New Economy – New Statistics

what counts when ICT is no longer taken at face value?

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Explanation of symbols

.	= figure not available
*	= provisional figure
x	= publication prohibited (confidential figure)
–	= nil
0 (0.0)	= less than half of unit concerned
blank	= not applicable
<	= fewer/less/smaller than
>	= more/greater than
2005–2006	= 2005 up to and including 2006
2005/2006	= average of figures for 2005 and 2006
2005/'06	= crop year, financial year, school year etc. beginning in 2005 and ending in 2006

Because of rounding, some totals may not fully equal the sum of the separate figures.

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Foreword

Previous scepticism about the so-called *New Economy* has not prevented Statistics Netherlands from paying considerable attention to the pervasive nature of ICT as an enabler and facilitator of economic change. One of the results of this has been the introduction of a strategic project called *New Economy*, of which the conference held in 2006 that this publication refers to was a part. While the dot.com companies could not deliver on their promises of a period of unprecedented economic growth, the emergence of ICT did continue and indeed has become a major factor in international competition and productivity growth. The latter has led to an increased interest in international statistical benchmarking.

This publication is well-timed in view of Statistics Netherlands' efforts to keep up with the times and modernise its statistical publications accordingly. The above-mentioned New Economy project is an example of research on how statistical innovation could take place. The research done in collaboration with different universities to come to grips with the impact of ICT on today's economy is intended to result in the selection of new indicators to enrich our regular statistical production programme.

As part of the EU's NESIS project, Statistics Netherlands compiled the publication *The EU-15's New Economy*. The publication presents a range of indicators supposed to be relevant for the Lisbon strategy (to make the EU the world's most dynamic economy). It appeared that the EU still has a long way to go before this goal will actually be reached. In this context, it makes sense to continue the search for indicators that bring to light what really matters with respect to the New Economy.

Statistics Netherlands has taken further steps in using ICT for statistical purposes. Statistics Netherlands is bound to make use of existing databases as much as possible. In this way the administrative burden relating to surveys can be contained. This implies the use of specific and advanced technological applications. However, in certain areas – such as services and the impact of ICT on the economy– surveys remain necessary as long as registration-based databases cannot help out sufficiently.

In the context of research on population ageing, we have executed an experiment with 'remote execution', i.e. the possibility for researchers to have remote access to Statistics Netherlands' microdata. Statistics Netherlands will extend remote execution to a wider audience, saving researchers many a trip to Statistics Netherlands' office in Voorburg.

There are unprecedented possibilities of using data for statistical purposes that are already available in existing advanced IT-based information systems. So for statisticians, too, the New Economy still has a lot in store.

Taken together, this publication gives a concise and accessible picture of the relevance of the New Economy as an intriguing concept, evoking our curiosity and reinforcing our interest in statistical innovation.

The Director-General
of Statistics Netherlands

G. van der Veen

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Preface

This publication is meant to inform a wide audience of recent research and discussions on the New Economy and its measurement. It is about the emergence and impact of ICT on the economy and a search for new indicators which could capture this development. The New Economy is not just a matter of technology. It interferes with how economic processes are organised, innovation is set up and new markets are being approached. Availability of ICT equipment and applications therefore is just a part of what makes the New Economy tick. Therefore, the central question is: What counts when ICT is no longer taken at face value?

In 2002 Statistics Netherlands started a so-called strategic project on the New Economy. After years of reorganisation, the time had come for Statistical Netherlands to emphasise the substantive aspects of its statistical work, especially where it concerns new (technological) developments which could have a major structural impact on how the economy operates.

As part of the strategic project, Statistics Netherlands launched own research on the New Economy in collaboration with researchers from the Free University of Amsterdam, Delft University of Technology and other knowledge institutions. This research has made efforts to discover the organisational variables which determine whether and to what extent ICT investments could make a positive contribution to process quality and productivity. It mainly focused on the business sector but also included e-government. A number of one-off surveys were carried out to collect the microdata that were needed to analyse the relationships between ICT investments and economic performance. These microdata were linked with existing databases so as to be able to study the relationships between available ICT applications and a company's features and performance.

On 26 January 2006 Statistical Netherlands held a conference on the New Economy and New Statistics to present and discuss the first research findings. The projects involved were:

– 'E-business, ICT and Statistics', carried out in collaboration with the Free University of Amsterdam (X. de Graaf and W. Keller);
– 'ICT and Complex Value Systems' (ICWAS), carried out in collaboration with Delft University of Technology (C. van Beers and H. Bouwman).

This publication contains the English translation of the recorded presentations and discussions during the conference. If required by further developments after the conference, some adaptations have been made. Prior to the presentations on the two above-mentioned researches, two other presentations were given: one on 'ICT,

innovation and entrepreneurship', and another one on 'ICT and economic growth', to indicate the wider policy and research context of the findings. Furthermore, there were presentations on:
– Sustainable transport systems, ICT and new statistical challenges;
– Monitoring of e-government (local authorities);
– Statistics Netherlands' publication 'The Digital Economy';
– Further research on ICT and productivity and;
– Statistics Netherlands' new publication on the Dutch investment climate.

Teun Wolters
Manager of the strategic project New Economy

Statistics Netherlands also conducted research on innovation in services together with EIM Business and Policy Research. This research was finalised and presented in a special workshop in 2003. For that reason, it was not on the programme for the conference held in January 2006. See J.P.J. de Jong, Y.M. Prince and P. Gibcus, 'Innovatie in de diensten – Toetsing van nieuwe indicatoren', EIM Onderzoek voor bedrijf en beleid, Zoetermeer, 8 maart 2004.

On the EU level, the SINE programme has given rise to various research projects which focus on the New Economy. One of these projects was the NESIS project, which Statistical Netherlands participated in, leading to the publication 'The EU-15's New Economy: A Statistical Portrait', presenting some 50 key indicators on the New Economy (see www.cbs.nl). This project was helpful in making visible relationships between ICT, national innovation systems and economic performance at the meso and macro levels.

Statistics Netherlands contributed to the discussion by among other things developing a set of 'knowledge-based economy' indicators consistent with the national accounts (so-called satellite accounts); see www.cbs.nl. The results of this research were presented at various EUROSTAT and OECD meetings.

Statistics Netherlands publications relevant to the field of New Economy and knowledge-based economy

Title	**ISBN**	**Price** (exclusive of postage and administrative costs)
The Digital Economy 2005	90-357-1636-1	€ 29.50
The EU-15's New Economy. A Statistical Portrait	90-357-2609-X	€ 22.50
Kennis en economie 2006	90-357-1606-X	€ 32.00
Het Nederlandse onder-nemersklimaat in cijfers 2006	90-357-1453-9	€ 43.50
Information:	E-mail: infoservice@cbs.nl	
Where to order:	E-mail: verkoop@cbs.nl	

This booklet is about the influence of ICT – or IT as it is frequently called in international meetings – on economic development.
'The relevance of the subject is great. There are three major aspects to be distinguished. Firstly, the scientific aspect: We know that the phenomena we are interested in are difficult to understand and hard to measure. Secondly, there is a statistical interest involved: Do we measure what needs measurement? Thirdly, there is a political aspect: It is important to inform the policy makers with up-to- date information'.

(Jarig van Sinderen, conference chairman)

1. ICT, innovation and entrepreneurship: the heart of the dynamic economy

Chris Buijink
Director-general innovation and entrepreneurship, Ministry of Economic Affairs

In the second half of the nineties the Netherlands was characterised by the international press as 'the miracle in the polder'. The Internet hype boosted the positive expectations emanating from this. Inflation was considered to become a non-issue, and the business cycle would die out: for growth the sky was the limit. Savings accounts were emptied to invest in stocks and shares. The development of ICT and its applications would bring unlimited economic prosperity.

ICT as a major force in the innovation of the economy

Reality has not lived up to these expectations, however. At a certain point ICT share prices plummeted. The Internet bubble burst, the Netherlands lost its leading position, and we were brought down to earth with a bang. There was no such thing as an ICT-based free lunch: economic growth had to be earned by means of entrepreneurship and innovation. Although the drastic predictions did not become fact, the world has changed profoundly.

The emergence of ICT has had a substantial effect on the economy's production processes, and this process has not come to an end yet, on the contrary. ICT will be a major force in economic innovation, both in manufacturing and in services. Because of this, ICT will continue to penetrate both the business community and the personal life sphere.

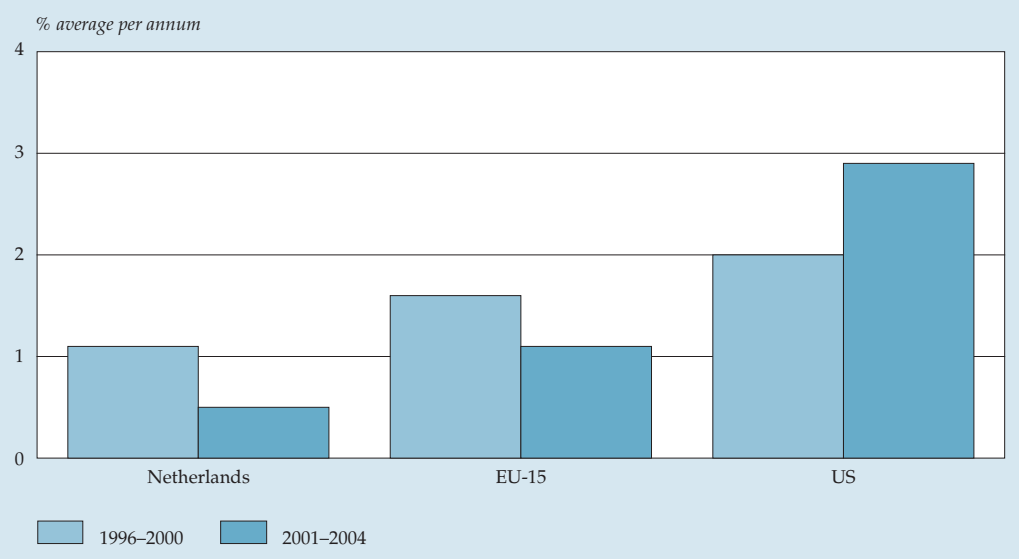
Organisational improvement after the Internet bubble

Today we can speak of a new phase in ICT. Before the Internet bubble burst, technological innovation was a matter of venture capital and short-term perspectives. Time-to-market and first-mover advantages were deemed so important that innovations were implemented as quickly as possible. Once the hype had died down, businesses started to focus on improving their organisation. Integration of processes, even throughout the supply chain, was considered extremely important. And this is still where the major opportunities lie for further organisational improvement.

Dutch productivity growth is rather low

What is reflected of ICT in productivity growth? Not very much if we look at the Netherlands: for the period 2001–2004, average productivity growth was 0.5 percent (1.0 percent in the EU-15). However, in the US productivity growth was notably higher (see Figure 1.1).

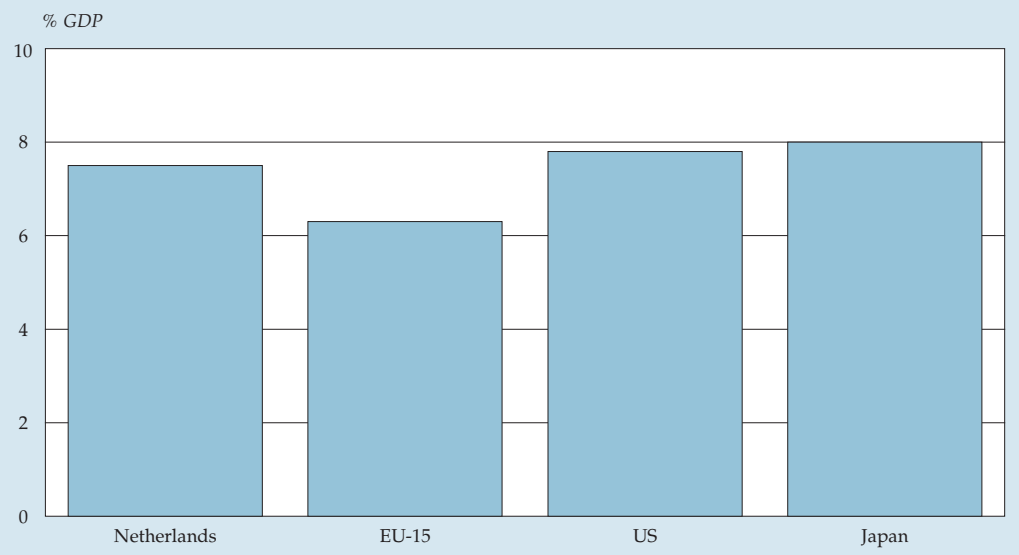
1.1 Labour productivity growth per hour worked



Source: Ministry of Economic Affairs, on the basis of data from OECD and GGDC.

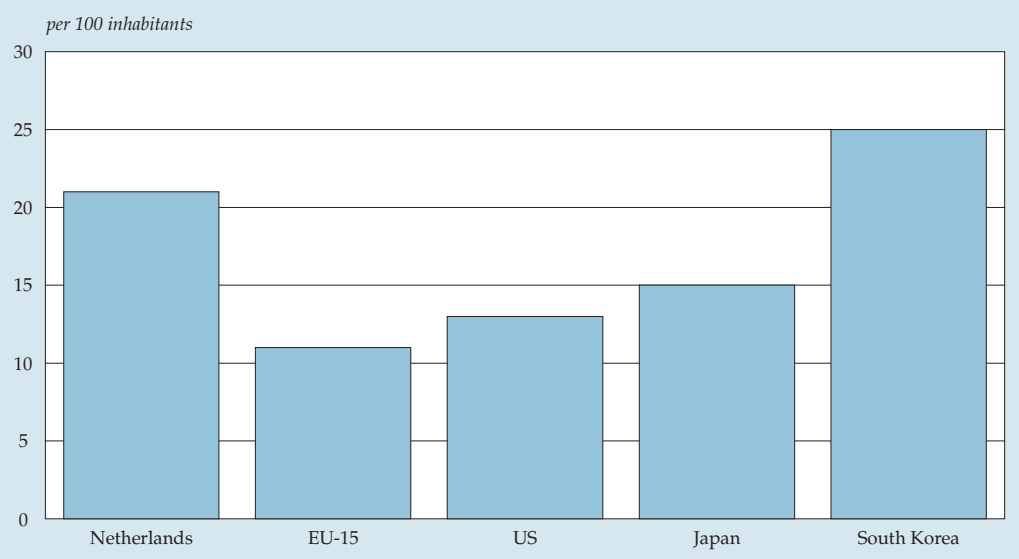
Why? It was not expenditure on ICT or the number of broadband connections that caused the gap in productivity growth (see Figure 1.2 and Figure 1.3).

1.2 ICT expenditure, 2004



Source: CBS, The Digital Economy 2005.

1.3 Broadband connections, 1st quarter 2005



Source: CBS, The Digital Economy 2005.

In fact, compared with the EU-15 and the US the Netherlands had prominent scores in these areas. Therefore, it is not the availability of computers and software as such that is to blame. It is a matter of how ICT is applied. The use of ICT in the US had a greater positive impact on productivity than in the Netherlands. How was this possible? One theory is that in the US markets are more efficient and as a result the ICT opportunities are better utilised. Moreover, the US seem to be better able to combine ICT usage with innovation, human capital and entrepreneurship. There were apparently differences in the way people were motivated and worked together which had an effect on productivity.

Frame 1.1
The position of the Netherlands in terms of the factors that determine productivity

Technological innovation:	average performer
Non-technological innovation:	relatively low scores
Entrepreneurship:	average (relatively low score for fast-growing companies)
Human capital:	average (relatively low score for number of graduates in science/engineering)
Competition:	average

Frame 1.2
Change agenda for the Netherlands

- Ambition: the Netherlands will be frontrunner in the EU;
- The Netherlands should become more entrepreneurial and innovative;
- Framework conditions need to be improved (regulations, administrative burden, competition, etc.);
- Financial support for technological innovation;
- Investments in education/availability of knowledge workers who connect SMEs to the knowledge infrastructure;
- Possible financial support for non-technological innovation.

The ICT sector in the Netherlands

Parts of the Dutch ICT sector are of high quality. Telecommunications in the EU is relatively strong, however we can still improve our performance. ICT as an enabling technology is of crucial importance. The Netherlands' R&D in the field of ICT should be supported. In addition, it is crucial to strengthen the capacity of the country to benefit from the results of this R&D. But it also demands the availability of high-skilled ICT workers. Ireland indicates what is possible if a country is open-minded towards foreign (knowledge) workers. We should make the Netherlands one of the most interesting places to live and work. We should stimulate and enable our business sector to undertake the complementary investments that improve the returns of the ICT market and finally we should really foster competition and innovation in a liberalised services market across Europe.

Meaning for research and statistics

This last issue is also important from a statistics perspective. The success of ICT seems to lie in the softer factors of productivity, the intangible aspects. There is a need for more knowledge in this area. In the statistical field, research on microdata should be promoted. Statistical information is of crucial importance for the government to know what is happening and prepare for effective policies. It is our link to the engine of our economy.

2. ICT and economic growth: measurement and understanding

Marcel Timmer
Assistant Professor of International Economics & Business, University of Groningen

This chapter is based on research done at the Groningen Growth and Development Centre. The starting point of the study is the stagnant labour productivity growth in Europe and the Netherlands. Is there too little investment in ICT? Is the ICT producing sector too small? Is ICT investment being used efficiently? It is in fact inefficient use that has caused the gap between the EU on the one hand, and the US and Australia on the other, particularly in the services sector.

Convergence and turning points

In the sixties and seventies of the previous century an ongoing convergence was visible between the performance of the EU-15 and that of the US. Figure 2.1 shows two major turning points in this process. Around 1974 per capita GDP growth began to stagnate in the EU-15, although GDP per hour worked continued to grow. This was caused by a decrease in the EU-15's hours worked per capita as a result of a lower participation by the population in the economy (fewer working hours per day, higher unemployment). The second turning point was in the mid-nineties, when the US' GDP per hour worked started to outgrow that of the EU-15.

Loss of Dutch productive strength

Figure 2.2 shows that for a long time labour productivity was relatively high in the Netherlands. However, slowly but surely, the US came closer and closer, and overtook us in 2004. The Dutch were no longer in a leading position. This was partially caused by increasing labour participation, which meant that less productive people entered the production process. The loss of productive strength is important, as labour productivity growth is a long-term source of economic prosperity. Various policymakers have adopted the subject as a political priority.

With the New Economy in mind, let us look at how ICT could promote labour productivity growth. There are three channels by which this could occur.

- *The first channel* is capital deepening and substitution. This leads to a higher capital intensity (defined as capital per unit of labour: C/L). Also, the substitution of capital (replacing old-fashioned capital technologies with modern ones) contributes to an increase in labour productivity.
- *The second channel* is fast technical change (innovation) in the ICT producing industry, resulting in total factor productivity growth.

– *The third channel* is the effect of the use of ICT on total factor productivity growth by means of knowledge spill-overs and complementary innovations in the economy at large.

Capital deepening and substitution

New computers and new telecom equipment are launched on the market, and replace existing technologies. This process took place throughout the eighties and nineties. The new equipment is more productive than the old, and thus contributes to an increase in labour productivity.

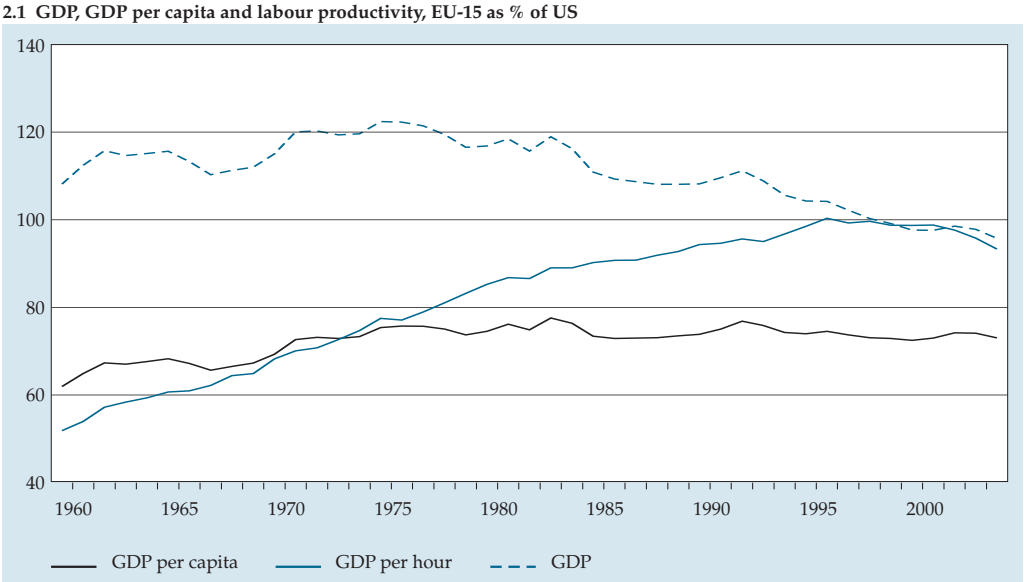
Fast technical change in the ICT producing industry

The ICT producing sectors are known for their process innovations which strongly increase labour productivity. The larger the entire ICT producing industry, the stronger this effect on overall labour productivity will be.

ICT use

ICT has the features of a general purpose technology. Such technology, once introduced, triggers all kinds of subsequent innovations throughout the economy. For instance, from the eighties on Wallmart invested heavily in scanner technology and ICT. This led to new business models with which stocks could be managed much better and shops could be supplied much more easily and efficiently. This is also a matter of efficient global sourcing. Although such innovations are mainly organisational in nature, they are facilitated by ICT (ICT as a facilitating technology).

2.1 GDP, GDP per capita and labour productivity, EU-15 as % of US

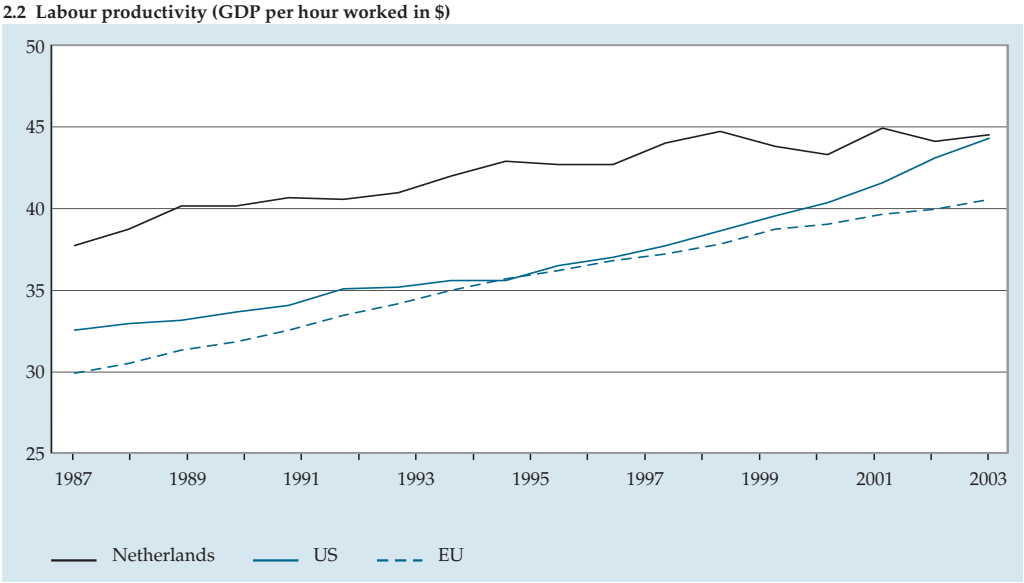


Source: Groningen Growth and Development Centre and Conference Board, 2005.

Three channels of labour productivity

The question arises whether these channels involve incidental productivity change or whether they lead to long-term productivity effects. ICT-based capital deepening and substitution have been taking place for several decades but they are approaching their limits. Therefore, they cannot be considered as a permanent source of productivity growth. Similarly, the ICT producing industry will reach a point where it cannot add to productivity as much as it did before. For instance, it will take more and more time and effort to increase the capacity of semi-conductors. Therefore, here too, the end of the productivity boosting effects are in sight. However, the third channel, ICT use involving continuous adoptive moves throughout the economy, is a source of long-term innovation and productivity growth. This process may continue for several decades. It took previous general-purpose technologies such as steam and electricity thirty to forty years before they were being used to their full potential. The time dimension of ICT-based productivity growth is illustrated in Figure 2.3.

2.2 Labour productivity (GDP per hour worked in $)

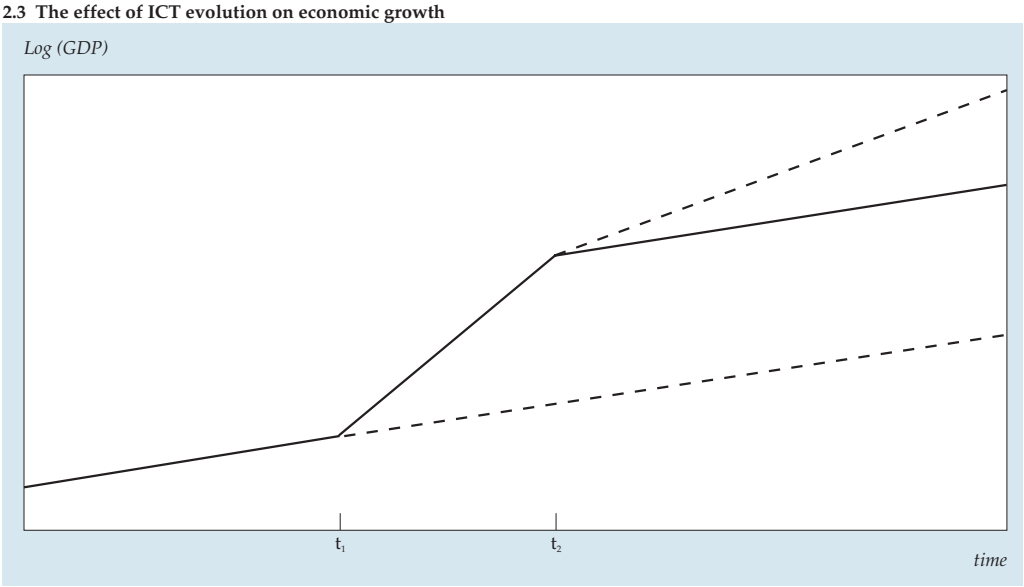


Source: Groningen Growth and Development Centre and Conference Board, 2005.

The crucial point therefore is whether our economy is capable of benefiting from the third channel: continuous innovation. If not, then we are confronted with just a restricted level effect. Let us take a look at indicators which highlight the three channels.

Figure 2.4 gives ICT investment as percentage of GDP. These figures differ from those on ICT expenditure (see Chapter 1), as the latter also include ICT expenditure by households.

2.3 The effect of ICT evolution on economic growth

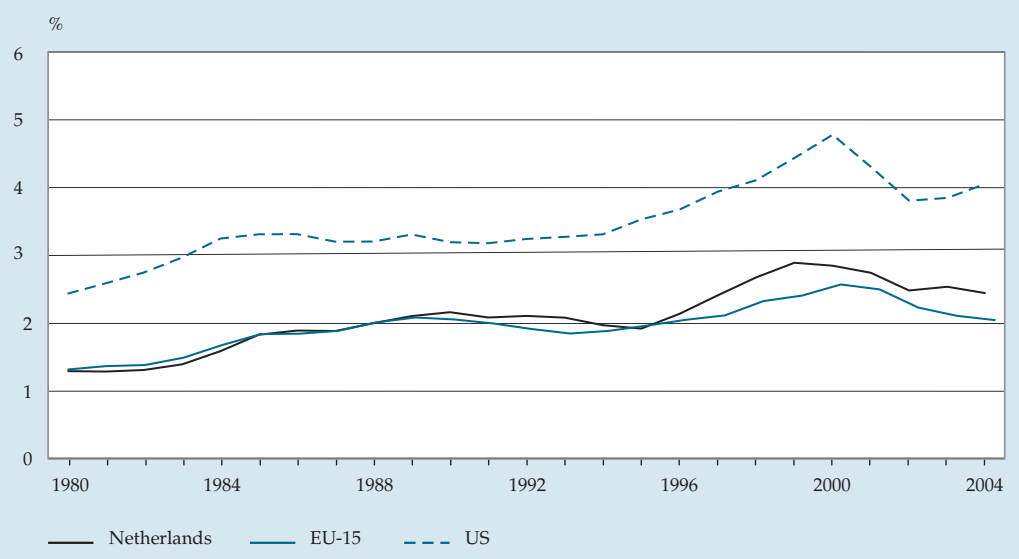


Source: E. Bartelsman and J. Hinloopen, 'De verzilvering van een groeibeloften', KVS Preadviezen, December 2000.

The figures show that Dutch ICT investment matches that of the EU-15 countries, but have been below that of the US for quite a substantial period. Although Dutch ICT investment has increased in the course of time, the same is true for the US so the gap has not narrowed. This suggests that ICT investment presents a problem for both the Netherlands and the EU.

The second indicator, ICT production, can be broken down into material products (such as computers, semi-conductor and telecommunications equipment) and ICT services (communication and computer services). If we take the entire ICT production together, then it appears that the Netherlands is able to keep up with EU and the US. However, the EU has a prominent position in ICT services, but lags behind the US with regard to ICT equipment and software (ICT goods). This also holds for the Netherlands, whose relative position in the production of ICT goods is relatively unimportant within the EU. This conclusion is significant, as productivity growth has been particularly high in the production of ICT goods. This indicator therefore explains to some extent why productivity growth in the Netherlands cannot match that of the US.

2.4 ICT investment as percentage of GDP



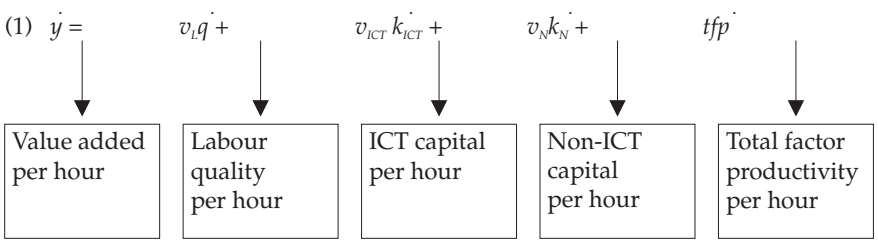
Source: Groningen Growth and Development Centre and Conference Board, 2005.

A need for a theoretical model

These and similar indicators are informative but require a theoretical model to link them to productivity growth. It then becomes evident how serious it is when a particular indicator reveals that a country is trailing. There has been a tendency recently to collect as many statistical indicators as possible. However, it is unclear how these indicators relate to one another.

Growth accounting

Fortunately, the science of economics has a model which could be very helpful here: the so-called growth accounts. This well-established model is based on an initial model of Jan Tinbergen in 1942, and was later further developed mainly by Dale Jorgenson and associates. The model has experienced a recent revival, as it is capable of measuring the relationships between ICT investment and productivity.



The model is expressed in equation (1). We see labour productivity (value added per hour) growth broken down into changes in labour quality, ICT capital per hour, non-ITC capital per hour and total factor productivity per hour.

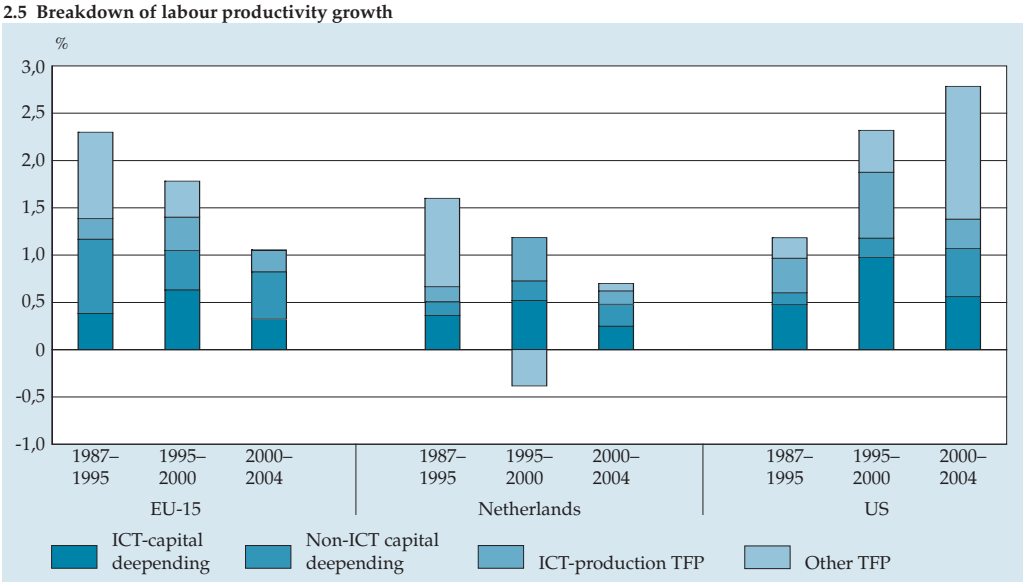
Labour quality is a matter of increasing education. Furthermore, the model distinguishes between the contribution of ICT capital and that of non-ICT capital. The fourth factor is total factor productivity, which indicates how efficiently human capital, ICT capital and non-ICT capital are applied in the production process. The v's are the shares of inputs in value added. The product of the share and the growth of a particular input is the contribution of this input. Hence this model indicates how much each of three production factors contributes to labour productivity growth.

Figures 2.5 shows that indeed the advanced position of the US in labour productivity growth since 1995 is mainly the result of total factor productivity growth in the economy as a whole. This points to a widespread process of innovation.

Sectors and productivity

Which sectors highlight this development? This is illustrated in Figure 2.6. First of all, in the US the contribution to productivity by the production of electronic equipment is obvious. As the Netherlands – in both absolute and relative terms – does not produce much in this area, the difference as a result of this is self-explanatory. However, the retail trade, wholesale trade, communication and

2.5 Breakdown of labour productivity growth



Source: Groningen Growth and Development Centre and Conference Board, 2005.

financial services have also caused the gap. In fact, all of these activities belong to the services sector. Even though the Dutch economy is to a large extent made up of services, it has failed to take the lead in new ways of doing business that boost productivity.

A wider global perspective

These differences in performance can be placed in a wider global perspective. Other figures demonstrate that the market-based services in other Anglo-Saxon countries – especially Canada, the UK and Australia – have total factor productivity growth figures which are also superior compared with countries like France, Germany and the Netherlands. In fact, in the period 1995–2003 productivity growth in the latter countries was mainly driven by capital deepening while total factor productivity growth slowed down.

Summarising conclusions

To wrap up, the following observations can be made.

- In the Netherlands and the EU as a whole there has been a slowdown in labour productivity growth, which has eroded their relatively high levels of labour productivity.
- To a limited extent, this can be explained by a relatively small ICT goods producing sector and a lack of ICT investment.
- However, the key to accelerating productivity growth is the productive use of ICT in the services sector. Here continental Europe has lagged behind.
- Part of a solution may lie in less rigid regulations so that new concepts, for example in the retail branches, can easily transform into concrete business (research has shown that this is what happened in the US retail sector). In general, entries and exits of firms need to be facilitated better.
- Economies of scale are important. In the services sector, these economies can be reaped by offering the same kind of services in different regions. Here, the US has major advantages because of its huge integrated market.
- There may be a lack of entrepreneurship (which is hard to measure) and skilled labour, for example technicians. Research has shown that the introduction of new ICT requires technicians. However, subsequent effective use of ICT is primarily organisational. Then people with different educational backgrounds will be able to do the job.

Statistical measurement and services

International cooperation has led to great improvements in the measurement of ICT and software, so that international comparisons can be made. However, in general, ICT has boosted the services sector and in that context has exacerbated the ancient problem of measurement of immaterial output.

In general, ICT has increased possibilities for customisation and tailor-made output and has therefore contributed to the heterogeneous nature of goods and services.

This makes measurement more difficult, especially as far as the making of time series is concerned. However, the importance of productivity growth justifies an extra effort to get to grips with this, especially for the services sector.

New models to deal with heterogeneity

At present new developments in industrial economics could help to find practical solutions. Models are being developed which explicitly deal with heterogeneity. Key is taking the demand side into account. This involves the development of assumptions about consumer behaviour and consumer preferences which makes it possible to see affinity between products that from a producer's point of view are completely different.

Micro research

The use of statistical microdata in research is extremely important to make progress in explaining productivity. However, such research should always be linked to the meso and macro levels. It is extremely interesting to know how individual companies increase their productivity, but there is also a need to know the effect of this at the level of sectors of industry and eventually at the national and EU level. Nowadays the micro-macro link tends to be left out. It would be preferable to place the micro research within a macro perspective rather than consider it as an isolated field of research.

Also with respect to micro research, the services sector needs to be examined from an international perspective. Just analysing what is going on in the Netherlands is not enough. There is much to be gained from the availability of international comparable data. Hopefully, the accessibility of international databases will improve considerably in the coming years.

The KLEMS project

Finally, the EU's KLEMS project is worth a mention here. KLEMS is an ongoing EU research project which aims to promote internationally comparable figures that are relevant for the measurement and understanding of productivity growth. Statistics Netherlands and the Netherlands Bureau for Economic Policy Analysis are both involved in this project. A publicly accessible database is to become available at the end of 2006. This database is expected to be beneficial for further attempts to better understand the determinants of productivity.

Discussion

Europeans seem to have a stronger preference for leisure time than Americans. However, we see that in their free time, Europeans perform all kinds of productive activities, for instance by being active in collecting information or in e-commerce (both buying and selling). It is, however, extremely difficult to measure these productive activities. The market value of a great deal of information is practically zero, but its consumer surplus can be enormous.

ICT has an influence on consumer surplus. Where ICT, in particular e-commerce, leads to lower prices (because of lower transaction costs or better information on alternatives available to buyers), this is measured in the sales statistics. However, consumers perform substantial productive activities by being active on the Internet.

To measure productivity, we use official statistics. There have been discussions on how to measure hours worked. It has been asserted that in the US the number of hours worked is underestimated, but this is hard to substantiate.

This conference has paid a lot of attention to process change and process innovation. However, productivity can also increase through product innovation. A company that puts a new product on the market increases the value of its output, and therefore increases labour productivity. For a long time, labour productivity was a matter of a saving on inputs. The Netherlands has been particularly good at this. This is the so-called anorexia strategy. Today, more thought is given to increasing productivity by making better products and designing new ways of marketing and distribution.

One important policy lesson is to refrain from promoting a larger ICT goods production sector. Policy is primarily a matter of facilitating. One of the major problems in the services is scale. The European Services Directive is extremely relevant here. Promoting such steps by the Dutch Ministry of Economic Affairs is important. Is it possible to induce small companies to embark on soft innovations? Perhaps generic measures will have some impact. However, it is much easier to stimulate the development of hard technologies. When it comes to soft innovations (focusing on organisation and marketing channels), the government's role is limited to facilitating them and creating a favourable business environment.

3. ICT investments and productivity

Wouter Keller
Professor of Information Science, Free University of Amsterdam

'ICT and productivity' is a subject that has given rise to fierce debate. There have been many misgivings on the topic in the past. Twenty years ago it was Solow who launched the paradox 'we see ICT everywhere, except in statistics'. Carr [1] claimed that ICT was not relevant, which came as a heavy blow for ICT professionals. I, too, tend to express some irony when explaining the usefulness of new CRM or ERP software: I ask my audience 'what makes this software tick?'. The answer: 'Power Point used by the suppliers to tell us that these systems are so marvellous.'

The central question in this respect is: what can ICT really do for a company? We attempt to answer this question with the aid of microdata rather than macro-data. We have done research on this and I shall present some preliminary results [2]. Scientifically, we are elaborating on the work of Brynjolfsson to find out what the impact of ICT could be on productivity. We focus on the processes within companies and their quality in terms of integration and standardisation. To do this we have made what we call the Integration Matrix.

From readiness to impact

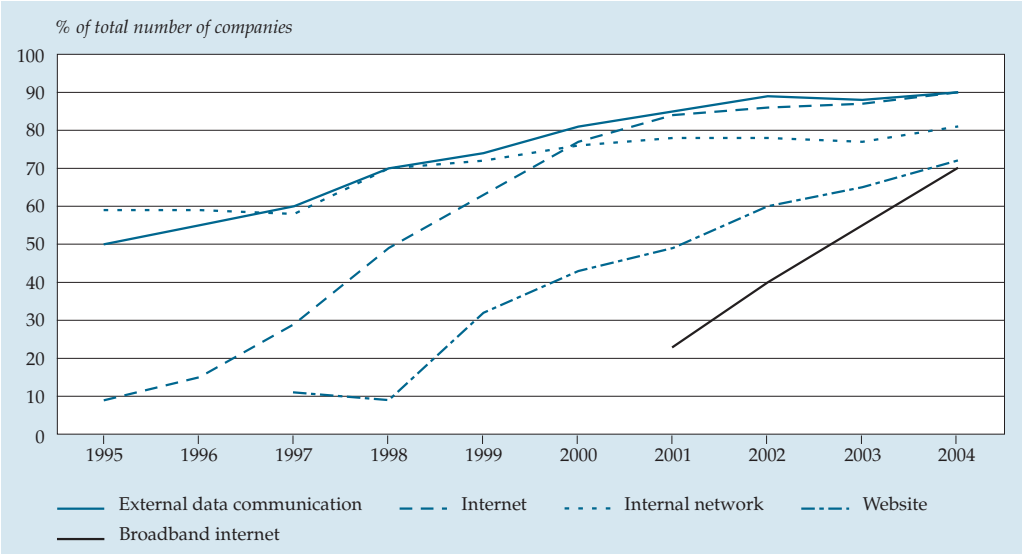
In the past, in preparation for the publication *The Digital Economy*, extensive discussion took place about the distinction between 'readiness', 'intensity' and 'impact', terms introduced in OECD studies (1999). 'Readiness' means a check on the available equipment, cables and cases. This continues to be a popular statistical field: how many pc's, how many Internet connections, etc.? 'Intensity' refers to the use of ICT. Lastly, we arrive at the impact of ICT, which is what we have tried to study.

Figure 3.1 shows that when it comes to ICT operated by companies (which is in fact *readiness* and to some extent, *intensity)*, broken down into the use of computers, external data communication and the Internet, we are approaching saturation.

Therefore, this information is about to lose its significance. Impact is the real issue here. Solow's paradox, defined in 1987 [3] (Solow, 1987), kept its relevance until 1996. Up to then it was hard to find anything like ICT-induced productivity growth in the available microdata. However, for 1996 Brynjolfsson and Hitt found such a relationship based on US data [4].

For our own research we linked company performance data and ICT investment data, and we came to a similar conclusion. Moreover, like Brynjolfsson, we found a

3.1 Developments in ICT use by companies

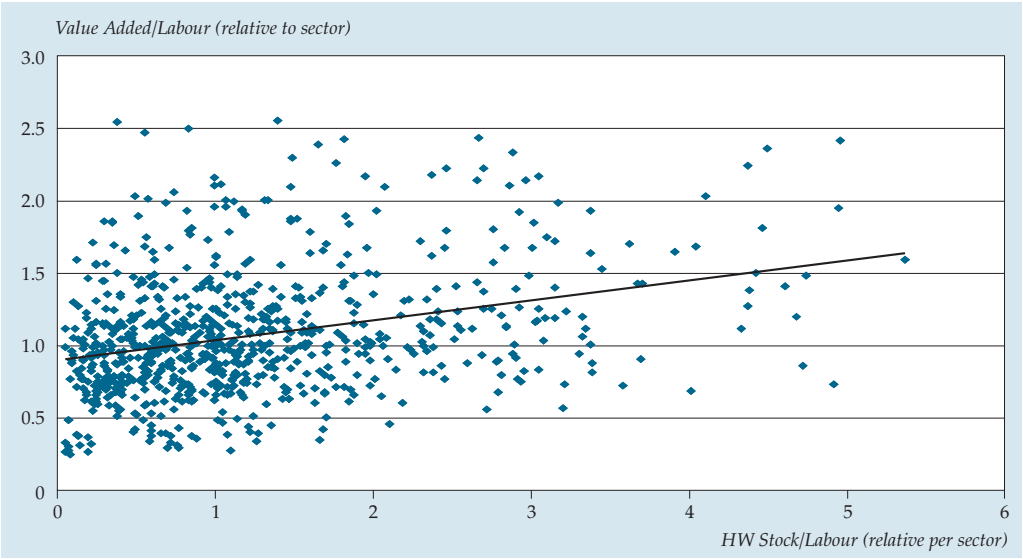


Source: The Digital Economy 2005.

positive, significant relationship between hardware stock per worker and value added per worker (see Figure 3.2).

Nevertheless, the scatter in the diagram is fairly diffuse. A number of companies had made substantial ICT investment without any visible positive effect on

3.2 Productivity plotted against ICT hardware capital stock (whole sample; N=826), 2002



Source: De Graaf (2007) [5].

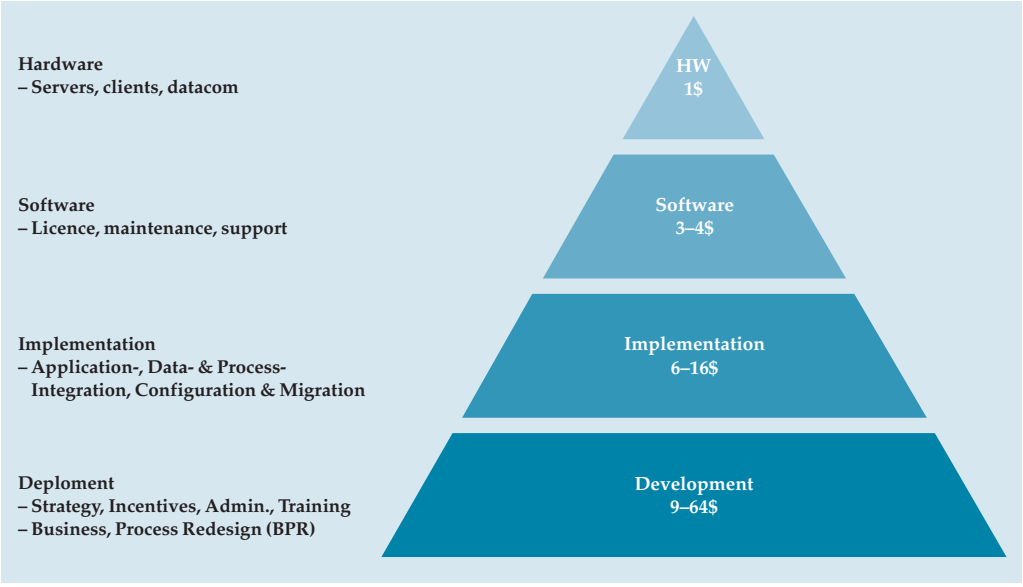
performance, while other organisations saw a great deal of positive returns from a similar level of investment.

ICT hardware is tip of the iceberg

One of the main goals of our research is to come to grips with the underlying factors which can explain this phenomenon. From a management consultant's point of view, an important explanation lies in looking at how ICT investment in hardware is implemented and operated. In reality, ICT hardware is just the tip of the iceberg (see Figure 3.3). Unfortunately, only hardware is measured. A successful trajectory, from hardware – through decisions on software and implementation (i.e. applications, data and process integration, as well as configuration and migration) – to deployment (among other things strategy, training and business process redesign), brings with it a multitude of decisions with increasing financial implications. Therefore, the success of ICT hardware depends on how the processes of implementation and deployment are shaped and managed. This implies a restructuring of the business processes. A company that wishes to maintain its current business process configurations while implementing ICT on a considerable scale is unlikely to be successful. ICT enables increased flexibility, and thus increased productivity.

It is important to realise that at the micro level, Statistics Netherlands' ICT investments involve hardware only. However, the software strongly outweighs ICT hardware in scope and costs. In fact, we have used the hardware as a proxy for the software and the 'manware'.

3.3 ICT investment: hardware, software and intangibles



A variety of business channels

The development of emerging ICT in recent years has led to a variety of new business channels: shops, call centres, websites, and others. By means of an integrated front office, customers can be served effectively as all sales channels meet at one point (client synchronisation). Similar developments have taken place where purchasing is concerned. Further integration makes it possible for a company to mediate between markets on the selling side and markets on the buying side. The same is true for government and education institutions.

Normally, companies have to combine old and new channels, which results in all sorts of integration problems. There may be one front office, but it is not uncommon for back offices to remain divided along traditional lines. Moreover, integration across the supply chain can be a real challenge.

However, there are cases where companies make a fresh start as a virtual organisation. For instance, the Dutch ING Bank (ING Direct) has been successful in operating financial services through two channels: a call centre and the Internet. This venture is based on a limited set of standard products (fewer than 10 rather than near to 200), especially savings accounts and mortgages. It was launched in countries where ING had not been active before. In these countries there are no 'legacies' such as a client base that has to be taken into account. Therefore, ING Direct does not operate in the Netherlands. ING started this venture in Canada. Initially a few clients wanted to see a coffee corner in a building to have some visible evidence of the bank's existence. But in the space of a few years, ING Direct became a fully-fledged virtual organisation. ING Direct now operates in eight countries and is realising a spectacular growth. This is an interesting example of a company embarking on a totally new formula without having to cope with the conventional way of doing business.

The single front office

As stated above, normally companies have to deal with their existing structures. The single front office implies a 'turning over': the client's needs must be put first, without him or her being bothered with how the company has organised its sales and production processes (channel integration and integration of front office and back office). However, for the back offices to comply, it is necessary to implement various interconnections that did not exist before. Similar processes take place in the supply chain (e-procurement, e-market places) where the company takes a purchasing and outsourcing role.

A research model

To keep the old and the new modes of production and sales together, standardisation of processes is very important. To understand the implications of integration and standardisation, we developed a model for our study consisting of three dimensions:

1. The ICT architecture consisting of five layers: business, process, information, application and technology;
2. The integration scope: none, department (activity oriented), business unit (process oriented), company (system oriented) and chain connecting clients and suppliers (chain oriented);
3. Business functions: sales (CRM), purchasing (e-procurement), production planning and logistics (SCM/DCM, financial management (ERP), personnel management (HRM), knowledge management.

The research hypothesis claims that the higher the integration scope, the more successful a company will be in turning its ICT investment into higher productivity. In this way we may be able explain the scattered results found by Brynjolffson.
With respect to ICT architecture, we focused on three layers: process, information and application. Ample time was devoted to the development of the questionnaire. Before Statistics Netherlands mailed the questionnaire to about 1,000 companies with more than 80 employees, 25 oral interviews were held with CIOs (of companies with at least 100 employees) to find out whether the model fits well with their thinking and experience.

Among other things, the selection of the companies was based on whether they had participated in different regular surveys over a longer period, in particular the production survey (business performance) and the automation survey. In this way, it was guaranteed that micro-research (panels) could be carried out by linking the results of the new one-off survey with other relevant data.

Response was approximately 60 percent. This is a good result and was partly caused by the fact the respondent did not have to dig into accounting systems or other databases. The answers were based on an insider's view of the company which could be expected from the CIOs.

Integration and productivity

A few results, referring to different applications, can be mentioned. For instance, companies which have high scores on integration (e.g. integration of financial applications) showed an above average score on productivity. This and other results were certainly statistically significant. In the financial field, this also applied not only to application standardisation, but also to information standardisation. Similar strong correlations were also found in the area of sales and production/logistics. In broad lines we can say that – at this point – the theory of integration and standardisation (impacting firm productivity) seems to work in practice.

Conclusions

Our study is examining ICT and productivity. The spread in the relationship between ICT investment and productivity prompted us to look for additional

explanatory variables, especially with respect to phenomena which were seen as intangible. We have focused on integration and standardisation at different levels of business activity within companies. The first results have brought to light new variables which explain productivity levels.

I have already indicated that it is a great pity that we have only figures on hardware. I would urge Statistics Netherlands to restore the measurement of software and 'manware'. If it were to do so next year, we will have a gap of four years. However, this would be better than letting the void continue.

Discussion

Links between sales, production and the supply chain also appear to have positive effects on productivity. ERP appeared to be a good instrument to centralise processes but may lead to more bureaucracy again. Different types of integration and standardisation must be distinguished. Flexibility can be achieved at the level of processes, even though applications and information flows are strongly standardised. However, flexibilisation within comprehensive ERP systems is expensive; that is why it does not happen very often. Indeed, companies often try to put their old processes into their ERP system; this requires a great deal of bespoke adaptations. If this is not done, there will be one stereotype ERP, which is not without flexibility, but such as system will require a change in the organisation's culture.

Notes

1) N.G. Carr, 'Does IT Matter? Information Technology and the Corrosion of Competititve Advantage'. Harvard Business School Publishing, 2004.
2) This refers to the project 'E-business, ICT and statistics', a joint project of the Free University of Amsterdam and Statistics Netherlands. The work was done by Xander de Graaf (Ph D student) assisted by Stephan Beckermann. In his capacity of informatics professor, Wouter Keller has supervised this project. Because of medical treatment Xander de Graaf could not participate in the presentation. We deeply regret to announce that Xander died on 1 August 2006 at the early age of 29.
3) R. Solow (1987), 'We'd better Watch Out', New York Times, Book Review Section, July 12, page 36.
4) Brynjolfsson, E. and Hitt, L. (1996), 'Paradox lost? Firm-level evidence on the returns to information systems spending'. *Management Science*, Vol. 42, Iss. 4; pp. 541–559.
5) See for De Graaf's analysis: Xander de Graaf, 'ICT Maturity and Firm Productivity. Adding Organisational Aspects to the Equation'; in: Teun Wolters (ed.) '*Measuring the New Economy. Statistics between Hard-Boiled Indicators and Intangible Phenomena*'. Elsevier Science Publishers, 2007; Chapter 8.

4. ICT and complex value systems

Cees van Beers
Associate Professor of Innovation Economics, Delft University of Technology

This chapter is about micro-economic research as part of the ICWAS project (ICT and Complex Value Chain), a joint project of Delft University of Technology and Statistics Netherlands. This research complements that of Xander de Graaf and Wouter Keller (see previous chapter) in that it focuses on external relationships and networks enabled or facilitated by ICT investment. The primary aim of the research is to find out whether new ICT-based external collaboration has an impact on a firm's productivity, and if it does: what exactly is this impact?

The data were collected by means of two surveys conducted in two business sectors: the travel sector (agents and tour operators), wholesale (in this case of electric motors and other electrical machines, and of chemical products) [1)]. The relevance of the sectors in terms of external networks had already become evident in previous research by Harry Bouwman of Delft University of Technology.

The two surveys included both travel and wholesales. The first survey was intended to find out what kind of ICT investment (i.e. investment in software) had been made, how this had had an impact on the way the companies work together with other companies in the supply chain, and whether it had an impact on certain qualitative performance measures (which can be surveyed without involving the firm's bookkeeping), such as improvement in competitive strength. This first survey also served the purpose of selecting companies for the second survey based on the following criteria:
- Existence of ICT links with other companies;
- New products which could not be produced without ICT and collaboration;
- Investment in ICT software which is conditional on 'deep business integration' (CRM, middleware and web services).

These steps were deemed important as they concern a relatively unexplored area of research. In the USA Seidmann e.a. [2)] had done some work on the subject, mostly based on interviews.

The first survey was used – among other things – to select companies for the second survey. These companies could be identified as having ICT-based information systems used to work together with other companies in the chain. The second survey made it possible to work this out further. It asked how many corporate

collaboration arrangements a company had, facilitated by ICT. Subsequently, it asked more about these interorganisational collaborative links.

Analysis of the travel sector

Tables 4.1 and 4.2 present the data collected in the first survey.

Table 4.1
Travel sector; first survey

Size class (employees)	Questionnaires sent	Cumulative %	Response	Cumulative %
<20	122	59.5	81	63.8
20–49	44	81	28	85.8
≥50	39	100	18	100
Total	205		127	

Table 4.2
Wholesale; first survey

Size class (employees)	Questionnaires sent	Cumulative %	Response	Cumulative %
<20	474	67.2	341	68.8
20–49	155	89.2	104	89.9
≥50	76	100	50	100
Total	705		495	

Table 4.1. shows that over 80 percent of the travel companies in the survey had fewer than 50 employees. The same is true for wholesale (Table 4.2). As the smaller companies are underrepresented in the production statistics, this makes it difficult to link the figures.

Table 4.3
Travel sector and Wholesale; second survey

	Questionnaires sent	Response
Travel sector	81	59
Wholesale	277	182
Total	358	241

The second survey resulted in a response of 59 travel and 182 wholesale companies (see Table 4.3). The first analysis was on the relationships between variables within the survey, relating available ICT to other economic performance variables (i.e. indirect productivity indicators). The second analysis attempted to relate survey variables to productivity variables from Statistics Netherlands' production statistics. The former are qualitative in nature (with the advantage of easy measurement as they do not require searching of records) while the latter are quantitative in nature. Unfortunately, these quantitative data were less up-to-date: during the analysis (late 2005/early 2006) the most recent figures referred to 2003, but here refer to 2002. Naturally, this was a negative aspect of the analysis, and calls for a new analysis as soon as more recent performance data become available.

Taken together, the following performance indicators were used for the travel sector:
- percentage of turnover through the Internet;
- perceived improvement of competitive position thanks to IT (2000–2002);
- value added per fte.

The following explanatory indicators were selected from the survey for the travel sector:

– company characteristics:	size, export-turnover ratio;
– IT investment:	CRM, middleware and web services;
– IT use:	website use and links with tour operators;
– IT dependence:	dependence on software suppliers, legacies and standards
– IT planning:	IT investment embedded in strategic planning;
– IT and collaboration:	purchasing, production, sales.

IT investment is not just a matter of the amount of money spent; it also involves implementation: small firms in particular frequently fail to use available IT to its full potential. That is why IT use is an important variable. IT dependence is a technical aspect which may reduce a firm's flexibility. IT planning is included as opposed to ad hoc provisions which are seen as less efficient than well considered integrated IT applications. IT and collaboration combines the question of whether there is external collaboration (in purchasing, production or sales) and the question of how important the role of ICT is in this respect.

Table 4.4 presents the results of a univariate correlation analysis, and Table 4.5 the results of a multivariate correlation analysis (regression analysis). Both tables show that IT planning in particular significantly correlates with the three performance variables. This confirms the hypothesis that companies that think strategically and incorporate their ICT needs in their strategic planning do better than those that do not. Surprisingly, IT collaboration has no visible effect on productivity, although the

fact that the latter data refer to 2002 may moderate the significance of this finding. Moreover, IT collaboration appears to have a positive effect on perceived competitive position thanks to IT (which in general appeared to correlate positively with value added per fte generated in 2002).

Table 4.4
Travel sector: Univariate correlation analysis

Explanatory variables	Percentage of turnover through the Internet (2003)	Performance variables Perceived improvement of competitive position thanks to IT (2000–2002)	Value added per fte (2002)
IT investments	0,17	0.39***	0,14
IT use: website	0.23**	0.51***	0,11
IT use: connected with tour operators	–0.25**	0.21**	0,08
IT dependence	–0,15	0.32***	–0,04
IT planning	0.28***	0.45***	0.21**
Collaboration: purchasing	–0.33**	0,01	0,02
Collaboration: production	–0,03	0,17	0,03
Collaboration: sales	–0,08	0,19	0,03

* = significant 10%; ** = significant 5%; ***=significant 1%.

Table 4.5
Travel sector: Multivariate correlation analysis

Explanatory variables	Percentage of turnover through the Internet (2002)	Performance variables Perceived improvement of competitive position thanks to IT (2000–2002)	Value added per fte (2003)
IT investments	–0,15	–0,03	0,12
IT use: website	0.62**	0.31***	0,15
IT use: connected with tour operators	–0.58***	–0,11	0,15
IT dependence	0,03	0,11	–0.29*
IT planning	**0.34****	**0.30***	**0.37*****
Collaboration: purchasing	–0.29**	0,03	–0,07
Collaboration: production	0,04	0.32*	–0,03
Collaboration: sales	0,02	0.27*	–0,03
Number of companies involved	35	44	44

* = significant 10%; ** = significant 5%; ***=significant 1%.

Analysis of the wholesale sectors

For the two wholesale sectors surveyed, the following performance indicators were chosen:

- Turnover from new products: this could not have been realised without IT and interorganisational collaboration (1= strongly agree; 5= strongly disagree);
- Because of IT, there was a better match between production and: demand of suppliers, demand of customers; cost reductions were realised (1= strongly agree; 5= strongly disagree);
- Value added per fte 2002.

It is important to take cost reductions into account, as part of this IT benefits will probably be transferred to the consumer (consumer surplus) through lower prices rather than resulting in higher productivity.

The following explanatory variables were used for the wholesale sectors:

- company characteristics: size, export-turnover ratio;
- IT investment: CRM, middleware and web services;
- IT use: website use and links with tour operators;
- IT dependence (1): technical dependence on software suppliers, legacies and standards;
- IT dependence (2): economic dependence (demand from suppliers and customers);
- IT planning: IT investment embedded in strategic planning;
- IT and collaboration: purchasing, production, sales.

Table 4.6. gives univariate correlation coefficients for the wholesale companies which participated in the survey in aid of the 2002 production statistics. Remarkably, there is no significant effect of IT collaboration on productivity (value added per fte). However, if we take the companies which participated in the surveys for the production statistics 2000, 2001 and 2002, then there is an undeniable positive effect between collaboration and productivity (see Table 4.7). An important explanation for this is the fact that Table 4.7 refers to a group of larger companies (as these are included in the survey for the production statistics every year or at least are likely to be selected repeatedly based on a large sample). Therefore, it may be concluded that for larger companies, IT-based collaboration with external partners is positively associated with higher labour productivity. The multivariate analyses do not change the overall conclusions (see Table 4.7 and Table 4.8).

If we compare the two groups of companies that were analysed, we see that in the travel sector IT planning is a distinguishing success factor, whereas in the wholesale sector external collaboration seems to make a notable difference as success factor. The qualitative performance variables used in the surveys, which were specifically set up as part of the research plan, turned out to provide added insight. They also

have the advantage of being able to be measured without putting the respondent to too much trouble. The analyses suffered from the relatively outdated production and performance data. This argues in favour of repeating the analyses as soon as more recent production statistics data become available.

Table 4.6
Wholesale: Univariate correlation analysis (involving firms in the production statistics 2002)

Explanatory variables	Turnover from new product (collaboration and IT)	Performance variables Perceived attuning cost reduction thanks to IT	Value added per fte (2002)
IT investment	–0.32***	–0.1	0.07
IT use:	0.25**	0.57***	0.01
Technical IT dependence	–0.07	0.15**	–0.14*
Economic IT dependence: on customers	0.09	0.23***	0.11
Economic IT dependence: on suppliers	–0.07	0.15**	–0.14*
IT planning	**0.12**	**0.41*** **	**–0.03**
Collaboration: purchasing	–0.14*	0.11	0.02
Collaboration: production	0.1	0.20***	0.03
Collaboration: sales	0.11	0.16	–0.03

* = significant 10%; ** = significant 5%; ***=significant 1%.

Table 4.7
Wholesale: Univariate correlation analysis (involving firms in the production statistics 2000, 2001 and 2002)

Explanatory variables	Turnover from new product (collaboration and IT)	Performance variables Perceived attuning cost reduction thanks to IT	Value added per fte (2002)
IT investment	–0.37***	–0.01	–0.08
IT use:	0.16	0.59***	0.06
Technical IT dependence	–0.15	0.03	–0.12*
Economic IT dependence: on customers	0.02	0.02	0.03
Economic IT dependence: on suppliers	–0.005	0.13	–0.01
IT planning	**0.03**	**0.32*** **	**–0.04**
Collaboration: purchasing	–0.15*	0.03	0.30**
Collaboration: production	0.21*	0.14	0.36
Collaboration: sales	0.07	0.15*	0.26**

* = significant 10%; ** = significant 5%; ***=significant 1%.

Table 4.8
Wholesale: Multivariate correlation analysis (involving firms in the production statistics 2002)

Explanatory variables	Turnover from new product (collaboration and IT)	Performance variables Perceived attuning cost reduction thanks to IT	Value added per fte (2002)
IT investment	–0.39***	–0.16**	0.09
IT use:	0.17*	0.52***	0.08
Technical IT dependence	0.01	–0.06	–0.12
Economic IT dependence: on customers	0.26**	0.18***	0.1
Economic IT dependence: on suppliers	–0.18*	0.05	–0.12
IT planning	0.01	0.23***	0.03
Collaboration: purchasing	–0.14	0.04	–0.02
Collaboration: production	0.02	0.04	0.07
Collaboration: sales	0.06	0.06	0.04
Number of companies involved	140	140	140

* = significant 10%; ** = significant 5%; ***=significant 1%.

Table 4.9
Wholesale: Multivariate correlation analysis (involving firms in the production statistics 2000, 2001 and 2002)

Explanatory variables	Turnover from new product (collaboration and IT)	Performance variables Perceived attuning cost reduction thanks to IT	Value added per fte (2002)
IT investment	–0.40***	–0.06**	0.05
IT use:	0.2	0.62***	0.26**
Technical IT dependence	–0.11	0.00001	–0.39
Economic IT dependence: on customers	0.22	0.31**	–0.15
Economic IT dependence: on suppliers	0.1	–0.09	0.02
IT planning	0.02	0.17	–0.05
Collaboration: purchasing	–0.14	–0.08	0.61***
Collaboration: production	0.24*	0.07	0.40**
Collaboration: sales	0.13	0.02	0.36**
Number of companies involved	69	69	69

* = significant 10%; ** = significant 5%; ***=significant 1%.

Notes

1) Statistics Netherlands has also conducted a third survey in the area which focused on larger companies in various industries. However, the results of this survey were not yet available when preparing the presentation from which this chapter derives.
2) A. Seidmann and A. Sundarajan, 'Sharing Logistics Information Across Organizations: Technology, Competition and Contracting', in: C.F. Kremerer (ed.), *Information Technology and Industrial Competitiveness: How Information Technology shapes Competition*, Kluwer Academic Publishers, 1998, pp. 107–135.

Discussion

The analyses did not corroborate all the expected relationships. The response of small firms seemed to suffer from a lack of accuracy. It is, however, questionable whether unwelcome results on the basis of such arguments should be discarded. It would be preferable to reconsider the situation. For instance, the fact that collaboration in the travel sector does not lead to expected results may also have to do with the turbulence in this sector and the shake out that is taking place. Travel agents may be resorting to collaboration in the chain to make the best of a bad job. Under such circumstances, a positive correlation between collaboration and productivity seems unlikely to be demonstrated.

It was suggested that working with panel data based on a group of companies followed over a number of years – taking productivity growth as dependent variable – would be a better way to measure the effects of ICT investment. This would mean that company-specific characteristics could be taken into account. It is quite possible that certain ICT characteristics of companies may relate to other more fundamental characteristics. This may be overlooked in a cross-section approach as presented here. However, such a panel-based approach would require further research over a number of consecutive years. The case as described above managed with data what was available. The variable IT planning already indicated that organisational features play an important role in a successful business.

5. *Sustainable transport systems: ICT and new statistical challenges*

Jo van Nunen
Professor of Decision and Information Sciences, Erasmus University Rotterdam

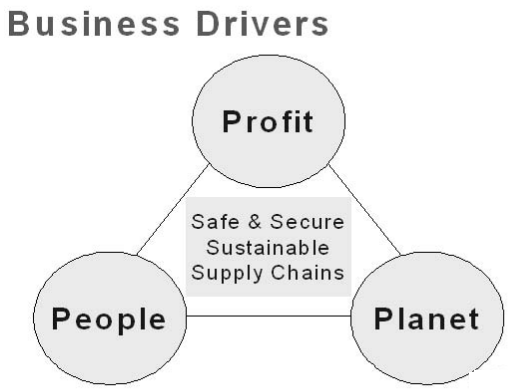
This presentation is about sustainable mobility, Supply Chain Management (SCM), measuring in chains and future statistics.

The statistical challenge is to take the right steps so that you can measure all kinds of (linked) processes without a need to conduct new surveys.

Many interesting new developments

The world is changing. There are no longer just products, we now have products and services. These are produced not just by single companies, but by companies and networks. Traditional vocations go together with electronic systems (brick and click economy), companies work together with universities, etc. Is there such a thing as the New Economy? There is no New Economy, but there *are* many interesting new developments. These invite us to look at the world in new ways. This is also true for Statistics Netherlands.

In fact, every sector has to be aware of what is going on, and ask itself what this will imply. This is very exciting. In the field of mobility, I am engaged in the *Transumo programme*, which makes it possible to see things in a coherent way. We need to develop a vision on mobility and people, a vision on transport and freight, and a vision on traffic and infrastructure.



Sustainable supply chains

It is not only ICT that is forcing us to change, various demands for security, safety and sustainability also play a part. These should all fit together in such a way that doing business (making money) is consonant with safe, secure and sustainable supply chains (according to the three P's of profit, people and planet).

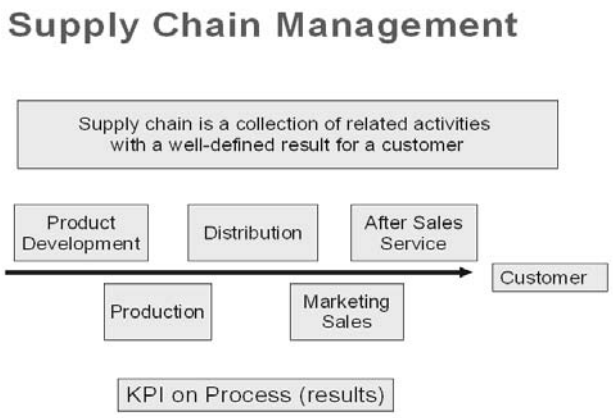
Mobile phones

All kinds of monitoring can be done through mobile phones, which makes it possible to trace their owners. This opens up opportunities to monitor freight and to measure the intensity of the use of infrastructure. Such measurements can be done instantly so that the available data are very recent, avoiding the problems of having to use figures on 2002 in 2006.

Demand management

As the supply chain is dominated by demand, we should also look at demand management. This means that it is the customer who determines the processes. This in turn implies multi-channelling: some customers order by phone, others via the Internet, some pick up the purchased products themselves, others requires delivery.

Performance indicators must consider entire chains, not just parts of them. Various drivers of integration are facilitated by ICT: ERP systems, web services, mobile communications, sensors, RFID, ASP, auctions, agents and smart components etc. Customers have changed, i.e. they have become more demanding. To guarantee quality and safety, we must have an insight into the goods flowing through the subsequent links of the supply chain. Process synchronisation is one of the new concepts that take the customer as point of departure (shop- shelves should be filled with a range of products; all processes should be geared to meeting this requirement). These concepts are supported by enormous possibilities for



measurement: demand, cargo, resources, products and components, infrastructure, processes, they can all be measured and monitored.

Online optimisation

To work this out, it is important to involve specialists in different areas, such as statistics in the form of data mining, decision support systems, feedback etc. Actually, planning and scheduling are outmoded in this context, even though we use the term 'advanced planning'. We can follow all the processes closely, which makes it possible to manage them (online optimisation). In particular: RFID tagging makes it possible to measure what is happening at many points in the supply chain. The prices of the required chips are expected to decrease in the course of time. The collected information can be used for several purposes. But the question arises of what effects this has on productivity etc. The data can be used for statistical description and statistical analyses, replacing written surveys.

The statistical opportunities of these developments can be demonstrated by briefly presenting four cases.

Import declarations

The first one is the Segitta electronic system to file import declarations with customs authorities. The system involves ample information on the vessel, the goods, materials, port of origin etc., which are also interesting from a statistical point of view. This process is real time, which makes it possible to have quick updates of point and flow measurements. The dynamic era begins when statisticians start measuring these flows continuously, so that it will be immediately known when, for instance, the economic tide is on the turn.

Measuring beer crates in circulation

The second case refers to the modern measurement (RFID, GPS) of beer crates in circulation.

The information needs are various.

Stock management, cost control	>>>	How many crates are in use?
Operations management	>>>	How many crates are available for production
Capacity utilisation	>>>	What is the turnaround time of containers?
Chain Management	>>>	Which parties in the chain contribute how much to the turnaround time?
Reverse logistics (origins of returns relative to sales in the past)	>>>	How does government intervention affect the productivity of operations?

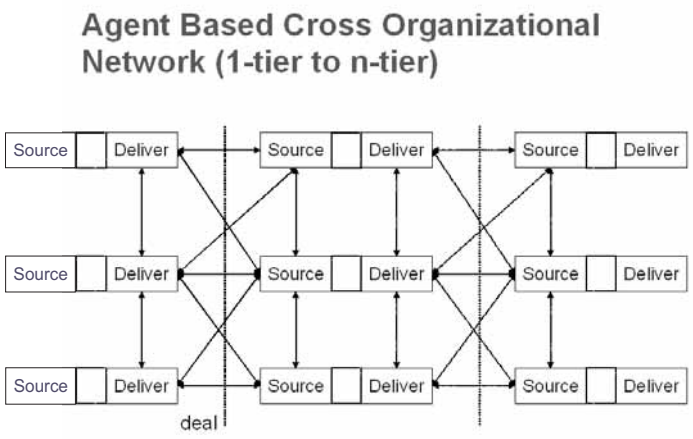
Indeed, modern measurement methods make it possible to have exact measurements of the turnaround times, exact information about the location and quality of the products and insight into chain dynamics. This allows better calculation of – for example – depreciation rates and turnaround time of stock. However, such advanced measurement implies processing of huge amounts of information acquired at a high frequency and the application of advanced methods of analysis on a routine bases. To do this, adequate statistical methods must be developed.

Online truck information

The third case involves a road haulage company. Thanks to the mobile phones used by the lorry drivers, it is possible to know exactly where the various lorries are. This information can be used for logistical purposes. When a new order comes in, the information from the network can be used to find out which lorry could be deployed to carry out the new order. In principle, it should be possible to use such a network to improve the company's planning system. However, it is also possible to provide other parties (such as the container handling company) with online truck information. Privacy issues which may arise here need to be solved. This practice increases the productivity and the capacity of the network It is important to realise that we are talking about the productivity of the entire network and not just that of one player. New opportunities are also created for setting up statistics for dynamic online supply chain control.

Virtual agents

The fourth case refers to the use of virtual agents to make use of data in sustainable supply chains. Intelligent agents make it possible to move from simple horizontal



Smart selling & buying lower integration- and coordination cost

sourcing and delivery to agent-based cross-organisational supply networks that deal with complex products and services. They optimise higher product values while reducing operation costs within the network.

New statistics

The research opportunities are the development of statistical theories and models that help to analyse dependent process data in supply chains, and statistical theories and models that help to evaluate the economic, ecological and social (or sustainable) consequences of transport, in practice and policy. This could lead – this is our challenge – to New Statistics for Trade, Transport and Logistics. This is a fantastic and exciting new area of working together.

Discussion

The systems discussed could be a threat to liberty as they seem to perplex people. Such a danger should be recognised. However, as explained, supply chain management is in fact about demand management. Everything is geared to pleasing the customer. In recent developments, the influence of demand has become notably stronger. Moreover, not all supply chains are so structured that they are liable to the optimisations as suggested here. Technology has its limitations, also when new horizons of achievement are emerging.

6. *Measuring e-government in the Netherlands*

Teun Wolters
Statistics Netherlands

For all of us it will be clear that the New Economy mainly concerns trade and industry. Does it also relate to the government? The answer is: yes. I shall try to indicate how Statistics Netherlands attempts to conceptualise this. One of Statistics Netherlands' strategic spearheads is measuring the knowledge-based economy, in particular technological renewal, i.e. developing innovative strength which is also based on ICT. There is a link to the Lisbon strategy in this respect, according to which the EU should be the most dynamic economy in the world within in a decade. Although this seems a difficult goal to achieve, as such it still is relevant. When it comes to technological renewal, in the view of Statistics Netherlands it is not only e-commerce or the use of PCs by households that should be measured. We need to go further, and look into e-business (processes within companies and production quality) and also into e-government. The latter implies recognition of the fact that the government produces all kinds of products – in particular services – which are of great importance to society.

E-business and e-government

Indeed, it is possible to draw a parallel between e-business and e-government. In both cases, we look at process changes and supply chain relationships. The chains in business and government differ on various points, but there are also similarities. With respect to the government, it is important that they make use of the same standardised registers within and between governmental organisations and with the customers of these organisations.

Municipalities

Statistics Netherlands is developing an e-government monitor, which will focus on municipalities in particular. Later the scope of the monitor will probably be extended to include other governmental organisations. The use of common registers (preventing all kinds of duplications) is also a matter of communication between different levels of government.

A total-quality model

The common conceptual framework we use is the INK model. This is a total-quality model also used in industry. The use of this model indeed underlines the parallels between the business sector and the government sector. The EGEM (a government unit specialised in promoting e-government for municipalities) uses the INK model to carry out quick scans in the area of e-government. These scans involve in-depth talks with municipalities to find out to what extent they have developed their

information systems as well as their online services to civilians and companies. The monitor that Statistics Netherlands has contemplated uses a number of basic concepts from the INK model so that it has a similar terminology and perspective for improvement. In this respect the harmonisation and standardisation of information systems and processes is a major element in the rating of progress in e-government. In addition to producing aggregate figures, it should be possible to use the monitor as a benchmark. For instance, individual municipalities should be able to compare their own score with the average score of the size-class.

Policy goals

How much progress has e-government made in terms of online services offered by municipalities? The government itself set the following goal: in 2007 65 percent of public services will be rendered online (i.e. through the Internet). The government's own monitor measures the progress. In July 2005 the average achievement rate was 55 percent. Just over half of the population lived in a municipality that more or less complied with the 65 percent target. The larger local authorities were in the lead.

The present monitor that the government has set up is the result of web-based research (Overheid.nl monitor). In other words, it measures the functionality of a municipality's website by inspecting it. In the first stages of development this information will certainly give an indication of how much progress local governments are making in e-government. However, in the longer run all municipalities will offer a range of services online. However, to find out whether they do so effectively and efficiently will require insight into the internal chain processes, which is much harder to measure. The INK model offers a major first step to help us do this. The scores a municipality receives from the Overheid.nl Monitor could be combined with the scores from a monitor based on the INK model. Duplications should be avoided.

Different strategies for implementing e-government

It has not fully been decided which information Statistics Netherlands will collect through its e-government monitor. However, in the first place, the monitor may ask questions about the strategy of municipalities with respect to implementing e-government. A number of municipalities may still be in the stage of basic orientation; they do not seem to be in a hurry and have not yet decided how much energy they want to put into this. Some municipalities may be inclined to adopt suitable solutions that others (mostly the larger municipalities) have developed. The larger municipalities in particular may decide to take the lead in developing e-tools for a selected field (one or more specific services), while for other services they wait until others have done the job.

Knowledge about these strategies may be interesting. For instance, if it is true that small local governments wait until they can copy e-government devices from the

larger bodies, to stimulate e-government it might be more helpful to subsidise larger municipalities so that they can speed up developments and provide support to smaller municipalities rather than to subsidise small municipalities directly.

A small number of municipalities appear to have taken the lead in developing the whole spectrum of e-services. This strategy is rewarded by extra subsidies while the frontier position gives positive publicity, which may help to position a municipality as a modern city, an attractive place to live and work.

Without a doubt, some of the questions will refer to the integration of front and back offices, because this a crucial to the success of e-government. Such questions can be differentiated according to the various sectors such culture and sports, education, care, spatial planning and the environment, public order and safety, and civil issues (such as passports).

Standardisation

Further questions need to address the levels of standardisation of definition and formats, the standardisation of software applications, the structuring of data exchange with allied organisations (such as the fire services) and other third parties. The design of the questionnaire requires ample attention, as the subject matter is surveyed on a fairly abstract level. Tests among the target group are necessary to find out whether the questionnaire makes sense to the respondents.

Respondents need to know their organisation fairly well and should be aware of what the e-revolution could bring about. However, the response should not require much work to find all kinds of information, so the questionnaire should be fairly easy to complete.

Real performance measurement, based on hard internal figures and evaluation by customers is not yet within reach. This would require measurement of the extent to which the public makes use of online services (assuming they have a choice between different media) and how they rate the quality of the services.

Nonetheless the following statement can be made:
The development of e-government statistics based on the INK model is a major step towards a better insight into how the government is functioning, as well as into the quality of public services.

7. *The Digital Economy*

Andries Kuipers
Statistics Netherlands

Around the year 200 The New Economy gave rise to high expectations and the question was whether Statistics Netherlands' statistical framework was capable of measuring the many far-reaching changes that were about to take effect. At that time I was taking the first steps towards the publication The Digital Economy. Now we have published the sixth annual edition.

The publication was originally instigated by the Ministry of Economic Affairs, which was puzzled by different – often contradictory and hardly transparent – figures on computers and the economy available from various private sources.

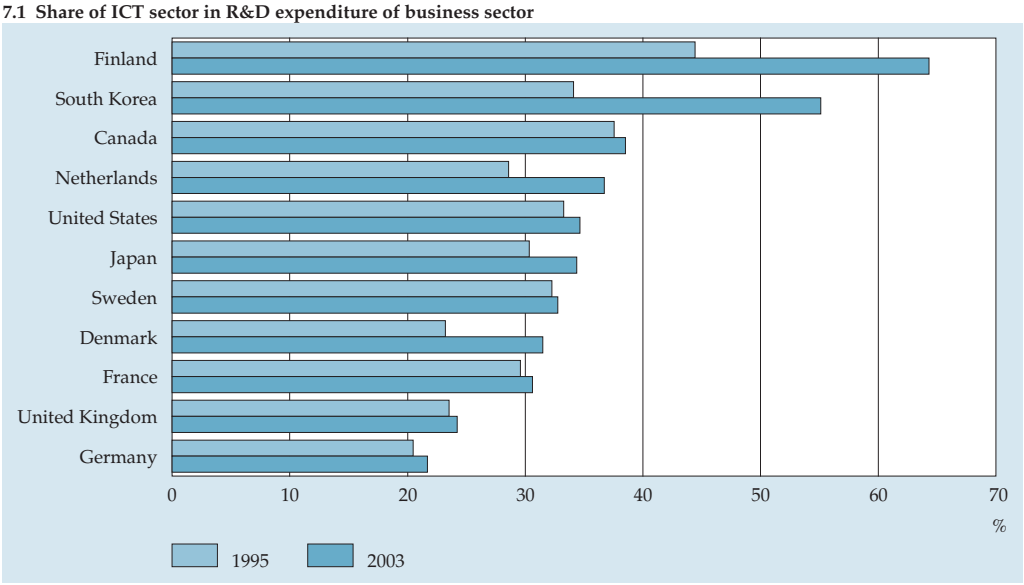
We started out with the available statistical material, selecting figures that related to ICT production and investment. This process ran parallel with the work being done at Eurostat and the OECD. Indeed we also participated in these international processes of searching and consultation.

We defined the ICT sector in conformity with the definitions agreed by Eurostat and the OECD and compiled figures on production, value added and employment for this sector.
We also defined ICT goods and services, whose components were identifiable within the existing classifications. This enabled us to publish figures on imports and exports of ICT goods, ICT investment and ICT expenditure; and also on the ICT labour market: employment and vacancies.

To demonstrate what kind of figures we are capable of producing, I present a few tables below. Table 7.1 gives the share of ICT in R&D expenditure by the business sector in 1995 and 2003. Countries with a substantial ICT manufacturing sector have particularly high scores (Finland and Korea). However, the position of the Netherlands is not bad in this respect. Table 7.2 gives the average annual growth rates of imports and exports of ICT goods (1996–2004). Other figures give the extraordinary annual growth of the import and exports of ICT goods by China (between 25 and 30 percent over the period 1996–2002).

Following initiatives within the EU, we have substantially expanded the measurement of ICT use, by both households and companies. We had already been compiling our own automation statistics since 1987, and we gradually transformed these into ICT statistics in accordance with international guidelines. At present there

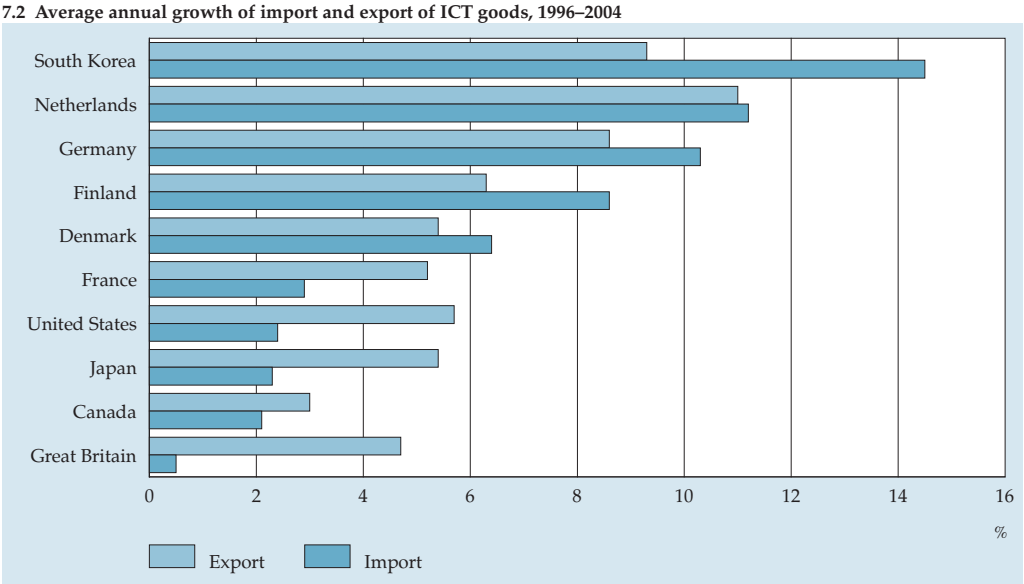
7.1 Share of ICT sector in R&D expenditure of business sector



Source: OECD, ANBERD Database, September 2005.

are no harmonised statistics on ICT use by the public sector. This is probably because of the institutional differences between the various countries, which make the production of comparable figures for the public sector extremely difficult.

7.2 Average annual growth of import and export of ICT goods, 1996–2004

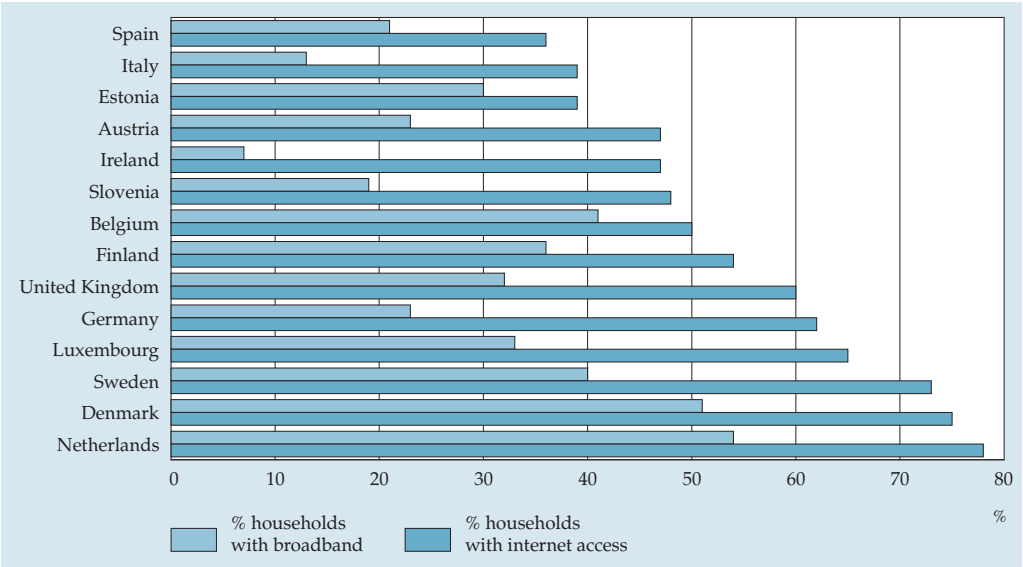


Source: OECD, ANBERD Database, September 2005.

The availability of international benchmark indicators on ICT use has increased significantly, partly to compensate for a lack of time series. Each year certain topics are singled out for extra attention; more details than usual are asked about these topics. In this way the need for information can be met while keeping the response burden within certain limits.

Table 7.3 demonstrates the outstanding international position of the Netherlands in terms of Internet access and broadband connections of households in 2005.

7.3 Internet access and broadband, households, 2005



Source: Eurostat.

However, when it comes to the supply of online public services in 2004, the Netherlands is lagging behind with a score below the EU-15 average.

In the near future, we expect to conduct further micro-research on the relationships between ICT, innovation and productivity. Results of this research will be published in subsequent editions of *The Digital Economy*.

An interesting recent development is a new European classification (NACE 2008) which defines an Information and Communication sector similar to that implemented in the US and Canada. This makes it much easier for us to follow what is going on in the ICT sector and the content sector:
– 58 Publishing (books, newspapers, software);
– 59 Motion pictures, video, music;

– 60 Broadcasting and programming;
– 61 Telecommunications;
– 62 IT- and information services.

Additional information which is dependent on surveys will probably be obtained by using existing questionnaires flexibly when possible: perhaps by adding new modules to Eurostat surveys, or introducing new indicators emanating from our own research projects such as those presented today. We are particularly interested in indicators which contribute to the explanation of successful ICT applications.

I have presented in a nutshell which topics are covered in *The Digital Economy*. It includes a wide range of statistics. One side-effect of this is that the book is growing thicker every year, with an emphasis on descriptive statistics. Perhaps it would useful to give a greater priority to analysis. But, this, of course is a matter of opinion.

Although statistical development which follows international coordination and consensus building is important, it is also very time consuming. In certain cases, we might opt for taking the lead and setting our own development agenda (with a focus on national policy issues). However, this, too, is a matter of opinion. I just mention it to elicit some debate among both the producers and users of *The Digital Economy*.

8. Follow-up research on productivity

George van Leeuwen
Statistics Netherlands

I would like to give a brief overview of the research on productivity and the knowledge-based economy that we have planned to do in 2006 and 2007, and which is one of the spearheads of Statistics Netherlands' medium term programme.

Broader concepts of productivity

Up to now the statistical information we publish on productivity has been fairly limited. There are tables on labour productivity (value added per fte) from the national accounts; but we want to present information on broader concepts of productivity, and this is the aim of our further research on productivity and the knowledge-based economy. Moreover, I would like to tell you about our participation in the international project *IT impact assessment,* focusing on firm performance.

Macro and micro

The spearhead 'productivity and the knowledge-based economy' has two major tracks: macro/meso and micro. Macro/meso refers to national figures and related industry figures. Micro refers to individual company data. Although the two tracks are related, it is not easy to establish a link between the two. We shall return to this later.

Collaboration

We are interested both in measurement and analysis. To do this, we want to work together with others (based on previous contacts), in particular with the University of Groningen and the Netherlands Bureau for Economic Policy Analysis (CPB) within the EUKLEMS project, EIM, and SenterNovem. And of course, within the above mentioned EU project, we shall have an opportunity to work together with colleagues from other countries.

As regards the macro/meso track, we intend to work on:

- Measurement of multi-factor productivity (MFP) growth;
- The knowledge module (embedding structural indicators in the National Accounts);
- Internationalisation of R&D (measuring R&D by multinationals);
- Innovation in services and small companies (growing importance of the services and the dynamics of small companies).

The micro-macro link

The micro track concerns the tie-up between productivity research at the micro level and at the macro/meso level. Even if there were complete quantitative coverage of

all companies (no samples) then the micro-macro link would not be perfect, as the macroeconomic framework has its own specific concepts, definitions and integration procedures.

However, at the micro level it is possible to apply the productivity analyses carried out at the macro/meso level. This could be a first step in establishing the link. First attempts in this area have already been made (by Bert Balk), and they seem to be opening up new perspectives, in particular for manufacturing. As for the services, special attention should be given to aspects such as survey design (which is an exciting area for statisticians).

Linking databases

The micro research will be based on the linking of various databases, in particular those from the Community Innovation Surveys (CIS), production statistics, investment statistics and the ICT surveys. By integrating the results in Statistics Netherlands' Economic Statistics Database, the research will also contribute to strengthening this framework for statistical integration of micro data.

Previous research

The international (Eurostat) project *ICT impact assessment* is a benchmarking exercise involving twelve countries (with ONS as leader). This project follows up two OECD projects. One of them dealt with decomposing productivity growth into figures for different industries. Here the enterprise dynamics (business demography, entries and exits) was taken into account. A particular area of investigation was how the incumbent firms contributed to productivity growth. The second project (which I did together with Henry van der Wiel of the Netherlands Bureau for Economic Policy Analysis) involved the Netherlands and Germany. This project touched on many issues which to date have not lost their relevance as they have emerged repeatedly in recent research. Using panel data, the project looked into the impact of ICT in the services sector, especially the significance of growth externalities.

Broadening the ICT impact assessment

However, results for two countries is not enough to draw general conclusions. Therefore, for the *ICT impact assessment* project we want repeat the previous research but now for more countries. We shall do in-house studies according to specifications which are as uniform as possible. An international expert group will guide the project.

Improving statistical measurement

The first stage of this research will be developing and testing a methodology for data linking and analysis. Next, the target group can be enlarged based on best practices found in the first stage. From this, recommendations will be made as to how the statistical measurement can be improved. At the same time the research will be extended to other policy areas (competition, innovation).

Statisticians and research

I would like to finish by positing that it is important for statisticians to be involved in analysis, rather than restricting themselves to statistical data collection. Only then will they learn what the properties of statistics are and what you can do with them.

Moreover, it is important for Statistics Netherlands, besides joining internationally coordinated research, to have its own research priorities and act accordingly.

9. *The Investment Climate Monitor* [1)]

Eric Wassink

A new publication

At the instigation of the Ministry of Economic Affairs, Statistics Netherlands has been working on a new publication on the investment climate in the Netherlands [2)]. This *Investment Climate Monitor* provides statistical benchmark indicators for 15 countries within the EU-25 (including a few east European countries) supplemented by 5 countries outside the EU: USA, Japan, Canada, South Korea and Australia.

The link with the New Economy is as follows. Benefits from economic opportunities associated with ICT will only materialise through innovation, which is dependent on enterprise and a country's investment climate.

A major motive for developing this monitor was the existence of a variety of international investment and innovation monitors which assign different rankings to the Netherlands. In a special annex the publication mentions three broad monitors, which use an elaborate set of indicators to indicate the growth potential of a considerable number of countries. The publication discusses the following:
- *The Global Competitiveness Report* of the World Economic Forum,
- *The World Competitiveness Yearbook* of the International Institute for Management Development, and
- *The Country Forecast* of the Economist Intelligent Unit.

The publication also mentions four partial monitors:
- *The European Innovation Scoreboard* of the European Commission
- *The Global Entrepreneurship Monitor* of a consortium of research organisations
- *The Enterprise Policy Scoreboard* of the European Commission and
- *The OECD-STI Scoreboard/Outlook*

Without detailed background knowledge, it is difficult to explain why these monitors give different scores for the Netherlands and to find out how these should be interpreted. Therefore, the new *Investment Climate Monitor* has been set up in such a way that resulting scores can be immediately traced back to particular indicators and related statistical sources [3)].

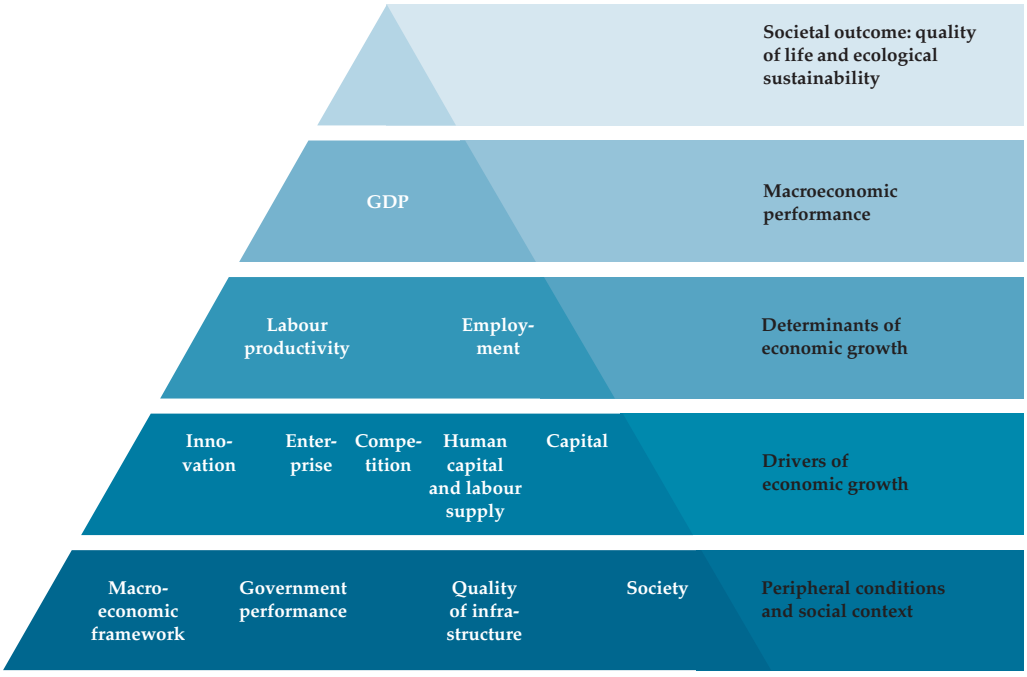
For the 20 countries selected, the publication uses 70 indicators to describe the economic achievements and the related Investment climate, with a special focus on the Netherlands.

The investment climate is unfolded at two levels. First, the publication discusses the drivers of economic growth: human capital, innovation, capital, enterprise and competition. Second, it goes into the peripheral conditions of economic growth: macroeconomic conditions, government performance and available infrastructure. Although these peripheral conditions can hardly be influenced by individual companies, they do to a great extent determine what companies find attractive to undertake. To some extent government policies may influence these factors.

Figure 9.1 illustrates the conceptual model used to structure the publication. At the top is the ultimate goal of economic activity: quality of life which is sustainable. The second layer is made up of macroeconomic performance, economic growth being the most prominent indicator.
Economic growth is dependent on the above-mentioned two layers of the investment climate.

The first *Investment Climate Monitor* was published in 2006 (both as a book and as separate domain on the website of Statistics Netherlands). It concluded that the Netherlands performed averagely in different areas relating to the investment climate. In some cases the scores were high, particularly for macroeconomic conditions and government performance.

9.1 The Investment climate in the Netherlands



The greatest bottleneck seems to be innovation and enterprise (entrepreneurship). A lack of innovation can to a large extent be reduced to a lack of entrepreneurship. The Netherlands seems to be benefiting insufficiently from the economic opportunities which emanate from new knowledge and new markets. Moreover, it appears that Dutch corporate expenditure on R&D is relatively small, which threatens to reduce the country's future innovative capacity and growth potential.

Notes

1) This publication has been completed and published since the conference. Because of this, the text of this chapter has been updated and therefore contains information that was not fully available when the presentation was given.
2) Centraal Bureau voor de Statistiek (jointly with the Ministry of Economic Affairs and Dialogic), 'Het Nederlandse ondernemingsklimaat in cijfers 2006', Voorburg/Heerlen 2006.
3) Similar national monitors have been developed in Ireland, the United Kingdom and Denmark. For details: see publication referred to in note 2.

10. Panel discussion

This chapters discusses different New Economy issues, inspired by a panel consisting consisted of the following persons: Jarig van Sinderen (chairman), Cees van Beers, Jo van Nunen, Marcel Timmer, Joost van der Vleuten and Wouter Keller.

Microsoft

Mando Weller (Statistics Netherlands) asked about the extent of the technical influence of Microsoft. Wouter Keller (Free University of Amsterdam) referred to EU Commissioner Mrs Neelie Kroes, who obviously has strong objections to the behaviour of Microsoft. Nevertheless, one could speculate about what would have happened if Microsoft had not existed. Would completely different systems have developed, operating according to other principles? Jo van Nunen (Erasmus University of Rotterdam) recognised the strong influence of Microsoft but said he believed in possibilities for others to manifest themselves. The Internet is not a product of Microsoft. Bill Gates was converted to the Internet only 10 years ago, after first denying its emerging significance. The problem with Microsoft (in terms of market monopoly) is that they have so much money that if they see a new firm doing interesting things, they just buy it. However, in Seattle, where Microsoft has its headquarters, there are many small innovative entrepreneurs. All of them hope that 'uncle Bill' will notice them; if he 'buys' them, they will be set up for life. There is thus a great deal of innovative activity going on. However, this is a discussion about the market, not about the possible bias that a company like Microsoft might have on statistical processes.

E-government

'Measuring e-government is an important stepping stone towards acquiring more insight into how governments are performing and the quality of services rendered to the public'.

Cees van Beers agreed with this statement in as far as it refers to public services. However, it becomes confusing when we talk about the government in general, which goes beyond services to the public. Jo van Nunen stated that if you want to find out the quality of the services, you have to ask the customers. However, according to the presentation on e-government, this was a bridge too far. Teun Wolters (Statistics Netherlands) stated that such direct measurements should not be excluded in the future. What we need to do now is take an intermediate step. Jo van Nunen believes that the public will find it unacceptable if the government lags behind when elsewhere so many interesting things are happening via the Internet. Teun Wolters mentioned that the Ministry of the Interior makes use of panels to gauge the public's satisfaction with government services. This may be a useful route to follow, rather than conducting extensive written surveys. In this way suitable

indicators could be found. Jarig van Sinderen referred to measurements which show that the public is increasingly dissatisfied with the government, although the public does not clearly distinguish between government and politics.

Joost van der Vleuten (Ministry of Economic Affairs) supported the statement, depending on how the measurement is done. It is a matter of linking straightforward indicators such as those on which services are available online, and the more complex issue of the quality of government performance. What do these say about each other? Public dissatisfaction – as we see among companies – seems to lie in the fact that people want to be in the driver's seat. There is a need for more interaction within the context of the (online) services provision. It is true that the success of e-services is determined by the customers. This can be measured fairly well just by looking at the use of the services. Do people persist in going to the town hall, or do they turn on their computer? Developments such as individual personal identification codes make it possible to measure the public services nationally rather than locally.

Wouter Keller (Free University of Amsterdam) suggested that we should try not to limit e-government to ICT. He used the example of an application for a social security benefit: social security is supported by websites and individual personal codes, making it possible to apply for a benefit online. He advised the audience to try this out. It requires the completion of a 40-page form printed in tiny characters. Hundreds of detailed questions have to be answered, and evidence has to be added (not only bank statements, but proof of payment of things like water rates). You can pump an unlimited amount of ICT into such procedures, but would it not be better to simplify the forms? Moreover, there are various administrative registrations which already contain much of the information that is repeatedly requested. Therefore, many things can be improved in the back office before we jump to the front-office software. These issues might also be subjected to statistical measurement.

Paul de Graaf (VNO-NCW) reported that companies (and the chains they are involved in) frequently deal with several municipalities, and are therefore in a position to compare and evaluate the services provided by different municipalities; the more so as companies have to contact municipalities more frequently than private citizens.

European coordination of statistical development and Statistics Netherlands' own research agenda

Marcel Timmer (University of Groningen) recognised that Eurostat is working slowly, but the resulting figures, which are comparable between countries, are of great importance. Although research on what is going on in the Netherlands might be interesting, the Netherlands is only a small country while we want an

international perspective. Therefore, it is useful to follow two tracks: join international programmes, and do own research (which will be noticed by other countries if it is deemed worthwhile to scale up). Cees van Beers (Delft University of Technology) sees a possible tension between the international requirements of statistical figures and the wishes of national politicians with respect to certain figures. From a scientific point of view, international comparability is extremely important and therefore should be considered at all times. According to Joost van der Vleuten, at times policymakers might like to see specific national figures and statistical analyses. However, the international dimension of today's economy – in terms of competitive strength and innovation – cannot be ignored. The latter calls for figures that are comparable internationally.

From a business point of view, Jo van Nunen underlined that the companies which take part in modern e-processes are not just located in one country. If the speed with which certain technology-related changes roll out differs between countries, this will have an impact on how various tasks will be divided between these countries. Outsourcing is also related to how good certain countries are at picking up new developments. For that matter, it is of great importance to monitor closely what is happening internationally.

Andries Kuipers (Statistics Netherlands) described how – when discussing a particular statistical issue – Eurostat asked the member countries whether there are related research results which are interesting enough to be shared at the EU level. There is usually no positive response to this, because most national statistical institutes are stripped 'to the minimum level of compliance with EU requirements'. Hardly anyone had therefore anything to tell on the basis of extra efforts. Statistics Netherlands seemed no exception to the rule. Against this, Jarig van Sinderen (Statistics Netherlands) stated that, despite limitations, Statistics Netherlands will not restrict itself to the minimum Eurostat requirements. The conference testified to this: the research presented, the publications on the digital economy and the *Investment Climate Monitor*, and the so-called spearheads, including new research on productivity. Gosse van der Veen (Statistics Netherlands) put forward that international collaboration required discussions because there are differing opinions which need to converge. This will take time, but it is all in the game. With respect to Statistics Netherlands' own research agenda, he agreed with Jarig van Sinderen.

Research on productivity as a framework for monitoring structural economic change, including developments related to the New Economy

Marcel Timmer strongly agreed with such a framework. This also supports George van Leeuwen's view that Statistics Netherlands should not just collect figures but should also do research based on them. This will result in a better feel for the nature and quality of the figures. However, this must not detract from facilitating external

researchers. More could be done to make anonymised datasets available online. According to Wouter Keller this had already been looked into many years ago. The techniques to anonymise data may apply to data on individuals but are doubtful when it comes to companies. He added that recently he had been given excellent support by Statistics Netherlands (CEREM) in using the data which he used for his presentation (chapter 3).

Paul de Graaf pointed at the rapidly growing informal economy, in particular in the area of second-hand goods. The fiscal authorities have already indicated that they wish to tax those who undertake such online activities professionally. Moreover, many people are moonlighting or just continue working for their boss at home. Where can these activities be found in our official statistics? Jarig van Sinderen responded by saying that to begin with the productivity framework asks for what is available, and from there explores new areas which have been difficult to measure until now. He referred to Jo van Nunen's inspiring presentation (chapter 5) on all kinds of new databases that will emerge from the progressive use of ICT in supply chains and wider economic networks. This is something Statistics Netherlands should look into. If the tax authorities become active in online markets for second-hand goods, new registrations will be created, which can also be used for statistical purposes. Nevertheless, in this case, too, new black markets may develop which escape statistical measurement.

Joost van der Vleuten referred to what had been presented at the conference. There appeared to be a link between ICT and productivity. A new informal economy is emerging. Travel agents are disappearing; the public are increasingly booking their own holidays online. Suddenly, the sale of encyclopaedias comes to a standstill. There is no alternative for which money is exchanged; the substitute – Wikipedia – is created by the unpaid work of its users. These unpaid activities (such as booking holidays, contributing to online books of reference) should also be covered in some way in the measurement of productivity. This is one of aspects to be taken into account when considering what ICT contributes to sustainable economic growth (a policy goal of the Ministry of Economic Affairs). Is this development covered by the concept of productivity as it is used now? Do we need to adapt the definition of productivity in the light of what is happening today? Wouter Keller touched upon the productivity of households, which are no longer mere consumers but producers as well. Leisure surveys could help to discover a productivity factor, even if this cannot be valued in money terms. Jarig van Sinderen added that the distinction between production and consumption has been blurred; the old definition of productivity may be called into question. George van Leeuwen pointed at the ongoing discussion on how to integrate all kinds of intangible phenomena into the national accounts. In revisions of the System of National Accounts (SNA), too, this discussion is taken into consideration. If certain phenomena which are apparently relevant for productivity are not included in our registrations, we will have to

improve our measurements. This is a process of continual improvement. Jarig van Sinderen highlighted that our society is becoming more and more complex, without being worried about statistical systems becoming obsolete. Therefore, we need to be prepared to take a critical look at these systems and ask ourselves where changes are required.