The European
e-Business
Market Watch

Sector Report
No. 6/ July 2002

6

e-business w@tch

ICT & e-Business in the

Telecommunications and Computer Services Sector

eEurope
Go Digital

European Commission
Enterprise Directorate General
e-Business, ICT Industries
and Services

Disclaimer

Neither the European Commission nor any person acting on behalf of the Commission is responsible for the use which might be made of the following information. The views expressed in this report are those of the authors and do not necessarily reflect those of the European Commission. Nothing in this report implies or expresses a warranty of any kind. Results from this report should only be used as guidelines as part of an overall strategy. For detailed advice on corporate planning, business processes and management, technology integration and legal or tax issues, the services of a professional should be obtained.

Acknowledgements

This report was prepared by *Berlecon Research GmbH* (Berlin, Germany) in co-operation with *DIW Berlin – German Institute for Economic Research* on behalf of the European Commission, Enterprise Directorate General. It is part of a deliverable in the context of the "European e-Business Market Watch" (short name: *e-Business W@tch*), which is implemented by empirica GmbH in co-operation with DIW Berlin and Databank Consulting on behalf of the European Commission based on a service contract running from January 2002 until June 2003.

Contact

empirica GmbH
Oxfordstr. 2
D-53111 Bonn
info@empirica.com

DIW Berlin
Königin-Luise-Str. 5
D-14195 Berlin
pkoellinger@diw.de

Databank Consulting spa
Corso Italia 8
I-20122 Milan
dbcons@dbcons.it

Rights Restrictions

Bonn / Brussels, June 2002

Table of Content

Introduction 5

Telecommunications and Computer Related Services: Sector Profile & e-Business 7

1 Economic profile 7

1.1 Definition and structure 7

1.2 Economic situation and key findings 10

1.2.1 Number and distribution of enterprises 10
1.2.2 Output, production and productivity 13
1.2.3 Employment and employee characteristics 17
1.2.4 Investment 20
1.2.5 International orientation 20

1.3 Sector-specific issues and challenges 21

2 Usage of ICT & e-business 26

2.1 E-business activities by companies 26

2.1.1 Industry characteristics and e-business drivers 26
2.1.2 E-business inhibitors 31
2.1.3 E-business activity 32
2.1.4 Case studies of e-business in ICT service companies 33
2.1.5 E-business impact 36

2.2 Marketplaces and other intermediaries 38

2.2.1 Bandwidth marketplaces 38
2.2.2 Marketplaces for expert knowledge 39
2.2.3 Intermediaries for software and research 41

2.3 Industry associations and e-business activities 42

2.4 Scoreboard of basic e-commerce indicators 43

2.4.1 Forthcoming: Results of the European e-Business Survey 44
2.4.2 The Eurostat survey on e-commerce 46
2.4.3 The e-readiness of industry sectors 50

3 Summary and conclusions – possible policy implications 54

3.1 Summary of main findings 54

3.2 Policy implications 56

References 58

Index of tables and figures

Tables

Table 1-1: Number of enterprises in telecommunications and computer services (1999) 11
Table 1-2: Turnover in the telecommunications sector (1999) 14
Table 1-3: Value added at factor cost in the telecommunications sector (1999) 14
Table 1-4: Turnover in the computer services sector (1999) 15
Table 1-5: Value added at factor cost in the computer services sector (1999) 15
Table 1-6: Total IT turnover in the EU (1998-2001) 16
Table 1-7: Number of persons employed (1999) 17
Table 2-1: Industry characteristics relevant for e-business 26
Table 2-2: Implementation of specific Internet business solutions in the US and Europe 33
Table 2-3: Estimated numbers of telecommunications-related B2B marketplaces 38
Table 2-4: Estimated numbers of computer services-related B2B marketplaces 40
Table 2-5: Indicators of the European e-Business Survey 45
Table 2-6: Basic e-commerce indicators for industries 47
Table 2-7: Sector benchmarking for "Transport, storage and communication" (best = 100) 48
Table 2-8: e-Commerce Typology: six stages of sophistication 50
Table 2-9: E-Commerce Typology: the e-readiness of industry macro-sectors (% of establishments) 51
Table 2-10: Use of specialised B2B marketplaces on the internet (% of enterprises using them) 53

Figures

Figure 1-1: Share of enterprises in computer services by sub-sector, Italy (1999) 13
Figure 1-2: Share of computer services employment in total service employment (1999) 18
Figure 1-3: Distribution of employees by sub-sector for computer services, Italy (1999) 19
Figure 2-1: E-Commerce Typology: the e-readiness of industry macro-sectors 52

Introduction

European policy is in a number of areas, including economic, innovation and SME policies, increasingly focused on promoting the business techniques and new ways of working which will provide the economic and social foundation of the information society in Europe. To help policy makers define their programmes, and to monitor the effectiveness of these policies, some indication of progress and of areas requiring active support is essential. At the same time, many areas of European business lack information about the speed of technological update in European markets, which they expect to have a strong impact on their global competitiveness.

Despite the increasing number of studies and market research on electronic business, and especially on electronic commerce, from a number of authors and research organisations in different European countries and world-wide, there is still a lack of reliable empirical information about the extent, scope, nature of and factors affecting the speed of e-business development in Europe at the sectoral level in an internationally comparative framework. It is the objective of this report to provide such information for the Telecommunications and Computer Related Services sector.

This report has been published in the framework of the "European e-Business Market Watch" (or, in short, the "*e-Business W@tch*"). This is a market observatory established by the European Commission, DG Enterprise. Laying the groundwork for a continuous facility, the *e-Business W@tch* monitors and assesses the maturity of electronic business in 15 industry sectors across all EU Member States over an 18 month period, including seven manufacturing and eight service sectors. At least two reports will be published on each sector during the lifetime of the *e-Business W@tch*. The sectors and the publication schedule for these reports are as follows:

	Sector	1st Issue Report	2nd Issue Report
1	Food, beverages, tobacco	July 2002	January 2003
2	Publishing, printing and reproduction of recorded media and audio-visual services	October 2002	April 2003
3	Manufacture of chemicals and chemical products	July 2002	January 2003
4	Manufacture of Metal products	October 2002	April 2003
5	Manufacture of machinery and equipment	October 2002	April 2003
6	Manufacture of electrical machinery and electronics	October 2002	April 2003
7	Manufacture of transport equipment	July 2002	January 2003
8	Retail	October 2002	April 2003
9	Tourism	October 2002	April 2003
10	Credit institutions, investment firms, leasing enterprises	July 2002	January 2003
11	Insurance and pension funding services	July 2002	January 2003
12	Real estate activities	October 2002	April 2003
13	Business Services	October 2002	April 2003
14	Telecommunications and computer related services	July 2002	January 2003
15	Health and social work	July 2002	January 2003

The research presented in these Sector Reports is intended to help to benchmark progress and to assess how electronic business development can be further enhanced at the European level or at Member State level with the objective to strengthen the competitiveness of European businesses. Special attention is paid to the SME dimension of e-business. More information about the *e-Business W@tch* is available at www.ebusiness-watch.org.

Telecommunications and Computer Related Services: Sector Profile & e-Business

1 Economic profile

1.1 Definition and structure

This sector of the *e-Business W@tch* analyses activities within the classifications of telecommunications (NACE Rev. 1 64.2) as well as computer related activities (NACE Rev. 1 72).[1] The latter can be subdivided on the 3-digit-level into six further groups. As all of these involve service activities as well as the production of non-material goods (software), we will also use the term “computer services” in this report to describe all activities within NACE 72.[2] For the combined sectors NACE 64.2 and 72 we will use the term "ICT services" for better readability, where ICT stands for information and communication technology. It has to be kept in mind, though, that ICT services can also be defined in a broader way, e.g. by including in addition wholesale of office machinery. [3]

Code	Activity
(64)	(Post and telecommunications)
64.2	Telecommunications
(72)	(Computer and related activities)
72.1	Hardware consultancy
72.2	Software consultancy and supply
72.3	Data processing
72.4	Data base activities
72.5	Maintenance and repair of office, accounting and computing machinery
72.6	Other computer related activities

ICT services are an important part of the ICT sector, which is often defined as consisting of ICT manufacturing, ICT wholesale, telecommunications and computer related activities. The exact definition of “the ICT sector”, however, differs from study to study, depending on the statistical data available, the focus of the study as well as the motivation behind it.

For example, there are good arguments for excluding wholesale of ICT products from the ICT sector, as one could argue that wholesale is not an ICT activity and that there is basically not much of a difference between wholesale of computers than of TV sets or coffee

[1] Originally, audio-visual services (NACE 92.1: Motion picture and video production, distribution and projection and 92.2: Radio and television) were planned to be part of this report. It has been decided, however, to cover these sub-sectors together with publishing and printing, as they are more concerned with content creation and distribution than with ICT.

[2] When writing about the NACE classification, we always mean NACE Rev. 1.

[3] This is done, e.g., by Eurostat (cf. Deiss, 2001). The OECD in addition subsumes renting of office machinery and equipment (NACE 71.23) under ICT services. (OECD, 2000) It is, however, not always possible to distinguish between ICT and non-ICT related activities in renting and wholesale.

machines.[4] In some instances one may want to choose a broader definition, for example for analyses of "the information society". Thus, some studies (e.g. RWI 2000) analyse the information and communication sector without restricting it to technology and therefore include in their definition the manufacture of paper, publishing, advertising and other sectors producing or distributing information or information bearers.

The sector definition chosen here is rather restrictive in order to focus on and facilitate analysis of the main e-business implications. But even with this strict definition some unavoidable fuzziness remains. First of all, with ICT becoming an ever more important element of companies' core business infrastructure, buying and integrating it becomes more and more a strategic issue. Therefore management consultancies (NACE 74.14, part of the business services report in the *e-Business W@tch*) increasingly cover ICT questions. At the same time, ICT consultancies (mainly to be found in NACE 72.1 and 72.22) move increasingly into strategy consulting.

Secondly, there is a tendency among enterprises active in ICT manufacturing to try to supplement their (cyclical) hardware business with a (supposedly) steadier services business. Typically they also produce and sell software, more or less tightly integrated with their hardware. Both activities are ICT services, but are not included in the ICT services definition chosen. As they do not always take place in juristically independent subsidiaries, some of the measured ICT manufacturing activities also contain a services component.

It is not possible to say to which extent these factors bias the aggregate data. We do know, however, that the extent differs from country to country, reflecting different organisational traditions (e.g. the propensity to outsource) and industry structures. It should also be kept in mind that the results derived here for ICT services apply to ICT manufacturing and management consulting as well, since these companies offer similar services to those discussed in this report.

Both sub-sectors analysed in this report, telecommunications as well as computer services, have one thing in common: while they are potential users of e-business like any other industry – and only this aspect will be analysed in this report – they also provide three of the most essential elements for conducting e-business. These are: the telecommunications infrastructure (also for data traffic), software, and consulting and outsourcing services. One could therefore assume that the companies in these industries are conducting e-business in the best way possible, as they are familiar with concepts and technologies, and as they are competent in realising e-business projects. Chapter 2 will provide some initial responses to this hypothesis.

Telecommunication services

Telecommunication services are much more than just telephone services. The sector embraces the distribution of data, sound, images, and other information via cable, broadcasting, relay or satellite. Included in this definition are management and maintenance of networks as well as the provision of services using this network. Excluded, however, is the provision of radio and television programmes (NACE 92.2).

The sector providing telecommunication services has undergone dramatic changes, especially in the 1990s, due to deregulation and privatisation of formerly government-owned postal and telecommunication services conglomerates (cf. section 1.3). Across the member

[4] That is why ICT wholesalers in the German IT industry are often simply called "Kistenschieber" (box movers).

states, there are variations on how these changes impact on the statistics available. The aggregated data describing the industry and its development should therefore be interpreted with care.

One major statistical effect stems from the break-up of state communication monopolies into different independent companies. While the former had been solitaires belonging to a single sector in the NACE classification, the latter are a potentially large number of companies belonging to different sectors. For example, if parts of the building infrastructure are organised in independent companies, the number of employees decreases in telecommunications and increases in the other relevant sector. Such effects tend to bias the employment development in the telecommunication services sector downwards.

Computer services

Section 72 of the NACE classification subsumes a variety of activities, more or less of a service nature, which relate to ICT. NACE 72.1 includes hardware consultancy services that are not conducted by hardware manufacturers or hardware sellers.

NACE 72.2 combines software consultancy and supply. One part of the activity in this sector is software consultancy (NACE 72.22), which, in many ways, is difficult to distinguish from hardware consultancy today. Another part is the actual supply of software (NACE 72.21). While this business used to be mainly a service activity, where software was produced according to individual specifications for each buyer, it is increasingly now product manufacturer. The end result of the production process – often called standard software – is sold in similar ways as hardware and often via the same sales channels. However, its digital form is distributed over digital channels, thus making specific forms of e-business possible, as we will see later. While some software packages are used without modification, others are customised to the needs of buyers, which provides additional service income for the software manufacturers.

The third element of computer services is data processing activities (NACE 72.3). These are typically called IT outsourcing in the industry, for example the operation of computer centres for companies or hosting of applications and activities like outsourced accounting or payroll services. Together with software consultancy and supply they make up by far the largest share of any measure for this sector.

Many computer services companies are active in all of these areas. A typical sales slogan of these companies is that they “plan, build and run”. The planning part comprises all sorts of hardware and especially software consultancy services; the building part consists of programming individual software as well as integrating existing software components; the running part is the actual operation of the IT infrastructure created.

The database activities in NACE 72.40 are of minor importance. This sector consists of companies that assemble databases from one or several sources, store the data and make it available to users. Thus, it also includes those Internet companies that offer a service based on databases, e.g. directories, search engines or content archives. However, our experience is that classification of companies in new industries by the institutions responsible (and often by the companies themselves) is not always accurate, so this sub-sector should be interpreted with care.

Maintenance and repair of office, accounting and computing machinery (NACE 72.5) is a service that can be used in very different ways. One variant is the purchase of hardware from an ICT product manufacturer together with a support and maintenance contract. While branded as the respective company’s maintenance, the actual work is often outsourced to

service companies, which are part of NACE 72.5. Another variant is maintenance and repair as part of a plan-build-run contract. Finally there is the “classic” case of getting a broken office machine repaired by an independent office machinery specialist, often someone specialised in repairing products of a certain brand.

Other computer related activities (NACE 72.6) contain those computer services that do not fall into the previous definitions. Not part of the computer services summarised in NACE 72 are, for example, the reproduction of computer media (22.33), the manufacture of computers (30.02) as well as the retail trade of computers and software (52.48).

1.2 Economic situation and key findings

Despite the hype surrounding telecommunications and computer services in recent years, very little up-to-date and consistent data for this sector exist. Consistency and comparability across sectors, size classes and countries is hard to achieve at any level, and for computer services, this is a problem which will have to be resolved with an ongoing improvement in service statistics. The 1990s saw the break-up of former state monopolies in telecommunications, and official statistics need a couple of years to adapt in order to come to terms with the new market configuration.

Unofficial data for the year 2000 and later are usually estimates, for which it is hardly ever clear under which assumptions they have been derived, which sectors and size classes of enterprises are covered, and on which sources data are based (e.g. whether they are based on surveys or official industry data). The borderlines between statistics based on hard facts and more or less sophisticated "guesswork" are therefore blurred.[5]

Official data for ICT services exist – to some extent – up to 1999. An extrapolation of developments to 2000 or later, however, as has been done in some of the other sector reports of this series, is not appropriate for ICT services. This sector boomed in the late 1990s until 2000/2001 when expansion came to a sudden stop. In many ways the 1999 figures probably provide a more accurate picture of the sector today, in mid-2002, than inflated numbers from 2000 would do. In this section therefore we are using the official data available for 1999.

1.2.1 Number and distribution of enterprises

Altogether, there were around 350,000 enterprises in European ICT services with 20 or more persons employed in 1999. Table 1-1 shows more than 12,000 enterprises in telecommunications and more than 338,000 in computer services. For 1996, Eurostat (2001) estimated 245,000 companies for computer services in Europe alone, which implies an increase in the number of enterprises by around 38% in these three years. However, as current numbers are only available for enterprises with 20 or more persons employed, and as ICT services in particular are characterised by a significant proportion of small enterprises, they still underestimate the true number of enterprises in this sector.

[5] This also applies to – but is in no way restricted to – the popular yearly EITO reports, which contain statistical data compiled by the market researcher IDC and the EITO task force. Most of the data compiled are product- and not enterprise-focused, which is adequate for market research purposes but poses some problems if data are to be used to assess the economic development of a sector in terms of value added or employment. In addition it remains unclear from the reports themselves which numbers are based on “hard data” and which are not.

Table 1-1: Number of enterprises in telecommunications and computer services (1999)

	Telecommunications	Computer services[1)]
Austria	186	6,425
Denmark	245	5,221
Finland	224	3,535
France	2,362	31,285
Germany	551	46,544
Ireland[1)]	-	1,785
Italy	583	69,515
Luxembourg	46	611
Netherlands[1)]	830	10,180
Portugal	149	2,280
Spain	1,040	17,702
Sweden	280	19,045
UK	5,946	124,501
EU-12/13[2)]	**12,442**	**338,629**

Source: Eurostat New Cronos, SBS, Enter-L (2002). No data available for Belgium, Greece.
1) Values for Ireland and the Netherlands are from 1998.
2) Value for telecommunications EU-12 except Ireland.

The number of firms shows no reliable correlation to the size of countries, neither in telecommunications nor in computer services. Table 1-1 shows, for example that the number of telecommunications companies in France is about four times that of Germany, despite the latter's larger size. Also the UK is home to a large number of telecommunications companies, accounting for about half of the figure for Europe.

Similar statements apply to computer services: the UK has almost three times as many computer services firms as Germany, although it is smaller. There is a range of potential explanations: different stages of development of the ICT sector in these countries; different ways of liberalising the telecommunications sector; different propensities for large and small companies in general.

As table 1-1 shows, there is a considerable difference in the number of firms between the two sub-sectors, with the number of firms in computer services being 27 times as high as the number in telecommunications. To some extent these numbers reflect the different histories of the sub-sectors as well as the different sort of services being produced. Broken-up former state monopolies, as in the telecommunications sector, tend to be larger entities than companies that have grown bottom-up. Telecommunication services are also utilities with a tendency towards natural monopolies while computer services are to a large extent traditional services with very limited economies of scale.

These explanations are supported by the data on firm size in table 1-2. In all countries and by different measures – turnover as well as number of employees – telecommunications companies are considerably larger than computer services companies, in some cases by more than a factor of one hundred. Taking Portugal as an example, the average telecommunications company has almost 22 times the number of employees and almost 52 times the turnover of an average computer services company.

Table 1-2: Average size of enterprises by turnover and persons employed (1999)

	Telecommunications		Computer services	
Country	Turnover (mill euro)	Persons Employed	Turnover (mill euro)	Persons Employed
Austria	30.0	131	0.6	4.3
Belgium	22.9	99	0.8	6.1
Denmark	15.6	83	0.9	6.7
Finland	18.3	86	0.8	7.2
France	-	-	1.0	8.4
Germany	72.7	-	0.7	7.5
Italy	48.2	181	0.3	3.8
Luxembourg	17.8	20	0.8	5.6
Netherlands	-	60	-	-
Portugal	31.1	142	0.6	6.6
Spain	17.5	72	0.5	6.4
Sweden	-	-	0.6	4.6
UK	9.3	39	0.5	4.1

Source: Eurostat New Cronos, SBS, Enter-L (2002).
No data available for Greece and Ireland.

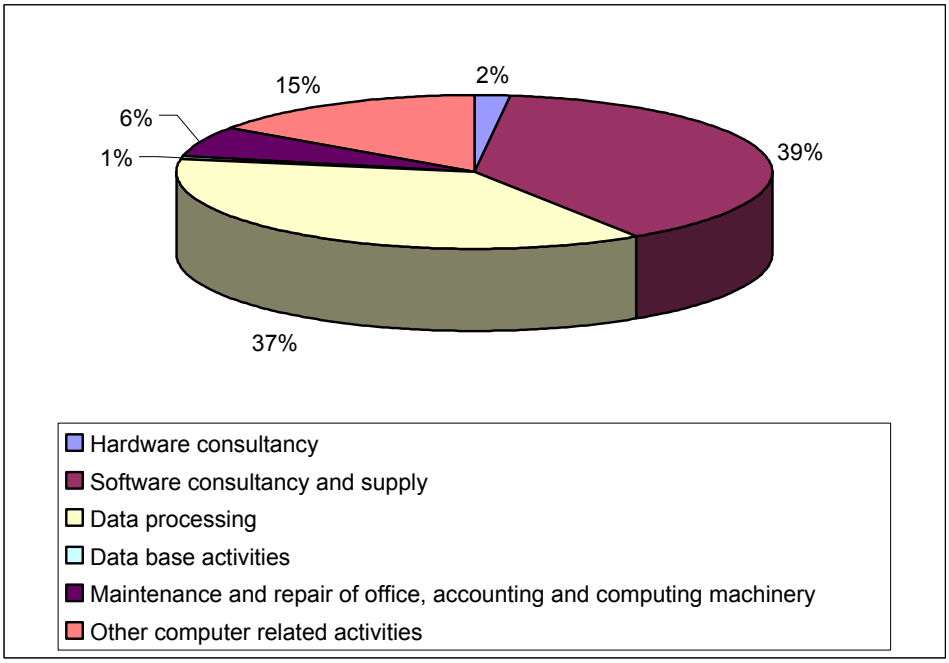
According to Eurostat (2001) the size structure of computer services companies differs from that in other services sectors. Firstly, the share of computer services companies without employees is relatively small. In 1996, 39.4% of European enterprises in this sector had no employees, whereas such companies make up the majority of enterprises in other service activities (from NACE G and K). On the other hand, the share of companies with 1-9 employees (53.7%) is relatively large. There are therefore more small businesses with few employees than "one-(wo)man shows" in computer services.

Secondly, large companies in this sector are smaller than large companies in other service activities. While those with 250 or more employees had on average 637 persons on their payroll, this number was 1,300 for services (NACE G and K) in general. The same applies to turnover, where large computer services companies billed on average 72m Euro, while large services companies in general had an annual turnover of 316m Euro.

Figure 1-1 shows the distribution of enterprises across the sub-sectors of computer services using Italy as an example.[6] The figure shows that by far the most enterprises (76%) are either in software consultancy and support or in data processing. As already set out above, these industries complement each other very well, so that larger companies in particular offer services from both sub-sectors. Next in importance are other computer-related activities (15%) as well as the maintenance and repair of office, accounting and computing machinery (6%). The last two sub-sectors - hardware consultancy and database activities - make up only a combined 3% of the number of enterprises in Italy's computer services sector.

[6] Italy is the only country for which data on this 3-digit industry level is available from Eurostat, so an aggregation of European data was not possible. However, data from the VAT statistic for Germany show a similar distribution across sub-sectors, so that some confidence can be put into this data.

Figure 1-1: Share of enterprises in computer services by sub-sector, Italy (1999)



Source: Eurostat New Cronos

1.2.2 Output, production and productivity

Turnover and value added

In 1999, the European telecommunications companies in those ten countries for which data are available had a combined turnover[7] of almost 168bn Euro[8] (see table 1-3). The large EU countries Germany, Italy and UK in this group are responsible for almost 74% of the combined turnover in Europe. All countries for which data was available showed an increase in turnover during the second half of the 1990s.

Table 1-4 shows a quite similar picture for value added. Total value added in those European countries for which data was available was almost 90bn Euro in 1999. In several, although not in all, countries mentioned in table 1-4 value added showed average yearly growth rates in the low two-digit range during 1997-9. With the exception of Portugal and Belgium, value added in telecommunications grew at low two-digit rates in the range of 12-31% in the European countries. In Portugal and Belgium the average annual growth rates were around 4%. Taking turnover and value added together shows a picture of a sector with healthy growth, which was well above GDP growth, implying an increasing importance of telecommunications for most European countries.

However tables 1-3 and 1-4 also show a rather wide diversity of productivity in telecommunications. Value added per person employed ranged from 99,000 Euro in Finland to 137,000 Euro in Italy (1999). Luxembourg even reached 540, 000 Euro per person employed, which is obviously due to special circumstances, possibly the presence of a small number of high performance firms and, at the same time, the presence of EU institutions. For turnover per

[7] We use turnover in this report, as more data are available than for other measures like production value.

[8] Without Greece and the Netherlands, for which no data was available.

person employed, the numbers range from 186,000 Euro in Denmark to 267,000 Euro in Italy. In this area as well Luxembourg shows values which are more than twice as large, with 902,000 Euro per person employed.

Table 1-2: Turnover in the telecommunications sector (1999)

	Turnover (mn euro)	Turnover per person employed (1000 euro)
Austria	5,583	228,4
Belgium	7,219	232,6
Denmark	3,816	185,8
Finland	4,094	210,6
Germany	40,065	-
Italy	28,094	266,8
Luxembourg	818	902,3
Portugal	4,632	218,2
Spain	18,230	245,1
UK	55,067	239,3
EU-10	167,618	-
Source: Eurostat New Cronos, SBS, Enter-L (2002). No data available for Greece, France, Ireland, the Netherlands, and Sweden.		

Table 1-3: Value added at factor cost in the telecommunications sector (1999)

	Value added (mn euro)	Value added per person employed (1000 euro)
Austria	2,555	104,5
Belgium	3,744	120,6
Denmark	2,330	113,4
Finland	1,886	97,0
Germany	29,099	
Italy	14,441	137,1
Luxembourg	567	624,7
Portugal	2,514	118,5
Spain	7,455	100,2
Sweden	-	-
UK	26,402	114,7
EU-10	89,993	-
Source: Eurostat New Cronos, SBS, Enter-L (2002). No data available for Greece, France, Ireland, the Netherlands, and Sweden.		

Table 1-4: Turnover in the computer services sector (1999)

	Turnover 1999[1)] (mn euro)	Turnover per person employed (1000 euro)
Austria	3,674	98,6
Belgium	5,503	139,3
Denmark	4,571	131,6
Finland	2,942	115,5
France	31,710	121,0
Germany	34,293	98,3
Ireland[1)]	2,136	-
Italy	22,498	85,3
Luxembourg	461	135,3
Netherlands[1)]	9,361	-
Portugal	1,477	98,6
Spain	8,949	79,0
Sweden	10,986	126,7
UK	58,264	114,9
EU-14	196,825	-

Source: Eurostat New Cronos, SBS, Enter-L (2002).
1) Values for Ireland and the Netherlands are from 1998.
No data available for Greece.

Table 1-5: Value added at factor cost in the computer services sector (1999)

	Value added 1999[1)] (mn euro)	Value added per person employed (1000 euro)
Austria	1,562	56,4
Belgium	2,348	59,5
Denmark	2,122	59,5
Finland	1,480	58,1
France	16,387	58,7
Ireland[1)]	777	-
Germany	27,229	-
Italy	9,939	37,7
Luxembourg	196	57,4
Netherlands[1)]	4,962	-
Portugal	595	39,7
Spain	3,599	31,8
Sweden	4,977	57,4
UK	33,945	66,9
EU-14	110,118	-

Source: Eurostat New Cronos, SBS, Enter-L (2002).
1) Values for Ireland and the Netherlands are from 1998.
No data available for Greece.

The computer services sector is of comparable size to telecommunications, as tables 1-5 and 1-6 show. Although the European turnover is 197bn Euro in computer services and 168bn in telecommunications, the latter number is based on ten countries (even excluding the large member country France), while the former is based on data from fourteen member countries. For value added, a similar relation exists.

Compared to telecommunications, the growth rates for turnover and value added are higher in computer services for those countries where data are available. During the period 1997-99 value added, for example, grew several times faster in computer services than in telecommunications in several member countries.

While there is no current data on the importance of SMEs for ICT services, the average firm size in table 1-2 already pointed out that SMEs are of much larger importance in computer services than in telecommunications. In addition, data from the mid-1990s shows that within computer services in the European Union more than two thirds of the turnover in this industry was generated in enterprises that employ less than 250 persons. The importance of large companies is most important in Germany, where more than 40% of sector turnover comes from SMEs. With the exception of Belgium, companies without employees do not contribute to a large extent to the sector's turnover.

Computer services as part of total IT turnover

According to estimates by EITO, software and services make up an important part of IT turnover in the European Union, and their importance is growing. (See table 1-7. These values are not directly comparable to those compiled in the other tables and to NACE, as EITO uses different definitions of the IT sector and its sub-sectors.) They made up roughly 54% of total IT turnover in 1998 and were estimated to reach a share of 58% in 2001. This makes IT software and services slightly more important than hardware sales.

Table 1-6: Total IT turnover in the EU (1998-2001)

	Turnover (mn euro)			
	1998	**1999**	**2000**	**2001**
IT hardware	86,405	92,937	99,425	105,865
Software	36,283	41,150	46,928	53,666
Application software	18,529	20,974	23,928	27,313
System software	17,754	20,176	22,939	26,353
Services	64,152	72,988	82,386	91,851
Consulting	6,549	7,660	8,946	10,401
Implementation	21,198	25,045	28,940	33,118
Operations management	21,689	24,642	27,894	30,872
Support services	14,716	15,642	16,606	17,460
Total	186,840	207,075	228,739	251,282
Source: EITO according to Eurostat (2001)				

Productivity in computer services is comparatively homogeneous across EU member states, especially if compared to telecommunications. With the exception of Portugal, Spain, and Italy, which show rather low numbers for value added per person employed, this number was typically in the range of 56-67,000 Euro in 1999. Differences in turnover per person employed were larger with values ranging from 78- 139,000 Euro per person employed, not taking into account Spain, Portugal, and Italy (Germany also had a low turnover per person employed of 98,000 Euro).

If one compares productivity between telecommunications and computer services, the four tables show that turnover and value added per person employed are considerably smaller in the computer services sector. This is the outcome one would expect given the high capital intensity of telecommunications and the fact that these quantities only measure labour productivity and not total factor productivity.

1.2.3 Employment and employee characteristics

Employment

As table 1-8 shows, more persons are employed in ICT services than in telecommunications, in most member countries. In 1997, according to Eurostat (2001), the companies in this sector employed more than 1.3 million persons compared to 899,000 in the telecommunications sector. For 1999 no complete data is available for all countries. Therefore the sum in table 1-8 for telecommunications is somewhat lower at 749,000. For computer services in those 14 member countries for which data are available, table 1-8 shows a total of 1.8 million persons employed in 1999, considerably more than the Eurostat data for 1997.

Table 1-7: Number of persons employed (1999)

	Telecommunications	Computer services[1)]
Austria	24,441	27,684
Belgium	31,041	39,496
Denmark	20,538	34,724
Finland	19,444	25,461
France	-	262,097
Germany	221,400[2)]	349,000
Ireland[1)]	-	16,850
Italy	105,296	263,694
Luxembourg	907	3,411
Netherlands[1)]	-	93,617
Portugal	21,225	14,979
Spain	74,372	113,293
Sweden	-	86,716
UK	230,077	507,216
EU-10/14	748,741	1,838,238

Source: Eurostat New Cronos, SBS, Enter-L (2002).
1) Values for Ireland and the Netherlands are from 1998.
2) 31.12. 1999. RegTP (2001), p.6.
No data available for Greece.

The labour force development in the second half of the 1990s differed considerably between the two sub-sectors. In telecommunications the only significant increase in the number of people employed was in 2000 for most member countries with available data. Prior to this there was a decline, or only a slight increase. Comparison across countries is made difficult, however, by the statistical offices' different ways of handling the former state monopolies in the second half of the 1990s. By comparison, the number of people employed in the computer services sector rose continuously over the last years in all member countries, and two-digit growth rates here are typical.

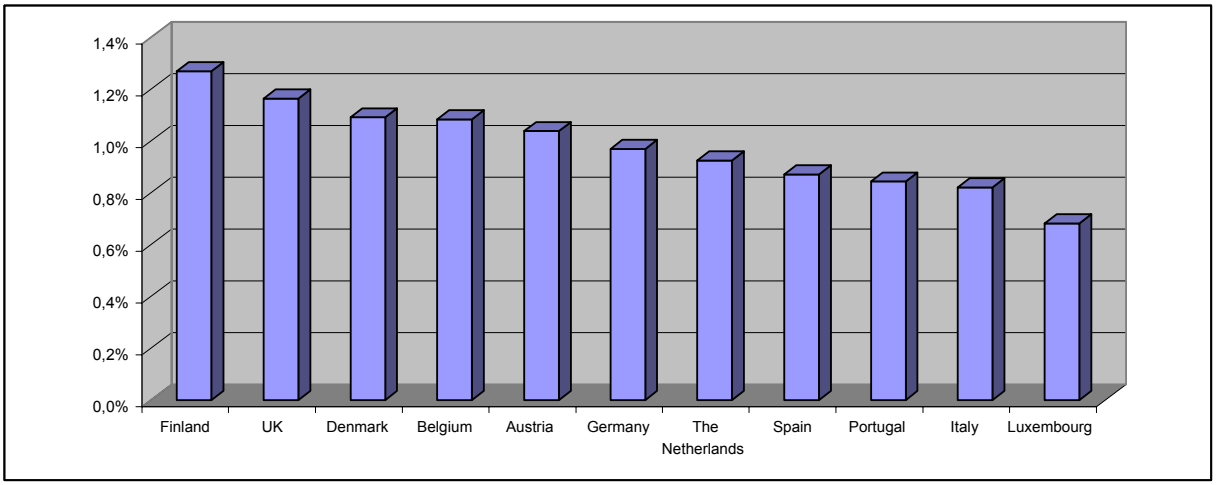
The development in the telecommunication sector shows that until very recently there still seemed to be possibilities for efficiency improvements in the former state monopolies. Despite the new jobs created by newly established companies in the telecommunications sector, the overall demand for labour in this sector was at best stagnant until very recently. However, productivity improvements were enabled by new technologies, not just by a decrease of bureaucratic inefficiencies. Telecommunication networks have been modernised considerably during the last decade, reducing the necessity of human intervention in many parts of the network maintenance and administration (cf. section 1.3).

As computer services are to a large extent traditional service activities with high labour intensity and little opportunity of substituting labour by capital, the increase in demand for computer services and software during the last years also required an extension of the labour force.

Table 1-8 also shows that the size of each of the two sectors, measured by the number of employees, differs considerably among member states and does not correspond exactly to the countries' size. The computer services sector in the UK, for example, is considerably larger than Germany's, despite the latter's larger economy. The same can be observed for telecommunications.

Figure 1-2 provides some information about the relative labour market importance of computer services by plotting the share of persons employed in computer services to total number of persons employed in the service sector. Finland, UK, Belgium and Denmark show the highest significance of computer services, with employment shares above 1%. By comparison, Luxembourg only shows a share of 0.7%.

Figure 1-2: Share of computer services employment in total service employment (1999)



Source: Eurostat New Cronos. No data for France, Greece, Ireland, Sweden.

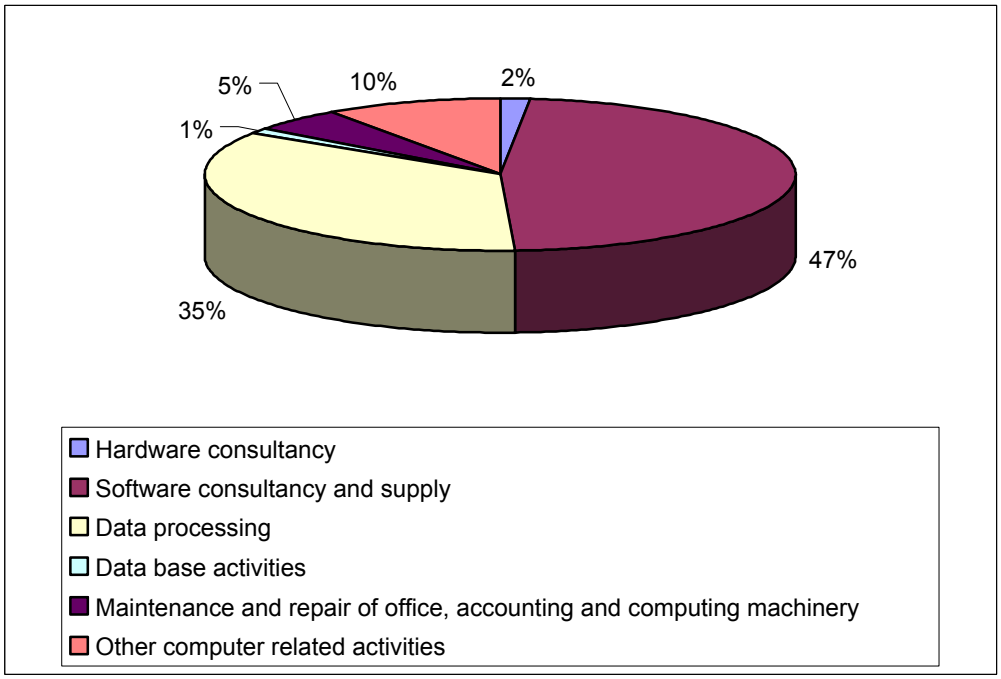
Employment distribution by size and sub-sector

No current data exists to assess the importance of SMEs in this sector. However, as already pointed out above, data for the mid-1990s shows that in Europe only about a quarter of those persons employed in the computer services sector are working in large companies with 250 employees or more. Only in Sweden and France (each having around a one-third share of large company employment) is this number significantly higher.

Micro enterprises without employees are only important in four countries: Belgium, Spain, Austria and the UK. In all other countries they employ considerably less than 10% of the labour force in this sector.

Figure 1-3 gives some information about the labour force distribution within the computer services sector, using Italy as an example. Software consultancy and supply as well as data processing employ the lion's share of employees. 82% of all employees from the computer services sector work in these two sub-sectors. However, while the employment share of software consultancy and supply is larger than the share in enterprises, it is just the opposite for data processing, pointing to the relatively larger size of the former companies.

Figure 1-3: Distribution of employees by sub-sector for computer services, Italy (1999)



Source: Eurostat New Cronos.

Employee characteristics

Unit personnel costs in both sectors are relatively high, according to Eurostat (2001), which estimated the EU average at almost 43,000 Euro per employee for telecommunications and 40,000 Euro per employee for computer services (1997).[9] For computer services education levels are reported: more than 54% of employees had completed a university degree or an equivalent qualification, which is higher than the average.

More detailed data is available for the Nordic countries Denmark, Finland, Iceland, Norway, and Sweden, for which a joint working group of the statistical offices has compiled some ICT sector related statistics (Statistics Denmark et al., 2001). These data show rather high shares of employees with third-level education in ICT consulting, ranging from 56% in Norway to 61% in Sweden. In telecommunications the share of more highly educated employees is lower, and the cross-country variance is also higher. The values ranged from only 25% in Iceland to 44% in Norway and 46% in Finland.

[9] Estimations did not include DK, D, EL, E, NL for computer services and D, EL, E, IRL, L, NL, UK for telecommunications.

The age characteristics are another difference between the two parts of ICT services. This only partially confirms the prejudice of a sector characterised primarily by young employees. In the telecommunications sector of the Nordic countries the share of employees younger than 35 years is only 36%. ICT consulting, however, is to a much larger extent characterised by young workers. Their share is 49% in the Nordic countries, rising to 56% in Iceland.

ICT service activities are characterised by an unusually high percentage of male employees, especially when taking into account the high labour force participation rates in Scandinavia. ICT services (including wholesale of ICT products) employ only 29% females, whereas this figure is 43% in total services. It would appear that working in this field primarily attracts men.

This measure confirms the difference between telecommunications and ICT services. Telecommunications is again much closer to the overall average, showing 38% of female workers of. ICT consulting, however, is again dominated by males: only 27% of employees are female in the Nordic countries, whereas the country-specific shares range from 25% in Denmark via 27% in Iceland, Norway and Sweden to 30% in Finland.

1.2.4 Investment

Considering total investment in EU Member States for which data are available, figures show that aggregate investment in telecommunications is between 3.9 and 13.7 times as large as in the computer services sector. This is a good indicator for the different natures of service production in the two sub-sectors. While the first is an infrastructure business requiring high capital intensity, the second is a “classic” service business. Large variations between sectors can also be seen in investment per employee. For the EU MS which reported data these were between 34,100 (Denmark) and 77,600 Euro (Portugal) in telecommunications (1999). For computer services, the country values ranged from 3-8,000 Euro, showing that the latter is an industry with lower capital intensity.

Investment fluctuates over the years in both sectors. These fluctuations can be rather strong with changes around 50% per year being not unusual. Spain even quadrupled investment in the telecommunication sector from 1999 to 2000. Such fluctuations have been more pronounced in telecommunications than in computer services, where a more steady growth over the years can be seen. Nevertheless, both sectors show for 2000 the highest investment value for most countries compared to previous years.

1.2.5 International orientation

With increasing international business relationships and falling prices for international phone calls and data transfer, the international use of telecommunication services grows. According to Eurostat (2001), the number of outgoing international calls from the EU-15 countries alone rose from 10.6 billion in 1988 to 23.2 billion in 1996. This growth continued: 35.8 billion minutes of international phone calls originated in the EU-15 countries in 1999, 58% more than just two years earlier. As each international call or data transfer requires termination in the country called and possibly transfer services on its way to the person called, it is an export of telecommunication services from the point of view of the country called.

ITU and OECD monitor the volume of international trade in telecommunication services. These differ by country. Import penetration rates, defined as imports in relation to the sum of imports and production, are high in Sweden, Belgium and the Netherlands and relatively low in France, Italy and Spain. These countries also show correspondingly high and low export

ratios, defined as exports in relation to domestic production. Thus, import penetration or export ratio alone is more a measure for the integration of a country's telecommunication network in the world's telecom infrastructure than a measure of export success or substitution of domestic products by imports. In this way telecommunications, being an infrastructure service industry, differs from traditional product-oriented industries.

Import penetration and export ratios for other ICT services tend to be lower than for telecommunications, but are also likely to show a positive correlation between import penetration and export ratio. Values are highest in Finland and the Netherlands.

1.3 Sector-specific issues and challenges

The ICT services industries are among the most dynamic industries in Europe's economies and in addition belong to the core industries for the e-business revolution. Because of this they have seen substantial changes during the last decade, which brought a variety of challenges for the companies. These differ between telecommunication services companies and the software services industry.

Telecommunication services

Telecommunication services have changed considerably during the previous years, bringing new sector-specific issues and challenges to companies. We have identified six major issues that we regard as significant for past, present and near future:

- Liberalisation of telecommunication markets and the resulting increase in competition;
- Regulatory disputes involving former monopolies;
- Development of the demand for mobile communication;
- Expectations about the future demand for telecommunication services, especially in the mobile area;
- Growth of data traffic on telecommunication networks;
- New technologies for network access as well as network administration.

Liberalisation was a major force in Europe in the late 1990s. As telecommunication sectors became liberalised (fully in January 1998) opportunities opened up for several sorts of arbitration companies, which at first offered long-distance voice calls at significantly cheaper cost than incumbents. This sudden increase in competition led to a rapid fall in prices, for the incumbents' telephone services as well. With falling prices and margins many arbitration companies went out of business, but prices for long distance calls remain comparatively low. Typically the former state monopolist has now competition, at least in some markets.

For example, liberalisation has brought in some new competitors at the regional level. These are often utility companies, which use their existing infrastructure to lay cables at comparatively low costs or which even use their existing communication infrastructure to offer telecommunication services. These companies have been only partially successful, due to weaker than expected demand and interconnection disputes with incumbents.

Such disputes about access to and pricing of access to essential facilities of the incumbents have been background noise for the telecommunication industry since its liberalisation. These disputes are based on the remaining regulation of the telecommunication sector, which is often asymmetrical in favour of the new entrants. As the former state monopolies try to keep as much as possible of their existing market dominance in certain markets, disputes inevitably arise.

A further major issue has been, and still is, cellular digital telephony. With the acceptance of the GSM standard by all European telephone operators and the awarding of frequency spectrum in all countries, an increasing number of companies – some subsidiaries of established phone companies, others entirely new ones – offered wireless phone services. The number of mobile phone users increased steadily to 2001. In Germany alone the number of mobile subscriptions rose from 48.2 million in 1999 to 56.2 million in 2001 (RegTP 2001).

Recently, this success story has lost some of its former appeal. The average revenue per user (ARPU) has fallen significantly, as mobile users with lower usage have become customers, as prices for mobile phone calls have fallen and as operators have subsidised phones considerably to win new customers. At the same time costs for running the phone network have remained constant or even increased, putting considerable pressure upon the margins.

Mobile phone operators have pinned high hopes on m-commerce to open up new sources of revenue from data traffic as well as from selling content. While the latter has not been very successful so far due to a variety of reasons, the increasing popularity of the short messaging service (SMS) provides telcos with significant revenues from data services.

The success of the so-called third generation wireless technology UMTS has also attracted high bets. When several countries conducted spectrum auctions for these services at the height of the mobile and Internet euphoria in the beginning of 2000, high prices were paid for them, at least in the UK and in Germany. With operators and commentators now being more cautious again, the general feeling is that the prices paid were too high. Many European mobile phone operators have come under pressure from financial markets, as they leveraged their companies highly to pay for the licences and now have to correct their value in their balance sheets.

Large telecommunication companies also went on a shopping spree for similar companies in other European and non-European countries. A major strategic idea of the late 1990s was that one would have to become a global (or at least European) operator to survive in the long run and to meet demand for seamless international telecommunication services.[10] As several transactions were conducted right in the middle of the technology bubble, the inflated stock market valuations paid at that time are now being corrected. This adds to the financial pressure put on telecommunication operators.

A third major trend is the rising importance of data traffic induced by the increasing popularity and usage of the Internet. The latter fuelled demand for Internet access services as well as for Internet backbone services. It was expected that data would quickly overtake voice as the main source of traffic on global telecommunication networks.

However, despite the increasing demand, considerable overcapacity for backbone services has been built up. During the Internet boom, established and newly funded companies buried an ever-increasing number of fibre-optic cables. This capacity was excessive, is now largely unused, and is putting pressure on prices for backbone services.

Finally, new technology has considerably influenced the services and has offered new opportunities for e-business. One of these technologies is broadband Internet access, loosely defined as access rates significantly higher than ISDN or analogue modem.[11] Cable

[10] Indeed, according to KPMG (2001) global communication connections were in 2001 considered by telecommunication managers in Europe to be the most important current topic.

[11] There is no universal definition for broadband. In consumer services but not enterprise services connection with lower transfer rates are considered broadband. Likewise in mobile communications but not in fixed-line services lower bandwidth is considered broadband.

modems as well as xDSL offer the potential for new bandwidth-intensive services like streaming media. The rollout of these services by established telecommunications companies as well as by new entrants has been slower than expected, though, due to a variety of technical difficulties.

Another group of new technologies relate to the telecommunication network itself as well as to its administration. The early telecommunication network was based on analogue technology and had several inflexible components installed, e.g. for billing the "voice minutes". In the 1990s operators digitised their networks to a large extent, which made additional services possible (e.g. simple forwarding of phone calls, calling line identification) and allowed increased flexibility for billing. These intelligent networks are also the foundation for much of customer-focused e-business in the telecommunication services industry.

Computer services

Within the computer services sectors we consider the following issues as especially important for past, present and near future:

- New forms of software delivery and software services enabled by the Internet;
- Application Service Providing;
- Demand for e-business related software;
- The spread of Open Source software;
- Legal issues concerned with the protection of intellectual property rights of digital goods and software patents;
- Demand fluctuations for ICT consulting services;
- New technologies for knowledge management and coordination;
- An increasing demand for outsourcing of ICT services.

Some of these issues are of larger importance for the software business, others for the consulting business. Only very few of these issues (e.g. legal ones) are different in Europe than in the US or in other countries. As the following box shows, the software industry is a worldwide industry with most large companies headquartered in the US.

Many of the issues faced by the software industry are directly related to the Internet and the possibilities it enabled. Firstly, the Internet made new forms of software delivery possible. Before the Internet (or better, before sufficient bandwidth) was available, software was distributed on disks or CD-ROMs. Now downloads are an alternative, which saves distribution costs and increases customer satisfaction through immediate delivery.

The Internet also offers an opportunity for customer care in the form of software updates. Much software that has been Internet-enabled during the last years can search on dedicated servers for updates or bug fixes, download and install them. That way, the "product" software is increasingly supplemented with service elements.

This service idea is even more apparent in the concept of application service providing, which came up in the late 1990s. Application service providers (ASPs) offer software functionality in a one-to-many model via the Internet. The idea is that the user neither has to buy a software licence nor install the software. She can simply use her web browser to use the software and will be billed according to usage. While interesting in theory, demand for such services has been rather flat until now, probably because the ASPs could not really prove that their model is superior to traditional software use (cf. Berlecon Research, 2001). The idea of software as service, however, can also be found in the new pricing model for

software announced by Microsoft for 2002, which provides incentives for companies to pay recurring fees if they want to keep their software up to date.

The World's Top 20 Software and Services Companies

1. IBM (USA)
2. Microsoft (USA)
3. PricewaterhouseCoopers (USA)
4. EDS (USA)
5. Oracle (USA)
6. Hewlett-Packard (USA)
7. Accenture (USA)
8. Cap Gemini Ernst & Young (F)
9. Compaq (USA)
10. Unisys (USA)
11. SAP (D)
12. Computer Associates (USA)
13. Hitachi (JAP)
14. Sun (USA)
15. NCR (USA)
16. Compuware (USA)
17. Siebel (USA)
18. Peoplesoft (USA)
19. SunGard Data Systems (USA)
20. Fiserv (USA)

Source: SoftwareMagazine 2001 Software 500, www.softwaremag.com, Headquarters in parentheses.

A further issue was the increasing demand for e-business-related software. These software solutions, mostly sold to companies, are supposed to enable all sorts of Internet-related activities. They are offered by established companies and by new ones alike. Examples of software solutions for the front-end are: shop solutions, search engines or content management solutions. In the back-office or for internal processes knowledge management solutions, common examples are software for customer relationship management or supply chain management. All these software solutions support e-business in one way or another. Much of the software is still relatively new and at a relatively early development stage, especially if compared to established software like spreadsheets or other forms of traditional enterprise planning software.

Another major sector-specific issue is the Open Source phenomenon, which became popular through operating systems like Linux and through Internet software like the Apache web server. This software can be read, compiled and modified by everybody, subject to certain conditions. It is usually made available free via the Internet and coded by groups of volunteers, who coordinate their activities over the Internet.

The software industry has also intensely discussed two related legal questions. The first is the question of intellectual property rights protection, as the easy international exchange of software over the Internet made copyright infringement easier, leading to an alleged increased piracy of software. The second, and related, question concerned software patents. While most forms of software were originally only protected by copyright, industry advocates in Europe called for the broader protection of software by patents. While some industry

advocates claim that patents provide better protection of R&D investments and therefore constitute an incentive to innovate on the individual firm level, others point out that an overly strong protection stifles technical progress on the national or international level.[12] Consequences of software patents as well as the ability of patent institutions to judge their adequacy are still questions to be resolved.

Within the IT consulting business, a major challenge was the rapidly increasing demand for e-business related consulting and integration services; now the challenge is the resultant sudden fall in demand. The bursting of the dotcom bubble has revealed overcapacities in many consultancies, which now have to adapt to the lower level of business activity without demoralising their remaining staff.

Other challenges for this industry are related to the new technologies for e-business and the complexity of e-business projects. The former requires considerable education efforts within the consultancies and has often led to specialisation in the products of few software manufacturers. The increasing complexity required consultancies to cooperate with freelancers as well as with other consultancies to manage larger projects. Technological support for managing such large and diverse groups of knowledge workers also became necessary.

The outsourcing industry (part of NACE 72.3, data processing) has seen an increasing demand recently. Firstly the management strategy of focusing on core competencies led many companies to outsource those parts of their IT infrastructure that they considered as not being of strategic importance. Secondly, the Internet decreased costs for some types of outsourcing, particularly for smaller projects. Where a few months ago expensive dedicated lines for the data traffic were necessary, now secure virtual private networks (VPNs) can be created on the public Internet.

The increasing demand for outsourcing as well as the possibility of outsourcing across borders led to a variety of legal questions posing challenges to the industry. These range from questions of labour law, i.e., how employees are to be treated when an IT department is outsourced, to data protection and privacy issues. The latter is important, as several outsourcing companies are located in the US with different protection rules than in Europe.

[12] For a general discussion of this dilemma see Baumol (2002).

2 Usage of ICT & e-business

2.1 E-business activities by companies

2.1.1 Industry characteristics and e-business drivers

Telecommunication services and computer services differ in the way they produce services as well as in the structure of their customer base. These differences also imply different e-business strategies and will consequently have an impact on what the key economic implications of electronic business will be for these sub-sectors of the ICT industry.

Table 2-1: Industry characteristics relevant for e-business

	Major input	Company size	Service provision	Number of customers
Telecommunicat-ion services	capital and technology	large	continuous	large
IT consulting services	knowledge and labour	small	project-based	one per project
Individual software	knowledge and labour	small	project-based	one per project
Standard software	knowledge, labour, capital	medium - large	produced in projects, sold continuously	large
IT outsourcing	capital and technology	medium –large	continuous	many, but individual outsourcing customers often treated as single project
ASP	capital and technology	all sizes	continuous	large

- **Telecommunication services** are largely infrastructure services, continuously provided to consumers and businesses. In addition, telecommunication services are produced with large inputs of capital and technology, typically by large enterprises and sold to a large number of customers.
- **Computer services**, in comparison, can come in three variants:
    - *Consulting services* are typically project-based, produced mainly by knowledge workers with only a limited use of capital and technology. They are produced mainly by small enterprises and often sold to a single customer.
    - *Software* is often produced in the same way, especially when commissioned by individual customers. It can, however, also have product characteristics when it is sold in the form of packaged standard software. Packaged software is distributed to a variety of customers instead of to a single company.
    - Finally, *database services* are very similar to telecommunication services in production but can differ in customer numbers.

While *IT outsourcing* is customised to the needs of each single customer, *Application Service Providing (ASP)* is offered in a one-to-many model for many customers.

The goals to be addressed by implementing e-business solutions will be different for each of these sub-sectors depending on their main activity. For instance for companies like telcos with a large number of customers, e-business customer relationship solutions to increase the efficiency of their customer relationships are of much higher value than for IT consulting companies which can easily handle their comparatively few customer relationships manually. We will therefore discuss the main e-business drivers separately for different groups of companies.

2.1.1.1 Telecommunication services and ASPs

Following Arias and Kinnaman (2000), the e-business issues for telecommunications companies can be analysed by using a service provider value chain. This value chain differs in some aspects, for example in the emphasis of billing, from other value chains. It consists of eight components: marketing, sales, customer care, billing, network, finance, human resources and procurement. Most of the e-business drivers discussed here are identical for ASPs, although these service providers have not (yet) as many customers as telecommunication service companies.

Telecommunication service providers have direct customer relationships with a very large number of customers (often millions). These customers often have specific requests such as troubleshooting (e.g. dead telephone lines), service changes (e.g. upgrade to ISDN) or location changes (e.g. due to relocation). Handling these requests can be a complex task with several internal processes to be started and followed through (e.g. notifying service technicians, following status of service task, notifying customer about completion, etc.).

These customer care tasks are therefore costly, which provides an incentive to invest in appropriate e-business tools to reduce these costs – internally as well as at the interface to the customer. At the same time liberalisation of telecommunication markets has provided customers with the opportunity of switching their telecommunication service provider when they are not satisfied. Since unsatisfactory handling of customer care requests results in dissatisfied customers, an additional incentive exists for e-business in customer care to speed up processes and reduce error rates.

Closely related to customer care is billing, also of special importance to telecommunication service providers, as each customer expects regular bills for the services used. These bills are traditionally sent to the customer in paper form. Clearly, the telecommunication companies have an incentive to move to electronic billing on the Internet to achieve cost savings as well as to shorten the accounts receivable cycle. According to Arias and Kinnaman (2000), cost savings can be in the range of 40-60%.

But electronic billing can also be in the interest of customers. Deutsche Telekom, for example, set up an Electronic Invoice Service targeted at business customers. Using this service, customers can check their phone bills, group, sort and filter details for all calls, validate phone activity, allocate telephone costs across business units, and analyse the use of telecommunication services to find potentials for savings as well as plan for the future.[13]

Billing systems in telecommunications companies have undergone substantial changes in recent years. Traditionally, billing for voice telephony was rather simple. The cost depended on the duration of a call, the distance between the parties involved and the time when the call

[13] More details about the service can be found at www.telekom.de. Further information about motivation and potential of this service is available at www.accenture.com in the communications industry section.

took place. e-commerce, however, calls for more sophisticated billing systems. Mobile telecommunications in particular requires billing for telephone minutes as well as totally different entities such as data packets, digital goods, or subscriptions of digital services. To complicate things further, these are not necessarily post-paid, but often pre-paid. In addition, rebates might apply and the proceeds might have to be shared between telephone operator and content provider. What is needed for this new world is a convergent or next-generation billing system.[14] Installing such systems has not been an easy task for existing telcos, as the new billing systems had to be installed alongside their existing ones to avoid a disruption of service.

Sales and marketing are related to billing and customer care: these value chain components are located similarly at the interface between company and customers. Targeted service offerings, lower barriers to buy and the exploitation of cross-selling potentials are core elements of e-business initiatives in these domains. Major instruments are the telecommunication service providers' websites.

Targeted service offerings are possible by combining existing customer data with additional information collected on the companies' websites. These offerings can be based on statistical data about the consumption pattern of existing customers as well as on their individual usage patterns. As existing customers might use their telecommunication company's website rather often, for example to check bills or change preference settings, the site offers an additional possibility to cross-sell targeted service offerings to them.

E-procurement is as much an issue for telecommunication service providers as for most other companies. Larger incumbents have of course used EDI systems for a long time, but Internet-based procurement now offers similar opportunities for cost savings and process improvements to smaller service providers. Opportunities exist for the procurement of MRO products in particular as well as for the sale and procurement of bandwidth capacity (cf. section 2.2.1).

Finally, telecommunications companies have the same interest as any other company in using e-business to streamline and accelerate internal processes. Some of these are to be found in other industries too (for example human resources or financial management); others are specific to telecommunications (for example the operation and management of the network). Significant changes have taken place in the latter. Digitisation of the core network components not only made the network easier to administer and more powerful, it also built the foundation for additional service offerings. In addition, it enables the customer to configure parts of the network directly via telephone or Internet without human intervention (e.g. mailbox, automatic call forwarding).

Application Service Providers, which offer "software as service" via the Internet as well as any other sort of xSP, share many characteristics with telecommunication companies. Their one-to-many model billing and customer care are of equal importance, so that e-business opportunities are very similar. However, ASPs and most other xSPs have far less customers than telecommunication providers, since the model is yet not as well accepted as originally hoped for by the companies.

[14] A condensed description of third-party billing problems and the demands on modern telecommunication billing systems can be found at Wichmann (2002).

2.1.1.2 Outsourcing service providers

As shown in table 2-1, outsourcing (i.e., part of NACE 72.3, data processing) is very similar to telecommunications, except for the degree of standardisation. While telecommunication services are highly standardised and offered in a one-to-many model to customers, outsourcing is often a one-to-one business, where the service company takes over part of its customers' IT infrastructure and manages it in an agreed way. Their business is largely not a mass business, so the potential of e-business on the customer interaction side is limited.

E-business plays a significant role in billing, and in managing information flows within these companies as well as between companies and their customers. Typically, very clear processes have to be defined for all sorts of activities, specifying: reaction time, resources spend on the tasks, involvement of customers' personnel, costs allowed, etc. E-business tools are necessary to support these processes and to enable a standardised reaction to requests.

2.1.1.3 IT consulting and individual software companies

The value chain for IT consulting and individual software programming looks different to that of telecommunications. Some components, such as billing and network, are not of similar importance or do not exist at all. Others, like sales, typically take place on a very personal basis. While these components are not part of the e-business enabled value chain, support of the internal "production" process through technology such as Intranet-based knowledge or process management becomes more important. The value chain relevant for e-business in these industries therefore consists of six components: marketing, customer care, service production, finance, human resources and procurement.

As IT consulting and software programming are knowledge-based activities typically organised in projects, the support of the associated knowledge discovery and coordination processes by suitable IT solutions is a major field for e-business. To a large extent, these IT systems are installed in the companies' intranets. Knowledge management solutions or web-based project-management solutions are general examples that support service production. Concurrent version systems (CVS) are another important example in software programming.

If these systems can be accessed by clients, they become part of IT-based customer care. Clients can then follow the progress of the projects, access and possibly approve deliverables at certain points of the production process. Other parts of customer care via Web portals also become possible, where background material or other sorts of information are made available to clients via the portal.

Marketing is another important value chain component, where e-business activities are supportive in this industry. Consulting firms in particular go beyond pure listing of activities and service offers on their websites. They often make considerable amounts of research available on their sites in the form of reports, extensive studies, white papers or newsletters. In this way they transform their websites into knowledge portals for their areas of specialisation and at the same time present themselves as having major competencies in these areas.

At the same time their sites are also important elements in their recruiting strategy: they give candidates a first impression of the company and enable them to apply for open positions. Expert marketplaces play a role in this area as well, more in software manufacturing than in consulting – companies can find very specialised experts to hire them on a project basis. (cf. section 2.2.2)

Other e-business application fields, e.g. procurement or finance, are of less importance than those helping to find and coordinate the skilled workers and information flows that form the basis for this sector.

2.1.1.4 Production of standard software

Standard software is created in a production process similar to the programming of customised software, so all e-business activities supporting the process are important for this sort of enterprise. The main difference is in the way standard software is sold. This can happen via distributors and similar sales channels, or directly, either by traditional direct sales or via the Internet with download possibilities.

e-business drivers for standard software companies are also efficiency improvers in sales processes, in customer care, in marketing and in all other processes important in a standardised product business with many customers. Selling standard software offers similar potential for e-business as selling other mass products (e.g., books, records) does.

However, the digital nature of the product and the potential for versioning is one difference between software manufacturing and manufacturing of physical goods. The digital nature makes it possible to offer the software on the seller's website for download – and indeed most of the larger consumer-oriented software companies now have web shops where the software can be bought for postal delivery as well as for download. The increasing use of broadband Internet connections by companies and private households has helped making the latter a feasible solution. For larger software, often enterprise software, which has to be configured by experts or which simply is too large for reasonable download times, direct download shopping possibilities are less popular.

The possibility of creating different versions of the same product without high costs makes it feasible to use the websites for marketing purposes. This can be done by offering trial versions of software, with only limited functionality. As with consulting companies, the companies' websites offer more than simple product listings, and this helps overcome typical trust problems with goods purchased in this way.

Subscription to Software Services

An unnamed software vendor used the Internet to employ an innovative pricing model going beyond buying permanent software licences. It offered its customers an annual subscription contract consisting of 12 monthly licences. Whenever a company started using the software, the vendor automatically locked the licence for 30 days to that respective user. Usage patterns differed across customers. While some used their licence one month at a time, others used multiple licences in peak times. The software vendor initially feared a decrease in revenues, but, as customers were satisfied with the new model, revenues increased by 30%.

Source: KPMG Consulting (2002).

Finally, distribution via the Internet allows new pricing schemes, where software is paid according to use. This can be done by integrating a communication module into the software that communicates with the sellers' site, whenever the software is being used.

2.1.1.5 Summary

This chapter has shown that the e-business drivers differ considerably within the ICT services sector. Although there are some common elements, the different outputs, processes, value chains, typical company sizes and numbers of customers lead to different driving factors. As in other industries this implies that there cannot be a single “best practice” usage of e-business in the ICT sector. For a small (half a dozen projects a year) IT consulting company, selling its services via the Internet (in the sense of completing sales transactions) does not make sense; for an equally small standard software company it does.

Despite these differences there are some similarities, especially if compared to other sectors: the procurement of direct inputs via online channels is of lesser importance in this sector than it is in many areas of manufacturing (e.g. transport equipment, chemical industry), where direct inputs are more significant. Indirect inputs like office equipment are, however, of similar importance.

More essential for the ICT services industry is, however, the management of information flows within their companies as well as at the interface of company and customer. The larger the company and the more standardised the product, the more important is the use of e-business to improve customer support. The pressing issues of e-business in this sector are thus more concentrated on the sell-side of these companies than on the procurement side.

2.1.2 E-business inhibitors

ICT services is probably the most informed and experienced sector within the *e-Business W@tch* project with regards e-business. Insufficient knowledge about potential and opportunities, one of the main e-business inhibitors in other industries, cannot therefore be an important issue for the companies discussed here.

However, there remain a sufficient number of inhibitors to e-business in this sector, and these unfortunately are more difficult to remove than simple information problems. They provide fewer opportunities for government intervention but rather require efforts by e-business users and providers of e-business tools.

One major potential of e-business already shown is a better flow of information and management of groups and knowledge. While the opportunities are large, several problems inhibit their realisation. Firstly, knowledge management and related tasks are at least as much a management problem as they are a technical problem. Processes for information and knowledge sharing within the ICT firms have to be defined, and the employees have to be convinced that it is in their interest to use IT tools made available for this purpose. Often this is far easier said than done as it involves the lengthy definition and acceptance of new processes.

Secondly, many of the IT solutions available are still complicated and expensive. Only a very few content management systems, knowledge management or groupware are simple to install and configure. Technology is still rather young in these domains and correspondingly immature. This implies that the potential gains from installing such tools must be large to offset the costs, and since this is more likely the case in large enterprises than in smaller ones, the latter has lower adoption rates.

In smaller enterprises the continuing high costs involved with such systems reinforce the existing effect: not everything that is technically feasible is economically sensible. This applies to internal process support systems but also to other e-business activities such as

web shops or e-procurement. As has been shown in the previous section, procurement of inputs as well as selling products or services off the shelf plays a lesser role in several sectors, simply due to their characteristics. As a consequence, e-business support of procurement or sales activities provide only limited benefits, which do not always justify the costs involved.

2.1.3 E-business activity

Telecommunication services and computer services are among the most important inputs for e-business. The focus of quantitative studies has so far been primarily on the products and services produced by these industries, not so much on the use of e-business within the industries themselves. While the *e-Business W@tch* project will change this to a larger extent, initial information is available from a small number of studies.

For the UK, Schema and WS Atkins (2000) have produced early numbers on the application of e-commerce in the telecommunications industry. According to their survey, in 2000 67% of UK telecommunication companies already used e-commerce, while 33% did not.

More detailed data is available from a recent survey by Varian et al. (2002). They compared the spread and impact of Internet business solutions between the USA and the European economies Germany, UK and France. Internet business solutions were defined in a broad way as “any initiatives that combine the Internet with networking, software and computing hardware technologies to enhance or improve existing business processes or create new business opportunities”, which also is a reasonable definition for e-business tools.

Varian et al. initially found a gap in adoption of these solutions between the two regional groups. While 61% of the companies surveyed (covering all industries and size classes from the US) have already implemented Internet business solutions, only 47% of the European respondents indicated this. Within the industry group service providers and telecommunications[15] the usage rate is higher, but the gap remains: 88% of US companies are using Internet business solutions while the figure is 64% for their European counterparts. Among the sectors investigated in detail, service providers and telecommunications is one of those showing a larger gap between the US and Europe.

Table 2-2 shows the implementation rates for specific sorts of Internet business solutions. The numbers show a quite consistent gap between the adoption rates in the US and Europe on one hand as well as between service providers and telecommunications and the average in each region on the other hand. The numbers also correspond to the main e-business drivers discussed in the previous section. Customer service and support systems are of much greater importance in telecommunications than in many other industries. 74% or European companies have such systems installed, but only 55% on average over all sectors. Supply-chain management, on the other hand, is of much lesser importance in this sector. Its usage is also below the average use of such e-business tools in the economies as a whole.

[15] Consisting of SIC 4812 (radiotelephone communications) 4812 (telephone communications, except radiotelephone communications) and 4841 (cable and other pay television services).

Table 2-2: Implementation of specific Internet business solutions in the US and Europe

	USA		Germany, UK, France	
	Average	**SPT[1)]**	**Average**	**SPT[1)]**
E-marketing	68%	74%	52%	47%
Customer service and support	71%	86%	55%	74%
E-commerce	52%	69%	42%	39%
Finance and accounting	36%	42%	26%	26%
Human resources	37%	37%	25%	29%
Procurement/MRO	33%	44%	28%	31%
Sales force automation	30%	50%	16%	27%
Supply chain management	30%	27%	11%	17%

Source: Varian et al. (2002).
1) Service providers and telecommunications.

Not much information exists about e-business activity and its impact in computer services. However, as the industry resembles management consulting, survey results for the latter can provide some preliminary information. With respect to e-business activity, results by PricewaterhouseCoopers (2001) for the UK management consulting sector show a high web- and e-mail use, but low B2B e-commerce activity. 100% of those surveyed have external e-mail, 84% currently have a website and further 8% plan to have one within the next two years. Only 50% either conduct EDI transactions with customers or plan to do so, and 42% conduct EDI transactions with suppliers or plan to do so. These results also correspond to the main drivers and priorities in consulting, as described above.

The website features are specific to the characteristics of consulting: on 88% of websites, further information can be requested and on 40% orders can be placed now or in the near future. 31% of the companies surveyed offer reports or research on their websites while 13% are planning to add this feature within the next two years. The website is also increasingly used for customer care: 6% of consultancies offer customers the opportunity to view information about their account and 13% are planning to add this feature.

The results from this survey are also interesting with respect to the impact of e-business. Most important was a better service provision: 68% of those surveyed indicated that it had improved, and 66% noticed an improvement in productivity. The percentage of companies noticing an improvement in costs or revenues was significantly lower.

2.1.4 Case studies of e-business in ICT service companies

The following two case studies are of suppliers of Internet-related services. The companies mentioned are providing telecommunication services, fixed and mobile Internet access and a large number of services in the realm of e-business. Both examples are of companies that act as providers and users of e-business related services. Often these roles overlap, and the same systems that have been developed for internal use are offered to customers. By showing both sides, we complement this report (which concentrates on the user side only) and demonstrate important links between the e-business supplier industries and other industries included in this project.

2.1.4.1 Deutsche Telekom

Deutsche Telekom AG is Europe's largest and the world's third largest telecommunication company. Its division T-Mobile International became the world's largest GSM-mobile communication provider through the purchase of the American companies VoiceStream and Powertel. T-Systems is the second-largest integrated systems house in Europe. In 2001, Deutsche Telekom had a total turnover of about 48,3 billion Euro. The company has a staff of about 257,000 people operating in 65 countries.

Deutsche Telekom provides various e-business solutions and support for companies, but it uses these solutions also for its own business processes.

ICT services offered

Deutsche Telekom's Internet subsidiary T-Online is one of Europe's largest single Internet Service Provider (ISP). Among the company's most significant Internet-related products are the B2B marketplace T-Mart, the information system ALLECO (particularly addressed to firms) and the online information platform Global Healthcare. In order to join the growing E-Learning-market Deutsche Telekom has provided the "Global Learning" portal (www.global-learning.de). The company's division T-Systems, a joint venture stemming from the merger of units of the Deutsche Telekom Group and the software company debis Systemhaus, has established the online marketplace Chemplorer for the chemical industry (together with SAP and CommerceOne). In addition, Deutsche Telekom is involved in the offer of 12 additional Internet portals covering different themes.

The company also operates as an Application Service Provider (ASP). Their distinctive products include Total Desktop Services, Content Business Solutions such as Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) support, branch specific modules and a Trust Centre for secure internet and software applications on ASP-basis.[16] Deutsche Telekom offers companies to outsource their IT applications to one of their IT service companies. Together with Deutsche Bank, the largest financial institution in Germany, Deutsche Telekom founded the "e-Transaction-Alliance" to develop solutions for secure electronic money orders and marketplaces.

E-business adoption in the company

E-business is also adopted within the company itself. However, due to the nature of the business Deutsche Telekom deals with, it is often difficult to distinguish between internal and external e-business initiatives. For example, an investment of almost 9 billion Euro for "expanding the networks of T-Com and T-Mobile" in 2001 (Annual Report 2001, p.45), relates to improving the quality and quantity of services for customers, but also to improving the efficiency of service provision internally. The same holds for the company's innovation network. In 2001, 900 million Euro were invested in a fibre optic network with a capacity of 1.28 terabit/sec. This network connects product development teams throughout the company. Initially the network will facilitate innovation within the company, but it is also seen as a pilot application and "an important milestone in the development of broadband networks for new services" (Deutsche Telekom 2001).

The company's worldwide operations and the widely scattered branch network and affiliations require efficient tools for the integration of operations and the sharing of relevant information. Their internal information system is realised as a portal that allows an effective

[16] http://www.telekom.de/dtag/presse/artikel/0,1018,x1592,00.html.

and quick information management. To enable their staff to adopt e-solutions, Deutsche Telekom has generated a corporate learning programme.

The size of the company allows for the realisation of substantial economies of scale. However, this can only be achieved with an integrated purchasing organisation for which Deutsche Telekom has installed several large e-business related software packages. According to company officials the e-procurement system helped to reduce the purchasing process from the former 18-step process to a leaner 7-step process. This is a significant step for the former monopsonist where purchases were guided by bureaucratic and extremely codified procedures. Deutsche Telekom estimates that a saving of about 67 % of total processing costs could be achieved.[17]

General Strategy

However, in its Annual Report the company is very cautious about e-business benefits. No exact savings figures are given, and the systems are presented as a logical consequence from geographical and product diversification as well as a requirement of sound governance structures that emphasise the exploitation of synergies between the various divisions. The order of magnitude of the phenomenon can be estimated from the fact that 13,000 units within the company have already used the e-procurement system to effect 100,000 orders. More than 20 online auctions have been conducted which have resulted in savings of operating and purchasing costs whose volume or dimensions are not specified in the report.

The business strategy of Deutsche Telekom underlines the necessity to converge the four main operating divisions: T-Com for the traditional telecommunication services business with the pillars T-ISDN and T-DSL; T-Systems for telecommunication based system solutions; T-Mobile as the global mobile communication branch of the company; and T-Online for internet access, management and content services. The mobilisation of synergies that derive from the combination of parallel, but related activities is a key challenge for the coming years. From the presentation of company strategies it becomes quite clear that the core concept consists of innovation, market, organisational and financial considerations that drive change. E-business solutions are adopted to support the strategies in these fields. As a specific feature of a telecommunication service company, internal e-business solutions can be used as pilot applications for improved services to the customer. And, of course, e-business and Internet related services are a key driver of product and service innovation in Deutsche Telekom.

2.1.4.2 Vodafone

Vodafone is one of the world's largest mobile telecommunications operators. Since its foundation in 1982, Vodafone has become one of the largest companies in Europe (by market capitalisation) and the largest mobile telecommunications company globally. It has a customer base of over 101 million and interests in network operators across 29 countries. The Vodafone Group employs over 100,000 staff worldwide.

ICT related services offered

Vodafone has established itself as a key provider of Internet-based services. The importance of Internet adoptions in many stages of business processes is growing, and there is consequently a demand from the business sector to provide adequate solutions. Vodafone

[17] http://www.computerwoche.de/index.cfm?pageid=254&artid=22481&type=detail

responds to this demand in various ways: it has implemented an Internet-based web access management solution that accelerates the deployment of secure e-business portals by providing plug-in authentication, authorisation and administration services. These services dramatically reduce the time and cost of deploying secure content on the Web for customers, suppliers, partners and employees.

As a part of the strategic alliance between Vodafone and IBM, IBM also builds, manages and runs a global Internet portal for wireless devices, including mobile phones and personal digital assistants.

Together with the Internet-router company Cisco, Vodafone developed new services to offer fast and secure wireless connectivity to enterprises. Vodafone plans to grow wireless data revenues to 25% of its total business. In addition, the company wants to create wireless data solutions and services for the enterprise sector and to drive productivity improvements through a common infrastructure and Internet applications. Vodafone established a global payment platform over mobile devices. According to Vodafone, the main benefit for users paying for goods with their mobile phones will be security and convenience when buying online. Their strategy to have a strong product line in the area of secure Internet connections is therefore an important contribution to market development.

E-business adoption in the company

In line with other IT service providers, Vodafone has integrated e-business solutions into its operational procedures, not only to optimise internal business processes but also to be able to provide convincing solutions to their customers. Vodafone Corporate is consistently expanding its dedicated, self-service portal for corporate customers, which already now allows clients to purchase goods and services directly from Vodafone Corporate. With this new solution Vodafone intends to provide customers with a better and faster service, together with a wider range of features and choice of options. However, the system requires profound re-organisation of back-office functions to secure reliable, up-to-date and efficient responses to customers' online requests. On this basis, Vodafone will be able to develop new services more quickly, at lower cost, and with greater resilience.

In order to keep pace with expanding business volumes, Vodafone needs to consolidate its multiple billing systems. It uses an application server from a major software company for this purpose and can process up to 24 million transactions per day, providing 100 percent availability during peak usage periods. A special software billing solution allows real-time customer billing, including content commerce and mobile IP.

2.1.5 E-business impact

The impact of e-business usage on individual ICT services companies has already been discussed in chapters 2.1.1 and 2.1.2. In this chapter we will point out major consequences of an increasing use of e-business on the industry as a whole. It is useful here to distinguish between those sub-sectors where strong economies of scale occur and those where they do not. Telecommunications, application service providing and related forms of IT outsourcing, for instance, are all infrastructure-businesses with strong economies of scale. The same is true for the production of standard software, where the largest part of production costs are first-copy costs. In comparison, IT consulting services and the programming of individual software are typical services industries that do not show significant economies of scale.

Economies of scale benefit concentration in an industry (average costs are decreasing with the number of customers, thereby giving large firms a cost advantage). As larger firms have a cost advantage, firms in such an industry have an incentive to use the widest-possible distribution channels for their products and services. The Internet and e-commerce conducted via the Internet gives them the chance to expand internationally and thus distribute their costs over more customers. These cost advantages can be used to drive companies with fewer customers out of the market. The consequence of this effect is an increased concentration in the industry. While such a tendency seems initially to favour large companies, it also provides opportunities for smaller companies if they concentrate on a niche where they do not directly compete with larger ones. As the Internet extends their potential market, it offers them the opportunity to become world market leaders in their niche.

Such concentration tendencies are reinforced by other significant effects in the ICT services industry. The network effect – a product or service providing a higher utility if many customers use it – particularly enhances concentration, particularly in standard software production and in telecommunications. The emergence of internationally known brands can have a similar effect.

Concentration tendencies are stronger in those industries where the services can be distributed via the Internet from any point (e.g. in standard software manufacturing), some forms of outsourcing (e.g. hosting) or in application service providing. They are less pronounced in those industries, where a local presence or even a local infrastructure is necessary, as is the case in telecommunications. These concentration tendencies, as well as a variety of legal issues related to international distribution of services, are important for policy, as they require sophisticated anti-trust policies as well as legal frameworks.

In those sub-sectors where economies of scale are not as strong, the main impact of the Internet and of e-business initiatives is a better flow of information within the industry and therefore improved knowledge within companies. Access to international information in particular becomes easier for companies like SMEs that previously did not have sufficient resources to collect this information. In these industries the Internet can therefore increase the chances for smaller companies and strengthen them, which is exactly the opposite effect to that discussed above. Small companies can successfully compete with larger ones if their appearance and work is professional – “on the Internet nobody knows that you’re a dog”. Using the Internet in a way discussed in section 2.1.1.3, they can also extend their market.

IT consulting services and individual software programmers generally have the prerequisites to make best use of these opportunities; in other business services sectors, Internet and e-business related know-how is less abundant.

Obviously these opportunities for SMEs are not present in all parts of the individual software and IT consulting business. There are a variety of sub-markets where the problems to be solved require resources far beyond those of smaller companies (e.g. large integration projects requiring many person-days to be provided over a short time-span), or where the customers tend to give contracts to companies with a well-known brand. Whether the much-discussed “virtual enterprises” can increase the chances of SMEs in such a situation is unclear, as they solve the resource problem but not the branding problem and in addition have project management problems of their own.

2.2 Marketplaces and other intermediaries

On the procurement side, ICT service companies can use exactly the same B2B marketplaces as other enterprises for buying inputs. They can for example order office supplies or other MRO products on horizontal marketplaces or they can use the help of sourcing solution providers like Freemarkets (www.freemarkets.com) or Portum (www.portum.com) to conduct procurement auctions with a selected set of potential suppliers.

However, there are three forms of intermediaries that are in some way specific to parts of the ICT services industry. These intermediaries will be the focus of this chapter. They are:

- Bandwidth marketplaces for telecommunications;
- Software-related marketplaces for expert knowledge;
- Internet-based intermediaries for software, research and similar non-physical products.

2.2.1 Bandwidth marketplaces

As mentioned, telecommunication companies should have the same advantages from using horizontal general procurement marketplaces as other industries do. One sort of vertical marketplace that can be of specific use for telecommunications companies are marketplaces specialising in electronic equipment and components. Some of the components traded on these sites are important for the technical infrastructure of telecommunication networks. Most services, however, are rather broad and not focused on the telecommunications industry.

Table 2-3: Estimated numbers of telecommunications-related B2B marketplaces

Active in	World	North America	Europe
Total	1060	669	381
Bandwidth exchanges	15	12	7
Electronic equipment, components	91	63	31

Source: B2B marketplace database from Berlecon Research (www.berlecon.de/services/b2bdb/).
The regional information denotes activity within the respective region, not necessarily the headquarters. Due to recent marketplaces closures and change of business models on the one hand and hidden existence of marketplaces on the other hand the number of active marketplaces might slightly deviate from the numbers stated.

Specialised marketplaces in the telecommunications industry are bandwidth exchanges, where capacity on all sorts of telecommunication networks is traded. Telecommunication capacity or bandwidth is a rather special “product” as it cannot be stored and is immediately perishable. Capacity cannot be built in a short time, as cables have to be buried, rights-of-way have to be negotiated and the necessary IT equipment has to be brought into place. Due to these short-term inflexibilities, situations will inevitably arise where one carrier has invested too much in capacity and another one not enough. By reselling this capacity for shorter periods of time both would be better off.

While the carriers could come to bilateral agreements, there are several advantages of bandwidth exchanges as neutral intermediaries. Firstly, they can protect anonymity of the parties, as bandwidth is (more or less) a commodity product. In this way, no telecommunications company has to worry that it signals unsatisfactory business development by offering capacity. A neutral, anonymous exchange can also lead to faster settlement of contracts and

prevent renegotiation, an important issue when prices are falling quickly. Finally, an exchange can also realise the technical part of interconnection. To this purpose carriers typically have lines to central exchange points operated by the bandwidth exchange. With a new contract, the traffic only has to be routed according to the contract – no new lines have to be installed.

Bandwidth exchanges originally have been heralded as a beneficial invention made possible by the invention of the Internet. Like many other marketplaces, they ran into difficulties with the new economy and telecommunication sector downturn. As many carriers have invested more in bandwidth than they actually needed, many carriers now have excess capacity or at least cheap access to excess capacity. At the same time, not many have capacity shortages. This state of the market makes it very difficult for bandwidth exchanges to survive on transaction fees (Roberts 2001). Some have therefore withdrawn from the bandwidth exchange business and concentrated more on providing interconnection services, which provide a continuous stream of income. In addition, independent exchanges might face competition in the future from carriers that start their own exchanges (cf. Bourne 2001).

Some of the better-known exchanges are the London-based Band-X and the US-based Arbinet. While most of the business is trading actual bandwidth and similar commodities along the lines of "trade-route-settle" (Arbinet), financial instruments based on these commodities are also of importance.

Band-X

Band-X is a European example of an early and at first quite successful bandwidth exchange. It started with a model based on transparency and neutrality. The market is made transparent by an information system, which Band-X established to help the buyers in evaluating offers based on quality and price. This information proved to be of value itself. As a consequence, Band-X is selling its knowledge on market prices and dynamics as well through a research company, TeleGeography, which it acquired.

Several sorts of capacity are traded on Band-X: the IP Transit exchange is focused on wholesale Internet backbone capacity. Several services are concerned with voice traffic capacity, among them a switched spot market for international voice traffic. An international networks exchange allows the anonymous posting of bids and requests for international network capacity. Finally, a co-location exchange for carrier neutral co-location space as well as recruitment services extend the exchange model to related non-bandwidth products of interest to telecommunication service companies.

Recently Band-X had to close subsidiaries in some markets (e.g. Germany, France, Brazil) and also sold some business in the United States.

2.2.2 Marketplaces for expert knowledge

As regards marketplaces, computer services are similar to telecommunication services. They can use general, horizontal marketplaces for procurement as well as sourcing service providers for conducting supplier auctions and similar competitions. However, as already set out in section 1.3, procurement is of lesser importance for computer software companies.

There are two specialisations of vertical marketplaces that are of particular importance for the computer services industry. The first is the field of software production, which is typically

project-oriented. These can be individualised software projects, which can be initialised and coordinated over a marketplace, as well as the production of standard software, which can be better addressed over a marketplace by drawing on a worldwide pool of specialised programmers. As we described above in section 2.1.1.4, the software production process is very similar. The second area is intellectual property such as software patents. We will focus on marketplaces for specialists in this section.

Table 2-4: Estimated numbers of computer services-related B2B marketplaces

Active in	World	North America	Europe
Total	1060	669	381
Experts, freelancers	26	20	10
Intellectual property	26	16	11

Source: B2B marketplace database from Berlecon Research [www.berlecon.de/services/b2bdb/].

The regional information denotes activity within the respective region, not necessarily the headquarters.

Due to recent marketplaces closures and change of business models on the one hand and hidden existence of marketplaces on the other hand the true number of active marketplaces might deviate from the numbers stated. For more information see the special report on marketplaces within the *e-Business W@tch* project.

As table 2-4 shows, only relatively few marketplaces exist that could at least in principle be used for these purposes. The real number of available services is even smaller, as some marketplaces in these categories have a different focus to the computer services industry.

The function of marketplaces for software programming services is to match potential buyers (organisations or individuals working on a software development project or looking for improvement of an existing solution) and sellers (the freelance developer community or companies offering programming services). Labour, especially in the form of skilled human capital needed for programming, is a scarce resource in this industry. In addition, software programmers are used to work independently on specific subtasks of large projects and to use the Internet for coordination. The preconditions are therefore comparatively good for services that match supply and demand and in addition help to coordinate a distributed network of programmers. Some examples for such services are GULP.de, smarterwork, or Projektwerk, each differing slightly in focus.

Freelancer marketplaces

GULP.de is a German marketplace matching freelancers and organizations for IT-projects (where the process of getting into contact and of coordinating the project is left to the participants). They have more than 30,000 freelancers registered in their database as well as about 1,500 project managers. Almost 1,000 companies offer projects. Additional value is provided through information on the situation of the IT labour market, e.g. the average wages asked and offered.

Smarterwork, with its head office in London, is not so narrowly focused on the IT industry but rather supports the whole process of contracting and completing projects (offering as an additional feature the “Seal of Satisfaction”, a kind of quality certification). They are operating worldwide, with local offices in the US, UK Germany, France, Norway, Spain and China. Smarterwork says it has attracted over 50,000 clients and experts from over 170 countries.

During times of high demand for programming services, these marketplaces can provide considerable efficiency gains for the market by matching the very specific demands for and supply of software specialists. However, during times of sluggish demand the use of such services diminishes, as many companies have a sufficient number of specialists available to conduct the few projects they have.

A related form of Internet services (which failed in their original form), are marketplaces dedicated to the development of Open Source software. Behind these services stands the idea that non-software companies mostly only need problem solutions, not software. The software developed in solving the problem can therefore be made available to the world in the form of Open Source software. Many programmers like to work on Open Source projects and are therefore willing to accept lower compensation for their work than they would for purely commercial programming. The developers can stay independent from a dedicated employer while still capitalising on their Open Source programming skills. Such projects are rare and are satisfying jobs for many developers. The ordering party get access to a highly skilled workforce that would be difficult to contract otherwise for those low rates. The marketplaces were supposed to bring together developers from all over the world, who then would commit themselves to a dedicated project for a certain price.

While a useful application of e-business in theory, these services were commercially not successful so far, as there was not sufficient demand. SourceXchange, for example, supported among others by Hewlett-Packard, abandoned its marketplace functionality and now focuses on collaboration support.

2.2.3 Intermediaries for software and research

A significant share of the computer services industry's output is not traditional services but non-physical goods in the form of software or electronic documents such as research reports or white papers. Due to their electronic form the actual product delivery as well as the matching of supply and demand can take place on marketplaces. Such products are the basis of several Internet platforms. Some of these constitute an important sales channel especially for smaller software companies or even for individual programmers. Others are a mixture of sales and marketing instrument for the sellers of software or research products as well as a knowledge repository for users of these products.

A classical form of services that try to match supply and demand are marketplaces for software components. Components are small chunks of reusable software that provide a strictly limited set of functionality. If companies realise their IT infrastructure using components, they can considerably reduce costs and time-to-market by reusing components. Internal reuse of software is therefore already frequently done. Mostly US-based companies like ComponentSource, Flashline or Xtras operate such marketplaces.

These services are often combined with additional functionality like tools for reuse management or the handling of marketing, delivery, and fulfilment for independent software component authors, who can then concentrate on writing code. ComponentSource, as an example, claims to offer 8,500 components and to work with 650 component authors.

Other services are more focused on software for end users. Download.com, a service offered by US-based CNET, is a database of software for all sorts of operating systems. The software can be freeware, shareware or a trial version. It must only be downloadable. As the service is very popular, gives users the possibility to rank software and also lists the most

popular downloads, smaller and less well-known software companies are given an opportunity to market their products.

The service also provides direct links to the respective software programmer's shop, for instance if the downloadable software is a trial version. In addition it links to payment service providers, which are often used by individual programmers or very small enterprises to process the payment and billing for software. This can typically be done fully electronically, as making the (already downloaded and tested) software fully functional often requires only entering a registration key.

Very similar to software marketplaces are research brokers or syndicators. These services (e.g. Mindbranch or Bitpipe from the US) offer databases full of commercial and free reports on markets as well as on technology. Some of the reports are free marketing material from consultancies or technology companies, while others are for sale. Again, these services offer an opportunity for smaller companies to increase their exposure.

2.3 Industry associations and e-business activities

Compared to other, more traditional, industries, there are relatively few industry associations focused on the ICT services sector. In telecommunications, many industry associations are international (e.g. ITU – International Telecommunications Union) and are focused on global telecommunications issues. Others are national and focused on regulatory issues and the continuous disputes between former state monopolies, regulatory authorities and smaller telecommunication service providers (e.g. VATM – Verband der Anbieter von Telekommunikations- und Mehrwertdiensten in Germany).

In computer services, industry associations often cover the whole ICT sector, from hardware and software up to consulting. The German BITKOM, which developed out of several smaller associations, is an example of such an association on a national level. Many of these associations are active promoters of e-business. However, unlike in other sectors, the major focus is not on the use of e-business within the industry but rather on promoting e-business as a whole, as these companies are major suppliers of e-business products and services and thus beneficiaries of an increasing acceptance of e-business.

Explicit promotion of internal e-business use takes place only occasionally. For example, the international Telecommunications Industry Association (TIA) set up a horizontal marketplace for MRO products through their subsidiary TIAB2B (www.tiab2b.net). One organisation, the European Telecommunications Standards Institute ETSI, even operates its own collaboration portal.

A major e-business-related issue, where many different organisations are involved, is standardisation. The agreement upon common standards is important for software manufacturers, consultants, telecommunication service providers and all other companies present in ICT services. Firstly, ICT services as well as software are typically technology stacks making use of underlying standards and protocols (web browsers use http, European mobile phones GSM, etc.). This requires a common definition of the different layers of these stacks. Secondly the increasing internationalisation of ICT services requires international interoperability, which can again only be achieved by standards.

E-business is difficult to separate from the rest of business activities in those parts of the ICT services sector that provide continuous electronic services like telecommunications or IT outsourcing. In these industries, all activities targeted at agreements on standards or at

education on using new technology to improve processes are related to e-business in some way. The telecommunications industry associations in particular have working groups on such issues and discuss them in depth.

The following list compiles industry associations, which are of relevance to the sector discussed in this report. Apart from these European and world-wide associations a larger number of national ones exists.

- **ATIS** – Alliance for Telecommunications Industry Solutions; 1200 G Street, NW Suite 500, Washington, DC 20005, tel.: +1 202 4348850, fax: +1 202 3935481, www.atis.org.
- **COMPTEL** – Competitive Telecommunications Association; 1900 M. Street, NW, Suite 800, Washington, D.C. 20036, tel.: +1 202 2966650, fax: +1 202 2967585, www.comptel.org.
- **EICTA** – European Information and Communications Technology Industry Association; Boulevard Auguste Reyers 80, 1030 Brussels, Belgium; Phone: +32 2 7068470;Telefax: +32 2 7068479; www.eicta.org.
- **EISA** – European IT Services Association; secretariat currently at CSSA, 20 Red Lion Street, London, UK, WC1R 4QN, Tel: +44 207 3956747, Fax: +44 207 4044119, www.eisaweb.org.
- **EMF** – European Multimedia Forum (Main European trade association promoting the competitiveness of the digital media industries); Rue Moniteur 9, 1000 Brussels, Belgium, Phone: +32 2 2190305, www.emf.be.
- **ETIS** – E- and Telecommunications Information Services; Central Office, Avenue Louise 331, BE-1050 Brussels, Belgium Tel: +32 22230771, Fax: +32 22192628, www.etis.org.
- **ETSI** – European Telecommunications Standards Institute; 650, route des Lucioles, 06921 Sophia-Antipolis Cedex, FRANCE; Tel.: +33 4 92944200, Fax: +33 4 93654716, www.etsi.org.
- **ITU** – International Telecommunications Union; Place des Nations, CH-1211 Geneva 20, Switzerland; Telephone number, +41 22 730 51 11, fax: +41 22 733 7256, Group 4: +41 22 730 6500, www.itu.org.
- **TIA** Europe – Telecommunications Industry Association; Avenue Marcel Thiry, 204, B-1200 Brussels, Belgium; Telephone: +32/ 2 7749623, Fax: +32 2 7749690, www.tiaonline.org.

2.4 Scoreboard of basic e-commerce indicators

This Sector Report is one of the first series of seven sector reports published by the *e-Business W@tch,* six months after its launch in 2002. Since desk research and interviews for this report and editorial work was going on in parallel with the preparation and fieldwork for a European enterprise survey on electronic business launched by the *e-Business W@tch*, it was not possible to use the survey results for this edition of the Sector Report. Instead, the report presents in this chapter

(1) An overview of the e-business statistics that can be expected for the forthcoming edition of this Sector Report (expected for January 2003), and

(2) an initial benchmarking of industry macro-sectors based on other sources, namely on data collected by (i) the Eurostat enterprise survey on e-commerce in 2001 and (ii) by a survey carried out by the "SIBIS" EU project (www.sibis-eu.org) in 2002. It must be noted at this point, however, that due to differences between these surveys in terms of survey methodology and sample there is only limited comparability of data, particularly on a sector level (cf. information below), to the statistics which the *e-Business W@tch* survey will deliver in the forthcoming issues of sector reports.

2.4.1 Forthcoming: Results of the European e-Business Survey

The European e-Business Survey is a cornerstone to the monitoring activities of the *e-Business W@tch*, as it is the key instrument to collect e-business indicators on a sector level which are not otherwise available yet, and certainly not in a comparable manner across sectors. The field work of this enterprise survey has been carried out in June and July 2002 (parallel to the desk research and editing of this Sector Report). Data are currently being processed and analysed. Results will be reported in the forthcoming edition of this sector report and in the European E-Business Report (both expected for early 2003). A first overview with a benchmarking of the 15 sectors covered by the *e-Business W@tch* based on a number of key indicators may be available earlier in the form of an electronic e-Business Pocket Book on the website of this observatory (www.ebusiness-watch.org).

The European e-Business Survey has been carried out by computer-aided telephone interview (CATI) technology. CATI was preferred to alternative survey methods, in particular postal surveys which are sometimes used for company surveys of this kind, mainly to guarantee sample size. The decision maker interviewed was normally the person responsible for ICT within the company, typically the IT manager. Alternatively, especially in small enterprises which do not have a separate IT unit, the managing director or owner was interviewed. In total, about 10,000 interviews with decision makers in European enterprises were conducted. The questionnaire used for the survey interviews will provide data for the following ICT and e-business indicators:

Table 2-5: Indicators of the European e-Business Survey

Area	Main indicators
Computer and internet usage by enterprises	• Percentage of companies using computers • Percentage of companies having access to the internet / not yet online but planning to have internet access (12 months) • "Refusers": Percentage of companies not online and not planning to get online • Type of internet access
Usage of network applications	• E-mail / WWW / Intranet / Extranet / LAN / WAN / EDI • Plans of non-users to use network applications (same as above)
Size of IT and web department	• Average number of employees occupied with maintenance of IT and networks • Average number of employees occupied with maintenance of company website
IT skills gap	• Percentage of companies having recruited staff with special IT skills • Percentage of companies having experienced some / great difficulties in recruiting IT specialists
Employees' access to ICT	• Employees' access to e-mail for internal / external communication • Employees' access to the WWW / to the intranet
Website	• Percentage of companies having a website / planning to have a website
E-commerce: selling online	• Percentage of companies selling online / planning to sell online • Starting point of selling online (for more than 2 years / for 1-2 years / for < 1 year) • E-commerce through company website / electronic market places / extranet / • EDI / mobile e-commerce • Online share of total sales • Method of processing online orders (orders are fully integrated with the back-end system / online orders generate an automatic e-mail / …)
E-commerce: procuring online	• Percentage of companies procuring online / planning to procure online • Starting point of procuring online (> 2 years / for 1-2 years / for < 1 year) • Online share of total procurement
Barriers to e-commerce	• Barriers to selling online • Barriers to procuring online
E-business: external business processes	• Online collaboration with business partners for designing products / to forecast product demands • Online management of capacity / inventory • Electronic exchange of documents with suppliers / customers • Online negotiation of contracts • Participation in B2B e-marketplaces / Type of activity undertaken on e-marketplaces
E-business: special solutions	• Implementation and usage of special solutions in the company / plans to implement: SCM / CRM / Knowledge management / ASP / ERP
E-business: internal business processes	• Sharing documents/ to perform collaborative work • Tracking working hours and production time • Supporting the human resources management • e-learning
Impact of e-business	• Impact of selling online: Volume of sales / Number of customers / Sales area / Quality of customer service / Efficiency of internal business processes / Costs of logistics and inventory • Impact of procuring online: Procurement costs / Relations to suppliers / Internal business / processes / Costs of logistics and inventory / Number of suppliers • Perception of general importance of e-business today • Impact on organisational structure and work processes • Impact on offer of products and services • Expected beneficiaries of e-business (SMEs vs. large enterprises) • Satisfaction with e-business • Trend in expenditure on e-business technologies

2.4.2 The Eurostat survey on e-commerce

Since data from the *e-Business W@tch* observatory's own survey are not yet available, this edition of the report presents instead some key indicators and a preliminary benchmarking of sectors based on data provided by the Eurostat survey "E-Commerce in Europe".[18]

The survey was conducted in the context of an effort by DG Enterprise to develop and carry out regular data collections in the area of e-commerce. DG Enterprise therefore supports Eurostat and the National Statistical Institutes to carry out such surveys. As a first step, a pilot survey on e-commerce was undertaken by 13 of the EU Member States and Norway in 2000. It was carried out as a questionnaire survey. More than 100,000 enterprises were contacted and the response rate was close to 50%. In the follow-up survey ("Community e-commerce survey 2002") all 15 Member States will participate and, in addition, several Candidate countries (Czech Republic, Estonia, Latvia, Poland) intend to carry out pilot surveys in 2002 based on the Eurostat questionnaire.

While the strengths of this survey are certainly the large sample size and the broad coverage of countries (in 2002), it must be noted, however, that there are some serious limitations with regard to the comparability of the data delivered by the (first) pilot survey across industry sectors, which is the main dimension of analysis and comparison for the *e-Business W@tch*.[19] The scoreboards presented below should therefore be regarded as in initial presentation of figures only which will be largely complemented and, for the sake of a coherent methodology, substituted by the more recent data from the *e-Business W@tch.* The following table shows the main differences between the two surveys by Eurostat and by the *e-Business W@tch*:

[18] Eurostat: E-Commerce in Europe. July 2002. Download:

http://europa.eu.int/comm/enterprise/ict/studies/lr-e-comm-in-eur-2001.pdf. A summary of main findings is available in an edition of Statistics in Focus: "E-commerce in Europe" (11 April 2002). This summary as well as a number of other resources can be downloaded from

http://europa.eu.int/comm/enterprise/ict/statistics/e-commerce.htm.

[19] For many variables covered by the Eurostat e-Commerce Survey there are considerable differences between 'global' figures broken down by size (category 'All') and 'NACE averages'. The most likely explanation is that this occurs because of gaps in countries' reporting on sectors, as Eurostat confirms: "The data with the breakdown by NACE have often been compiled with a more restricted country coverage than the global (and size class) figures because of weaker data availability. Hence, a direct comparison between the data by activity and the global figures cannot be made. For this reason, most of the tables and figures providing data by activity include a second global figure called the 'NACE average'. (…)" A closer look at the coverage of NACE sub-sections shows that in general figures Germany, Finland and Sweden are missing in the NACE related statistics altogether. For some sub-sections other countries are not included either, and for some variables yet another different set of countries is considered. In some tables footnotes state that the UK is not included (for example, Table 2.3.9: Internet e-sales processes). For many of the sectors monitored by the e-Business W@tch, however, Germany and the UK account for a substantial part of the production value (often over 40%) in Europe. Hence information that excludes these two countries has only limited value for a sector analysis, for instance in the chemicals or the transport equipment sector where Germany is the largest industry in the EU. This problem becomes evident when figures for the category 'all' are compared with 'NACE averages' which tend to be far below the 'global' averages. This is not surprising when considering that Germany belongs to the countries with the highest e-commerce activity in Europe.

	European E-Business Survey	Survey E-Commerce in Europe
Method	CATI (telephone interview)	questionnaire mailings
Focus	e-business sectors	e-commerce countries
Sample	~ 10,000	~ 50,000 (returned questionnaires)
Time (field work)	June/July 2002	1st half 2001
Field work organisation	Inra (based on contract with the e-Business Watch)	National Statistical Institutes in participating countries

The following table presents the findings for six basic ICT and e-commerce indicators broken down by business activity (cf. note under table). The breakdown includes NACE Rev. 1 section I ("Transport, storage and communications"), which is composed of subsections 60-64 (land and air transport, supporting and auxiliary transport activities, post and telecommunications) and thus include telecommunications which is a key business activity analysed in this Sector Report. The second business activity which are dealt with in this report, computer related services (NACE Rev. 1 72), are included in section K ("Business services").

A vast majority of companies in all NACE sections use computers. In e-business surveys, this indicator is consequently mainly used as a filter for follow-up questions about e-commerce and e-business in order to get a second optional computation base for more significant indicators.

Table 2-6: Basic e-commerce indicators for industries

% of enterprises using / having implemented	Computers	intranet	EDI	Web access	e-purchasing	e-sales
Manufacturing	89	27	12	68	13	8
Food, beverages and tobacco	*88*	*25*	*17*	*66*	*7*	*9*
Textiles	*73*	*16*	*7*	*49*	*6*	*4*
Leather	*78*	*11*	*3*	*51*	*4*	*3*
Wood	*90*	*16*	*7*	*61*	*6*	*5*
Pulp, paper, publishing and printing	*95*	*34*	*14*	*77*	*23*	*13*
Coke, refined petroleum, nuclear fuel	*94*	*54*	*37*	*87*	*27*	*24*
Chemicals and man made fibres	*97*	*43*	*15*	*86*	*16*	*10*
Rubber and plastics	*96*	*31*	*12*	*75*	*19*	*12*
Other non-metallic mineral products	*91*	*25*	*8*	*72*	*7*	*4*
Basic metals, fabricated metal products	*91*	*26*	*12*	*66*	*11*	*6*
Machinery and equipment n.e.c.	*95*	*37*	*13*	*82*	*17*	*8*
Electrical and optical equipment	*94*	*40*	*14*	*80*	*28*	*12*
Transport equipment	*94*	*37*	*20*	*74*	*17*	*12*
Manufacturing n.e.c.	*89*	*24*	*11*	*64*	*11*	*7*
Distribution	94	34	18	71	20	11
Hotels and restaurants	72	12	6	47	11	15
Transport, storage and communication	**87**	**31**	**18**	**67**	**17**	**12**
Business services	93	35	16	73	29	9
Nace average	**89**	**29**	**14**	**68**	**18**	**10**

Source: Eurostat / own presentation

Note: The Eurostat survey presents "NACE average" figures based on the NACE Rev. 1 Sections D (Manufacturing), G (Distribution, i.e. mainly wholesale and retail trade), H (Hotels and restaurants), I (Transport, storage and communication) and K (Real estate, renting and business activities). Since J (Financial intermediation) was not included in a number of national surveys by the NSIs, the "NACE average" does not include this section.

In the table below, the NACE sections including Section I (Transport, storage and communication) are benchmarked according to the same six indicators as presented above. For each indicator, the highest penetration has been indexed as 100.

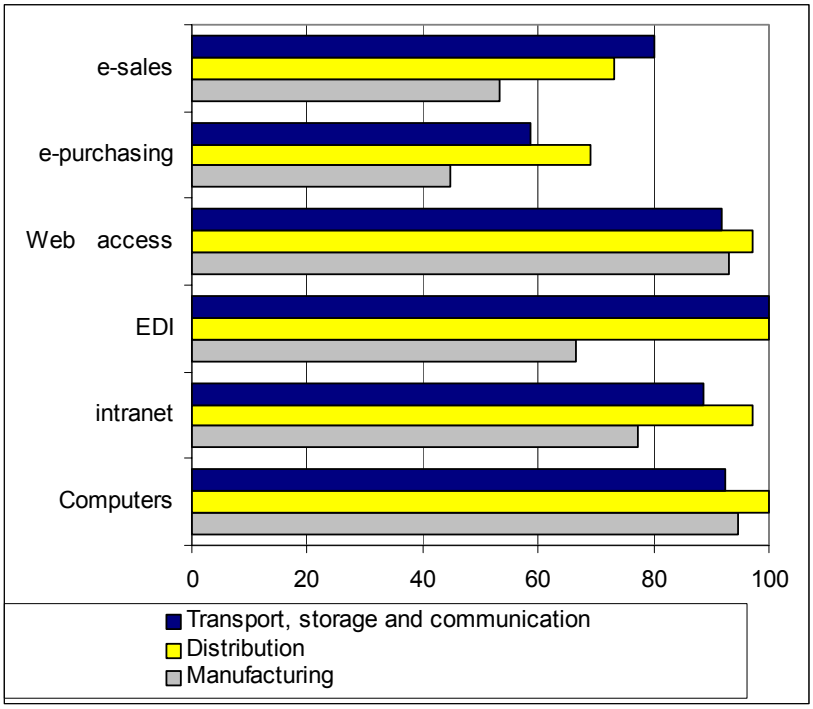
Table 2-7: Sector benchmarking for "Transport, storage and communication" (best = 100)

Benchmark = 100	Computers	intranet	EDI	Web access	e-purchasing	e-sales
Manufacturing	95	77	67	93	45	53
Distribution	100	97	100	97	69	73
Hotels and restaurants	77	34	33	64	38	100
Transport, storage and communication	**93**	**89**	**100**	**92**	**59**	**80**
Business services	99	100	89	100	100	60
Nace average	**95**	**83**	**78**	**93**	**62**	**67**

Source: Eurostat / own calculations

Benchmarking " Transport, storage and communication" in e-commerce against distribution and manufacturing

(100 = best of the industries covered, see table above)



Source: Eurostat / own calculations

Summarising the results of the survey, Eurostat finds that the diffusion of ICT infrastructure among businesses from the NACE section I which includes telecommunications is very close to the NACE average.

31% of the enterprises in this section used an **intranet** in the year 2000 which corresponds to the average diffusion of 29%. This indicator varies widely across sections and subsections, and it can therefore be concluded that usage will also vary within the storage and communication section. The structure of the respective sector is clearly one of key determining variables, since large enterprises are much more likely to make use of the intranet than small enterprises. Also, the value of an intranet is inherently higher for enterprises with a large number of office workers and/or teleworkers and mobile workers who need to access company information from abroad. It can be assumed that the intranet diffusion is much higher among telecommunications companies than the figure for the whole

section I suggests. In fact, this sector is likely to be one of the most intensive users of intranet applications, as the survey of the e-Business W@tch will probably show.

EDI usage also varies across sections, usually in a range between 8 and 20% for most sections and sub-sections. The Eurostat survey shows a diffusion of 18% for the section "storage and communications" compared to 14% for the NACE average (2000). Again, it can be assumed that the figure should be higher for telecommunications companies, but the difference to the section average should not differ as much as in the case of intranet diffusion.

Web access was above 60% for all NACE Sections except for H (Hotels and restaurants) in 2000. Due to the specific role of the ICT services sector with respect to this indicator – it is one of the key services of this sector to provide internet access to other companies – practically all enterprises operating in the ICT services industry have web access today.

"Web access" must not be confused with the frequently used indicator "having a website", which is basic requirement for conducting e-commerce on the internet. The percentage of companies from the ICT services sector with a website is expected to be one of the highest among all sectors covered by the e-Business W@tch. We estimate that more than 85% of all companies in this sector (employment weighted, i.e. companies representing 85% of employees) have a website by 2002.

The Eurostat survey reports that 29% of enterprises had their own website (NACE average) at the end of 2000 and 11% planned to have one in 2001. Business services was the most advanced section in that respect with 40% of enterprises having a website, while the other sections showed very consistent figures between 24 and 29%. We assume that figures for 2002 are much higher, especially if presented as employment weighted figures.

Online selling and purchasing, obviously highly correlated activities, are key indicators for the maturity of electronic business and cornerstones in all surveys on this topic. The Eurostat survey – taking into account all the methodological implications discussed above – suggests that almost twice as many enterprises practised e-purchasing (18% NACE average) as e-selling (10%) in late 2000. This is in line with the general observation that B2B electronic commerce has developed faster than B2C e-commerce. Companies are more likely to buy electronically from their suppliers than to sell online. Comparing the industry sections reveals some interesting results. While enterprises in business services are most likely to procure online, hotels and restaurants – the "laggards" in many of the other indicators – are most advanced in selling online (15% of enterprises). Tourism was clearly one of the forerunners in establishing online reservation systems, and this is probably one of the factors reflected by this figure. It is also interesting to see that the distribution sector (NACE G) which could be expected to be a leader in online selling is only slightly above average (11%), but in fact makes more use of online purchasing (18%). Hotels and restaurants are the only sector where online selling outperforms online purchasing, which again reflects the nature of the business.

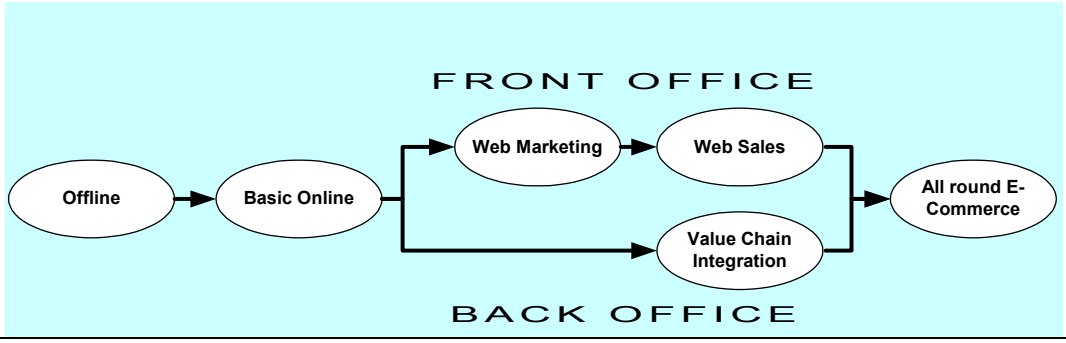
In the ICT services sector, selling online plays a more important role than in most of the other sectors. Software, for instance, is besides books and hardware components one of those product categories with the highest share of online sales. With the increasing diffusion of broadband internet access in households, the opportunity to download software instantly from the web rather than 'only' purchase it online and then get it delivered by mail will probably further boost B2C e-commerce in this market.

2.4.3 The e-readiness of industry sectors

The "e-readiness" of an industry sector (or, alternatively, of a country or size class) can be described by the percentage of enterprises that have implemented a certain level of ICT infrastructure and actually apply this infrastructure for e-business purposes. empirica has developed an e-commerce typology by using an ordinal scale of six levels ranging from "off-liners" (level 1 – companies without a website that do not have access to the Internet or e-mail) to "all-rounders" (level 6 – the most advanced companies that sell online and practise value chain integration).

Table 2-8: e-Commerce Typology: six stages of sophistication

Level	Type	Description
(1)	**Offline**	Companies / establishments without access to the Internet, e-mail and without a Website
(2)	**Basic Online**	Companies / establishments without a presence on the Internet (e.g. Website), but with access to the Internet or e-mail.
(3)	**Web Marketing**	Companies / establishments with a presence on the Internet (e.g. Website), but none of the following
(4)	**Web Sales**	Companies / establishments that sell goods or services via the Internet (through own Website and/or via e-marketplaces), but none of the following
(5)	**Value Chain Integration**	Companies / establishments that use EDI or Extranets for communication with forward or backward linkages in the value chain, but none of the following
(6)	**Allround E-Commerce**	Companies / establishments that sell online as well as practise value chain integration



Source: empirica

The model distinguishes between "front office" applications and "back office functions" as regards achieving full e-commerce potential. Companies that concentrate on the development of e-commerce for front office applications use the Internet, often in combination with other ICTs, for marketing and conducting online sales to customers. Companies that concentrate on back-office functions exploit the Internet as a way to integrate business processes (also involving suppliers and distribution partners) along the value chain.

The model works for individual companies as well as for aggregates of companies, e.g. on sector or country level. For instance, the higher the percentage of companies from an industry sector is in the more advanced levels, particularly in levels 5 and 6, the higher is the "e-readiness" of this sector. This e-commerce typology has proved to be useful to monitor

progress over time[20], although the definition of the levels may have to be adjusted in the future once e-business has reached a certain maturity, requiring monitoring activities to focus on other (and probably more qualitative) aspects than simply on whether a company has an internet presence or sells online. For the time being, however, the model can still be considered as a useful tool to benchmark the maturity of electronic business in various industry sectors or countries.

A recent decision maker survey in establishments of seven EU Member States (Germany, France, the UK, Italy, Spain, Finland and Greece) carried out by the SIBIS project (www.sibis-eu.org)[21] finds that 13.6% of establishments are e-commerce all-rounders, and another 33.2% have reached the level of value chain integration. Only 6.5% are still off-line. The results are comparable for the macro-sectors covered by the SIBIS survey, especially those for the lower levels. On the highest level, the public and social services lag behind with only 5.7% of establishments being characterised as all-rounders. Financial and business services, on the other hand, are most advanced with more than 50% of establishments having reached levels (5) or (6).[22]

Table 2-9: E-Commerce Typology: the e-readiness of industry macro-sectors (% of establishments)

Type	Manu-facturing	Distribution	Financial & business services	Public & Social services	Total EU
Allround E-Commerce	11,6	20,3	17,9	5,7	13,6
Value Chain Integration	33,2	26,3	35,7	39,5	33,2
Web Sales	5,8	11,9	9,9	5,0	8,0
Web Marketing	18,6	15,1	15,9	26,4	19,1
Basic Online	23,1	16,5	17,0	20,6	19,6
Offline	7,8	9,9	3,6	2,8	6,5
	100,0	**100,0**	**100,0**	**100,0**	**100,0**

Base: all establishments (N=3139), weighted by employment; EU7 additionally weighted by employment per country. Each establishment is assigned exclusively to one e-commerce type. Macro-sectors as defined by SIBIS:

(i) Manufacturing, energy, mining, construction

(ii) Distribution, catering, communication & transport

(iii) Financial and business services

(iv) Public administration, health, education, other social/personal services

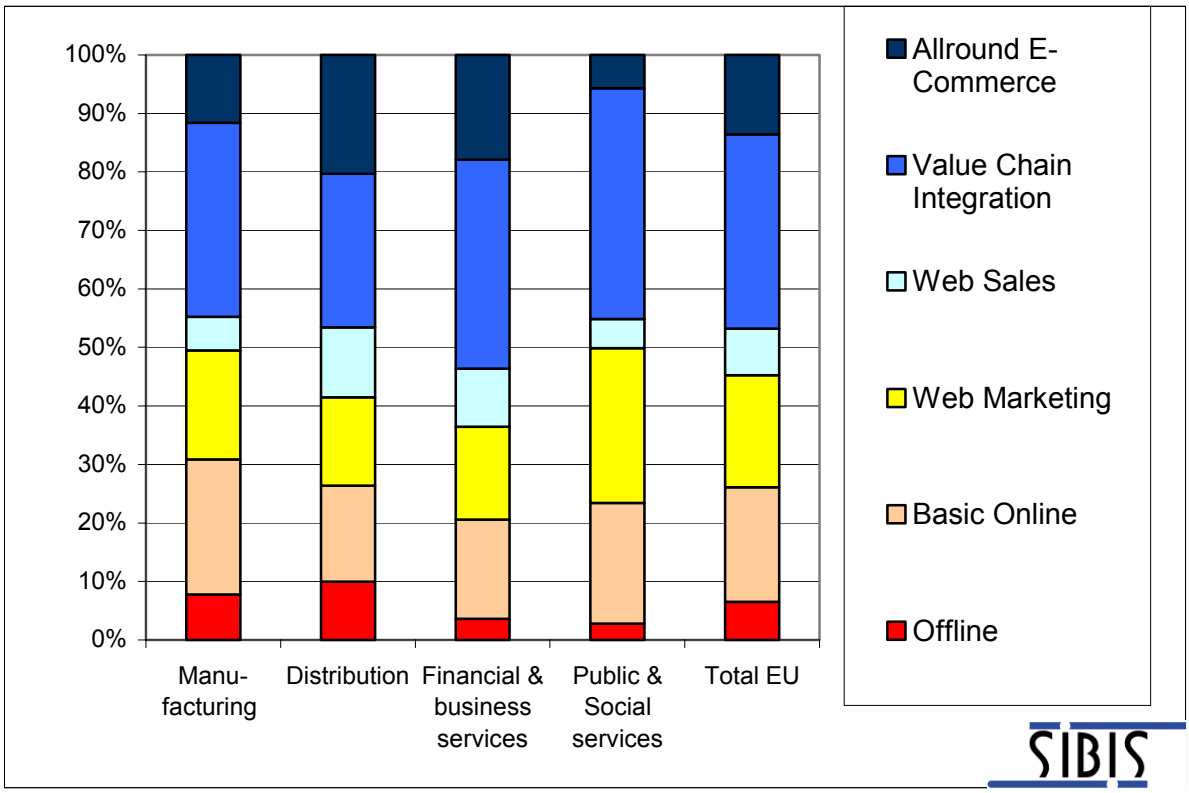
Source: SIBIS (DMS – preliminary data)

[20] cf. EC-KMU: Status Quo and Development Prospects of Electronic Commerce in Germany, Europe and the USA 1999 and 2001. Study by empirica for the German Ministry of Economy and Technology.

[21] SIBIS (Statistical Indicators Benchmarking the Information Society) is a project in the "Information Society Programme" of the European Commission (IST-2000-26276) running from January 2001 to June 2003. SIBIS has taken up the challenge of developing innovative information society indicators to take account of the rapidly changing nature of modern societies and to enable the benchmarking of progress in EU Member States. The SIBIS Decision Maker Survey (DMS) covers the five topics e-commerce, telecommunication & access, security, e-government, and Internet for R&D. It is targeted at establishments and carried out in Germany, France, the UK, Italy, Spain, Finland and Greece. The sample taken is a disproportionately stratified sample reflecting labour force distribution across establishment size bands. Sample sizes range from 300 to 500 per country resulting in an overall sample of 3,100. The survey was conducted via CATI (Computer Aided Telephone Interview).

[22] Important note: These data are only preliminary (the fieldwork was carried out in April and May 2002) and still need to be consolidated by the SIBIS project. They are not yet officially reported. Data have been technically checked e.g. for consistency and for correct filtering.

Figure 2-1: E-Commerce Typology: the e-readiness of industry macro-sectors



% of establishments

Source: Source: SIBIS (DMS – preliminary data) / own presentation

Participation in e-marketplaces

An indicator which is not considered in this model, but which may become an important indicator for measuring e-readiness in the future, is the participation of enterprises in e-marketplaces. These are specialised sites on the Internet that allow buyers and suppliers to trade goods and services. Electronic marketplaces can be operated by individual buyers or suppliers, by consortia or by third parties. Access can be public or restricted to selected business partners. The SIBIS survey has investigated whether establishments trade on such electronic marketplaces. As expected, the percentage of establishments doing so is still rather small, but reaches 9.8% in total if figures are employment weighted.[23] Initial results suggest that the main activities on marketplaces are catalogue based offering of goods and services (5.2%) and catalogue based selling (4.2%), compared to a lower level of participation in auctioning (1.6% for bidding, 2% for selling), launching calls for tender (1.8%) and answering calls (2.3%).[24]

The Eurostat survey on e-commerce also presents figures about marketplace participation. These are somewhat lower than in the in the SIBIS survey, but considering that (i) the field work of the Eurostat survey took place in early 2001 (compared to April 2002 for SIBIS) and

[23] That means that 9.8% of employees work in establishments that participate in e-marketplaces. 1.9% of the establishments surveyed said "don't know", the rest said "no" or was not asked (filter) because of lacking infrastructure requirements.

[24] Important note: Data reported are only preliminary (the fieldwork was carried out in April and May 2002) and still need to be consolidated by the SIBIS project. They are not yet officially reported. Data have been technically checked e.g. for consistency and for correct filtering.

that (ii) presentation of Eurostat data is not employee-weighted, figures stemming from the two surveys are quite consistent. Eurostat finds that already in late 2000 about 10% of the large enterprises participated in e-marketplaces and about 5% of SMEs. Business services seem to be the most active users (6% of enterprises). Furthermore, the Eurostat survey finds that SMEs seem to use marketplaces for procurement purposes more than for selling, while large enterprises were more frequently selling (10%) than buying (7%).

Table 2-10: Use of specialised B2B marketplaces on the internet (% of enterprises using them)

	Purchases through B2B internet marketplaces *	**Sales through B2B internet marketplaces ***
Manufacturing	2%	1%
Distribution	4%	1%
Hotels & restaurants	2%	3%
Transport & communication	5%	2%
Business services	6%	1%
NACE average	3%	1%

* Note: Activity breakdown excludes D and S – therefore percentages are lower than the figures given for "All" where D and S are included.

Source: Eurostat

The European e-Business Survey of the *e-Business W@tch* will provide fresh data about the usage of marketplaces by enterprises from the 15 industry sectors covered. Considering the high level of attention which the B2B marketplaces receive from policy and industry alike, it will be interesting to see whether trading on marketplaces has actually gained momentum.

3 Summary and conclusions – possible policy implications

3.1 Summary of main findings

This Sector Report of the *e-Business W@tch* analyses activities within the following classifications: telecommunications (NACE Rev. 1 64.2) as well as computer-related activities (NACE Rev. 1 72). The latter can be subdivided into six further groups that cover IT-services from hardware and software consulting via outsourcing services to individual software programming. One sub-sector also covers the production of standard software. These two industries have one thing in common: While they are potential users of e-business like every other industry, they also provide some of the most essential elements for conducting e-business. These are: the telecommunications infrastructure (for voice, image and data traffic); software; and consulting and outsourcing services. One could therefore assume that the companies in these industries are conducting e-business in the best way possible, as they are familiar with concepts and technologies and as they are competent in realising e-business projects.

Telecommunications: key issues

The main challenges for telecommunications derive from market liberalisation, from trends in mobile communication and from network and service management. Challenges in computer services focus on innovative software services, copyright problems and fluctuating demand for services. Telecommunication services have changed considerably during the previous years, bringing new sector-specific issues and challenges to companies. Six major issues are identified as important for past, present and near future. These are:

- The liberalisation of telecommunication markets and the resulting increase in competition;
- regulatory disputes involving former monopolies;
- uncertainties concerning the development of demand patterns for mobile communication and consequently expectations about its future;
- growth of data traffic on telecommunication networks;
- and finally new technologies for network access as well as network administration.

Computer services: key issues

Within the computer services sectors we consider the following issues to be especially important:

- new forms of software delivery and software services enabled by the Internet;
- application service providing;
- demand for e-business related software;
- the spread of Open Source software;
- legal issues concerned with the protection of intellectual property rights of digital goods and software patents;
- demand fluctuations for ICT consulting services;
- new technologies for knowledge management and coordination;
- an increasing demand for outsourcing of ICT services.

The current use of e-business

E-business activities are well developed in the sector and reflect differences in the nature of products and services provided between sub-sectors. Standardised products offer a set of e-business related opportunities that differs substantially from that for customised services.

A hypothesis was raised earlier that this sector might be already a sophisticated user of e-business due to its familiarity with concept and technology, and the limited data available seems to support this. The survey currently carried out in the framework of the *e-Business W@tch* project will provide more detailed data for the second issue report.

The type of e-business activities taking place differs between the sub-sectors of ICT services. These differences reflect the peculiarities of production, service characteristics and the composition of their customer base. Some sub-sectors are capital-intensive (telecommunication services, outsourcing, application service providing); others are human-capital intensive (ICT consulting, software production). Some sub-sectors produce standardised output for a huge number of customers (telecommunications, producers of standard software); others deliver very specific services to single customers (ICT consulting, commissioned software). Some provide their services continuously (telecommunications); others on a project-by-project basis (consulting).

The different forms of e-business usage reflect these characteristics. Employing e-business tools to improve customer-faced processes such as customer service, sales and marketing is vital in areas of the industry that deal with large numbers of customers. Improving internal coordination as well as the flow and management of knowledge is vital in the sub-sectors that produce their services mainly from skilled labour.

Much of the technological development during recent years has been favourable to the use of e-business in the ICT services sector. It has provided opportunities for new service offerings, methods of customer support and marketing. New service offerings in the telecommunication sector are often based on new possibilities of the digitalised networks (e.g. network mailboxes). Examples of new service offerings in software are the application service provider model or the combination of software with update services over the Internet, although not all of these offerings have as yet been successful.

New ways of marketing include the increasing use of companies' websites to provide material beyond pure service description. Trial versions of software, research documents or white papers can help smaller companies in particular in these sectors to overcome trust problems typical for goods like services and software. Specialised Internet marketplaces that compile research or free software add another interesting potential.

The use of e-business for procurement is less important for this sector (particularly for computer services), than for most manufacturing sectors. Firstly, apart from labour and installed capital, direct inputs are not significant. The potential savings from organising this procurement process better are therefore relatively small, and this is reinforced by the size structure of firms. Computer services firms are relatively small, while procurement inefficiencies tend to be larger with large companies.

The role of marketplaces and other intermediaries

In addition to individual e-business projects by companies there are several industry-wide activities, especially marketplaces and other intermediaries. However, compared to other sectors, these are of a somewhat lesser importance. Three main types of intermediaries can be found: bandwidth marketplaces for telecommunications, software-related marketplaces for

expert knowledge, and Internet-based intermediaries for software, research and similar non-physical products.

Marketplaces respond to sector specific inefficiencies in input management. They are still in an initial phase, and their development is currently suffering from the low dynamics of the ICT sector. The marketplaces have tried to capitalise on the industry-specific input inefficiencies that exist, such as volatile demand for telecommunication capacity, for software components or for experts. Not all of these have been successful, however, and their future will depend to some extent on their ability to survive the current lack of demand for their services. Only very few marketplaces for expert knowledge exist. While these can provide useful matching functionality in times of scarce human resources, the recent downturn in the ICT sector has also affected these intermediaries.

Intermediaries for software and research make use of the nature of software and electronic documents and often act as a sort of library or reseller of such products. Some of these constitute an important sales channel, especially for smaller software companies or even for individual programmers. Others are a mixture of sales and marketing instrument for the sellers of software or research products as well as a knowledge repository for users of these products.

3.2 Policy implications

Final policy recommendations for the ICT services sector can only be derived after all facts, including survey results, have been collected and analysed thoroughly. The conclusions of this first part of the project, however, point already to important policy issues in the ICT services sector that could be identified on the basis of the analysis conducted so far.

It is an important challenge for policy makers to provide a statistical basis that allows the monitoring of the dynamics of technology and markets in ICT manufacturing and services industries.

As can be seen from this report, there is a significant lack of consistent and up-to-date data for these important dynamic sectors. Improving this unfortunate situation poses a significant challenge to public institutions responsible for gathering data as well as to policy, which defines the legal foundation for improving statistical information.

As ICT services are developing quickly and have been in the centre of public interest in recent years, there is a significant demand for any sort of quantitative information, which is often satisfied by data of dubious quality. Public policy institutions can help in improving the quality of data, not only by supporting data gathering and setting the right framework, but also by establishing and following standards for a prudent use of statistical information.

There are different 'optimal' e-business strategies for different sub-sectors. Measures to promote e-business should therefore not impose standard solutions on all companies.

It has been shown that the companies in the ICT services industry are diverse with respect to their products, business processes and value chains. This diversity is also reflected in the companies' motivation for engaging in e-business as well as the priorities attached to different e-business initiatives.

This implies that different sub-sectors will follow different "optimal" e-business strategies. It also implies that one sub-sector might seem to be more advanced than another if measured

by the same yardstick (e.g., by measuring the share of transactions conducted electronically), although these sub-sectors simply follow different strategies. It is therefore important that every institution wishing to promote e-business use in companies does not impose certain ways of conducting e-business on all companies.

Substantial economies of scale that exist in the sector will be further enhanced by exploiting e-business opportunities. Concentration tendencies are thus likely to be reinforced.

Telecommunications, application service providing and related forms of IT outsourcing are all infrastructure-businesses with strong economies of scale. Economies of scale benefit concentration in an industry as average costs decrease with the number of customers, thereby giving large firms a cost advantage.

The Internet and e-commerce conducted via the Internet underlines this effect, as it facilitates world-wide distribution and thus even more possibilities of distributing costs over an even larger number of customers. Such concentration tendencies are reinforced by other important effects in the ICT services industry. The network effect aggravates the concentration forces in standard software production and telecommunications in particular. The emergence of internationally known brands can have a similar effect.

These concentration tendencies, as well as a variety of legal issues related to international distribution of services, are an important policy issue, as they require sophisticated anti-trust policies as well as legal frameworks.

References

Arias, S.; J.C. Kinnaman (2000): E is for Earnings – The Economic Imperative for E-Business, in: PricewaterhouseCoopers InfoComm Review, 39-50

Berlecon Research (2001): ASP 2001 – Was wollen die Nutzer? Ergebnisse einer repräsentativen Befragung deutscher Unternehmen.

Baumol, W.J. (2002): Free Market Innovation Machine: Analyzing the Growth Miracle of Capitalism.

Bourne, E. (2001): Carriers shouldn't fear bandwidth exchanges, Total Telecom, 28.9.2001, www.totaltele.com.

Deiss, R. (2001): Information Society Statistics, in: Statistics in Focus, Industry, Trade, and Services, Theme 4, 34/2001.

Deutsche Telekom (2001): Annual Report.

Eurostat (2001): Panorama of European Enterprises 2000.

KPMG (2001): Information, Kommunikation, Medien 2001-2004 – Branchenprognosen aus vier europäischen Ländern.

KPMG Consulting (2002): White paper – Making the Case: Transformation to Digital Licensing.

OECD (2000): Measuring the ICT Sector.

RegTP (2001): Jahresbericht 2001, Bonn.

RWI (2000): Wachstums- und Beschäftigungspotenzial der Informationsgesellschaft bis zum Jahr 2010, Endbericht zum Forschungsauftrag Nr. 30/99 des Bundesministeriums für Wirtschaft und Technologie, mimeo.

Wichmann, T. (2002): Billing Woes, Electronic Payment Systems Observatory Newsletter, 13/2002, epso.jrc.es.

PricewaterhouseCoopers (2001): E-Commerce Impact Study for the Management Consulting Sector, www.ukonlineforbusiness.gov.uk.

Roberts, D. (2001): Broadband markets find narrow trader interest, Financial Times, 19.8.2001.

Schema and WS Atkins (2000): Applications of E-Commerce in the Telecommunications Industry, www.ukonlineforbusiness.gov.uk.

Statistics Denmark et al. (2001): The ICT Sector in the Nordic countries 1995-2000.

Varian et al. (2002): The Net Impact Study – The Projected Economic Benefits of the Internet in the United States, United Kingdom, France and Germany, V. 2.0. www.netimpactstudy.com.