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What Do the Statisticians Know about the Information Society and the Emerging User Needs for New Statistics?

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Abstract:
The statistical system has been put under pressure by the emergence and the rapid changes of the information society. This paper describes different aspects of the changing reality and the emerging statistical needs. One is the structural change in the economy in most of the 20th century, lately with the increasing role of the information sector of the economy. Another aspect is how the in-formation technology affects our activities at work and leisure, moving to a more knowledge-based economy where the skills of human capital will be vital. The paper also discusses how the increased use of new technology affects the economy and «the productivity paradox».

The need for statistics on the different aspects of the supply side and the user side of the information society is presented. One main conclusion is the importance to improve the general statistical systems. At the outset, statistics for the information society are a global term that might comprise all sorts of statistics: economic, social, cultural, environmental etc. A valid description of the information society will have to incorporate and extract elements of relevance to the information and communication technology into a wide spectre of the statistical landscape. The measurement problems especially in the service sector are a serious obstacle, not the least to treat the new products of to-day adequately.

For the interest of the users in the field of information statistics the NSIs should capture a larger part to secure that a central core of statistics for the information society is produced with a systematic approach, and with continuity and comparability.

Keywords: Information society, information and communication technology, productivity paradox

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1. Introduction

Monitoring the information society by statistics is not an easy task. Despite that, we are more or less every day confronted with statistics about the information society. Some figures are from statistical offices, but more often from other sources. There seems to be a lot of information, but how relevant and reliable are the various figures? One problem here is what do we mean by the concept of information society? Sometimes this seems to be synonymous to information *technology,* and in a broad sense we then can include most activities as part of the information society. Are computerized industrial processes included, are electronic components (chips) in cars and washing machines included or shall we only delimit activities related to text, sound and picture?

In this paper this topic is illustrated from different angles. First (chapter 2), there is a description of the structural change in the economy in most of the 20th century, tracing the emergence and importance of the information sector of the economy and some reflections on the present concept of the information society and the link to information technology. On this basis, the need for statistics on the different aspects of the supply side of the information society is presented.

Secondly (chapter 3), we look at how the information technology affects our activities at work and leisure. We are moving to a more knowledge-based economy where the skills of human capital will be vital. Working at home will be more usual (teleworking) and more of our personal activities will be changed (teleshopping, telebanking). What will be the total effect on people's use og time?

Next (chapter 4), we will follow up on the increased use of new technology. Where have all the chips gone and how does this affect the economy. Despite huge spending on software and information and communication technology, productivity gains in the big industrial economies have slowed sharply. This is known as «the productivity paradox» and this represents a big challenge to the system of national accounts. Some recent Norwegian experiences are presented.

The paper ends up with some reflections on the NSI's role in this field.

2. The information society - industrial structure and the supply side

2.1. From the industrial to the information society

2.1.1. The industrial structure

As a starting point, the emergence of the information society could be traced by studying the changing industrial structure throughout the 20th century. Table 1 gives a summary picture of the industrial structure of Norway since 1930 based on GDP from the national accounts.

Table 1. Gross domestic product (GDP) by kind of activity. 1930-1990. Per cent

		GDP by kind of activity. Percentages		
		1930	1960	1990
1	Agriculture, forestry and fishing	16.7	9.0	3.1
2	Oil production and mining	0.9	0.8	13.4
3	Manufacturing	23.0	21.3	13.7
4	Electricity, gas and water supply, construction	6.5	10.3	8.5
5	Wholesale and retail trade, hotelsand restaurants, transport and communication	27.8	35.4	21.1
6	Other services	25.1	23.2	40.2
1	Agriculture, forestry and fishing	16.7	9.0	3.1
2-4	Industrial activities	30.4	32.4	35.6
5-6	Service activities	52.9	58.6	61.3
1-4	Goods producing activities	47.1	41.4	38.7
5-6	Service activities	52.9	58.6	61.3

Source: Historical Statistics 1994, Statistics Norway 1995.

We are all familiar with the sharp relative drop of the agriculture sector - here by almost 14 percentage points from 1930 to 1990, and, specific for Norway, the rise of the oil production sector from nil to about 13 per cent of GDP in less than 30 years. Another perspective shows us a near constant share of GDP comparing 1930 with 1990 combining the two into some sort of extraction aggregate. Rising trends for service activities and for industrial activities - respectively by 8,4 and 5,2 percentage points over the whole period - and a drop (by 8,4 percentage points) for goods producing activities, are also structural changes mostly well-known. It might appear more surprising that the share of service activities in the total economy - measured by GDP - exceeded 50 per cent already in 1930, i.e. services contributing more to total value added than goods. Thus, in tracing economic development in Norway from the so-called *industrial society* to the *information society*, some may be puzzled by finding already at the dawn of statistical macro-economic measurement that the *service society* might have been the pertinent expression to use ! That is without taking into consideration all the service activities within households, that - by convention so to speak - are not counting in GDP.

Table 1 is based on the old system of the Norwegian national accounts. However, revised estimates for the period 1988-1993 based on the new system of SNA (System of National Accounts) 1993 and ESA (European System of Accounts) 1995 fit well in with the broad picture given above. Table 1 and 2 are not entirely comparable as the part of GDP not allocated to industries has been treated differently and has also been extended due to valuation of output and value added being changed from producers' prices in the old system to basic prices in the new system. Nonetheless, the structural trend is not much affected by this change of methodology. More substantively to note is that the share of service activities has been higher in the new system, now approaching a 2/3 share of the total economy.

Table 2. Value added by kind of activity. 1988-1993. Per cent

		Value added by kind of activity. Percentages of total value added	
		1988	1993
1	Agriculture, forestry and fishing	3.6	2.9
2	Oil production and mining	7.9	13.2
3	Manufacturing	14.6	12.5
4	Electricity, gas and water supply, construction	9.9	6.7
5	Wholesale and retail trade, hotels and restaurants, transport and communication	24.2	23.6
6	Other services	39.8	41.1
1	Agriculture, forestry and fishing	3.6	2.9
2-4	Industrial activities	32.4	32.5
5-6	Service activities	64.0	64.7
1-4	Goods producing activities	36.0	35.3
5-6	Service activities	64.0	64.7

Source: National Accounts 1988-1983, Statistics Norway 1996.

2.1.2. The developing services

Next, we should look further into the development of service activities. By looking into what happened later to the services that were already such a significant feature of the industrial structure at «start of statistics» in 1930, we will find a diversed picture that might give some insight into the development towards what became the *information society*.

One analysis of the service sector - based on a grouping suggested by Kantouzian (1970) and modified by Krantz (1987) in a Swedish study - leads to suggest quite different development after 1960 for individual consumption leisure-oriented services termed as *new services* (education, health and social work, cultural and sporting activities, repair of motor vehicles etc.), as opposed to *goods producing -related services* (such as distributive trade and transport services) with a steady decreasing trend over the last 30 years. Two other groups - counting together some 10 per cent of total services - i.e.other individual consumption services termed as *old individual services* as they were hardly affected by the industrialization (religious services, domestic services, sanitary services), and collective consumption *social collective services* (part of government services) - both have an almost constant share of total services over the whole period, the former somewhat downward, the latter somewhat upward in direction, however.

In looking back to item *other services* in the first table, with its increased GDP share of 17 percentage points (i.e. from 23 to 40 per cent) , we note a strong increase in the share of *new services* as well over the same period (about 15 percentage points in total value added of service activities). This is not the whole impact to *other* services, however, as therein has been also a considerable contribution from business-oriented services, such as financial services, business activities and communications. Alternatively, if separating out an *office-environmental services* part from that second large category and combining that part with *new services*, the upward trend for the combined category and the downward trend of the remaining part of *goods producing-related services* will be even more apparent.

Table 3. Services by analytical groups. 1960-1993. Per cent

		Total services by analytical groups. Percentages			
		Old estimates		Revised estimates	
		1960	1985	1988	1993
I	New services	8.4	23.1	22.3	23.4
II	Goods producing-related services	81.9	66.2	67.0	66.1
III	Social collective services	6.8	8.1	9.1	9.0
IV	Old individual services	2.9	2.6	1.6	1.5
I+IIa	New and office-environmental services	31.4	49.5	55.3	56.2
IIb	Other goods producing-related services	58.9	39.7	34.0	33.3
III	Social collective services	6.8	8.1	9.1	9.0
IV	Old individual services	2.9	2.6	1.6	1.5

Source: *Den Norske Informasjonssektoren,* Rapporter 88/32, Statistics Norway 1989, and special estimations for 1988 and 1993.

2.1.3. The information sector

Something seemed to develop with great strenght within the services' bulk, and this something created a new expression «the information sector» (Porat 1976). From American researchers this new concept made its entry into the work of OECD, who wanted to search for a universal trend beyond the US development. Two such aggregates were constructed by OECD, the primary information sector and the secondary information sector, the latter playing a secondary role and considered a supplement to the first. During the 1980s, several OECD-countries tried to estimate these information sector aggregates, in particular the primary information sector which was the easiest to associate with the expression as such. It was defined from industry-characteristic goods and services thought to be «information goods and services». They were defined rather detailed, meaning that some parts were easily translated to the appropriate grouping of goods and services in the national accounts, while for other parts this was not possible (e.g. Norway could utilize its detailed approach to define relevant information shares at the most detailed level for this part).

Calculations made in 1988 showed that the primary information sector amounted to between 15 and 20 per cent, and approximately 30 per cent when adding the secondary part. In general, the Norwegian information sector shares of the total economy were on the low side, however not unlike those estimated for Finland and Sweden. The figures for Norway were presented in percentages of total output (not GDP) with a composition indicated in the table that follows. It is evident from the contents of the various items that there is a good connection between the new services - that showed such a particular big increase relatively speaking during this late period - and the information services, which constitute the bulk of the information sector, defined in the OECD way.

Table 4. Primary information sector in Norway. Per cent of total output. 1985

	Primary information sector in Norway. Percentage shares of total output. 1985
	13.6
Information mediation and communication (education, museums and libraries, printing and publishing, post and telecommunication)	6.9
Information production (research and development, parts of business services)	3.5
Information handling (financial services etc.)	3.2
Information goods	3.6
Information investment goods (computers and other office equipment, radio, television and other electronic equipment, etc.)	2.1
Information consumption goods (radio, television and other electronic equipment, photografic equipment, etc.)	1.5
Primary information sector	17.2

Source: *Den Norske Informasjonssektoren,* Reports 88/32, Statistics Norway 1989.

2.2. The Information society

2.2.1. Information technology and the information society

Some central arguments can be focussed on from the previous paragraphs: The information sector is an important part of the economy, making up close to one third of the production in the Norwegian economy in the late 1980s. The information sector has emerged from the service sector, and partly with the development of new services. However, this has been a process long in the making. The service sector counted for 50 per cent of the Norwegian GDP already in the 1930s, and information has been a central factor in the economy for a long time.

However, new developments have taken place during the last decades. The information sector has introduced a rapidly expanding and changing new information and communication technology. As a result, the content and the structure of the information sector have changed radically. For the purpose of argument in this paper a tentative definition of **Information and Communication Technology (ICT)** might be: *technology used for producing, storing, manipulating and transferring data, text, sound and picture.* This technology is built up on basis of the digitalized «bit industry». The rapidity of change in this technology might be indicated by the fact that the price per bit of digital information today is said to be 0,1 per cent of the 1975-price level. With an information sector covering 30 per cent or more of the economy the potential impact of the new information technology obviously takes on great dimensions. A common hypothesis, therefore, is that this technology carries the potential for transforming important aspects of both economic activity and daily living - creating the Information society.

Various possible definitions could be made of the information society. A citation from a paragraph in an Australian paper makes a useful indication of the concept: «The term information society could be taken to mean the production and use of digital technologies by Government, business and household sectors. Emphasis is not perhaps on information per se but on progress towards the mobilisation and

use of information in digital form. An information society could therefore be described in terms of its production and use of digital products which would include the digitising of existing information» (Australian Bureau of Statistics 1996).

Taking into account that use of new information technology is adopted gradually in most other sectors, defined outside the strict information sector, the effect of new information technology is even more demanding. There are a number of examples on how new information technology have radically changed the actitvities in various sectors, for instance in the financial markets.

On this basis, statistics for the information society will be a global term that might comprise all sorts of statistics: economic, social, cultural, environmental etc. The implication is that the information society cannot be captured and described through the development of any separate statistical survey. If we want to give a valid description of the information society, we will have to incorporate (and extract) elements of relevance to the ICT into a wide spectre of the statistical landscape.

In this chapter focus is put on the need for statistics on the supply side and statistics on production of goods and services for the information society.

2.2.2. Information infrastructure

In Norway, more than one third of the households has installed cable-TV, and one in two households has access to either cable or private satellite receivers. The number of mobile phones has increased more than fivefold only during the 1990s, and the number of personal computers is up close to 70 per cent the last four years. Nearly one in five persons had access to the Internet either at home, at work or at school in the beginning of 1997, and the number has increased sharply during the last couple of years. These few examples illustrate that the information infrastructure already is important for the Norwegian society. With liberalisation of the networks and new competiton for network services, further increase in the access to network services and information equipment is expected.

The information infrastructure, defined as fixed and wireless communication and equipment which make it possible to store, process, transform and transport information, is the foundation of the information society. This concept of infrastructure covers on the one side local information equipment such as computers, modems, televisions and mobile phones etc, and on the other side equipment and networks linking these local units together. Both these elements are necessary conditions for the spread and functioning of the information society.

Throughout history, developments of transport and communication technologies and networks have strongly influenced the economic and social reality. The information society is expected to be realised via social and economic networks using telecommunications infrastructure. This has also been noted at in political arena. The political leadership in several countries has launched national initiative for developing better information infrastructure.

Traditionally, the concept of infrastructure has focused on the physical constructions. The ICT-based infrastructure makes further requirements of the networks. The physical constructions are still important, but it is equally important that the conditions for use of the infrastructure are adapted. Thus, the information society requires support also from an «information infrastructure». The information infrastructure is made up of the systems and standards for information exchange. In addition to the physical dimension, the concept of infrastructure in a broad sense will cover also software systems and standards that make it possible to exchange information.

Information has for long played an important role both for the market economy and for daily living. What is new is the efficient support offered by the new technologies and the telecommunications network. Digitalisation is driving towards the convergence of computing, telecommunications and television. Ultimately, it may be possible to provide all three services over a single network.

Liberalisation and commercialising are other important keywords in describing the development of the flow and use of information. Meanwhile, there is still lack of band-width to utilise some of the innovations e.g. in multimedia services.

2.3. Needs for supply statistics

The supply of information infrastructure is necessary for the development and functioning of the information society, and is taken as the starting point for the discussions in this chapter. Statistics on infrastructure will be crucial for an understanding of the developments of the information society and for comparisons both regionally and internationally. Secondly, the supply of information goods and services should be understood. However, the goods and services of the information society will be produced not only within the information industries, but also as a secondary market activity in other industries and as in-house non marketed production. Several analytical perspectives are relevant, such as: the relation between domestic production and imports and exports, the balance between market and non-market production, production of information goods and services as share of total economic activities and the shifting structure of production. Furthermore, a definition and a more detailed understanding of the information industries will be important. This will allow statistical analysis of the performance and the importance of the information industries. These are some of the perspectives making the foundation for the presentation of statistics for the supply side in the following paragraphs.

2.3.1. Statistics on Information structure

The statistics on infrastructure should describe the physical capacity and performance of technical networks or other facilities, that are necessary for supplying several service products. Information on the telecommunication networks - their capacity, characteristics, coverage, accessibility - is crucial for all actors in the field. Additional important statistics is *volume information relating to supply side, i.e.* statistical variables which give information about the use of the networks and the development of the output of the sector in «real» terms, i.e. in physical or performance parameters which are typically used in the sector, e.g. traffic minutes in tele- and data communication. The statistics should be possible to use as benchmark statistics, when using information from other sources for analyses.

A lot of these statistics already exist in most countries. Statistics on infrastructure should also give a description of local equipment. There is still a need for the «old indicators», like number of telephone main lines, number of televisions, mobile phones etc. Statistics on new equipment like number of computers, fax machines, modems etc should be added. The technological and commercial developments will also create a need for still new types of data, e.g. on transmission speed of the networks. Infrastructure is the domain where traditionally the statistics have been best developed. Since long the national operators have published statistics on the networks. However, the liberalisation of the market creates a new situation with several operators, which therefore gives the NSIs a new responsibility for developing statistics. Information on the networks and the use of networks can be taken from the operators. Information on the local information equipment can be produced through household surveys and surveys on the use of information technology in organisations.

Eurostat has launched a project (COINS) for developing information and communication statistics of central importance in this context (Eurostat 1996). The four sub-sectors of the project are telecommunication infrastructure, telecommunication services producers, telecommunication services and telecommunication services users and usage. A pilot study, covering the first three sub-sectors, will be carried out in 1997.

2.3.2. The Information industry. The challenge of industrial classification

The products and services of the information society are produced in a number of different industries. There is no such group as «the information industry» according to the Standard Industrial Classification. This implies that the information industry is not really defined in the international industrial

classifications in use. Furthermore, important parts will be found within the service sector, which traditionally tend to be poorly covered by statistics. At the outset, therefore, producing the necessary supply side statistics for the information industry is a most demanding task.

The first task for establishing supply side statistics might seem obvious: The information industry needs to be defined according to the industrial classification. This is a prerequisite for producing supply side statistics comparable with other industries of the economy. The challenge has been taken up by several actors. In 1997, North America will adopt a broad definition of the information industry (Statistics Canada et al. 1996). Eurostat has prepared a paper «Information industries from the classification point of view» (Eurostat 1996b). Both Sweden (Statistics Sweden 1996) and Finland have made proposals, and the task has been more or less explicitly visited in surveys on the information industry in other countries (e.g. Australia) (Australian Bureau of Statistics 1996). In this paper, we will not take a position on the definitions used and proposed. However, we recognise that there are common elements in all the proposals. Possibly, therefore, a number of core information industries could easily be agreed upon. Telecommunications, computer industries, radio and television services might be examples of such core industries. The further challenge will perhaps be to make definitions that are both sufficiently complete in coverage and at the same time sufficiently simple and practical to be integrated in the statistical system.

Different industries fill different functions in the information society. This could be used as a basis for making categories of industries with different relations to the information society. This is taken up in the Eurostat paper, in which the following categories are identified:

1) *Operating:* industries operating the system, telecommunications, data processing services and technical operation of the information system.
2) *Material production and distribution:* industries producing or distributing equipment for production or consumption of ICT-products and constructing the relevant networks
3) *Service, information and content production:* industries producing the services and information products for the network and closely related industries.

The use of the industrial classification for defining the information industry might uncover a need for revising the classification, and make it more suitable for the purpose. To what extent this will be necessary is not dealt with here, but will be discussed in a later presentation at this seminar.

2.3.3. Structural statistics

The kind of analysis to be taken from structural statistics on the information and communication industries (ICT industries) is well illustrated in a Canadian paper (Statistics Canada et al. 1996). After having defined the ICT industry on basis of the industrial classification the importance and performance of the industry during the first half of the 1990s are analysed. In addition to indicating the importance of this kind of analysis, the results give a picture of an expanding ICT industry outperforming the rest of the economy in these years. Some of the Canadian conclusions are described in this way:

- By 1995, the ICT industry (service and goods sectors) contributed 6,8 per cent to Canada's GDP, up from 4,9 per cent in 1990. Including the self -employed, the ICT service and goods sectors employed 3,1 per cent of total employment in 1995 as against 2,8 per cent in 1990. (The Canadian ICT industry is defined more ?? than in the OECD-study refered to in chapter 2.1).
- The ICT sectors consistently outperformed the economy as a whole. Between 1990 and 1995, GDP in the ICT sectors increased by 50,0 per cent whereas the economy grew by only 7,7 per cent. GDP growth was more pronounced in the ICT goods sector than in the ICT services sector.

- The ICT sectors employment grew by 11,2 per cent during the 1990 to 1995 period, substantially faster than the 2,6 per cent in the economy at large. This increase was attributable to the ICT services sector, as the ICT goods sector's employment actually declined.
- The ICT sectors' revenues and profitability also significantly outperformed the economy averages.
- In 1995, R&D by the ICT sectors accounted for 36,1 per cent of total private sector R&D expenditures in the economy, considerably more than the ICT sectors' relative contribution to GDP and employment.

Basic structural statistics on employment, accounting variables, business demography etc. are of central importance for all industrial statistics. For long, this has been a fundamental building block in the national statistical systems. Presently, important activities are developing in Eurostat to establish a comparable system of structural statistics for all industries at the European level. This is done within the framework of the regulation on structural business statistics. There is an obvious need for this kind of statistics for the producers and suppliers of the ICT industry as well.

Once the ICT industry has been defined according to the industrial classification, we have the necessary basis and frame of reference for producing (or extracting) structural statistics. At the outset, the statistical challenge is then similar to the requirements for structural statistics in other sectors of the economy. The purpose of structural statistics should be to describe the information industry according to its size, structure, importance in the total economy etc. This could be done by a rather limited set of «classical» economic variables. For several of the information industries, these structural statistics will already be (or about to be) obligatory at the European level under the regulation on structural business statistics. However, there will be a need for regrouping activities to construct statistics according to the definitions and industrial categories adopted for the ICT industry.

A list of relevant variables for the structural statistics should be defined. Inspiration for such list could be taken from many sources. Comparability is imperative. The requirements from national accounts should be used as an obvious frame of reference.

To monitor the geographical spread and variations in development of the ICT industry will be important. At the national level regional distribution of activities and local importance is central. At the international level, comparisons between nations will be needed.

2.3.4. Information goods and services. Market production and trade

The structural statistics will provide a rough picture of the ICT industries. Statistics on the output and trade in the goods and services of the information society will supply more detail and a better coverage. Firstly, the output of establishments within the ICT industry should be broken down by type of goods and services. Secondly, and as pointed out in chapter 2.3.3, information goods and services will be produced also outside the ICT industry, either as secondary market activity or as non-marketed in-house production. To give a more complete picture of the supply side of the information society these activities should also be described statistically.

To some extent this is again a question of classifications. Information goods and services should be classified and regrouped according to the international product classifications (CPA/CPC). International trade in information goods should be classified and regrouped according to the international trade nomenclatures (UN Harmonized System). The Eurostat paper "Information Industries from the classification point of view" makes suggestions as to the products of relevance. As a stream of new products will be produced within the existing industries, the need for revising the product classifications (CPA etc) might be more imperative than for revising the industrial classification. As a recognition of this, Eurostat has already made proposals for a revised CPA for the telcommunications industry.

With high proportions of R&D and Innovations the supply side of the information society will change rapidly in the years to come. Statistics based on products will catch the dynamics of the supply side in more detail. Presumably, a flow of new information products will arise in the coming years. The changing structure of production should be described as technologies change. The statistics should describe the balance between goods and services, and the rise of new and fall of outdated products. The international specialization will be covered by international comparisons.

The relation between exports, imports and domestic production should be described. The foreign trade statistics will, however, meet new challenges as trade in services increases. International trade based on internet shopping by credit cards will put yet another challenge to the trade statistics. As increased globalization will be an effect of the information society, it is important, somehow, to find ways to measure the new patterns of trade.

2.3.5. In-house production

So far, focus has been on market production. To complete the supply side statistics, also the in-house production should be taken into consideration.

Many services of the information society could either be bought at the market or produced in-house. A familiar example: A NSI database for regional statistics could be established by in-house resources, or the computer services could be supplied by external consultants. In house production of information services is extensive in many industries and for many types of services. For illustration: An Australian survey conludes that in-house support costs constitute about 30 per cent of total operating expences on information technology and telecommunication of government organisations. In Norway, a similar estimate of about 25 per cent is made for the central government. If the ambition is to assess the size and structure of the total supply side information production, these activities cannot be neglected.

Obviously, for the actors in the market a knowledge of the balance between in-house production and market production for the different industries and for the different products is important. In-house production is a potential market for the commercial operator. With new technologies the balance between market and in-house production might change, and knowledge of both sectors is necessary to have the right understanding of total development. Knowing only the market production would be misleading in an environment of increasing outsourcing of in-house production. Thus, for several reasons, it seems important to also include in-house production in the supply side statistics for the information society. The foundation for these statistics will be closely related to the surveys on use of information technology in organisations.

3. Use of Information and Communication Technology (ICT) at work and leisure

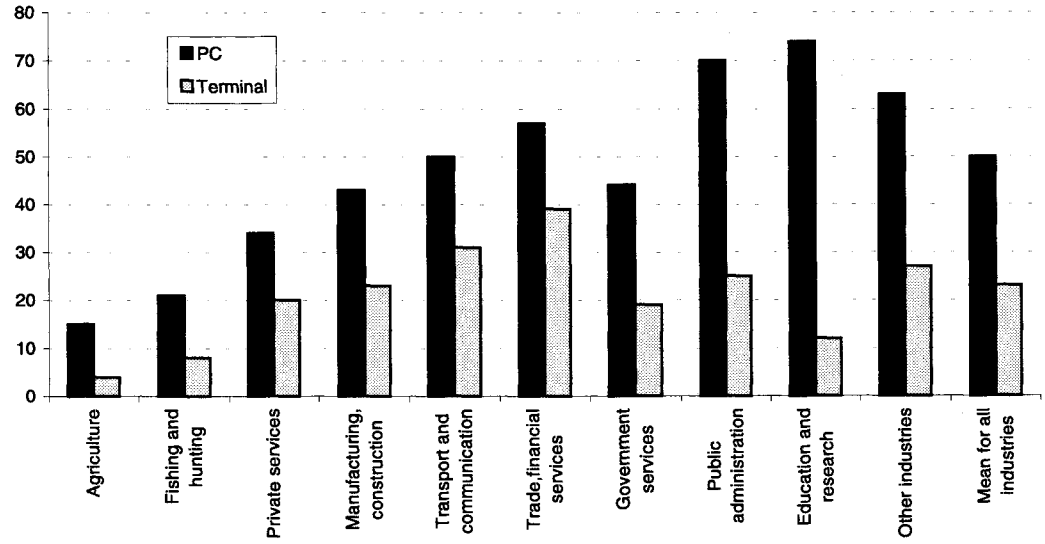
To what extent is ICT used at work and leisure? The intention of this chapter is to examine the diffusion of ICT. Is there any significant changes in the way we carry out activities at work and in the home? This will mainly be searched for by looking at the time spent using ICT, both at work and in the home. Some of the most potential areas that may be affected are use of PCs, teleworking, information habits and skill structure. However, the conclusions are uncertain because of the limited empirical material available.

3.1. ICT and PCs at work

We do not have data that describe the exact time spent working with ICT, but in general, three out of four employed persons in Norway used a PC or terminal more or less as a daily tool in 1994 (see figure 1). Looking across different industries, the employed in the service industries are the most

frequent users of PC/terminal. Furthermore, 35 per cent among those who used a PC also used electronic mail.

Figure 1. Percentage shares of employed persons using PC/terminal in different industries. 1994



Source: Telenor R&D 1995, not published data.

It is interesting to take a closer look at the use of communication services in the service industries. Table 5 shows shares of firms in the business services industry in Canada (which approximately has the same PC-density as Norway) that use communication services extensively. The figures tell us that traditional communication services are being frequently used while the new communication services are not, e.g. facsimile vs. electronic text-message. Even if these industries have a high PC-density, the possibilities for electronic communication are utilised to a small degree only. This indicates that firms take time to identify the most efficient way to use new technology, which is in accordance with earlier studies of diffusion.

Table 5. Use of communication services in Canada by the business services industry. 1995

Services	Per cent of firms using the services all the time by size of firm			
	All firms	Small	Medium	Large
Local telephone services	100	100	100	100
Long-distance tel. services	41	41	48	38
Facsimile	73	70	87	88
Data transmission	19	16	29	39
Voice mail	13	11	16	30
Electronic text messages	7	5	16	25
Teleconferencing	2	1	6	5
Internet	3	2	6	5

Source: Statistics Canada et al. (1996).

3.1.1. Information society and skill structure

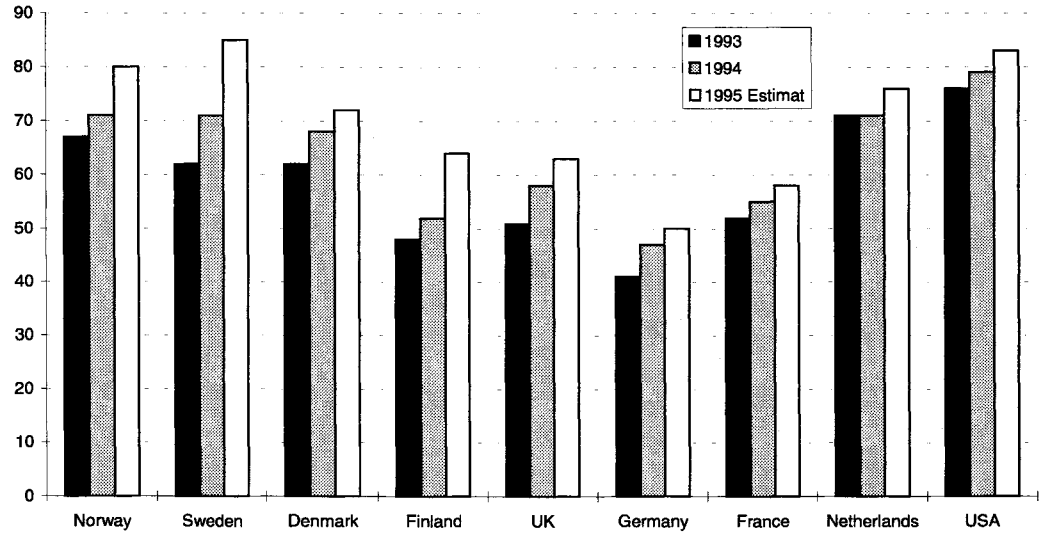
In the previous chapter, structural changes from an economic point of view have been described. Structural changes also appear in the workforce.

- There has been a growth in the number of jobs in the service sector and a loss in manufacturing: The service sector shares of employment: From 37 per cent in 1950 to 69 per cent in 1995
- and levels of educational attainment are rising: 6,7 per cent of persons 16 years and over completed highest educational level in 1970, increased to 19,5 per cent in 1994

This indicates a shift to a more knowledge-based economy. Transformation of information is in general assumed to be more dependent on knowledge and competence than transformation of material and energy. The contemporary employment problem is frequently articulated in terms of movement from 'industrial' work to ICT-intensive 'knowledge work'. The skill of professionals is more often seen as a great competitive advantage. More than ever, the ability to develop and harness technology rests on the ability and quality of a skilled work force. Technology, as a sole agent, will not increase productivity.

OECD has earlier made an effort to describe information occupations. That examination had a very wide scope and the mean value (for 12 countries) of information occupation amounted to about 32 per cent of total occupations in 1975 and 36 per cent in 1981. Finland has recently used the OECD-classifications on information occupations and found that appr. 44 per cent of the labour force worked in information occupations, compared with 30 per cent in 1981. The fast increase in information occupations shows that an important aspect of the economy has changed and that information and knowledge are crucial. Figure 2 shows that most white-collar workers use ICT as a tool in their work, and this share is sharply increasing over the years in all countries. The figures are uncertain (1995 is estimated), but indicate that a large and growing part of the employed in information occupations is using ICT as a tool in their work.

Figure 2. ICT-places of work in some countries - percentage shares of white-collar workers



Source: IDC (International Data Corporation), 1995.

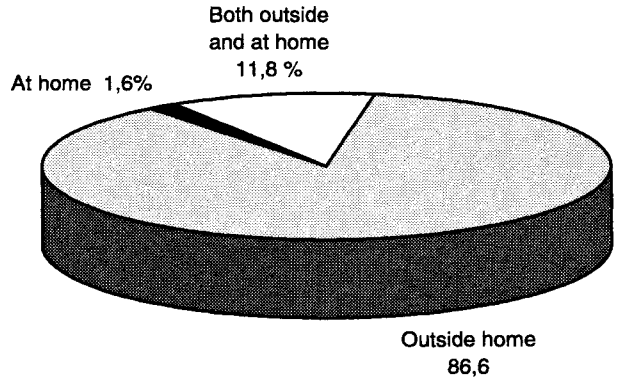
Is the requirement of skill reflected in a growth of knowledge and competence? With respect to the rising educational level we should think so, but we know little about the relationship between human

capital and the corresponding actual demand. This is something that is badly covered in statistics and should be more emphasised since it becomes more crucial in today's information society.

3.1.2. Teleworking

Another trend that enters into many visions of the future working life is teleworking. ICT gives new possibilities for working at home, which open up for a lot of possibilities with respect to localisation and organisation of work. To what extent have these visions been realised already? Figure 3 illustrates the situation in Norway in 1994, showing that 13,4 per cent of the employed executed whole or most of their work at home. However, it was few who worked at home exclusively. 'The teleworkers' mainly used simple means to keep in contact with the employer (telephone, telefax and mail), but a significant part also used more advanced communication techologies (e.g. teleconferencing, e-mail). Not all the persons feferred to in figure 3 use ICT in their work at home. To describe the whole population working at home as 'teleworkers' would then be wrong.

Figure 3. Teleworking in percentage of employed. 1994



Source: Bakke, J.W.: Fjernarbeid - en visjon i forandring (Changing scenarious of teleworking), Telenor FoU, Forskningsnotat, 1995

A corresponding survey in Sweden showed a higher share of teleworking (TCO 1995), i.e. 29 per cent of the employed worked at home either from time to time (23 per cent) or regularly (6 per cent). However, the two surveys are not comparable because the Swedish survey included work at home with a lower time limit than the Norwegian survey.

3.2. Use of ICT for private purposes

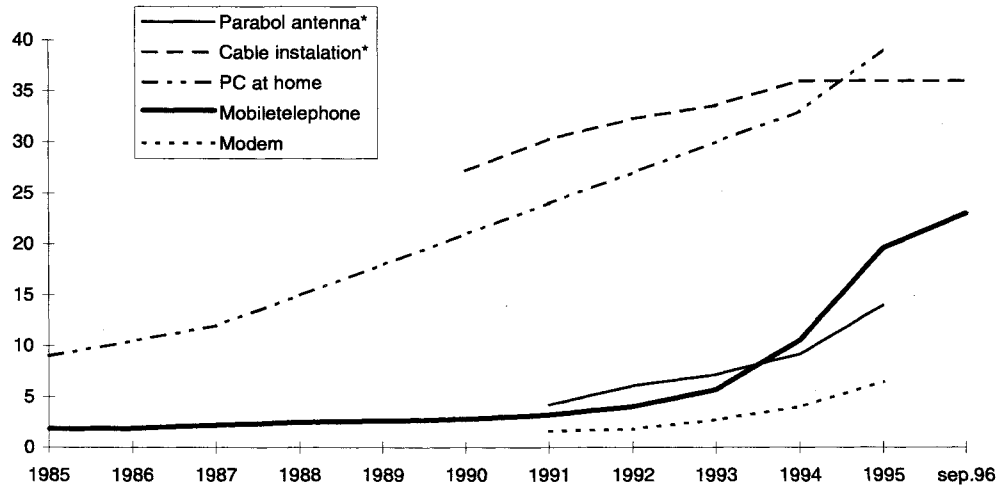
So far we have dealt with the information society from the 'working life' point of view.
If we want to know how ICT affects and changes our society, we also need to take the 'leisure society' into consideration. Technological developments have changed the work in the households throughout the history and more services have become commercialised. We have seen above that in the development of service activities, individual consumption leisure-oriented services have had a sharp increase over the last 30 years as opposed to goods producing-related services. The surveys of consumer expenditure confirm this development, and more people apply ICT-equipment in their homes that may change some of the daily domestic activities. In what way and to what extent will ICT affect our daily life?

The use of time is important in this context. Will ICT save time because of increased efficiency in doing old activities in a new way? The marketplace in a physical meaning becomes less important

because more consumption and transactions of services may be carried out from home via e.g. telebanking and on-line services. This may, in some instances, lead to a transfer from physical communication and transactions to electronic communication and transactions executed from the home. In Sweden, a survey of the persons' use of telecommunications as an element in the total communication system has been completed. The objective was to link the use of telecommunication to actual travelling by adding questions on the use of telecommunications to the regular surveys of persons' travelling patterns. The hypothesis is that electronic communication and transactions will replace physical communication and transactions. Another question is whether ICT will change the allocation of time because of time spent on new activities and services. ICT brings the opportunity to use new services that may change information habits.

First of all, let us look at development of access to the infrastructure. Figure 4 displays the development of different electronic media which all show an increasing rate over the years. Compared with the development for television, the spread of PCs has not been equally fast. After ten years with television in Norway (1970), nearly 75 per cent of the households had acquired a TV set.

Figure 4. Percentages shares of population with access to infrastructure in Norway



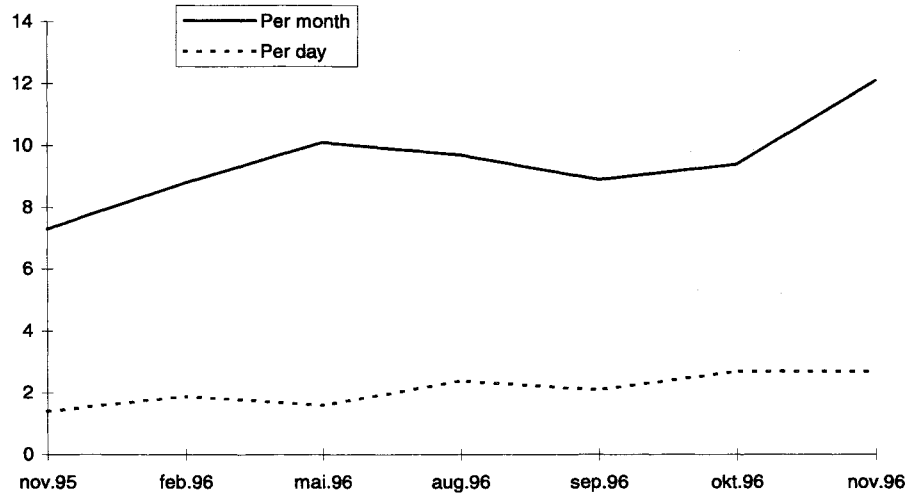
* Percentage of households.
Source: Vaage (1996) and IDC (International Data Corporation): PC Hardware, 1995.

We are now interested in the actual use of ICT equipment. One out of ten uses a PC an average day in about one and a half hour. Among the users, the time spent is rather high, but gets less significant when divided on the whole population (Vaage 1996).

The group of people between 20 and 24 years, that spent most time with a PC (i.e. 19 per cent), used it in 161 minutes on an average day. It is observed a huge gap between generations, and a decisive point is whether the use will follow the group the rest of the life or will be specific for the young generation.

The development of the use of internet has been of special interest. Figure 5 shows the use of internet on an average day and within a month in Norway. The survey does not separate between use at work, at school or at home. Among those who have access to internet, 44 per cent has access at work and 27 per cent respectively at school and at home. The survey also tells that internet was used for e-mailing, searching for information or news, reading newspapers and searching for companies.

Figure 5. Use of internet per day and month



Source: Norwegian Gallup (1996).

For quite a lot of users, internet is used for home working. This indicates that the use of computers and the use of modems and internet have introduced competing or supplementary alternatives to the classical ways of communication and collecting information into the household sector. The use has increased sharply during the last year, but is still of limited size.

In general, the use of ICT at home is not very high so far compared with the use at work. However, almost all graphs and figures which show the development over time are sharply increasing. The development has to be followed for a longer period, and statistics have to be improved before definitive conclusions about the effects can be stated.

3.3. Need for user statistics

To chart the use of ICT from the perspective described above, questions obviously have to be directed to individuals. Also use in organisations may be charted using the individual as a unit. Surveys which examine individual use of ICT have the advantage that they both may examine the use at work and in the home.

Use of ICT could be covered through separate sample surveys for this purpose or through integrating questions on use of ICT into other and already existing surveys. Current surveys of interest are time use surveys, household budget surveys and the survey of living conditions. The most obvious information that will be required concerns the following aspects:

- who are the users of the networks
- the extent of the use in terms of time and costs
- use of different services and applications
- competence and knowledge

Models for this type of surveys have been developed by e.g. Australia and Sweden. Some agreement on the variables to be covered will be necessary for international comparisons.

Statistics on infrastructure and networks will make a link between the supply side and the user side. Information on the existence of central infrastructure could be collected from the companies

supplying the networks. These companies could also supply some information on the use of the central infrastructure. Information of this type will also be collected in the user surveys. The existence of local and private infrastructure covered as part of the individual use may complete the picture. Statistics along these lines should be able to give the necessary description of the use of infrastructure for the information society.

4. Information as technology change - the productivity paradox

4.1. Usages of information products

In the last section, we have looked at the use of ICT at work and leisure, particularly from the viewpoint of volume indicators and time use. Let us try to complement this kind of usage information by adding to it some economic data. In the introduction, on the information sector, we have presented output figures on information goods and services. Some words might be added on usages of these information products. In looking into the supply and use of the information services and information goods listed in table 4, we are able to extract information that could be summarized as follows (based on 1993 data, approximate shares) for the services part:

Table 6. Uses of groups of services in broad outlines. Percentages

Business services	75 per cent as intermediate consumption, 10 per cent as gross fixed capital formation (technical business services), smaller parts to exports and final consumption
Financial services	80 per cent as intermediate consumption, 10 per cent as final consumption, less than 10 per cent as exports
Postal and telecommunication services	70 per cent as intermediate consumption, 20 per cent as final consumption, small parts as exports and gross fixed capital formation (own-account construction)
Entertainment services	75 per cent as final consumption, more than 20 per cent as intermediate consumption
Travel agency services	70 per cent as final consumption, 30 per cent as intermediate consumption

Source: National Accounts for 1993, Statistics Norway.

For the less important part containing information goods, we have looked for the gross fixed capital formation component in particular. For printing and publishing products there are no such usages; for radio, television and communication apparatus there are some limited products involved (not much); for the instruments group, gross fixed capital formation takes about 30 per cent of total usages, while for office machinery (including computers) some one-third of total usages has been estimated as gross fixed capital formation.

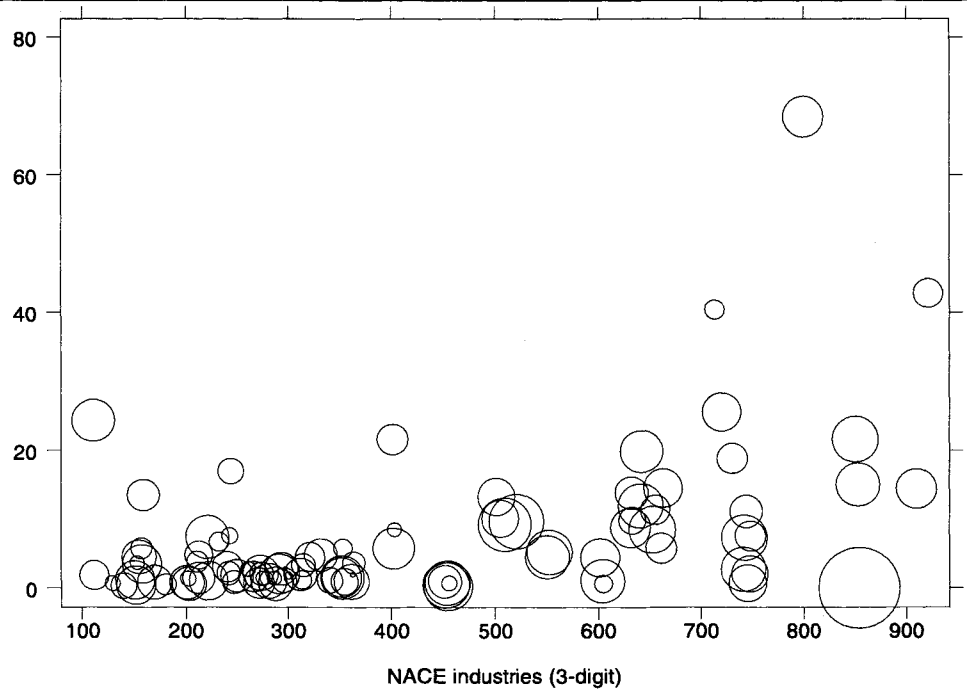
4.2. Where have all the chips gone?

In total, computers and office machinery investment was estimated at 9,1 billion NOK in 1993, i.e. between 5 and 6 per cent of total gross fixed capital formation (or close to 9 per cent for mainland-Norway). This item also contains office furniture, but electronic machinery (computers, copy machines, printers etc.) still counts for the major part.

To get a closer look at the effects of ICT technology on the economy, it is useful to identify which industries have invested most heavily in ICT technology in recent years. In other words, where have all the chips gone? A first try (for Norway) to approach this question has been made on the basis of detailed figures from the National Accounts for 1993. We have looked at the distribution by industry of the product group already referred to: computers and office machinery. The intermediate consumption part of this product group has been eliminated, in other words, we have identified from the commodity flows of the national accounts the industry breakdown of computers (and office machinery), here regarded as an indicator for ICT investments.

Figure 6 shows that ICT investments (per hours worked) tend to be highest in non-manufacturing industries (see Appendix D). Clearly, these results raise more questions. Are they really true, or isn't it more likely that ICT investments in manufacturing are embedded in machinery and equipment not classified as computers and office machinery. If we tentatively associated ICT investments with products (heavy) loaded with microchips, one would like to see where the distribution of chip-use across industries occurs. Furthermore, one might want to distinguish between chips embodied in production equipment and chips used as material inputs, e.g. the productivity gains from these different uses of chips might typically be quite different.

Figure 6. Investments in «computers and office machinery» per man-year in 1000 NOK for 3-digit NACE-industries*



*The size of the circles indicates the level of employment in the sector.
Source: National Accounts for 1993, Statistics Norway.

It is useful to give some early warning to the quality of the above-mentioned investment figures. Among the high-ranked non-manufacturing industries in terms of ICT investment per hours worked, we find industries like wholesale and retail trade, financial intermediation and insurance. The industry allocation of detailed items of gross fixed capital formation as such is not firmly based, and as we shall see later, the general problem of statistical deficiencies for services industries in particular is a

topic of main concern. Thus, improved data on gross fixed capital formation in the services industries are among the most pressing needs for improving the quality of the national accounts estimates.

Another important issue is how useful the hardware investment figures are as indicators for the distribution of total ICT investments across industries. We know that hardware investments constitute only a relatively small fraction of the total investment associated with ICT investment; it has been argued that less than one third of the ICT investments is hardware, while the remaining two thirds are software, maintenance and training (Statskonsult 1996). But even if the hardware is only a fraction of the total investment, the hardware might still be a useful indicator for the distribution by industries if software and training investments tend to follow the hardware investments. We need more information about this, and on the issue of software in general.

Software has a new treatment as gross fixed capital formation in the new national accounts system which Norway has adopted, but we need more time for it to be implemented in basic statistics and subsequently in the national accounts. Presently, only specific software data available have been implemented in the revised national accounts. Few countries have only some explicit items in their basic statistics referring to software. Often accounting practices or tax rules determine the assumption on how enterprises fill in the surveys. Guidance on software in basic statistics is very weak, and mostly due to the fact that many surveys were designed in an era when software was not yet an important part of costs.

It has been documented in a number of studies that training and maintenance costs constitute a large fraction of the investments associated with ICT-projects, and that these complementary investments are essential for the success of the ICT-projects. Unfortunately, few official statistics, or even basic statistics, are available to through light on these complementary investments in training and maintenance costs. Statistics on these kinds of investments clearly needs to be developed to quantify the role ICT-technology in the economy.

4.3. The Productivity Paradox

The question «Where have all the chips gone ?» brings to our attention a most debated issue these days, referred to as The Productivity Paradox. It is known as one of the puzzled feature of economic development of the last decades, i.e. productivity gains in the big industrial economies have slowed sharply despite huge spending on software and ICT. Labour-productivity growth in the big seven economies has dropped from an average of 4,5 per cent a year in 1960-1973 to a mere 1,5 per cent since then. US data point in the same direction, from some 2,5 per cent to less than 1 per cent. Among explanations given to this paradox, it is suggested that standard economic statistics are failing to capture them (The Economist, September 28th 1996).

«The tools used for measuring productivity are more suited to the output of 19th-century dark satanic mills than 21st-century electronic wizardry», is a picture used for making this point.

And a famous American economist - Robert Solow - once remarked that «you can see computers everywhere but in the productivity statistics».

And more discouraging, the notoriously hard measurement problem in the service sector and the structural change in the economy towards an increasing weight to services, would make the paradox more of an increasing serious problem as time elapses. No doubt, the reputation of statisticians seems to be under attack.

One possibility, that would be favourable for the statistician, is that there are delays in realising potential productivity gains because of organisational, social and institutional factors. Former technological breakthroughs show that there is often a delay of several decades before it deliver

economywide productivity gains. Producers take time to apply new technology and to make organisational changes. This means that we need to follow the development for a longer period before making any conclusions. But is this acceptable and how long do we have to wait to capture the results in the statistics?

Statistics Norway - from its recent main revision and pioneer work in introducing the new international standard of national accounts - has tried to explore whether:

- this «development» strikes a small country like Norway as well?
- the measurement problem as encountered here - to some extent at least - has been tackled by this recent new statistical development in Norway?

4.4. Avenues of productivity measurement

To explore this, and in establishing adequate productivity measures, a number of challenges and obstacles confront the statisticians in their practical work. They may fall into three groups:

(i) choice of concept
(ii) basic measurement
(iii) choice of deflation methods and price measures.

Type of productivity measure could include at least labour productivity, capital productivity or total factor productivity. We have confined discussion here to labour productivity. In measuring labour productivity, some standardization seems necessary on a conceptual level to avoid a wealth of different labour productivity measures. See Appendix A for the issue of choice of productivity concepts. For reasons of international comparison at least, making a standard choice (or a few) may prove fruitful and should be aimed at. Labour productivity in a sound macroeconomic framework could be measured by output per hour worked, output being valued at basic prices and deflated in a statistical input-output framwork (from which emerges a better statistical basis for output than for value added figures by industry). Before the new international system of SNA 1993 / ESA1995 has been implemented in most countries, the labour productivity concept in most common use is likely to remain as valued at producers' prices per persons employed, however.

Basic measurement should here be associated with the compilation capability in current prices. The quality of production data in most countries tends to vary a great deal by item and by industry - i.e.

- output usually has a better quality than intermediate consumption
- more unsolved problems in service industries than in goods producing industries.

The productivity paradox discussion in the United States, involved using a rough dividing line between «reasonably measurable» sectors, and «unmeasurable sectors», the latter for which the situation is not much better today than it was at the beginning of national accounts. Griliches (1994) referred to US data, pointing out that «measurable» sectors in the US amount to just 30 per cent of GNP in 1990, down from nearly 45 per cent in 1959. Measurement problems thus have indeed become worse. The measurable sectors, according to Griliches, are defined to include agriculture, mining, manufacturing, and transportation and utilities.

Choice of deflation methods and price measures play a most significant role for constant-price estimates or volume measures which again are prerequisite for designing productivity measures. Although compilation of current price estimates is also problematic, in many activitites and services in particular, a lot of challenges are facing us in making the step from current estimates to constant-price estimates. Most important are:

- the design of appropriate framework
- the choice of direct or indirect price indices
- refining the price or volume indices.

The framework of detailed supply and use tables (i.e. statistical input-output framwork) and using the double deflation method is in general considered the most ideal vehicle available to constant-price estimation, although modifications might seem appropriate in special cases. Choice of price indices is a question of choice between direct or indirect use of price indices, the latter to be applied when direct volume indicators are preferred in terms of overall better quality. And not the least, refining the price or volume (whatever the choice) indices should challenge the fundamental problems of delimiting the quality aspect from the genuine price part, and furthermore find the relevant price indices for the particular uses. Countries should seek improvements towards all these three aspects. Hedonic price indices are a new development to the latter aspect, into which the search for appropriate price indices on computers has gained much attention these days.

Griliches (1994) has emphasized that we might miss a technological «revolution» in the manufacturing industries, as our price indices do not properly account for technological change and quality improvements in outputs (and inputs). Using the well-known example of price deflators for computers for the US (based on a hedonic price index from Bureau of Economic Analysis), Griliches shows that a proper deflator for computers reveals a dramatic productivity growth in the industry producing computers, and he suggests that computers might not be quite as outstanding as we tend to think. However, hedonic price indices are unavailable for almost all sectors, so the presence of a revolution going on that we do not see can not be ruled out - even in many manufacturing industries. The available statistics leave much scope for speculation in this perspective.

4.5. Norwegian case: what data environment and revision mean to labour productivity

We now turn to the Norwegian data to face the questions announced concerning the productivity paradox. Recalling that Solow did not trace evidence of ICT development in the US productivity statistics, we might be tempted to suggest that the main conclusion from analysis of the Norwegian data is a more positive one, although deficiencies occur even after the recent main revision of the national accounts in Norway.

To illustrate the Norwegian case, we have considered both the formerly published figures on labour productivity to look for comparable development and features as revealed by the US data, and furthermore considered the revised data published for the period 1988-1993* and the recently published data for the period 1981-1987 to look for still more improvements made over the years to Norwegian productivity data.** The time perspective thus would be 12 years (1981-1993), hopefully long enough to see any developments along the time axis.

We look at two concepts of labour productivity, output per hour worked and value added per hour worked, partly to detect the differences between the two. The revised figures use basic prices, the former figures producers' prices.

Main results for the total Norwegian economy could be summarized as follow:

- average annual growth in labour productivity is between 2,5 and 3 per cent for total economy
- an uplift for both concepts in the most recent period (1988-1993) compared with the former period

* National Accounts 1988-1993 (Statistics Norway 1996).
** National Accounts 1980-1988 (Weekly Bulletin no. 6/97, Statistics Norway).

Thus, increased weights for the service sector in the revised estimates have given the opposite statistical effect in Norway than stated as the American productivity paradox. The weighting factor was stronger for the US than Norway, however, as the drop in «measurables» (see Griliches above) in Norway was 5 percentage points from 1960 to 1990 compared with a 15 percentage points drop in the United States (see Appendix C). Statistical explanations behind the more uplifting result for us are at least two:

- significant improvements in basic statistics over the recent decades (particularly the 1980s) for a good part of the service industries
- the recent main revision and the implementation of the new national accounts system.

The effects of the revision are illustrated in Appendix B. If the recent revision had not occurred, total output per hour worked would have remained 0,3 percentage point lower as an average over the whole period, while GDP per hour worked was unaffected. The increasing trend from first to second period, however, could not be traced in the former estimates.

Then, let us have a further look into the two sub-sets of industries, manufacturing and the remaining ones. Main results for manufacturing could be summarized as follow:

- the concept based on output shows a steady growth at some 3,5 per cent
- the two concepts differ more for manufacturing than for the total economy
- there has been a clear negative trend over the period using the value added measure, but not for the output measure.

We suggest that the output measure is the more reliable of the two, given the data environment of the manufacturing industry. The discrepancy between the two measures is even 2 percentage points in the most recent period when the commodity flow technique has been more utilized than in the first period. The factors behind this drop should be further examined.

Labour productivity growth in the non-manufacturing industries with a heavy weight for the service sector is still estimated to between 2,5 and 3 per cent on average.

- 2,7 per cent applying the output measure
- 2,9 per cent applying the value added measure

The small difference suggests that which of the two measures to apply should not be that important for the non-manufacturing group. Both in the former figures and even more in the revised figures, we suggest that Norwegian data do possess a considerable growth of productivity in the service sector as a whole. Productivity growth of 2 - 3 per cent in the service sector is far above the «zero-sized» contribution from the service sector as indicated by the American critics. Service activities with significant labour productivity growth may be evidenced from two examples:

- wholesale and retail trade now come out as an average industry, not differing from first to second period, but after a considerable upward revision
  - value added measure revised from 1,6 to almost 3 per cent
- post and telecommunications (particularly the latter) show both a very high level of productivity growth, and a quite remarkable increase from the first to the second period
  - value added measure up from 5,5 per cent in the first period to around 12 per cent in the second

We might be tempted to suggest that the formidable and increased productivity growth recorded in the telecommunication industry reflects recent trends of increased information technology.

4.6. Needs for improved national accounts statistics

Before modifying the view that the situation in Norway seems to be stabilized and beyond critics - on the contrary, Norway faces part of the «unmeasureable statistical paradox» as well. Some kind of statistical infrastructural work is needed in most countries, such as:

- establishing and upgrading the quality of the statistical sources in the service sector
- establishing better and more relevant price indices in this area
- establishing a wider effort on labour accounting, including the appropriate labour input data of hours worked
- establishing supply and use tables on current basis

The first three points speak for themselves. On the last point, we should emphasize that supply and use tables on current basis are extremely useful and important for the consistency work and to validate the national accounts estimates, and thereby the quality of national accounts data and the derived labour productivity measures. It is interesting and encouraging to know that on this last point most European countries now are developing or having recently developed such a framework of supply and use tables to join the relatively few countries (including Norway) that have used this tool for a long time.

National accountants all over the world including Norway, do strive with the service industries, both in terms of finding the appropriate statistical sources to use, including the relevant indicators and refined enough for appropriate use (see above). Also revealed by the Norwegian data, there are at least three major areas in the service sector that are particularly weakly covered in terms of productivity, and which should be improved in the years to come. They are:

(i) non-market producers, i.e. central and local government services, and NPIs
(ii) financial services
(iii) business activities.

In these areas, Norway meets the «unmeasureable paradox» as - roughly speaking - labour input is used both in the numerator and the denominator to rule out any productivity growth.

To a limited degree, national accountants , by convention, have allowed introducing labour productity into the compilation in the government industries to remedy the basic problem of using a cost principle for output and value added measurement. But the real challenges are still there, indicated in the new international standards. i.e. to provide direct output volume measures for the constant-price estimation (while still keeping the cost principle for the current-price estimation).

We are, however, not very optimistic about the readiness for providing direct output measures for government in the near future, but we should take on board this general challenge for the forthcoming main revisions of the national accounts.

From Norwegian data, it is clear that ICT investment per hours worked has been among the highest in a number of the government industries (see Appendix D). An analysis of the government sector in Norway (Statskonsult 1996) found that while one out of three employees had direct access to a computer in 1988, the number had increased to three out of four in 1995. In the government sector, thus, an ICT revolution might be going on invisible from the view of official statistics.Diffusion in terms of computer density is probably completed in the government sector. However, the same analysis also presents a long list of productivity enhancing steps based on ICT technology that are expected in the years to come.

Employment used as a volume indicator in industries such as financial services and business activities is not defendable, we should be able to do better. National practices in the countries do deviate a lot , some are using price indicators rather than direct volume indicators such as employment, a choice which is advocated in general in the new international standards. However, we have experienced how difficult the compilation of relevant price measures is, especially outside the household consumption sphere. The challenges are though inexorable:

- We should continue the effort to develop relevant price indices for use in the area of business services and thereby avoiding the «unmeasurable» element in the industries of business activities
- For financial services, in finding a common solution to the problem of defining and allocating financial intermediati on services indirectly measured (FISIM), there are good prospects on achieving a solution to the price deflator problem for the constant-price estimation.

Establishing price indices will be necessary for several purposes. Measuring price developments is important in itself. Furthermore, output should be measured both in current and in constant prices. This is necessary for analysing productivity and production across industries. However, establishing good price indices will be a demanding challenge. Changing technologies, changing qualities and a flow of new and short-lived products are characteristics of the information society. Both methodology and statistical data will be put on trial in these environments. None the less, price indices will be important for getting a «real» grasp on the supply side of the information society.

It is clear that industries such as financial services (financial intermediation and insurance) are heavily affected by the ICT technology. Direct observations reveal that an ICT revolution has taken place, at least in the banking sector, but this is not visible in the productivity figures. It is equally clear that output is extremely difficult to measure and even define in theory in these industries, as the nature of the services provided has changed dramatically over the last decade as we all know. Output measures must still be considered rather tentative for financial intermediation and insurance. In the European cooperation work, in establishing a common ground for reporting revised figures by 1999, the particular improvement on FISIM should be able to meet the critics by introducing a significantly better solution to the constant-price problem, and it might not be surprising that we in some near future might observe at least some growth in labour productivity in the midst of the ICT revolution taken place in this sector.

In conclusion, more generally, it is important to improve the general statistical system. The revision of the Norwegian national accounts has shown that this will result in more reliable (reasonable) figures, but there are still problems unresolved, a.o. output measures in services and price indices for capital goods.

More specialised statistics on the use of information technology will also have to be developed. The infrastructure, goods and services of the information industry are used as an input in the production process of a broad spectre of industries. The intensity and spread of Information technology in the different sectors of the economy should be measured, and from various angles. The use of ICT in organisations should be measured in economic terms (ICT-cost, ICT investment, ICT-stock).

The cost of ICT will cover both goods and services bought in the market and the cost of in-house production related to ICT. It should be broken down by type of cost, and where relevant linked to the international product classifications. This would give a foundation for describing the supply-side as well as the user-side within a coherent framework.

The economic variables should be supplemented by some physical measures of the availability and use of information technology in the organisations. The number of computers installed, mainframes

and dumb terminals, communication technology and access to the Internet etc. might be some variables of relevance.

Likewise, more information of the human capital is important. The extent and types of ICT-relevant tasks performed by the workforce will give yet a supplementary aspect of the use of information technology in the organisations. Staff according to standards of occupation and education would also be relevant to complete the picture.

5. Summary and conclusions

5.1. The NSIs ability to answer the user needs

The statistical system has been put under pressure by the emergence and the rapid changes of the information society. The preceeding chapters have described different aspects of the changing reality and the emerging statistical needs. Will the NSIs have the ability to adapt to the new requirements and establish a statistical system suitable for the Information society?

As stated in chapter 4, it is important to improve the general statistical systems. At the outset, statistics for the information society is a global term that might comprise all sorts of statistics: economic, social, cultural, environmental etc. The implication is that the information society cannot be captured and described through the new development of any separate statistical survey. If we want to give a valid description of the information society we will have to incorporate and extract elements of relevance to the ICT into a wide spectre of the statistical landscape. In general, this requires the statistics to be well developed in all areas. The measurement problems especially in the service sector are still serious as pointed out in chapter 4, and this makes it hard to chart the size of the information society where services constitute the main part. We are not very optimistic about the ability to solve these problems in the near future, but we should take on board this general challenge for the future revisions of the national accounts, and possibly also in the context of satellite accounts or analysis.

The situation is somewhat more reassuring if the statistical requirements are defined along the lines sketched in chapter 2 and 3 focussing on supply and use of ICT. We believe these challenges could be met without too much problem, even if these surveys will contain limitations. Some of the necessary elements will already be part of the national statistical systems. Other elements could be extracted from existing systems or established according to familiar models. However, user-surveys, new patterns of trade in services and price indices will confront statisticians with partly new and more complex territory. An obvious need and a major challenge will be to link the different elements together in a more coherent statistical system aimed at catching the dynamics of the information society. Of course there will be problems of measurement and problems of keeping up with the rapid changes in the field. In principle, however, the NSIs can draw on their experience of meeting similar problems in other fields. In this respect, the challenge of the information society is not new.

In our opinion, the NSIs have in general been too slow to meet the growing demand for statistics on the Information society. With the NSIs partly on the fence, room has been granted for other actors to meet this demand. Presently therefore, statistics of relevance for the information society are too often produced outside the NSIs and often on an ad hoc basis The result is a lack of systematic approach and lack of continuity in the statistics. For the interest of the users the NSIs should capture a larger part of the field of information statistics. This is the best way to secure that a central core of statistics for the information society is produced with a systematic approach, and with continuity and comparability. Still of course, there will be room for special purpose supplementary statistics and analysis made by other actors.

5.2. International cooperation

The information society plays an important part in furthering the globalization of the economy. The need to follow the international spread and impact of the information technology and the different aspects of the information society is rather obvious. In our opinion, international cooperation in this field of statistics will be extremely important. More or less the different countries will have the same need for knowledge of the information society. And most countries are more or less at the starting point of establishing the statistical systems required. However, this is a good setting for international cooperation.

The international cooperation could be based on the following tasks:

i) Defining the information and communication industries according to the industrial classifications.
ii) Defining information products according to classifications of products and trade.
iii) Defining occupation and education classes relevant to the information society according to the international classifications of occupations and education.
iv) Considering the need for revising these classifications in light of the needs of the information society.
v) Develop a list of variables for an ICT industry survey and user-surveys, and launching a system of pilot surveys in a system of international cooperation.
vi) Develop a compendium of methodology for statistics on the information society.
vii) Develop satellite accounts or analysis responding to SNA 1993 framework.
viii) In Europe, a legal foundation for statistics on the information society might be considered.

5.3. Priorities

The information society is a multi-faceted phenomenon. The preceding paragraphs have addressed several aspects of the information society and a number of relevant statistics and surveys have been sketched. Could any priorities be given for a strategy aimed at establishing a statistical system for the sector. Perhaps the foundation for priorities should be sought in the political aims and interests both at the national and international level. Most countries do have or are about to develop national political strategies for the information society. The European communities do the same at the European level. Presumably, a large extent of convergence will be found in these strategies. What should be avoided is the development of an ad hoc and fragmented statistical system. This can only be avoided if the NSIs and the relevant authorities make the necessary decisions to give high priority to statistics for the information society. The need for systematic approach is obvious.

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Appendix A

Choice of productivity concepts

Type of productivity measure could include at least labour productivity, capital productivity or total factor productivity. In the context of this paper, we have confined the issue to labour productivity only. Nevertheless, in measuring labour productivity, some standardization seems necessary on a conceptual level to avoid a wealth of different labour productivity measures (see page 22 above).

In discussing the conceptual base of labour productivity, several choices need to be made both for the numerator and the denominator. For the numerator, choice of concept (output or value added) and valuation (basic price, producer's price or factor cost) both need to be clarified. For the denominator, there is a choice between different concepts of employment or labour inputs (hours worked, full-time equivalent persons (FTEP) or employed persons). Two basic measures of production, valued at three alternative prices and related to three alternative measures of labour, theoretically make 18 different concepts of labour productivity, as spelt out in the following table.

Alternative compilations of labour productivity

	Numerator Concept	Valuation	Denominator Concept
1	Output	Basic price	Hours worked
2	Output	Producer's price	Hours worked
3	Output	Factor cost	Hours worked
4	Output	Basic price	FTEP
5	Output	Producer's price	FTEP
6	Output	Factor cost	FTEP
7	Ouptut	Basic price	Employed persons
8	Output	Producer's price	Employed persons
9	Output	Factor cost	Employed persons
10	Value added	Basic price	Hours worked
11	Value added	Producer's price	Hours worked
12	Value added	Factor cost	Hours worked
13	Value added	Basic price	FTEP
14	Value added	Producer's price	FTEP
15	Value added	Factor cost	FTEP
16	Value added	Basic price	Employed persons
17	Value added	Producer's price	Employed persons
18	Value added	Factor cost	Employed persons

For reasons of international comparison at least, making a standard choice (or a few) may prove fruitful and should be aimed at. Among the criteria to be used for making such a choice, availability (presently and in future) and the principles recommended in the SNA (presently and particularly its revised version) should have a prominent role. Productivity in macroeconomic sense - as dealt with here - is a concept derived from the national accounts. The diversity of national accounts figures in the countries may explain the current non-standardized situation in the productivity sphere of to-day. At the same time, it calls for taking to the revised SNA as a guiding device for compiling adequate labour productivity measures.

Regarding criteria of availability and SNA recommendation, the situation - presently and into the future - may be summarized as follows:

(i) Value added is more easily available today than output
(ii) Output may prove to be more available in future, due to development of statistics in general, and more supply and use tables in particular
(iii) Output is a direct statistical measure (transaction); while value added is not (balance item)
(iv) Output benefits - more than before in former SNA - from the revised SNA principle of recording closeness to transactors
(v) Basic price is adopted by the new international standards of SNA and ESA
(vi) Producer's price is only resorted to as a second alternative price standard to basic price (in revised SNA, not even so in revised ESA) if deemed necessary
(vii) Until more countries have implemented the revised SNA, producer's price has a wider use than basic price in production valuation
(viii) Factor cost has been scrapped altogether in revised SNA
(ix) Factor cost still is widely used
(x) Hours worked is the preferred concept in terms of labour inputs
(xi) FTEP (Full-time equivalent persons) - or man-years formerly - is a second choice of labour inputs
(xii) Employed persons is more available than other employment measures, but being a stock variable it is not strictly recording labour inputs as such.

	Criteria considerations			
	Availability		SNA recommendation	
	Presently	Future	Presently	Revised
Output	Fair	Increased	Yes	Increased
Value added	Wide	Wide	Yes	Yes
Basic price	Limited	Increased	Yes	Increased
Producer's price	Wide	Less	Yes	Second choice
Factor cost	Wide	Fair	Yes	No
Hours worked	Limited	Increased	Yes	First choice
FTEP	Limited	Increased	Yes/man-year	Second choice
Employed persons	Wide	Wide	Yes	Third choice

Concluding from this criteria situation, it is suggested that the following order of priority may be followed in a search for international standards on labour productivity measures in the years to come. Output and value added are kept on equal footing in the general recommendations. For manufacturing industries, it may be noted that many users and analysts are tempted to use output rather than value added. For example, U.S.Department of Labor has collected and published - for worldwide dissemination - statistical information in this field for a long time on manufacturing, and - although presenting several measures - this institution seems to consider output per hour worked as its first choice of labour productivity concept.

First priority:

1 Output at basic price per hour worked
10 Value added at basic price per hour worked

Second priority:

2 Output at producer's price per hour worked
11 Value added at producer's price per hour worked

Third priority:

4 Output at basic price per FTEP
13 Value added at basic price per FTEP

May still be considered (fourth priority):

5 Output at producer's price per FTEP
14 Value added at producer's price per FTEP

May resort to in short run only (fifth priority):

7 Output at basic price per employed person
16 Value added at basic price per employed person

Not recommended for the future:

3 Output at factor cost per hour worked
6 Output at factor cost per FTEP
8 Output at producer's price per employed person
9 Output at factor cost per employed person
12 Value added at factor cost per hour worked
15 Value added at factor cost per FTEP
17 Value added at producer's price per employed person
18 Value added at factor cost per employed person

It has been possible - by using Norwegian national accounts data - to illustrate how productivity changes vary in magnitudes with the different alternatives of concept used. In the first place, the calculations have been confined to manufacturing (including also mining and quarrying), wholesale and retail trade, post and telecommunications, besides total industries and total non-manufacturing industries. The results are shown in the table below, with accumulated changes over the 12 year period 1981-1993, as well as annual averages, for all 10 alternatives of labour productivity concepts presented above.

Labour productivity in Norway
Percentage changes from 1981 to1993 (and annual averages)

Priority	Alt.	Manufac turing and mining		Non-manufac turing		Wholesale and retail trade		Post and telcomm unications		Total industries	
1	1	52.6	(3.6)	42.0	(3.0)	37.4	(2.7)	154.5	(8.1)	41.0	(2.9)
	10	30.2	(2.2)	41.4	(2.9)	44.1	(3.1)	154.1	(8.1)	41.3	(2.9)
2	2	52.3	(3.6)	42.0	(3.0)	34.8	(2.5)	154.5	(8.1)	41.2	(2.9)
	11	32.3	(2.4)	41.4	(2.9)	41.4	(2.9)	154.1	(8.1)	41.8	(3.0)
3	4	50.9	(3.5)	34.8	(2.5)	32.9	(2.4)	147.1	(7.8)	35.0	(2.5)
	13	28.8	(2.1)	34.2	(2.5)	39.3	(2.8)	146.7	(7.8)	35.3	(2.6)
4	5	50.6	(3.5)	34.8	(2.5)	30.4	(2.2)	147.1	(7.8)	35.2	(2.5)
	14	30.8	(2.3)	34.2	(2.5)	36.8	(2.6)	146.7	(7.8)	35.8	(2.6)
5	7	52.3	(3.6)	34.9	(2.5)	34.0	(2.5)	126.9	(7.1)	34.6	(2.5)
	16	29.9	(2.2)	34.3	(2.5)	40.5	(2.9)	126.6	(7.1)	34.9	(2.5)
	High	52.6	(3.6)	42.0	(3.0)	44,1	(3.1)	154.7	(8.1)	41.8	(3.0)
	Low	28.8	(2.1)	34.2	(2.5)	30.4	(2.2)	126.6	(7.1)	34.6	(2.5)

Main conclusions drawn from this study may suggest that:

1. Choice of labour productivity concept may mean a lot to the productivity results of the individual industries. The average span between high and low has been as much as 1,5 percentage point for manufacturing (including mining an quarrying), and around 1 percentage point for wholesale and retail trade as well as for post and telecommunications, considering a fairly long period (12 years). Most important for the results at the industry level is the choice between output and value added. In fact, these empirical results may suggest that just one single alternative - rather than the two - should be given first priority at the industry level.

2. For the economy as a whole, choice of labour productivity concept is not that conclusive. The average span between high and low is recorded as 0,5 percentage point for total industries, and the same result seem to apply to non-manufacturing industries. At the global level, the main choice lays with the measures of labour, while the choice between output and value added has minor importance in this case. Thus, for total economy, double sets of labour productivity measures for priority order has a better empirical basis in the Norwegian data.

Revision effects on labour productivity in Norway

Some effects of the recent main revision of the national accounts in Norway are illustrated below. Illustration is here confined to alternative 11 - value added at producer's price per hour worked, which proved to be the most accessible concept among the top priorities, given the set of tables published over the years and easy access to unpublished data. It should be possible to reproduce some more comprehensive results on the revision effects in a separate study, taking into consideration several alternatives and analysing at least two sub-periods to detect some more results - than already presented in the paper - on the development within the 12-year period.

Industries have been analysed in two sections. Section I has the same industry breakdown as in appendix A. It covers the total economy (total industries) and sub-divided into manufacturing and non-manufacturing industries, plus two examples of service industries - wholesale and retail trade, post and telecommunications - for which labour productivity has been calculated in a normal manner. Section II covers three classes of service industries for which labour productivity has not been calculated in a satisfactory manner (areas of needs for improvements, as emphasized in the paper). These are service industries - non-market producers, financial services, business services - for which labour input is used in the compilation in such a way that productivity growth is more or less ruled out. Non-market producers mainly consist of central and local government activities, but adding also NPISH (non-profit institutions serving households) activities in the revised figures. For these services, the results reveal that a small growth of labour productivity has been assumed and built into the calculations for the governement activities (0,5 percentage point in the revised figures).

Labour productivity. Alt. 11
Percentage changes from 1981 to 1993 (and annual averages)

	Former data		Revised data	
Section I				
Manufacturing (and mining)	40.7	(2.9)	32.3	(2.4)
Non-manufacturing	41.2	(2.9)	41.4	(2.9)
Wholesale and retail trade	20.8	(1.6)	41.4	(2.9)
Post and telecommunications	154.2	(8.1)	154.1	(8.1)
Total industries	42.4	(3.0)	41.8	(3.0)
Section II				
Non-market producers	12.0	(0.9)	6.8	(0.5)
Financial services	-14.2	(-1.3)	-6.7	(-0.6)
Business activities	- 1.0	(-0.1)	1.7	(0.1)

Measurables and unmeasurables

Classification used by Z. Griliches to divide industries into two groups

«Measurables and unmeasurables» *
GNP/GDP by major industries. United States and Norway

	United States		Norway	
	1959	**1990**	**1960**	**1990**
Agriculture	4.1	2.0	9.0	3.1
Mining	2.5	1.8	0.8	13.4
Manufacturing	28.6	18.4	21.3	13.7
Transport and utilities	9.1	8.7	18.2	14.1
«Measurable sectors»	44.3	30.9	49.3	44.3
«Unmeasurable sectors»	55.7	69.1	60.7	55.7

* Measurables (measurable sectors) and unmeasurables (unmeasurable sectors) are expressions used in Griliches (1994), defined by the sectors specified in the table. Sector Agriculture includes agriculture, hunting, forestry and fishing. Sector mining includes oil and gas extraction, as well as mining and quarrying. Sector Transport and utilities includes transport and communication, and electricity, gas and water supply.

Investments on computers and office machinery

Investment figures on computers and office machinery are available in the national accounts. It is the item of fixed assets that comes closest to computers as such. The product composition of this investment group reveals that computer equipment constitutes somewhat more than one half of the total (4.8 billion out of 9,1 billion in 1993). On the other hand, less than half of the total supply and use of computer equipment is recorded as gross fixed capital formation (4.8 billion out of 12.7 billion). The import share at cif. of the latter purchasers' value is about 50 per cent (6.6 billion).

Investment figures on computers and office machinery are also available by industry of investment in the national accounts (values are at purchasers' prices, investment levy and non-deductible VAT included). These estimates have been referred to in the paper itself. It should be stressed that these are estimates compiled in a rather indirect way by using the commodity flow method etc. The industry breakdown of these investment figures are therefore quite uncertain. In the table that follows, we have listed the industries with highest figures in 1993, and to stress their uncertain quality they are given by shares of total. Virtually all industries are included in such an industrial breakdown; here are listed those industries only which have a share total of more than 2 per cent.

Computers and office machinery. 1993
Investment by large industries. Percentage share of total.

Retail trade	10.6
Wholesale trade	8.5
Public administration, local government	7.4
Human health activities, local governmnet	4.8
Extraction of crude petroleum and natural gas	4.1
Education, central government	3.7
Defence activities	3.7
Education, local government	3.5
Telecommunications	3.1
Post and courier activities	2.8
Computer and related activities	2.6
Other monetary intermediation	2.4
Radio and television activities	2.2
Real estate activities	2.1

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