business sector are accelerating, also on the global level. A large number of new products and services based on new technologies enter the market and the quality of existing products changes rapidly. The cost of information and its transmission has decreased. Global capital markets have directed enormous sums of money to ICT enterprises. The digital sector plays an important role not only in the US economy but also in some smaller economies.

The fact that national borders have totally lost their meaning as regards the operations of the big multinational enterprises is problematic from the perspective of economic statistics. These enterprises cannot easily report separately the production shares of individual countries from their global production network. Market has more relevance to the analysis. Compilation of statistics on cross-border transactions is very difficult because these transactions are only recorded in the internal net of these enterprises. Moreover, the statistical concepts used are often not very well compatible with the accounting terminology and practices of the enterprises.

Additional problems of economic and business statistics are related to the changing nature of business itself. Larger and larger shares of business turnovers consist of other revenues than sales of their own products. Typical items in this sense are royalty income from abroad, income from sales of other services and dealing in securities. An increasing share of value added is created in the digital market. As the production and business environment in general becomes more and more immaterial, the compilation of statistics will be more difficult. The delineation between the conventional manufacturing and service production is becoming blurred.

All these changes due to the development and rapid diffusion of ICT and the globalisation of economies bring about big challenges to official statistics. The most urgent development requirements are directed to existing economic statistics, the system of national accounts, business statistics, balance of payments statistics, wage and price indices as well as statistics on production output and input. Statisticians should be able to develop new methods and new data sources in order to keep the overall quality of economic statistics good.

3.3. Intellectual capital approach: focus on inputs

The development of statistics in the field of intellectual capital is no new idea. The need was recognised by the OECD as early as the 1980s. The thrust of those early efforts was primarily on intangible investments, that is, on corporate investments in R&D, marketing, training, software and other immaterial assets. Before long, however, the compilation of internationally compatible statistics came up against major problems of definition, and interest waned for a time. At the beginning of the 1990s, the attention of researchers and also of statisticians was directed to the innovation activities of businesses and accordingly, to innovation statistics. In the mid-1990s, researchers and statisticians got to learn that "a firm's most important resource is its personnel". Interest then focused on the development of statistics to describe the personnel, its competence and other qualifications. So far, however, the results have been modest in the extreme.

As the doctrines of business management have been refined and the need to explain the factors underpinning economic success has grown, hopes of developing statistics to describe intellectual capital have once again gained prominence. The discussion about the knowledge-based economy and the role of intangibles turns the attention towards the basic inputs of businesses. Investment in fixed assets does not explain the profitability and economic success of ICT or service companies. On the contrary, the most significant success factors are related to immaterial investment and the qualifications and competence of personnel. The fundamental question, now as before, is: What should statistics in fact record? Before we can measure intellectual capital we must be able to define its scope.

If we are concerned with the competitiveness of a firm and the need to explain and predict it, we could well start with the division set out in the work "Knowledge management – tietopääoma yrityksen kilpailutekijänä" (Knowledge management - knowledge capital as a corporate competitive factor) by the Finnish researchers Pirjo Ståhle and Mauri Grönroos. We should then be looking at the entire knowledge capital (intellectual capital) of the firm, that is:

- Human capital: know-how, motivation, commitment;
- Intangible capital: data, information, immaterial rights, organisation;
- Strategic reserves: the capacity to produce innovations and create new products.

In this case we are talking about a very broad perspective, and statistically speaking, – at least for the time being – about largely immeasurable factors. Available statistics, however, describe the development of factors related to the intellectual capital in many ways. Statistics on R&D measure inputs related to the creation of new information and new applications. Innovation statistics describe inputs and outputs of innovation activities as well as different aspects of innovation processes. Data on training expenditure of businesses can serve as an indicator of investment in human capital. Statistics are available on educational

attainment and occupational structure of employees and on other background factors related to employment.

However, any evaluation of current statistics soon shows that despite the large volume of statistical data touching on the subject of intellectual capital, it is still not sufficient. In addition, the international comparability of these statistics tends to be poor. Service sector statistics are still at an embryonic stage in many countries.

It has often been said that there is a lot of information about the economic activity of enterprises but very little on their inputs and outputs. Statistics on the most important inputs (e.g. personnel, R&D) are not readily combined with those describing output, competitiveness or economic performance. It is as if each statistical system were living a life of its own, producing only fragmentary, unorganised information for its users. Current statistics mainly examine economic transactions between an enterprise and the outside world; official statistics rarely, if ever, look inside the enterprise. Even though there are some statistical data on employment, measuring the overall competence of employees encounters great difficulties because of lack of proper definitions. There is still a strong need for methodological development in this field.

4. Basic requirements for production of new statistics

The compiler of statistics must be able to identify the need for information as clearly as possible. To pinpoint the real focus of the statistics among the multiple and partly conflicting needs for information, we must have a reference framework to which the need for information is linked. We certainly need to have more research work and a proper scientific frame linked to the concepts presented.

The basic problem in setting up a new system for compiling statistics arises from the concepts and classifications. Statistics must always be based on well defined and measurable concepts and their definitions. Especially in this area statisticians should work more closely with researchers.

Another major problem involves the classifications already in use and the new ones required. The statistical classifications used must be relevant and generally accepted. Uniformly and unambiguously defined concepts and accepted classifications are the keystones of temporal and geographic comparisons. Development and maintenance of common classification standards takes time and a great deal of resources. The big problem of international statistical classifications is that they are out of date the moment they are created. For example, it took almost ten years to develop the standard industrial classification now in use, but it recognises none of the new economic activities that emerged with the breakthrough of the Internet. The same applies to the classification of occupations. As technology and business operations change, new professions are created at such a rate that the occupational classification is always hopelessly outdated.

The third serious problem is how to track down the basic data required for statistics, and preferably with as little effort as possible on the part of the statistical organisation and the provider of data. New data sources might become available when businesses are developing their activities and internal accounting systems. For example, human resources accounting is becoming more common and also increasingly uniform, and it could form an excellent basis and source of information for statistics describing the human capital of enterprises in the future.

A fourth concern is related to the feasibility and cost-effectiveness of the statistical system. These could be tested for a new system by a pilot survey, for example. The outcome of such a survey might well go to show that statistical surveys conducted on an ad hoc basis are in fact more reliable than laborious and costly annual surveys. Ultimately, the need for information and the motivation of the respondents are the decisive factors.

It should also be emphasised that, when being developed, any new set of statistics will always have points of contact with existing statistical systems. The new and the existing systems must therefore be consistent.

5. Concluding remarks

When new statistics are being developed, it is crucial that there is smooth co-operation between the users of statistics, researchers and data providers. Close co-operation is in fact the basic requirement for the success of the development work. It is equally important that the statistical institutions from different countries work closely together. The international statistical organisations should co-ordinate and direct the work on standards and frameworks.

The creation of new statistics or a new statistical system takes at least two or three years, often much longer. The cost is also considerable. It seems more sensible to divide the work between several countries than to invent the wheel once again in each country separately. The experience of the co-operation of the Nordic countries shows that a small group of countries can work efficiently together and share the workload so that all the parties can benefit.

Finally, it is important to report on the countries' experiences, exchange views with colleagues and try to identify the best practices in this development work. In this sense, these kinds of conferences are extremely important. The Japanese Statistical Office deserves all our gratitude for hosting this meeting and for offering us an opportunity for inspiring and fruitful discussions.

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