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All publications of the SIBIS project – including this booklet – are available in electronic format on the internet at:

www.sibis-eu.org

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Acronyms

.	No data available
AAPD	American Association of People with Disabilities
ADSL	Asymmetric Digital Subscriber Line
ALL	International Adult Literacy and Life Skills Survey
AT	Assistive Technologies
B2B	Business to Business
B2C	Business to consumer
B2G	Business to Government
BB	Broadband
BEGIX	Balanced e-Government Index
C2G	Citizens to Government
CAST	Centre for Applied Special Technology
CATI	Computer-Aided Telephone Interview
CD-ROM	Compact Disk - Read Only Memory
CEPIS	Council of European Professional Informatics Societies
CGEY	Cap Gemini, Ernst & Young
CH	Switzerland
CIP	Critical Infrastructure Protection
CIS	Community Innovation Survey
CMC	Computer-mediated communication
CVTS	Continuing Vocational Training Survey
D	Germany
DELOS	Developing a European e-Learning Observation System (Project)
DG	Directorate General of the European Commission
DG SANCO	Health and Consumer Protection Directorate-General
DIDIX	Digital Divide Index
DK	Don't know
DMS	Decision Marker Survey
DSL	Digital Subscriber Line
DVD	Digital Video Disk
E	Spain
EB	Eurobarometer Survey
EB-F	Eurobarometer Flash Survey
EC	European Commission
ECaTT	Electronic Commerce and Telework Trends
ECDL	European Computer Driving License
ECHP	European Community Household Panel
ECTA	European Competitive Telecommunications Association
EdeAN	The European Design for All e-Accessibility Network
EHCRs	Electronic Health Care Records
EICTA	European Information and Communication Technology Industry Association
EIDD	The European Institute for Design and Disability
EITO	European Information Technology Observatory
EL	Greece
ELS	Electronic Library Services
ERA	European Research Area
ESDIS	High level Group on the Employment and Social Dimension of the Information Society
ESIS	European Survey of the Information Society
ESWCs	European Survey on Working Conditions
EU	European Union
EURYDICE	The information network on education in Europe
F	France
FIN	Finland
FTE	Full-time equivalents
G2B	Government to Business
G2B2C	Government to Business to Citizen
G2C	Government to Citizen
G2G	Government to Government
GPS	General Population Survey
HIS	Hospital Information System
HR	Human resources
I	Italy
IALS	International Adult Literacy Survey
ICT or IT	Information and Communication Technology
IDC	International Data Corporation
IEA	International Association for the Evaluation of Educational Achievement
ILO	International Labour Organization
IP	Internet Protocol
IRC	Internet Relay Chat
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
ISDN	Integrated Services Digital Network
ISI	Institute for Scientific Information
ISIC	International Standard Industrial Classification
ISP	Internet Service Provider
ITU	International Telecommunications Union
JPO	Japanese Patent Office
Kbit/s	Kilobit per second
LAN	Local Area Network
LFS	Community Labour Force Survey
LLL	Lifelong Learning
Mbit/s	Megabit per second
MMS	Multimedia Message Service

MSTI	Main Science and Technology Indicators
NALS	National Adult Learning Survey (U.K.)
NAS	New Accession States
NRA	National Regulation Authority
NRN	National Research Network
NSI	National Statistical Institutes
OECD	Organisation for Economic Co-operation and Development
OFTEL	U.K. Office of Telecommunications
PACS	Picture Archiving and Communication System
PC	Personal Computer
PES	Public Employment Service
PIAP	Public Internet Access Point
PPP	Purchasing Power Parity
PSTN	Public Switched Telephone Network
R&D	Research and Development
RN	Research Network
RPS	Regional Population Survey
SCI	Science Citation Index
SIBIS	Statistical Indicators for Benchmarking the Information Society
SITES	Second Information Technology in Education Study
SME	Small and Medium Enterprise
SMS	Short Message Service
SOHO	Small Office, home office
SSCI	Social Science Citation Index
SSL	Secure Socket Layer
TCP/IP	Transmission Control Protocol/Internet Protocol
TCR	Total congestion ratio
TERENA	Trans-European Research and Education Networking Association
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United States
USPTO	US Patent and Trademark Office
VAT	Value Added Tax
W3C	World Wide Web Consortium
WAI	Web accessibility initiative
WAN	Wide Area Network
WAP	Wireless Access Protocol
WLAN	Wireless Local Area Network
WP	Work package
WPIIS	Working Party on Indicators for the Information Society

Executive Summary

An adequate data basis is essential to carry out research on the properties and results of societal change towards an information society; it is also important for the development of new products and services that are targeted towards the use of information and communication and for designing policy measures that influence the use and impact of information and communication technologies (ICT) in society. The purpose of this handbook is to advance the establishment of this data basis by suggesting core elements of an indicator system on one of the most influential technological innovations of the last decades: computer networks in general and the Internet in particular.

The indicator system consists of 133 indicators in total of which 34 indicators have been selected as key indicators as they are believed to be particularly well suited for monitoring the information society. The indicators come from the SIBIS project and from a large variety of sources outside of the project (such as Eurostat, the Eurobarometers, NSIs and other national authorities, consultants, other research projects etc.). They are described and explained with the mathematical formulas that should be used for calculating them, the question wording if based on survey questions, the availability at geographical level and the available time frame. The importance and value of the indicators has been assessed by referring to current political priorities at European level. Strengths and weaknesses of the indicators are discussed based on the results of the SIBIS pilot surveys or other data collections. In order to clarify all terminological issues as much as possible an extended glossary is also included.

Matters of *general access to and use of computer networks* are covered with 24 out of the 134 indicators. The issues included in this section can be considered as basic preconditions for the diffusion of more advanced applications and services in society.

- They cover the *Internet readiness* of citizens and businesses, that is to what extent individuals and businesses have the necessary infrastructure and devices at their disposition to access the Internet. The key general access indicators go beyond a mere assessment of computer and Internet access and look at the access to more advanced infrastructure (broadband, multiple networks) and devices which are better suited to lay open the differences of Internet readiness in developed economies.
- Furthermore, indicators for assessing the various so-called *digital divides*, meaning gaps between different groups of individuals or firms with regard to access to and usage of ICTs, are included. The key digital divide indicators are a mixture of straightforward and more sophisticated indicators which should help to provide a clear picture of this highly complex problem.

Further 45 indicators refer to the *factors which determine the general access to and use of computer networks* at the individual as well as at the firm level.

- An important issue that affects in particular applications which include an exchange of vulnerable data and information (such as on-line transactions in e-Commerce or banking, EDI between firms etc.) is *information security*. Key indicators deal with the incidence of malicious activities, the presence of preventive and countermeasures against malicious activities and the awareness of Internet users of the measures applied for safeguarding the security of transactions.
- Another factor which is not always given its proper weight is *the perceptions of Internet users* which refer to privacy and security in Internet transactions or the assumed costs and benefits of using the Internet. These perceptions sometimes tend to be biased to disadvantages and problems and then constitute major access barriers.
- A more objective access barrier is the level of *computer and Internet skills*. A lack of skills can constitute a barrier to broadening the use of Internet technologies at the individual level as well as at the firm level, particularly if enterprises cannot fill in the needed skills from the labour market. The key indicators measure how skills are acquired by individuals and how firms support this; they also measure the differences in computer/Internet skills levels among economies.

The biggest group of indicators (64) deals with one of five different *on-line purposes* for which the Internet or another computer network can be used.

- *E-Commerce* relates to electronic transactions in which goods and services are ordered and/or transmitted over a computer network. The indicators in this field are either general indicators or related to Business to Consumer or Business to Business transactions. The key indicators cover the percentages of firms involved in the different forms of e-Commerce and the percentage of overall sales that is conducted via a computer network. In a "readiness-intensity-impact" model these indicators mainly refer to the intensity dimension. However, readiness issues are covered by other sections of the indicator system (see section 3.1.1 on Internet readiness). The impact of e-Commerce can be assessed by relating intensity indicators to general economic variables such as productivity figures, profit rates, employment changes etc.
- *E-Work* deals with indicators on the changes of work content, work arrangements and the labour market induced by the spread of ICTs in general and computer networks in particular. The ability of individual countries to adapt to these changes appears to affect their success in securing economic development. The key indicators look particularly at the place of work and the new opportunities of moving the workplace away from the office-based desk, as one of the major features of computer networks appears to be to enable new spatial configurations of work via telework and tele-cooperation.
- The section on *e-Science* is a further focussing of the e-Work section insofar as it takes out a specific work setting which is directed towards the production of new knowledge. E-Science is both, an important driver of the information society and one of its most accentuated testbeds. The key indicators in this field cover aspects of readiness for e-science such as the capacity of research-specific computer networks, the use of the World Wide Web and an impact indicator which should help to assess the impact of e-Science applications on scientific knowledge production.
- The focus of the SIBIS *e-Government* work has been on building a set of indicators that complement what is already available. E-Government comprises a number of functions and services inside of the government (G2G) and with parties outside of government (G2C and G2B). The G2G part had to be excluded from SIBIS as it would have required a separate empirical approach and no adequate indicators could be found in other sources. For G2C and G2B a number of indicators were identified and new indicators were developed. The key indicators look particularly at the experience of citizens and preferences of citizens and businesses in regard to e-Government.
- *E-Health* is a very broad and complex topic area for benchmarking, as it includes many different stakeholders and relationships, some resembling electronic commerce and market-like transactions, others including public sector organisations in a highly regulated environment; additionally the range of e-Health applications and services is large and of differing maturity. The section in this handbook therefore gives an overview of indicators on e-Health that are related both to the general public and to healthcare providers. The key indicators selected focus on the aspects of the SIBIS work of most relevance for the eEurope 2005 benchmarking - use of the Internet by the general public for searching for health-related information, for interacting with their own doctors and other health professionals and for purchasing medication.

The main benefit of this handbook (and as a matter of fact of the SIBIS project in general) is that it contributes to a better understanding of how to apply benchmarking in the different areas included in this handbook and that it brings together information on the current state in indicator development from a broad variety of sources on a broad range of topics. Still, the authors are totally aware of the fact that many gaps in regard to measuring information society developments remain which can only be closed by further research.

Part A: Description of the indicator system

1 Introduction

1.1 Structure and delimitation of this handbook

Since Daniel Bell's seminal work on the post-industrial society [13], post-industrialism and information society metaphors have flourished. Ideas of technological revolutions depicted the computer as the engine of change and linked its diffusion to positive, optimistic and progressive views of society. Organisations were described as being increasingly oriented towards the delivery of services instead of the production of goods [13]. Information was considered to be the driving force leading to "knowledge-based" forms of organisation and economy [283]. Since these views appeared social scientists have criticized them widely as being deterministic, uncritical in regard to the transformative capabilities of technology, simplistic in regard to innovation processes, underestimating the influence of individuals and organizations in regard to the use of technology and acquisition of skills etc. [195], [208], [252]. This indicator handbook does neither add another interpretation of the information society nor support nor criticize any of the existing views. This should be the objective of scientific research using elaborate tools for the analysis of quantitative and qualitative evidence on the use of information and information technology in society.

However, a detailed data basis is essential to carry out this kind of research; it is also important for the development of new products and services that are targeted towards the use of information and communication and for designing policy measures that influence the use and impact of information and information technologies in society. The purpose of this handbook is to advance the establishment of this data basis by setting up an indicator system on one of the most influential technological innovations of the last decades: computer networks in general and the Internet in particular. Since the early research on packet switching and computer networks in the 1960s and the development of the ARPANET the Internet has developed into a global information infrastructure [13]. The present indicator system contains methods and proposals how the spread of this information infrastructure across Europe can be assessed and benchmarked (internally as well as externally to the United States). Different structures run through this indicator system:

- *General access and use versus specific purposes:* On the highest level general access and use of ICT is distinguished from the use for specific purposes. General access and use also includes the factors, especially barriers, by which it is determined. Specific purposes are the provision of goods and services (e-Commerce), work (e-Work), the production of knowledge (e-Science) and the maintenance or restoration of health (e-Health).
- *Stakeholders:* Different economic agents or stakeholders are another dimension that is used for differentiating the indicator system. Usually households, firms and governments are distinguished. However, for certain purposes only a certain activity of individuals or organizations or a subgroup of either are picked out. For instance, e-Commerce indicators focus on the sales and procurement activities of firms and the purchase activities of consumers and governments; e-Work indicators consider the working activities of individuals and the firms' role as employer. The use of the Internet in science focuses on scientists, in healthcare on healthcare providers and the population in their role of (possible) patients etc.
- *Applications:* The biggest part of the indicator system is related to the applications which currently cover the majority of data transmission on computer networks that is e-Mail and the World Wide Web (WWW). These applications have become fairly stable in a technological sense and widespread in Europe and on a global level. This increases the chances that they will still be present and important in 10 years from now and that a creation of time series is possible and meaningful. However, some indicators also include information on other Internet applications such as chat, collaboration applications, FTP, and on other computer networks besides the Internet (e.g. Extranets, Intranets, EDI networks, GRIDs).
- *Readiness, use and impact:* The indicator system also acknowledges the value of differentiating between these three dimensions of computer networks. The readiness dimension contains two

aspects, access and determinants of access. Access to the Internet is possible with computers and other access devices (e.g. mobile phones, PDAs, game consoles etc.); access can be differentiated among different groups of the population and it is possible with different levels of security. Perceived barriers of costs, security etc. and digital literacy are social factors that determine whether the Internet is actually accessed. The latter determine also the intensity of use (of e-Mail and WWW services as well as of access devices) which can also be measured directly. The impact dimension is more critical. The Internet has been around for more than a decade and many users will not be able to draw a reliable picture of how their daily life was before the Internet. Other things have changed too, and it is hardly possible to evaluate the net effects of other changes versus the effect of the Internet. In some cases, indicators were based on hypothetical questions ("Would you say that you would be less well informed as a consumer if your country were without the Internet for a month?"). The value of this approach, however, is debatable from a methodological point of view. A better approach to assessing the effects of the Internet on European societies is to bring together Internet access and use variables with dependent variables (e.g. income, productivity) in causal analyses. For this purpose, not Internet impact indicators but statistical and econometric calculations are needed. However, these go beyond the scope of the present indicator system and are left to future scientific research.

In order to develop the indicator system the SIBIS project carried out

- an assessment of policy goals and measures at the European as well as at the national level,
- a stock-taking of statistical indicators and data from reports, databases and manuals provided by multinational institutions (e.g. EUROSTAT, OECD, ILO), national statistical institutes (NSI), academic and private research institutes and consultants,
- and a review of the scientific literature.

Based on these thorough descriptions of the topic areas and reviews of the available indicators, the indicator systems were set up using wherever possible existing indicators and filling the gaps with new indicators.[1] Furthermore, questionnaires were developed in order to collect empirical data for those (existing or new) indicators for which no data were available from statistical or other sources. The objective of this data collection was twofold: first to test and develop further the indicator system, and second to perform a benchmarking of European countries in regard to the selected information society topics.

Indicator denominators

The indicators listed in this document make use of different denominators. In some cases, the base includes the universe (e.g. general population from a certain age on; all establishments; etc.), while in other cases, subgroups of these populations are being used (e.g. all Internet users; labour force; etc.). The decision for a certain denominator was based with a view towards maximising the value of the indicators for generic benchmarking exercises, and in order to ensure meaningful results.

However, users of this handbook are likely to have very specific research questions for which they are seeking adequate statistical indicators. This means that modifications to the denominators presented in this volume might be required. Below we give an example.

A person who is interested in the extent to which the banking tasks of private households are carried out through the Internet may want to use the following indicator:

$$\text{INDICATOR} = \frac{\text{Users of on-line banking}}{\text{Total adult population}} * 100$$

Note that a low value on this indicator can either be the result of a low overall rate of Internet take-up, or the result of a low rate of Internet users which use it as a tool for carrying out banking tasks.

[1] Of course, the objective is not to maximise the number of available indicators, but to single out or construct those that describe best the current status and trends of the information society at international and national levels.

If, however, the interest is more on online banking as an advanced application of the Internet, and the indicator is being used to measure how big a share of all (adult) Internet users can be considered advanced and confident enough to carry out banking tasks through the Internet, the indicator would have to be:

$$\text{INDICATOR} = \frac{\text{Users of on-line banking}}{\text{All adult Internet users}} * 100$$

Note here that the indicator can take on a high value even if the overall rate of Internet take-up is very low – such as it might be the case in countries with an "elite" of advanced Internet users next to a majority of citizens who are too poor or too illiterate to access the Internet. It should therefore only be used for comparing countries which have a reasonably similar state of development.

Neither of these indicators is the "better" one, but the decision for one of them needs to be informed by the research question, that means by the purpose and target of the benchmarking exercise.

While the results of the benchmarking are documented in the SIBIS topic reports (deliverables 5.1 and 5.2), the results of the indicator development are summarised in this indicator handbook. The latter has been developed with the purpose in mind to provide an easy to browse and use source of information on terms and statistical measurement of IS issues. The target groups of the handbook are

- NSI and multinational statistical institutions which regularly collect data on information society issues and which have to look for a further development of their current data assessments,
- scientists, research and consulting firms and other institutions which themselves undertake regular or one-off data collections on information society issues usually for specific purposes (e.g. the analysis of social or economic phenomena, a policy or programme evaluation etc.)
- politicians and administrators which set guidelines to operationalise and evaluate information society policy measures.

The handbook consists of two basic parts: the indicator system description and the glossary.

- Part A: The indicator system description starts with overview tables of key indicators, i.e. indicators which are particularly valuable for benchmarking IS development in Europe, and the entire indicator system (section 2). The detailed indicator descriptions of section 3 present each indicator with its exact definition, a discussion of its added value as well as its strengths and weaknesses, information on the availability of data, the wording of survey questions developed within SIBIS (or taken from existing surveys for existing indicators) and references to supplementary indicators.
- Part B: The glossary of section 4 defines the most important constructs and terms used in the different sections of the indicator system. Finally the bibliography cites the sources used for developing this handbook.

Before the indicators are described a brief methodological preface is necessary, to clarify the rating scheme that SIBIS used for selecting the indicators.

1.2 Methodology for evaluating the SIBIS indicators and selecting key indicators

The number of indicators that can be invented and constructed for measuring and benchmarking information society developments is in principle boundless. In contrast, the capacities and resources of any researcher or other user of indicators to collect data, calculate indicators and interpret the results are usually very limited. For this reason the evaluation and selection of indicators is helpful to highlight very valuable indicators and sort out the less valuable ones (from the perspective of measuring and benchmarking information society developments).

The methodology for evaluating and selecting the SIBIS indicators was developed on the basis of the outcomes of social science research on indicator development ([291], [297]) and the common practice as it is being employed by statistical institutes (see [128], [36], additionally some unpublished material

from Eurostat was used).[2] The dimensions used for evaluating the quality of an indicator were benchmarking value, validity, reliability and availability. For some dimensions additional subdimensions were developed (see the more detailed discussion below). For each dimension and indicator a four-point rating scale with values from 0 to 3 was employed:

-: The dimension cannot be evaluated as the necessary information to rate the indicator is not available (for instance no comparable indicator exists to check the validity).

0: The indicator has significant problems in this dimension (subdimension).

1: The dimension (subdimension) can be evaluated but the indicator receives a rather low rating as it only meets less than 50% of best practice in this dimension

2: The indicator receives a rather good rating as it achieves more than 50% but not a 100% of best practice in this dimension (subdimension).

3: The performance of the indicator in this dimension (subdimension) cannot be improved.

This methodology was employed for two purposes: first to pick out the indicators that are included in this handbook which was done during the work on the SIBIS project since its beginning.[3] Second to pick out key indicators which

- contain the most important and far-reaching aspects of IS developments,
- are particularly appropriate for benchmarking,
- bundle information and provide a general picture,
- are easy to calculate and understand,
- are suitable to be targeted by policy measures,
- can be regressed on indicators that measure potential outcomes or impacts of IS developments,
- are sustainable (e.g. suitable to be part of existing EU-wide surveys).

1. Benchmarking value

It is not enough to base the quality of indicators on whether numbers are easily measured or already available. Indicators in general should be “rooted in theory”. That means that for any indicator arguments have to be provided why it is related to the latent concept it aims to measure. In the SIBIS context this concept is some feature of the information society that is benchmarked across the SIBIS countries (EU15, NAS, US and CH). The benchmarking value was operationalised through three subdimensions:

- First the more arguments relating an indicator to a relevant concept of the information society in Europe exist the higher is its benchmarking value. These arguments can either be related to a particular concern of European IS policies, IS policies at national level (in several EU or NAS countries), and/or important scientific IS problems.
- A second feature of the benchmarking value of an indicator is its goal orientation. This means that it should be unambiguous, how large and small values as well as increases or decreases over time should be interpreted.
- The variance of the indicator values is the third dimension of its suitability for benchmarking. If there is only very little variation across the data set, the indicator is obviously not suited for assessing differences.

[2] The SIBIS team is highly indebted to Tony Clayton, ONS, for providing comments and sources on this issue.

[3] A broader range of the (then) available indicators and additional desirable indicators is documented in the deliverables of the SIBIS work package 2 (available on the website at: http://www.sibis-eu.org/sibis/research/reports.htm).

Each of these three criteria is rated on the rating scale and the values are added up to obtain the overall rating scale.[4]

[4] The overall scale ranges from 0 to 9: 0 is equal to 0 on the rating scale described above; 1, 2 and 3 are equal to 1, 4, 5 and 6 are equal to 2, 7, 8 and 9 are equal to 3.

2. Validity

Validity means that an indicator should measure what it is intended to measure. It is based on theoretical reasoning or arguments substantiating why latent concepts come to light in an indicator and explaining its suitability for measurement. Validity must be investigated and proven empirically through testing and using an indicator. This can be done in different ways which result in a certain form of validity (see [291] p. 86):

- Prognostic validity: comparing prediction and actual development of an indicator for different points in time
- External validity: comparing different indicators which aim to measure the same construct
- Construct validity: the indicator values are interpreted in regard to the concept that stands behind.

Testing prognostic validity usually requires a set of elaborated research methods and/or long time frames of data collection which are not yet available for IS indicators. The main validity criteria for SIBIS were therefore external and construct validity.

An external validity assessment could only be carried out when comparable indicators focusing on the same concept – ideally from other sources – were available. The SIBIS surveys were functional for this purpose. Best practice in regard to external validity was reached, when the values of the SIBIS indicator provided an identical picture as the values of the comparable indicators. Deviations had to be explainable by variations of the definitions and delimitations, data collections or indicator calculations. If deviations appeared in the comparison of the indicators, the suitability, clarity and accuracy of the question wording were used as additional criteria to rate the indicator.

For assessing construct validity the strengths and weaknesses of an indicator as well as the plausibility of its values were taken into account.

Again, both dimensions, external and construct validity, are first rated separately and then added up to obtain the overall rating scale.

3. Reliability

Reliability refers to the necessity that an indicator produces the same results whenever it is implemented to measure a concept. Reliability is not inherent to an indicator it also depends on the context and diligence of data collection. Reliability can also be checked, through

- Repetitions
- Data collections for sub-samples

Under experimental conditions highest reliability is reached if an indicator demonstrably produces the same results whenever it is applied to the same population. As experimental conditions are not available in the SIBIS research (and rarely in applied social research in general), the best practice criterion had to be modified. In the present analysis maximum reliability is reached, if the differences between indicator values collected at two different points in time are plausible and explainable.

4. Availability and accessibility

The final dimension refers to availability and accessibility of data for the indicator. It includes three subdimensions which are especially important from the perspectives of the current benchmarking effort and future uses of the indicator.

- Completeness: comparable data are available for all countries of the SIBIS benchmarking exercise (EU 15, NAS, US and CH)
- Timeliness: best practice in regard to timeliness is availability of data either in 2003 or 2002

- Repeatability: this refers to two issues, first whether the data collected for the indicator comes from a regular data collection or a one off data collection exercise and second whether time series are available.

Each of these three criteria is rated on the rating scale and the values are added up to the overall rating scale as in 1.

Example

An example should help to clarify the methodology described above. We take the "Core usable backbone capacity on a national research network" from section Table 3.3-27.

Dimension	Evaluation	Rating
1. Benchmarking value		**3**
Relevance	The maximum backbone capacity reflects the maximum service level for data transmission between different R&D sites within a country. The indicator is particularly valuable from a policy perspective. An upgrading of the network infrastructure for research has been formulated as one of the action-lines in the original *e*Europe initiative ([90][87]).	3
Goal orientation	An increase of the core capacity reflects an increase of the data transmission capacities and unambiguously constitutes an improvement of the service level.	3
Variance	The variance of the core usable backbone capacity is consistently large across the EU country sample.	3
2. Validity		**1**
External validity	There are no other comparable indicators available. However, besides the core capacity on an NRN also the transmission capacities of other connections on the NRN, the external connections, the transmission capacities on LAN or MAN affect the service level.	–
Construct validity	As data on other network components is not available it cannot be assumed that the core backbone capacity really reflects the conditions that any researcher encounters at his workplace. For a representative country comparison more detailed data on different RNs and on the users would be necessary which is currently not available. A cross country comparison faces some additional problems: most notably, the topologies of NRNs vary and in "star topologies" lower capacities might lead to the same service level as higher capacities in "network topologies" (if the large site in the RN is the centre of the star).	1
3. Reliability	A comparison of the values for 2001, 2002 and 2003 showed some inconsistencies which could be due to problems which the respondents had with answering the question.	**2**
4. Availability and accessibility		**3 (2.66)**
Completeness	Data is available for EU member states, NAS and CH. US is missing.	2
Timeliness	Data is available for 2003.	3
Repeatability	A short time series is already available and the TERENA data collection is carried out on a stable basis.	3

2 Overview of the indicator system

2.1 Selected key indicators

Indicators have been selected as key indicators because they are supposed to be suitable for monitoring the most important and far-reaching aspects of IS developments and benchmarking in the current EU member states, the US and Switzerland. However, they may be less suitable, if the benchmarking is extended to societies with less penetration by ICT like some of the Central and Eastern European accession countries. More basic access indicators (such as "Table 3.1-8: ICT that respondents have at home" and "Table 3.1-17: Internet at home access divides") and use indicators (such as "Table 3.1-15: Computer use amongst citizens" and "Table 3.1-16: Internet use amongst citizens") are necessary in such an environment as they show more variation. However, the following table lists key indicators for developed information societies, and ignores less developed information societies, which is in line with the original SIBIS intentions and helps us not to overstrain the reader (which would certainly be the risk of two sets of key indicators, one for developed and another one for less developed information societies). For a more detailed description of the indicators see the individual tables.

Thematic Domain	Sub-domain	SIBIS key indicators	Sources of data
1. General access and use			
Internet readiness			
Citizens' Readiness	ICT infrastructures	Table 3.1-1: Degree of broadband technologies take-up	SIBIS GPS, eEurope 2005 indicators
Business Readiness	ICT access availability indicators	Table 3.1-9: Multiple computer network presence within enterprises (Internet, Extranet, Intranet, EDI over IP)	SIBIS DMS
Digital divides			
Basic access divides		Table 3.1-16: Internet use amongst citizens	SIBIS GPS, Eurobarometer, NTIA
2. Factors determining Internet access and use			
Information security			
Malicious activities and their prevention	On-line malicious activities	Table 3.2-1: Security breaches occurred in the organisation	SIBIS DMS
Perceptions as possible access barriers			
Concerns regarding security and privacy		Table 3.2-16: Concerns regarding on-line privacy	SIBIS GPS
Digital literacy, learning and training			
Skill acquisition		Table 3.2-24: Participation in ICT-related training	Eurostat
		Table 3.2-30: Use of e-learning tools for work-related learning	SIBIS GPS
Skill provision		Table 3.2-40: Digital literacy (COQS-Index)	
3. On-line purposes			
E-Commerce			
General e-Commerce indicators		Table 3.3-2: Share of businesses selling on-line	SIBIS DMS
B2B		Table 3.3-9: Share of businesses procuring on-line	

Thematic Domain	Sub-domain	SIBIS key indicators	Sources of data
E-Work			
Work Organization	Place of work	Table 3.3-13: Share of home-based teleworkers	SIBIS GPS
		Table 3.3-19: Share of mobile teleworkers	
E-Science			
Readiness for e-Science	Research Networks (RN)	Table 3.3-27: Core usable backbone capacity on a national RN	TERENA
Use of e-Science	Scientists' web presentations	Table 3.3-39: World Wide Web penetration ratio	SIBIS R&D survey
E-Government			
G2C	Usage	Table 3.3-51: Citizen experience of using on-line government services	SIBIS GPS
	Assessment	Table 3.3-53: Citizen preference for on-line government services	
E-Health			
Usage of e-Health		Table 3.3-63: Usage of the Internet by the general public to search for health-related information	SIBIS GPS
		Table 3.3-66: Usage of the Internet by the general public to purchase medications	BISER survey

2.2 Entire indicator system

The following overview presents the entire SIBIS indicator system structured according to SIBIS domains and sub-domains. More detailed indicator descriptions are provided in section 2.

Thematic Domain	Sub-domain	SIBIS indicators	Sources of data
1. General access and use			
Internet readiness			
Citizens' Readiness	ICT infrastructures	Table 3.1-1: Degree of broadband technologies take-up	SIBIS GPS eEurope 2005 indicators
		Table 3.1-2: Degree of broadband extensiveness in the consumer market	Oftel, EITO
		Table 3.1-3: Competitiveness of broadband technologies	eEurope 2005 indicators
	ICT access availability indicators	Table 3.1-4: Share of at home Internet users according to type of bandwith	Oftel, OECD, EITO
		Table 3.1-5: Degree of multi-device users	SIBIS GPS eEurope 2005 indicators
		Table 3.1-6: Users accessing the Internet from different locations	
		Table 3.1-7: Internet access awareness – utilisation of PIAPs	Eurobarometer, SIBIS GPS
		Table 3.1-8: ICT that respondents have at home	EITO
Business Readiness	ICT access availability indicators	Table 3.1-9: Multiple computer network presence within enterprises (Internet, Extranet, Intranet, EDI over IP)	SIBIS DMS

Thematic Domain	Sub-domain	SIBIS indicators	Sources of data
Business Readiness	Website accessibility	Table 3.1-10: Priority levels regarding corporate websites accessibility	SIBIS DMS
		Table 3.1-11: Website adaptability potential for people with special needs	
		Table 3.1-12: Adherence to the website accessibility guidelines	
		Table 3.1-13: Prevalence of evaluation of website accessibility	
		Table 3.1-14: Website accessibility scale	
Digital divides			
Basic access divides		Table 3.1-15: Computer use amongst citizens	SIBIS GPS, Eurobarometer, NTIA
		Table 3.1-16: Internet use amongst citizens	
		Table 3.1-17: Internet at home access divides	
		Table 3.1-18: Digital Divide Index (DIDIX)	SIBIS GPS, Eurobarometer, 1997, 2000
Utilisation divides	Duration and intensity of Internet use	Table 3.1-19: Users according to on-line tenure	SIBIS GPS; US GAO
		Table 3.1-20: Percentage of heavy intensity Internet users	SIBIS GPS
	Stopping Internet use	Table 3.1-21: Internet dropouts - Internet home access churn	
		Table 3.1-22: Hypothetical removal of Internet access – impact regarding a sense of inclusion	
	E-Mail use	Table 3.1-23: Supporting existing social contacts via using e-Mail	
	On-line content creation potential	Table 3.1-24: On-line content creation potential	
2. Factors determining Internet access and use			
Information security			
Malicious activities and their prevention	On-line malicious activities	Table 3.2-1: Security breaches occurred in the organisation	SIBIS DMS
		Table 3.2-2: Damage severity index	
		Table 3.2-3: Threats to on-line security – computer hackers	
		Table 3.2-4: Security issues encountered	Eurobarometer
		Table 3.2-5: Source of information on occurred breaches – loss of data	SIBIS DMS
		Table 3.2-6: Source of Information on occurred breaches – notified by their own information security system	
	Prevention of on-line malicious activities and downtime	Table 3.2-7: Presence of information security policies	
		Table 3.2-8: Barriers to information security	
		Table 3.2-9: Tools for information security	
		Table 3.2-10: Secure servers per capita	Netcraft

Thematic Domain	Sub-domain	SIBIS indicators	Sources of data
Attitudes towards security issues	Awareness of and attitudes to security features	Table 3.2-11: Awareness of security features of Websites	SIBIS GPS
		Table 3.2-12: Effects of security concerns on e-Commerce	
		Table 3.2-13: Relevance of web security features in e-Commerce	
	User handling of security issues	Table 3.2-14: Reporting of on-line violations	
Perceptions as possible access barriers			
Concerns regarding security and privacy		Table 3.2-15: Concerns regarding on-line security	SIBIS GPS
		Table 3.2-16: Concerns regarding on-line privacy	
Perceptions as access barriers		Table 3.2-17: Perceived lack of skills as a potential barrier to Internet use	
		Table 3.2-18: Perceptions regarding lack of ease of access regarding the Internet	
		Table 3.2-19: Perception regarding efficiency of the Internet – the time aspect	
		Table 3.2-20: Perception regarding affordability of the Internet	
		Table 3.2-21: Perceived lack of usefulness of the Internet as a barrier to access	
		Table 3.2-22: Psychosocial barriers to Internet use	
		Table 3.2-23: Internet access barriers index	
Digital literacy, learning and training			
Skill acquisition		Table 3.2-24: Participation in ICT-related training	Eurostat
		Table 3.2-25: Participation of the unemployed in ICT-related training	Not piloted yet
		Table 3.2-26: Intensity of ICT-related training	
		Table 3.2-27: Participation in ICT-related self-learning	Not piloted yet (Basic module: SIBIS GPS)
		Table 3.2-28: Lack of adequate supply as obstacle to participation in ICT training	Not piloted yet
		Table 3.2-29: Establishments providing ICT training	BISER DMS
		Table 3.2-30: Use of e-learning tools for work-related learning	SIBIS GPS
		Table 3.2-31: Use of the Internet for learning	EB-F; NALS 2002
		Table 3.2-32: Establishments providing e-learning	BISER DMS
		Table 3.2-33: Establishments using an Intranet for staff training	Not piloted yet
		Table 3.2-34: Establishments supporting ICT-related self-learning of their staff	
		Table 3.2-35: Share of establishments giving staff access to the Internet	SIBIS DMS

Thematic Domain	Sub-domain	SIBIS indicators	Sources of data
Skill provision		Table 3.2-36: Share of population who feel very confident in communicating over the Internet	SIBIS GPS
		Table 3.2-37: Share of population who feel very confident in obtaining and installing computer software	
		Table 3.2-38: Share of population who feel very confident in identifying the source of information on the Internet	
		Table 3.2-39: Share of population who feel very confident in using an Internet search engine	
		Table 3.2-40: Digital literacy (COQS-Index)	
		Table 3.2-41: ICT training qualifications	EB 54.0
		Table 3.2-42: European Computer Driving Licences	ECDL
		Table 3.2-43: ICT user experience in the labour force	Eurostat
Skill requirements		Table 3.2-44: Deficiencies in basic ICT skills in establishments	UK Employers Skill Survey
		Table 3.2-45: Jobs for which access to the Internet is of high importance	UK Skills Survey 2001
3. On-line purposes			
E-Commerce			
General e-Commerce indicators		Table 3.3-1: Share of establishments involved in "All round e-Commerce	SIBIS DMS
		Table 3.3-2: Share of businesses selling on-line	
		Table 3.3-3: Share of businesses participating in e-marketplaces	
		Table 3.3-4: Barriers to on-line selling	e-Business watch
		Table 3.3-5: Barriers to on-line purchasing	
B2C		Table 3.3-6: Internet usage for on-line banking	SIBIS GPS
		Table 3.3-7: Usage of mobile phones for e-Commerce	
		Table 3.3-8: Businesses' sales to consumers	SIBIS DMS
B2B		Table 3.3-9: Share of businesses procuring on-line	
		Table 3.3-10: Businesses' sales to businesses	
		Table 3.3-11: Self-assessed impacts of on-line sales	
		Table 3.3-12: Self assessed impacts of on-line purchases	

Thematic Domain	Sub-domain	SIBIS indicators	Sources of data
E-Work			
Work organisation	Place of work	Table 3.3-13: Share of home-based teleworkers	SIBIS GPS
		Table 3.3-14: Share of jobs which are perceived feasible for telework	
		Table 3.3-15: Effect of telework on work performance	
		Table 3.3-16: Effect of telework on working hours	
		Table 3.3-17: Effect of telework on work location	
		Table 3.3-18: Telework-enabled labour force participation	
		Table 3.3-19: Share of mobile teleworkers	
		Table 3.3-20: Establishments with Remote Access	eBiz Marketwatch
		Table 3.3-21: Enterprises practising telework	ECaTT DMS
		Table 3.3-22: Share of workforce practising tele-cooperation	SIBIS GPS
		Table 3.3-23: Share of self-employed teleworkers in SOHOs	
	Work contract	Table 3.3-24: Spread of e-Lancing	
		Table 3.3-25: Use of the Internet for job seeking	
		Table 3.3-26: Establishments advertising vacancies on the Internet	BISER DMS
E-Science			
Readiness for e-Science	Research Networks (RN)	Table 3.3-27: Core usable backbone capacity on a national RN	Data from TERENA
		Table 3.3-28: Total congestion ratio on the RN	
		Table 3.3-29: Average budget of a national RN	
	Computer equipment	Table 3.3-30: Quality of scientists' computer equipment	SIBIS R&D survey
	Electronic information sources	Table 3.3-31: Size of digital journal collections	Not piloted yet
		Table 3.3-32: Staff providing electronic library services	
		Table 3.3-33: Scientists' access to on-line information sources	SIBIS R&D survey
	Awareness of Internet potentials	Table 3.3-34: Influence of the Internet on choosing R&D problems	
	Computer skills	Table 3.3-35: Computer skills of scientists	
		Table 3.3-36: Internet skills of scientists	
Use of e-Science	On-line data collection and analysis	Table 3.3-37: Usage of Internet-based data collection and data analysis methods	
	On-line information sources	Table 3.3-38: Usage of on-line information sources	
	Scientists' web presentations	Table 3.3-39: World Wide Web penetration ratio	
	E-publishing	Table 3.3-40: Working papers available via the Internet	
	Computer-mediated communication	Table 3.3-41: Computer-mediated social communication for R&D purposes	

Thematic Domain	Sub-domain	SIBIS indicators	Sources of data
	Collaboration applications	Table 3.3-42: Usage of collaboration applications	
Impact of e-Science	Scientific publications	Table 3.3-43: Publications in scientific journals per capita	ISI data
		Table 3.3-44: Citation index	
	Patents	Table 3.3-45: Triad patent families per capita	OECD based on patent offices
	R&D collaborations	Table 3.3-46: Involvement in international R&D collaborations	SIBIS R&D survey
		Table 3.3-47: Percentage of coauthored scientific articles	ISI data
E-Government			
G2C	Availability	Table 3.3-48: On-line availability of government services for citizens	EC, CGEY
		Table 3.3-49: Citizens' awareness of availability of on-line government services	SIBIS GPS
		Table 3.3-50: BEGIX Index (Balanced e-Government Index)	Bertelsmann Stiftung
	Usage	Table 3.3-51: Citizen experience of using on-line government services	SIBIS GPS
		Table 3.3-52: Usage of on-line Government Services by citizens	EC, Eurobarometer
	Assessment	Table 3.3-53: Citizen preference for on-line government services	SIBIS GPS
		Table 3.3-54: Attitude towards on-line public services	
		Table 3.3-55: Citizen perception of the safety of on-line government services	
G2B	Availability	Table 3.3-56: Availability of on-line government services for businesses	EC, GCEY
		Table 3.3-57: Business awareness of availability of on-line government services	SIBIS DMS, not piloted
	Usage	Table 3.3-58: Business use of on-line government services	SIBIS DMS
	Assessment	Table 3.3-59: Business preference for using on-line government services	
		Table 3.3-60: Attitudes of businesses towards on-line government services	
E-Health			
Usage of e-Health		Table 3.3-63: Usage of the Internet by the general public to search for health-related information	SIBIS GPS
		Table 3.3-64: On-line communication by the general public with one's own doctor/ clinic	BISER survey
		Table 3.3-65: Usage of the Internet by the general public to consult with a medical professional/service other than one's usual doctor	Not piloted yet
		Table 3.3-66: Usage of the Internet by the general public to purchase medications	BISER survey

3 Description of the indicator system

3.1 General access and use

3.1.1 Internet readiness

Introduction

In Europe, the focus of the Information Society is changing from concentrating on basic issues such as access to infrastructure to more complex issues of e-Readiness, both for businesses and for citizens. Basic infrastructure was much easier to measure than the many dimensions and factors associated with what is now needed to be part of the digital economy. The multifaceted nature of Internet availability, support, content availability, the right kinds of skills and the right attitude to technology has given rise to numerous new definitions of e-Readiness.

The definitions of citizen's readiness tend to be centered on issues of awareness of use, access, content and skills for the individual. Business readiness is more complex. One much quoted definition from the OECD for e-Commerce is 'the capability to engage in electronic transactions' [41]. This is just one part of e-Readiness; there are issues of transactions and the connectivity and relationships between employers and employees. There are also the transactions and connections across a supply chain, between suppliers and distributors and consumers. Readiness also covers the internal processes of an organisation including the relationships between individuals and organisations. All of these areas rely upon organisations having the appropriate access and understanding of ICTs in order to profit from ICTs in the business setting.

There are many different studies that have been collecting "readiness indicators" in countries across the world. Although consumer indicators are still more prolific, business indicators are also quite well covered. As suggested by the analysis undertaken through the SIBIS project, there is still a need to keep improving the level of sophistication of readiness indicators as businesses and citizens start to climb the ladder. In particular, SIBIS suggests indicators for readiness have been segmented in the following sub-domains.

- ICT access availability indicators
- ICT infrastructures

'ICT access' availability indicators

In this report, 'ICT access' availability is considered from the user's viewpoint. Focusing on consumers, this section highlights two aspects that have not been investigated before in great depth. The first aspect is the use of some of the newer Internet access devices, i.e. platforms such as Digital TV, game consoles, or the mobile phone, These new devices are slowly becoming available everywhere and have been developed in order to facilitate an "always on" culture, both for information services and for buying and selling – a larger networking effect. This means that access to services through other devices will facilitate the improvement and the impact of the information society. An example of this type of indicator can be found in EITO 2001 [66] which asks about the level of ICT technologies penetration and adoption in European households. Through these indicators, studies will be able to measure the extent to which PCs, PDAs, phones or kiosks are purchased, installed and used.

The second aspect studies multi-context users of the Internet - or those who access the Internet from more than one location; for example, at home, at work, at a Public Internet Access Point (PIAP), etc. This indicator was developed as part of the SIBIS project and when piloted, showed that most users access the Internet principally from home. However, although at home access remains high and the most likely location, the data also shows that there are fast emerging patterns of 'bimodal usage' especially in more sophisticated markets, as many users appear to access the Internet from more

than one location; in the US as in Scandinavian countries, the UK and the Netherlands there is a large proportion of 'bimodal users' who access the Internet from both at-home, and at-work locations.

Moving onto business readiness, these indicators are moving apace as the access to the Internet becomes almost universal. The main focus of readiness is on e-Business or participation in aspects of e-Commerce. This requires more than just access to the Internet and needs businesses to invest in software and other forms of hardware (e.g. routers' readiness). Thus indicators measuring e-Business have focused on the co-presence of main ICT technologies within an organisation, as well as the level of accessibility which a company's website has (i.e. the company has designed the corporate/ commerce website following formal accessibility guidelines so that everyone can potentially access it). These elements help to segment the business ICT presence by level of sophistication and access to ICTs.

In this section we will be only considering the level of ICT implementation - a necessary step towards doing e-Commerce or e-procurement activities.

Another section of the report is focused exclusively on more sophisticated e-Commerce indicators (see section 3.3.1). These will look at "intensity" and "impact" of e-Business, rather than merely measurements of the readiness to do business.

ICT Infrastructures

In "ICT infrastructure" indicators presented in the handbook focus on what has been – to date – among the most important eEurope policy goals: to boost the development of, the extensiveness, and the take-up of broadband technologies, as well as ensuring the competitiveness of the broadband markets for both residential and business markets.

Broadband is probably the single most important enabling technological development of current time and it is, therefore, imperative to measure who has access to it, and what it is being used for. Several other indicators stem from it and, therefore, it was piloted in the SIBIS survey. One of the principal features of broadband in Europe is its diversity. Therefore, the indicators developed had to reflect the many broadband access methods, subscription cost and extensiveness of broadband infrastructures available across the different countries. Hence respondents to the SIBIS questionnaire were asked what type of Internet connection they use at home. It is no surprise that dial up modems are the most popular method of at-home connection. This is classified as narrowband (less than 64Kbit/s). Further classification of the responses according to bandwidth is a contentious process as definitions and availability of bandwidth still vary. In this assessment, ISDN has been classified as midband and the definition of broadband has followed EITO's approach looking at the type of technology used, rather than establishing a speed threshold. Hence satellite, cable modem, xDSL, leased line, fibre, and multiplex (T1/T3) have been included as broadband technologies.

Markets with higher levels of broadband competition have also shown higher and most sophisticated levels of adoption among both citizens and business. The leading countries all exhibit very high levels of basic penetration, and show strength across the range of other usage dimensions. A high level of basic use typically forms the foundations for other desirable elements of use, including equality of use, and in particular, sophistication of use, intensity of use and on-line experience using the Internet. For business readiness there have already been some useful indicators piloted and used. Oftel, the UK regulator, for example have specifically focused on looking at SMEs broadband adoption. The reasons for this are that large enterprises are usually most likely to have already adopted. Those SMEs most likely to be ready to upgrade still face barriers such as the cost of upgrading, or the availability of broadband services in their areas. SMEs are much more likely than large companies to be located in rural or semi rural areas and this still severely limits choices.

According to a recent report by Booz Allen 'The world most effective policies for the eEconomy,' cost is still a major driver of broadband uptake [20]. Although the price is coming down it is still much more expensive than narrowband. Generally, experience has shown that cost appears to be a driver of both narrowband and broadband access. The relationship is not uniform, and analysis is complicated by changes in pricing. For instance Oftel has shown how in the UK there has been a very strong correlation between recent prices and increasing levels of broadband penetration [250]. In the

countries under the scope of SIBIS, broadband services are currently primarily provided through DSL and cable modem services. Alternative technologies such as fixed wireless access, electric powerlines and satellites, are anticipated, but have not fully been brought to market yet. Competitiveness in the broadband market in Europe is still generally low if compared to the US market.

The work of the SIBIS project started back in 2000 and as a consequence was one of the first of its type, covering all aspects of the eEurope Action Plan. Since then, many other related studies have been published. During the first phase of the project relevant existing ICT readiness indicators for business and citizens were selected and explained. For some indicators experiences from previous statistic work was used which was extensively analysed in the previous deliverables in the topic area "Telecomms and Access" (see in particular the reports from work packages 2 and 5 at the SIBIS website http://www.sibis-eu.org/sibis).

Taking the results of the SBIS GPS which was undertaken in the first quarter of 2002, as well as looking at more up to date data coming out of newer studies, a number of differences have been identified across the participating European countries and between Europe and the US. The indicators that were piloted as part of the SIBIS GPS were chosen for two central reasons: They had to be questions, which could be answered in a meaningful way given the audience and also the methodology (telephone survey). This meant that interesting questions relating to estimations of subscription costs or the extensiveness of broadband availability were out of scope, since telephone methodology is not an ideal tool for collecting data on those questions. The work has therefore widened its approach in order to construct this handbook. Indicators have been selected and developed with four quality criteria in mind - benchmarking value, validity, reliability and availability. E-Readiness is a section of this handbook where these four criteria rank highly since the availability of e-Readiness indicators for comparison with SIBIS has increased dramatically in the last year.

Citizen's readiness

Table 3.1-1: Degree of broadband technologies take-up

Definition and explanation	Percentage of users accessing the Internet via DSL) $EB = \frac{\text{At home users accessing the Internet by DSL}}{\text{All Internet at - home users}} * 100$ EB Percentage of users connected via broadband DSL connections The Percentage of users connected via DSL technology is found by summing the number of Internet users who have an at-home DSL connection and dividing it with the total number of at home internet users. This is expressed in percent. Value range: $0 \leq EB \leq 100$
Importance and Value added	As formulated this indicator allows comparisons on the degree of penetration of different broadband technologies across Europe One of the main objectives of eEurope initiative is to track the penetration of broadband technologies in households, businesses, and on-line administrations. Hence this indicator is of major importance to implement policies which develop competition among different broadband technologies and which benchmark the penetration of BB technologies across all EU15.
Sources of data	SIBIS GPS, Eurobarometer 2002, Eurostat ICT Outlook
Countries and time intervals covered	EU member states, Switzerland and the US
Question wording	I will read to you a number of methods of access to the Internet. Which of these do you use at home? (Multiple response question) MULTIPLE ANSWERS

	(1) Dial-up with modem (2) Cable Modem (3) Leased line (4) xDSL (5) ISDN (6) T1 or T3 line [TRANSLATOR: Digital Multiplex connection] (7) Internet access via satellite (8) Other not mentioned (e.g. mobile) (9) DK
Discussion	This question including its subsections was asked only to those who previously answered positively to 'my household has access to the Internet". BB technologies consider included DSL, cable, and 'alternative technologies' which included (leased lines, satellite, and T1/T3.). We did not include fibre technologies at the time of piloting. However this technology should be also consider among the choice of broadband technologies. At the time of the survey, results showed only a small percentage of respondents to some of the access methods, and the differences in the availability of broadband technologies across Europe. For the weighting of this indicator it is important to note how BB users are more likely to take part in a telephone survey than narrowband users are. This is especially true for heavy narrowband users who will have their telephone lines engaged while using the Internet.
Supplementary indicators	In addition to the percentage of at home users connected to the Internet via DSL, similar indicators have been constructed for users accessing the Internet from home by cable, and 'alternative broadband technologies' including leased lines, fibre, satellite, and T1/T3 [77].

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1.5	1	1.5

Table 3.1-2: Degree of broadband extensiveness in the consumer market

Definition and explanation	Percentage of consumers within a cabled or DSL enabled exchange area $\text{HDSL} = \frac{\text{households within a DSL or cabled enabled area}}{\text{All households in a country}} * 100$ HDSL: Percentage of consumers within a cabled or DSL enabled exchange area The percentage of consumers within a cabled or DSL enabled exchange area is found by summing the households within a cabled or DSL enabled exchange area and dividing it with the total number of households. This is expressed in %. Value range: $0 \leq \text{HDSL} \leq 100$
Importance and Value added	This indicator constitutes an explanatory framework to monitor the degree of take up of broadband technologies in the consumer market. It will help policy makers to spot regional broadband 'deserts', where no broadband infrastructures have been deployed. This indicator is necessary for policy implementation, especially since every Member State in the EU has to have an existing National Broadband strategy by 2005.
Sources of data	Oftel Benchmarking studies, March 2003
Countries and time	UK

intervals covered				
Question wording	This data has to be provided to the NRA by the major ISPs. Data collection methodologies would include executive interviews with main ISPs in the country, and desk research.			
Discussion	Oftel in the UK is monitoring on a quarterly basis the level of competitiveness in the UK, which has improved substantially in the last year. This indicator has allowed them to put in place policy addressing consumers in rural areas where there is no broadband infrastructure in place. It is important to note not only if the area is covered by broadband, but also how many infrastructure and service providers are offering broadband. The more technologies the providers make available, the more competitive the broadband market is.			
Supplementary indicators	SMEs within the area of a cable or DSL enabled exchange [250] Number of ISPs per one million inhabitants [238]			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2	2	2

Table 3.1-3: Competitiveness of broadband technologies

Definition and explanation	Costs of Internet access by frequency of use: 20, 30, 40 average hrs/month, and for unmetered rates. Prices to be indicated separately for xDSL, cable modem, and dial-up.			
Importance and Value added	The indicator is important to benchmark and the best way of doing this would be as part of a large benchmarking study that compares price and speed. The index will be useful because it collects information across emerging technologies to give a picture of competitiveness and consumer choice.			
Sources of data	eEurope 2005 indicators OECD			
Countries and time intervals covered	OECD countries, 2002			
Question wording	This data should be collected by National Regulation Authorities (NRAs) in the different countries, it is not to be collected by telephone survey.			
Discussion	Given the wide diversity of tariffs packages, speed, and availability of broadband technologies in the OECD countries, measuring the degree of competitiveness of broadband markets is a it is a very difficult indicator to construct.			
Supplementary indicators	• Oftel's Internet access costs index: DSL/Cable modem Price/Speed Index [249]: The index compares speed of service (downstream bandwidth) and monthly cost in residential and business markets. Oftel's index has recently included WLAN access among the broadband technologies it tracks (both one way access and two directions) • OECD Internet access basket cost studies, 1999-2002 [241] • DG information Society: Internet Access Costs Via a Standard Telephone Line, ADSL, and Cable Modem, European Commission benchmarking indicators [108] • Identification of cheapest broadband access type in each Member State; this indicator is included in the eEurope 2005 indicators [106].			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1.6	1.5	2	2.6

Table 3.1-4: Share of at home Internet users according to type of bandwith

Definition and explanation	Share of at home users connecting to the Internet via broadband $BBH = \frac{\text{at-home users connecting to the Internet via Broadband}}{\text{all at-home Internet users}} * 100$ BBH: Share of at home users connecting to the Internet via broadband The share of broadband at home users is found by summing the number of Internet users which have an at-home broadband connection and dividing it with the total number of at home internet users. This is expressed in %. Value range: 0 ≤ BBH ≤ 100 (Multiple response question)
Importance and Value added	As formulated this indicator allows us in a general sense to compare the share of households connected via broadband technologies, with mid-band and narrowband bandwidth. One of the main objectives of the eEurope initiative (in both 2002 and 2005) is to track the penetration of broadband technologies in households, business, and on-line administration. Hence this indicator is of a major importance to implement policies which benchmark the penetration of broadband across EU25. Main value added is that SIBIS distinguishes, not only between narrowband, and broadband connections, but also has a 'midband' category for ISDN. This also affects results because ISDN is still popular in some countries, and it is a faster technology than dial up but a much slower enabling technology than xDSL. Hence it is better to consider it separately.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the US
Question wording	Will read to you a number of methods of access to the Internet. Which of these do you use at home? MULTIPLE ANSWERS (1) Dial-up with modem (2) Cable Modem (3) Leased line (4) xDSL (5) ISDN (6) T1 or T3 line [TRANSLATOR: Digital Multiplex connection] (7) Internet access via satellite (8) Other not mentioned (e.g. mobile) (9) DK
Discussion	This question including its subsections was asked only to those who previously answered positively to 'my household has access to the Internet". This indicator is useful since currently there are substantial qualitative differences of broadband infrastructures across all countries. Hence this indicator looks at the overall broadband penetration rates without distinguishing between different technologies and speeds. Three different types of Internet bandwith have been created with the information provided At-Home connection via a broadband, mid-band, or narrowband technology. Being: • broadband (DSL, cable, leased lines, satellite, T1/T3) • only midband (ISDN) • only narrowband (dial-up modem)

	For the weighting of this indicator it is important to note how BB users are more likely to take part in a telephone survey than narrowband users, especially heavy narrowband users who are more likely to have their telephone lines busy while using the Internet. Also, we have included a response category for 'fibre' which is a broadband technology currently used in countries such as Sweden or Italy. In addition to households, data can be collected for SMEs. It would be interesting to measure broadband take up among SMEs, since larger companies and multinationals are more likely to have already upgraded to broadband.			
Supplementary indicators	In addition to the broadband at-home usage indicator, similar indicators can be constructed for mid-band and narrowband indicators. Mid-band includes ISDN at home users, narrowband includes users accessing the Internet through dial-up modems. %SMES with Broadband, and narrowband connections [250]			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	1	1

Table 3.1-5: Degree of multi-device users

Definition and explanation	Weighted use of alternative devices other than a PC/Mac for accessing the Internet at home $\overline{MD} = \frac{\sum_1^P D_p}{P}$ D_p Use of alternative devices other than a PC/Mac for accessing the Internet at home per person p (in the questionnaire four devices and an open category were listed) $\overline{MD}$ Average use of alternative access devices per country P Total number of respondents Value range: $0 \leq \overline{MD} \leq 10$ The use of each device D receives a value of 2, so the answers vary from 0 (no other access device used) to 10 (the four listed devices and another device are used).
Importance and Value added	The number of devices used to access the Internet is an important factor to track. Different devices imply different Internet services and killer applications.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the US
Question wording	Question: In the last four weeks did you access the Internet in any way other than via a PC or Mac at least once? Which devices did you use for that: Did you use ... MULTIPLE ANSWERS (1) Digital TV* (2) a PDA or palmtop, (3) a mobile phone with WAP or 2.5G** capability (4) a game console (5) other (6) DK
Discussion	There was a problem with high response rates in the "other" category in some European countries (it was lower in the US and other more sophisticated markets). It could be that some respondents though that a laptop would come under the 'other' category. The question could be therefore improved if formulated as:

	- In the last four weeks did you access the Internet in any way other than via a PC, Mac or a laptop computer at least once? There were also problems with getting representative samples. The data collected was broken by different age groups in order to be able to observe the use of alternative on-line devices, such as games consoles by younger age groups. According to European law, telephone survey methodology does not allow under-16s to be interviewed. Since young users are early adopters of technologies, it is very relevant to take this factor into account when analysing the data (i.e. access through game consoles)			
Supplementary indicators	Percentage of households with access to the Internet broken down by device for accessing via digital TV, mobile device (include all forms of mobile access; handheld computer, mobile phone, identifying 3G (UMTS) separately when available) [106]. Type of access the household is fitted with, 'Internet and the public at large' studies [77].			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2	1	1

Table 3.1-6: Users accessing the Internet from different locations

Definition and explanation	Weighted use of multiple locations where to access the Internet from $\overline{ML} = \frac{\sum_1^P L_p}{P}$ L_p Use of alternative locations where to access the Internet from (in the questionnaire five locations and an open category were listed) $\overline{ML}$ Average use of alternative access locations per country P Total number of respondents Value range: $0 \leq \overline{ML} \leq 10$ The use of each location receives a value of 2, so the answers vary from 0 (no Internet use from any location) to 10 (the five listed locations are used for accessing the Internet)
Importance and Value added	This indicator supplies useful data about the context and nature of Internet usage. Different access locations can lead to different on-line activities and there are potentially many disadvantages when compared to at-home access. In addition to being able to access information at-home at any time, a person may be less likely to access, for example, personal health or financial information from a library or other public facility.
Sources of data	SIBIS GPS A very similar indicator has been already included in the Eurobarometer Internet surveys 'Internet and the Public at large', although covering fewer countries and other location categories [77].
Countries and time intervals covered	EU member states, Switzerland and the US
Question wording	How much time do you spend in a typical week on using the Internet ... [item] [INTERVIEWER: Read out answer categories for the first 2 items] (a) at home? (b) at the workplace? (c) at school, university or another educational institution? (d) at a public place where Internet access is free? (e) at an Internet café or other place where you have to pay for access? (f) at another place not mentioned yet

Discussion	SIBIS collected information on different places where users access the Internet. A methodological lesson learnt from the data collection, is a problem of under representation of at-school users, or the under-16s as telephone survey methodology does not allow under-16s to be interviewed. Since young users are often early adopters of technologies, it is very relevant to take this fact into account when analysing the data, especially when considering the number of users accessing the Internet from school or educational places. A second methodological lesson learnt when asking about time spent using the Internet on a weekly basis, is that the highest usage is seen at home and at work, whereas PIAPs and other locations are less commonly used on a weekly basis. Therefore the time frame will influence the response rate for this question, and if the general use of PIAPs is to be explored, the time frame should be extended to a typical month. A potential emerging area for measuring is Wireless LANs (WLAN) which are being increasingly deployed for providing Internet access in specific locations. Commercial WLAN 'hot' spots are springing up across a number of European countries at locations such as railway stations, airports, business parks and coffee shops. There are already several thousand hot spots across the US and numbers are expected to grow rapidly in Europe. As wireless 'hot' spots in Europe become more prevalent, it would be interesting to add one more contextual category to the question - asking about hotspots in public places such as airports, restaurants, etc where access has been provided. This needs to be distinguished from other free PIAPs.
Supplementary indicators	In addition to users accessing the Internet from school, similar indicators have been constructed for users accessing the Internet from home, work, free PIAPs, paid PIAPs and 'other' locations. Supplementary indicators from other sources: • eEurope 2005: Percentage of individuals with access to the Internet broken down by place of access (home, workplace, place of education, Internet cafe, PIAP etc) and by gender [106] • Eurobarometer Internet and the Public at large indicators [77]

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2	1	2

Table 3.1-7: Internet access awareness – utilisation of PIAPs

Definition and explanation	Share of the total population who access the Internet at a Public Internet Access Point (PIAP) at least once in a typical week. $\text{PIAP use} = \frac{\text{PIAP users}}{\text{Total population aged 15 and older}} * 100$ Value range: 0 ≤ PIAP use ≤ 100
Importance and value added	This indicator has been designed to track the success of the initiatives to boost Internet diffusion and is relevant for access at local and community level, where PIAPs offer a possibility for the population to gain experience in using the Internet [272]. As such, it can be seen as a proxy for awareness of access possibilities. However, SIBIS data point that PIAPs are very relevant for the existing users, with home access. In any case, in addition to Internet access at home (data about which is collected for some time already) PIAP use data is of special relevance in countries with relatively low Internet penetration and relatively high costs for Internet access and computer equipment, such as Greece and Portugal in the EU, and the candidate countries to the east. An indicator on PIAP usage is, therefore, a necessary supplement to indicators on access in the home and / or at the workplace, and can be considered in conjunction with these.
Sources of data	Eurobarometer, SIBIS GPS 2002

Countries and time intervals covered	EU member states, Switzerland and the US			
Question wording	Posed to regular Internet users – reference period: 4 weeks – derived on time spent on separate location of use PIAP • How much time do you spend in a typical week on using the Internet ... [item] • (d) at a public place where Internet access is free? • (e) at an Internet café or other place where you have to pay for access? Answer categories for each item: (1) none (2) less than 1 hour (3) between 1 and 5 hours (4) between 6 and 10 hours (5) between 11 and 20 hours (6) more than 20 hours (7) DK			
Discussion	PIAP users are defined as those who use the Internet at either a public place where Internet access is free, or at an Internet café or other place where they have to pay for access. Problems might arise in relation to differences in the nature of PIAPS. New approaches to set up PIAPs vary from using government offices (Ireland), libraries (Belgium, Denmark, Finland, France, UK; public libraries in IRL) post offices (France), employment services (Austria, France, UK), centres for elderly (Spain) or in the streets of some cities (Austria-Vienna, Italy – Bologna, Spain – Barcelona)[95] making this issue relevant for the future. In addition, the nature of PIAPs (e.g. whether they provide training and support, individual location of PIAPs, whether mainly paid or not) influences the uptake rates. Indicator and findings validation can be cross-checked against results from the Eurobarometer Flash surveys on “Internet and the Public at large” (pp. 88, 97, 103, 112, 125) eliciting location of Internet use, PIAP being one of them (without mentioning of any reference period) [77]. The Eurobarometer figures differ from the SIBIS ones (some are lower, some are higher), which may be caused by the lack of a reference period in the Eurobarometer instrument, as well as by the use of a buzzword (“cybercafé”) which may have different connotations in different countries, and is difficult to translate.			
Supplementary indicators	• Average time spent at PIAP in a typical week • A variation of this indicator focuses on the utilisation of PIAP by the existing Internet users with access at home vs. those without home accesses (this indicator was used in the process of indicator evaluation) • Difference / relation in country use and availability rates – Number of PIAP per 1000 inhabitants (can be used to relate availability and usage rates of PIAPs) • Use of free versus pay for PIAPS			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	1	3	3

Table 3.1-8: ICT that respondents have at home

Definition and explanation	Technologies that respondents have/use at home The indicator is based on survey results and indicates the type of technologies that respondents have/use at home (expressed in % of respondents) across a range of technologies: • mobile • digital TV • Desktop • Internet • ISDN • DVD • fax • cable TV • games console

	• laptop • PDA or Palmtop • satellite • CDRom			
Importance and Value added	The indicator attempts to illustrate the penetration and usage of the technologies surveyed in households. A basic indicator important for measuring the e-readiness of households and to track the digital divide across countries, age groups and incomes.			
Sources	EITO			
Countries and time intervals covered	Unknown			
Discussion	Digital TV and other technologies are penetrating homes in Europe, therefore it will be useful to study them for the future. SIBIS concentrated on studying devices which currently allow users to access the Internet. Nevertheless other ICT devices such as DVDs, or CD Roms, are also important for the development of the Information society.			
Supplementary indicators	Number of ICT mobile devices individuals carry on a typical day 'on the move' [190].			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1	1	1

Business readiness indicators

Table 3.1-9: Multiple computer network presence within enterprises (Internet, Extranet, Intranet, EDI over IP)

Definition and explanation	Weighted use of multiple computer network presence within enterprises (Internet, Extranet, Intranet, EDI over IP) $\overline{MC} = \frac{\sum_1^P C_p}{P}$ Cp Presence of different computer networks within enterprises (Internet, Extranet, Intranet, EDI, EDI over IP) $\overline{MC}$ Multiple computer network presence within enterprises P Total number of establishments Value range: $0 \leq \overline{MC} \leq 10$ The use of each computer network presence receives a value of 2, so the answers vary from 0 (no computer network) to 10 (the five listed computer networks are present within the establishment).
Importance and value added	SIBIS selected an indicator of co-presence of computer networks in establishments as a useful marker of the level of maturity and sophistication of businesses in technology use, and therefore of readiness for e-Commerce. Increasing numbers of computer network presence reflect the confidence and resources dedicated to ICTs. The value added of this indicator relies in that, at the aggregate level of industries it illustrates the transition of sectors from those having limited service provision to more complex ICT forms (Internet, Intranet, extranet, EDI).
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	Does your establishment have access to the WWW, i.e. the Internet? Does your

	establishment have an Intranet? Does your establishment use EDI? Is your EDI Internet based? Does your establishment have an Extranet?
Discussion	The indicator based on the aggregated elaboration of questions on the presence of the Internet, Extranet, Intranet, EDI over IP in establishments and their level of co-presence by business sector (% of respondents). Within the SIBIS survey 3,139 enterprise IT managers were contacted, and whilst the results may fairly reliable when split across four economic activities, for further disaggregation it is possible that a higher number of respondents would be required. Other data was available for validation. For example, the International Benchmarking Study from DTI (as other studies) shows that different ICT services are used for different business processes: for instance, e-Mail is generally the application used most for receiving orders on-line, while Extranets are least used [60]. EDI over the Internet or Extranets are used for supply chain integration applications. Also, according to a 2001 survey carried out by empirica in 2,300 establishments in Finland, Germany, Italy, the UK and the US, there is in fact a strong correlation between the co-presence of ICT services in a company and the level of positive impacts of e-Commerce introduction [203]. Companies most successful in selling and purchasing on-line appear to be the ones implementing a wide range of ICT services and conducting e-Business across many business functions. Other recent studies show that Intranets are often used to distribute e-Mail internally and carry non-sensitive information, because of security reasons and lack of business process re-engineering within the company (see e.g. [54]).
Supplementary indicators	Further disaggregation across countries or more specific economic sectors may yield useful information about the maturity of a sector in terms of ICT services.
Evaluation results	Benchmarking Value: 1.5 / Validity: 1 / Reliability: 1 / Availability: 2

Table 3.1-10: Priority levels regarding corporate websites accessibility

Definition and explanation	Average level of priority which a company can assign to its on-line accessibility in terms of target audience (in SIBIS, target audience is comprised of three groups – people with visual difficulties, with a limited dexterity and limited literacy) $\overline{PLA} = \frac{\sum_{1}^{oc} \sum_{1}^{3} PLoc}{OC}$ $\overline{PLA}$ Average level of priority that can be assigned to on-line accessibility regarding the three target groups OC Total number of on-line companies in an entity (here: SIBIS survey) PLoc $\sum$ PLv, PLd, PLI; with PLv: Priority level regarding people with visual disabilities PLd: Priority level regarding people with limited dexterity PLI: Priority level regarding people with limited literacy Within each, the level of priority is scored as 0, 1.11; 2.22; and 3.33; for each item, (max score is 3x3 i.e. high priority for each group) Value range: $0 \leq \overline{PLA} \leq 10$ Priority levels regarding corporate on-line accessibility. It is based on the share of companies with website / Internet presence who assign relatively high levels of priority to their sites' user friendliness with regard to people for whom [website] accessibility is thought to be an important issue. The high level of priority has been defined in relative terms, as an aggregate score combining individual items. Each of the [three] items relates to one specific subgroup of people for whom accessibility is an important issue.
Importance and value added	This indicator is important regarding the on-line accessibility set of indicators. The importance of improving on-line accessibility for at risk groups, namely people with

	disabilities cannot be overstated. Indeed true participation for all is only possible if the above group can access information, services and products from both public and commercial on-line establishments. Notwithstanding the fact that for some groups the accessibility is heavily dependent on assistive technologies the indicator relevance is not diminished. In effect, given the diversity of accessibility requirements, there are three indicators here, given the three potential target groups of people. Indeed, as confirmed by the experience form the field (i.e. SIBIS DMS data) it has been found that different companies have assigned varied levels of priority depending on the target group. While it is therefore justifiable and rewarding to analyse each of the above indicators in its own right, the rationale behind these indicators is common in terms of considering accessibility. Hence the initial classification as a 'single' composite indicator, not least given the need to capture heterogeneity regarding website accessibility or user friendliness in terms of relevant groups specified.			
Sources of data	SIBIS DMS			
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002			
Question wording	What priority has making your website user friendly for … [item] in your establishment? a) People with visual disabilities or sight difficulties b) People with reduced or limited dexterity c) People with limited literacy For each group, respondents [target group IT manager] could assign different level of priority: 1) High priority 2) Medium priority 3) Low priority, or 4) DK			
Discussion	The above composite indicator is in effect an amalgamation of three indicators : a) The level of priority being attached to making the website user friendly for people with visual difficulties b) The level of priority being attached to making the website user friendly for people with reduced / limited dexterity c) The level of priority being attached to making the website user friendly for people with limited literacy Another variation of this indicator has been designed – the share of companies with on-line presence who at least medium level of priority regarding at lest one target group with special accessibility needs. This indicator, either in its composite form (as above) or as a set of individual simple indicators can be seen as a proxy for awareness regarding the issue of website accessibility for special needs groups, among on-line companies.			
Supplementary indicators	A variation of the above with different treatment for DK			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	1	1

Table 3.1-11: Website adaptability potential for people with special needs

Definition and explanation	Share of on-line companies with website adaptability potential (here: WAP) regarding improving accessibility. $WAP = \frac{\text{Establishments with websites easily adaptable}}{\text{Establishments with medium and low priority for user friendliness}} * 100$ Value range: $0 \leq$ Website Adaptability Potential (WAP) ≤ 100 In SIBIS, it is based on the share of on-line establishments whose websites are easily adaptable to the needs of disabled persons, the base being on-line establishments who currently assign medium or low priority to their sites' user friendliness (in terms of disabled persons, cf. Table 3.1-10.).			
Importance and value added	With regard to promoting on-line accessibility in future, it is important to consider to what extent additional content can be made available to special needs groups. While the main inherent aspect of design for all relates to taking account of widest set of users in the early design phase, it is inevitable that some user needs are only considered at a later stage. Hence the need to adapt websites accordingly usually 'retrofitting' tools enhancing accessibility.			
Sources of data	SIBIS DMS			
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002			
Question wording	Bearing the specified groups (with special accessibility needs) in mind: Would you say that your website could be adapted rather easily, would prove difficult to adapt, or could not at all be adapted to these peoples' needs? [single answer, DK]			
Discussion	This indicator can also be seen as a proxy for the implementation of design for all principle, albeit only in retroactive manner for those who did not consider accessibility to be of a high priority in the first place.			
Supplementary indicators	The above indicator could be supplemented and or considered together with the share of on-line companies who have adopted main aspects of design for all principle. SIBIS has undertaken some work that can contribute to this area, examining the extent to which corporate websites were designed with adherence to formal accessibility guidelines (presented as a separate indicator overleaf).			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	1	1

Table 3.1-12: Adherence to the website accessibility guidelines

Definition and explanation	Share of on-line companies that adhere to accessibility guidelines (a close proxy for WAI guidelines, as operationalised in SIBIS DMS questionnaire).) $AWAG = \frac{\text{Establishments with websites designed adhering to formal guidelines}}{\text{Establishments with at least medium priority to user friendliness}} * 100$ AWAG Adherence to website accessibility guidelines The version focused upon in SIBIS is the share of companies with website presence who assign high / medium priority regarding accessibility whose websites are / have been designed with adherence to formal [accessibility] guidelines. Value range: $0 \leq AWAG \leq 100$
Importance and value added	On-line accessibility is an extremely important issue regarding the content provision or 'supply side' of the Information Society (conceptualised as the Information Society services and products available via the Internet). It is a necessary precondition for promoting participation for all in the Information

	Society. Adherence to website accessibility guidelines at level / priority one has been promoted from the highest level for public sector companies (e.g. [84]), motivated by the need to provide equivalent information to all members of general public (e.g. ensuring the access to eGovernment services). However, in the absence of comparable actions regarding the commercial sector, it is important to assess to what extent the on-line strategies of the latter set of companies are geared towards reaching widest possible audience.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	Does you establishment or your organisation have formal guidelines for making your website accessible to people with such special needs? By formal guidelines, I mean rules which have to be followed by your website developers? (Yes, No, DK, single answer)
Discussion	This indicator can also be seen as a proxy for the implementation of the web accessibility initiative (WAI) and the conformation to relevant accessibility guidelines Limited data exists measuring compliance levels with: • Generic technical standards for basic web interoperability, • WCAG-A, • WCAG-AA • WCAG-AAA (Note compliance level with WCAG-AAA standard is still extremely rare – hence its usability would be doubtful). The above indicators however are only obtainable from an independent detailed website post hoc evaluation analysis from the point of view of technical compliance. Hence the limited coverage, usually national level or case studies approach [209]. In addition, while have been some welcome developments of late, with increasing sophistication of webometric accessibility tools [296], it is nevertheless not sufficient to rely on webometric tools only in this regard [160]. In terms of experience from the field, given that IT managers were the main target respondents, this had a positive impact a reliability of answers, since it was more likely that they would be familiar with this specific issue.
Supplementary indicators	Webometric based / originating website evaluation undertaken by a third party on a sample of on-line companies e.g. [209]. In general, the findings correspond to the SIBIS ones, suggesting that on-line companies need to do much more in this area.

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	2	2	1

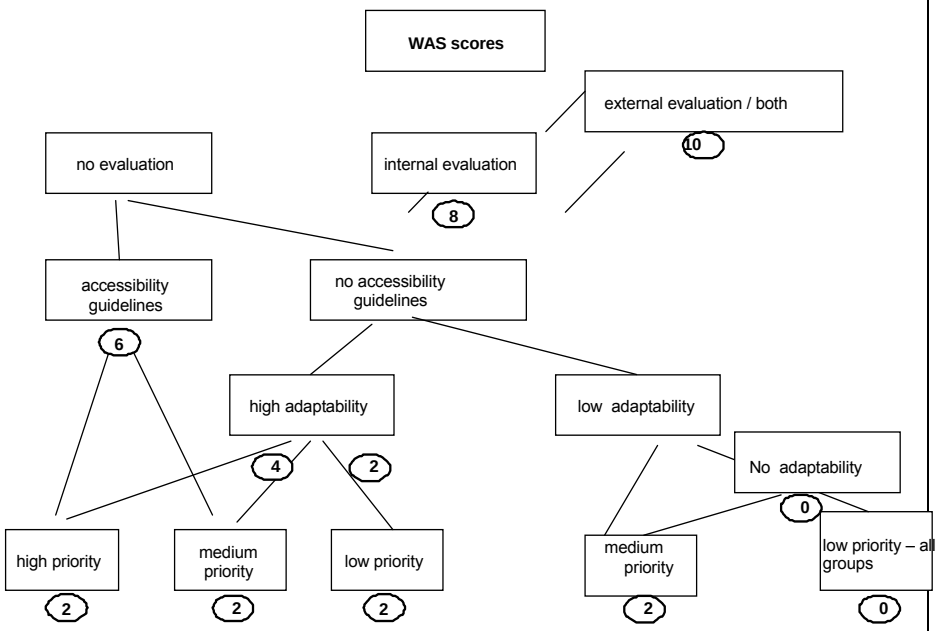
Table 3.1-13: Prevalence of evaluation of website accessibility

Definition and explanation	Share of on-line companies who have evaluated their Website accessibility. The focus in SIBIS was on the share amongst those who assign high / medium priority to their sites' accessibility, hence indicator base being on-line establishments with higher than low priority given to accessibility. $EWA = \frac{\text{Establishments with websites evaluated vis-a-vis accessibility}}{\text{Establishments with at least medium priority to user friendliness}} * 100$ EWA Evaluation of Website accessibility Value range: $0 \leq EWA \leq 100$
Importance and value	While awareness of accessibility is an important issue, having undertaken some

added	evaluative actions in this regard is a sign of a coherent strategy and espouses a certain level of commitment to the accessibility principle. Indeed, if a structured approach was followed, evaluation is an integral part of overall strategy. However, it can also be a precursor for actions regarding improving accessibility where an on-line company undertakes evaluation and uses results as a base for future changes and justification or making a sound case for these.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	Was your website ever evaluated concerning its accessibility for people with such special needs? (YES, NO, DK – single answer). . Variation of this indicator: If Yes, evaluation type… (internal , external, both)? Question wording: If (YES to evaluation of website accessibility), then: Was this evaluation done internally or using external evaluators? 1) Internal evaluation 2) Using external evaluators 3) Both
Discussion	A distinction has been made between the evaluation relying on internal and the one being conducted using the external resources. Hence the following indicators: • Internal evaluation of website accessibility [prevalence of] • External evaluation of website accessibility [prevalence of], and • Both internal and external evaluation of website accessibility [prevalence of] Although this indicator (i.e. its variations) captures various types of accessibility evaluation, the main emphasis is on whether establishments, as digital content providers, have had their websites evaluated, rather than on particular technical aspects of evaluation per se. Research in this area suggests that external evaluation should carry more weight. While it is extremely useful to consider this type of indicator in conjunction to technical evaluation indicators based on webometrics and utilising available accessibility tools (such as Bobby and LIFT), the latter indicators are thus far only gathered on national level and often on non-representative samples. In addition, while extremely valuable, independent analysis done by screening individual websites (e.g. [209]) is extremely demanding on time and resources.
Supplementary indicators	• On-line establishments who have conducted internal evaluation Establishments with websites being internally evaluated vis-à-vis accessibility *100 On-line establishments with higher than low priority re accessibility • On-line establishments who have conducted external evaluation Establishments with websites being externally evaluated vis-à-vis accessibility *100 On-line establishments with higher than low priority re accessibility • On-line establishments who have conducted both internal and external evaluation Establishments with websites being internally evaluated vis-à-vis accessibility *100 On-line establishments with higher than low priority re accessibility • Webometrics based evaluation surveys utilising technical tools such as Bobby, LIFT etc.

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	2	1

Table 3.1-14: Website accessibility scale

Definition and explanation	Website accessibility scale (WAS) - distribution of on-line companies according to the accessibility strategy pursued.  Value range: $0 \leq WAS \leq 10$ Interpreting value range: Score of 6 and higher indicates relatively 'high accessibility strategy'.
Value added and importance	Making an assessment regarding on-line accessibility is a complex task and has thus far been performed by external independent website analysis, utilising specialist accessibility tools [160]. There are however no indicators regarding on-line accessibility at the EU level across the wide spectrum of on-line companies. In addition, given the complexity involved, this phenomenon is best captured by utilising a composite measure which combines measuring various accessibility issues and strategies.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	A composite measure, based on indicators described in Table 3.1-10, Table 3.1-11, Table 3.1-12, and Table 3.1-13 and / or their variations.
Discussion	This composite measures combines individual accessibility indicators and utilises comprising distinctions made by individual companies each of these indicators. Having considered individual accessibility items, it become apparent that different actions, usually of divergent intensity have been (or have failed to be) undertaken by companies / corporations / public sector organisations. Hence, a scale aiming to gauge the overall accessibility of corporate websites has been constructed. While it is possible to capture this to a considerable degree by using individual indicators, many of which have become scale items, the scale as a composite measure offers a greater potential for capturing different degrees of commitment across the on-line companies. Furthermore, such a relatively new phenomenon as on-line accessibility evaluation is best captured by a such composite measure. This scale's construction logic involved assessing different degrees of accessibility related actions, seeking to capture varied patterns of corporate actions relating to their website. At the operational level, it was decided to exclude DK answer categories

	from individual items, given the experience from, and evaluation of, the field work. Initially, that is to say, during the indicator construction process, it was envisaged that a certain amount of ex-post analysis of the survey data would be necessary. This prediction was borne out, consistent with the nature of process of constructing scales in social research when studying relatively new areas. The rationale behind the website accessibility scale is based upon the premise that accessibility can be assessed in terms of reaching out to the different target groups and also in terms of different levels of commitment to this concept, with both being measurable through the associated actions undertaken. Given the different target groups regarding accessibility, which might also translate into rather diverse requirements, it has been, for the purpose of the scale building, decided to 'reward' equally the on-line companies for positive strategies concerning either of the three 'target groups' specified (people with visual / hearing difficulties, limited dexterity and people with limited literacy). The corollary of this was to focus more on the type and level of commitment espoused by companies, which was done by including other accessibility items into the scale. In terms of internal consistency of the scale, two issues need to be mentioned. Firstly, the diversity of accessibility target audience is not fully captured by this scale and is best captured by individual items in terms of the three groups identified (these are captured by indicator depicted in Table 3.1-10. Hence, scale is based on awarding' equal 'reward' for any positive accessibility action, even if only one of the three groups was prioritised. This might have led to some loss of sensitivity of the scale (e.g. a company prioritising all three groups could effectively get the same score on this first item as a company prioritising only one group. Another issue has arisen from the piloting experience – the distribution of companies along assumed pathways contained in the scale logic was not always uniform for all companies i.e. not all companies have both adhered to formal accessibility guidelines and have conducted accessibility evaluation subsequently. While taking account of these two issues can be used for creating additional versions of this indicator with a potential for improvement, the findings would not change materially.			
Supplementary indicators	All comprising individual indicators			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	2	1

3.1.2 Digital divides

Introduction

The e-Inclusion domain is a quite broad and complex one. One of the main reasons is that the advent of the Information Society has added another dimension to the already extensive debate regarding social inclusion, which then has been enhanced with another, so-called digital dimension. The above has some direct implications for domain indicators system – not least the importance of general inclusion concepts and variables for most of the e-Inclusion indicators. Another set of implications relates to the importance of the existing social theories' concepts that need to be taken into account when considering e-Inclusion. The most important ones stem from the social network theory (e.g. the interaction of the exiting ties and the impact of new media use), theory of social change (advent of changes and the resulting winners and losers scenario), social diffusion theory (early vs. late adopters scenario), and theories covering issues such as social capital (e.g. advent of ICTs and social interactions and impact on these), and ultimately social shaping of technology. All of these concepts had to be considered during the process of indicator generation, evaluation and interpretation.

Justifiably, the advent of the information society has been accompanied by concerns as to whether and to what extent will all members of society be participants in it [29] [95]. Fears have been expressed that traditional social inequalities may be continued, or even magnified, in the form of divisions between 'information rich' and 'information poor'. The rationale for considering participation gaps derives from the implicit assumption that lack of access to information in a world where access to it is increasingly important can confer disadvantages, or compound them where already present. In addition, this issue touches upon the opportunity to make a choice and not being deprived of the potential for voluntary participation. The above then provides a foundation for the basic notion of the *digital divide*, focusing on the extent to which those already at relatively higher risk from exclusion are at the same time more likely to experience relative digital disadvantage embodied in differential access to and use rates of ICTs. Given that the concept of the digital divide is a very broad one, SIBIS has focused on one of its *main aspect of access to the Internet, and can be conceptualised as being on-line or not.*

However, even for considering the narrowly defined digital divide, as above, there is a need to highlight some additional issues. Barriers to access, while discernible at the individual level are more often than not contextual in nature and can be traced to some underlying structural issues. Thus both access and usage of Internet, just as other ICTs, are inextricably linked with individuals' possession of skills and competencies. Access can be denied by the lack of accessibility of technology i.e. by the insufficiencies in its design, and this applies especially to the Internet [137], [95]. Hence a need to consider both of these issues - skill endowment and accessibility - as an integral part of the digital divide. In addition, access barriers can also be related to insufficient awareness, of lack of trust, and a failure to provide sufficiently engaging content. These aspects and arising issues regarding this particular facet of the digital divide are covered under accessibility and access barriers subheadings in other sections of the handbook (cf. sections 3.1.1, 3.2.1 and 3.2).

At another level, concerns were raised that familiar forms of community interaction may be displaced by indirect ICT mediated and increasingly individualistic communication [164], with an associated decline in social interaction and some negative implications for the participation in a wider social life. A related set of issues concerns the nature and type of interactions (e.g. those interacting and those interacted in a network society [29], motivation to sustain the participation in such a society and to make one's participation more meaningful (e.g. by contributing to the information flows and direction of these by having more involvement in the network content). Hence then a need arises to consider issues around sustainability of participation, active involvement and the impact on one's enfranchisement.

With a due regard to aforementioned issues, the indicator system presented in this section regarding the digital divide then could be divided into two main subgroups. These are, firstly, basic divides focusing on access and use of the Internet, and, secondly, digital divide in terms of going beyond a simple on-line headcount and moving into the area of utilisation of access to begin with, but endeavouring to decipher some resulting higher order issues. However, while it is important to go beyond basic access and use, this particular aspect of the digital divide is still a critical issue and still perceived as its main aspect. The rationale is traced back to the implicit assumption that the lack of access and potential for voluntary participation can confer disadvantages, or compound them where these are already present. The aim is then to establish, at first, whether and to what extent the basic digital divide coincides with other socio-economic divides and social inequalities, given the potential of access to information and services to exacerbate welfare differences over and above the existing non-technology related levels. This is crucial both from the general social equity perspective but also from the ability to participate notion, given that more and more services associated with everyday life are migrating onto the net. Hence, the need for monitoring whether for example, the Internet diffusion can achieve ubiquity so that 'traditional' communication channels might be toned down.

A related issue is exploring whether ICTs might be used to the aim of overcoming the existing disadvantage, at least in terms of access and use patterns transcending the existing socio-economic divides. SIBIS demonstrated that, once access barriers have been surmounted, in some ways this may well be occurring due to the nature of Internet content. Thus on-line activities regarding accessing health-related information were less determined by individuals' socio-economic background, and even apparently benefiting relatively more to some disadvantaged groups such as people with disabilities.

Consistent with the existing eEurope benchmarking exercises relating to the Information Society, the SIBIS project prioritised a survey approach regarding the indicator testing and utilisation. Both benefits and limitations of this approach were elaborated elsewhere (e.g. WP 2, 5, topic area Social inclusion and the Information Society, http://www.sibis-eu.org/sibis) as well as some inevitable implications for the selection and design of indicators for the topic. In brief, the main implications were ensuing requirement regarding compatibility between indicator design and main research data gathering technique (that is to say, indicators had to be suitable for operationalisation to the level of survey questions), as well as suitability for the audience – general public. It is worth restating that, in terms of the digital divide subtopic, surveys collected robust and representative data suitable for benchmarking purposes. A particularly welcome feature was the fact that benchmarking, without time lags and based on sound and identical methodological approach, across the EU Member States and the US was enabled for the first time.

The indicator generation process was based on sound theoretical basis and on the state-of–the art-in the topic area, with a due regard to political relevance (e.g. eEurope actions). Although the majority of social inclusion related indicators have been developed within the SIBIS project (e.g. Social Inclusion reports at http://www.sibis-eu.org/sibis), some of the indicators regarding the digital divide presented in this section have been in use for some time now. This particularly relates to the indicators regarding basic access and use. However, variations of these indicators were created and successfully used, proving that they are still a basic starting point for researching and benchmarking the topic. Thus the issue of persistence of digital divides was also explored using available time series data, which utilised the existing equivalent indicators (as done in developing DIDIX indicator, for example).

Regarding further indicator development and research in this area, there is a potential to develop indicators that could complement the benchmarking exercise for this topic. There were inevitably some limitations on the scope of the work that could be carried out within one project. Apart from the enormous scope of the topic itself, there were unavoidably some constraints posed by the SIBIS methodological approach, which had to follow the standard procedure for a cross-national study. Thus, and arising out of this, relevant issues for indicator development concern mainly the choice of the target audience, with resulting implications for types of indicators that could be generated. Thus some hard to reach groups could be targeted, eliciting data on their access to and use of ICTs. This approach though, however revealing and to be welcomed, is not without limitations in its own right, in terms of generating indicators and data suitable for benchmarking. That is to say, there would be, depending on the research technique employed, significant issues to resolve in order to get replicable and reliable data. Still, while it is true to say that the 'omnibus' type of survey may well be very conducive for capturing a horizontal nature of the topic, the benefits of a focused approach should not be underestimated.

Finally, it is worth explicitly stating that, with relatively little effort, most of SIBIS indicators can successfully accommodate the change of the target audience, with a potential to generate additional indicators and data for benchmarking (and this is not limited to the digital divide and e-Inclusion area). Thus SIBIS DMS indicators could be successfully applied to social inclusion relevant organisations such as voluntary sector, specific social services etc. eliciting data on diffusion of ICTs and associated networking integration levels, as well as the nature of information flows in this sector.

Basic divides

Table 3.1-15: Computer use amongst citizens

Definition and explanation	Share of computer users in general population, with the focus on individuals and groups relatively more likely to be late adopters of new ICTs. $CU_x = \frac{\text{Computer users amongst the general population}}{\text{General population (age} > 16)} * 100$ CU_x Percentage of computer users for the subpopulation group x (here: general population)

	Value range: $0 \leq CU_x \leq 100$
Value added and importance	This is not a new indicator, but the relevance of continuous monitoring of this aspect of the digital divide merits its inclusion. The emphasis in SIBIS is on a regular usage i.e. the reference period of 4 weeks is used. Furthermore, it is used as a building block for a composite measure capturing the digital divide.
Sources of data	SIBIS GPS; comparable sources for this indicator include Eurobarometer surveys in Europe [112] [114], surveys conducted as a part of Falling Through the Net series in the US [218][219][220], PEW Internet survey [202], General Accounting Office [158] etc.
Countries and time intervals covered	EU member states, USA 2002 by SIBIS; using a 4 weeks reference period
Question wording	Have you used a PC, Mac, or any other computer, for work or for private purposes – in the last four weeks? • Yes • No • DK
Discussion	This indicator can be used to ascertain the level of use of a computer, as the most widespread Internet platform, but also IS tool, amongst at risk groups (e.g. women, older people, people on relatively low income, people with relatively low educational attainment, people with a disability, the unemployed, and people in manual occupation). All differentiations were utilised in SIBIS. In principle, it can be extended to capture the level of use amongst any other relevant at risk subgroups, such as members of ethnic and racial minorities etc. (as, for example done in NTIA survey [220], or surveying in depth a particular subgroup of population as for example done by Pew Internet [147]). However, some of the necessary information regarding background variables which are considered sensitive (such as racial background, presence of a disability etc.) might be difficult to obtain through surveys. Hence the lack of information regarding some hard to reach subgoups of population (as above, members of ethnic minorities, immigrant communities, which are largely considered to be excluded) as well as some transient subgroups of population (e.g. students living away from home with no telephone land line). This issue is relevant for all indicators to follow – hence, from the social inclusion perspective value '2' for availability of data. A variation of this indicator, a ratio that relates directly the [use rates of] groups at the opposing ends of dividing spectrum can be a very effective measure. For example, share of male users over share of female users, share of users with a disability over share of users without a disability etc. The ratio indicator is easily interpreted too – the further the ratio value (based on directly relating relevant subgroups departs from value one (with 'one' indicating 'no divide'), the bigger the particular digital divide is within a society (or nation state, EU, etc). Another variation utilises the relative comparisons based on the distance of a specified subgroup from the population average (with this average including the said subgroup). The latter method is mostly used for the purposes of generating a compound indicator (DIDIX) utilising longitudinal data at the EU level elaborated later on.
Supplementary indicators	• Share of computer users, with the focus on individuals and groups relatively more likely to be late adoptors of new ICTs, that is to say. $CU_X = \frac{\text{Computer users amongst group x}}{\text{general population (age 16+)}}$ CU x Percentage of computer users for the subpopulation group x Value range: $0 \leq CU_X \leq 100$ • Ratio measure directly relating 'opposing' spectrums within a subgroup of population (e.g. highest income subgroup of computer users versus lowest

	income subgroup of computer users) $CU_{x/\neg x} = \frac{\text{Computer users amongst subgroup x}}{\text{Computer users amongst subgroup } \neg x}$ • Digital divide in relative terms as a distance form population average $D_i = \frac{p_{xj}}{p_j} * 100$ Pxj denotes use rate of a particular subgroup x of population, Pj denotes use rate of general population Digital divide regarding computer use amongst users			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	3	2

Table 3.1-16: Internet use amongst citizens

Definition and explanation	Share of Internet users in general population (with the focus on groups relatively more likely to be late adopters) – digital divide at general population level $IU_x = \frac{\text{Internet users amongst the general population}}{\text{General population (age} > 16)} * 100$ IU_x Percentage of Internet users for the subpopulation group x (here: general population) Value range: $0 \leq IU_x \leq 100$
Value added and importance	This is not a new indicator, but the relevance of continuous monitoring of this aspect of the digital divide merits its inclusion. The emphasis in SIBIS is on a regular usage i.e. the reference period of 4 weeks is used. Furthermore, it is used as a starting point for driving other digital divide indicators – e.g. a building block for a composite measure capturing the digital divide.
Sources of data	SIBIS GPS, comparable sources for this indicator include Eurobarometer surveys in Europe [76], [114], surveys conducted as a part of Falling Through the Net series in the US [218], [219], [220] and Pew Internet and American Life project [202].
Countries and time intervals covered	EU 15, USA 2002 by SIBIS; using the 4 weeks reference period
Question wording	Have you used Internet at least once in the last four weeks, at home, school, or work or at any other place? "[regular use] "Have you used it in the last 12 months at least once? [occasional use] 1) Yes 2) No 3) DK
Discussion	This indicator can be used to ascertain the level of use of the Internet, as the most relevant ICT tool, amongst at risk [from e-exclusion] groups. In the context of SIBIS, these groups were: women, older people, people on relatively low income, people with relatively low educational attainment, people with a disability, the unemployed, and people in low skill end of job spectrum. In addition, the focus can be extended to capture the level of use amongst other relevant at risk subgoups, such as members of ethnic and racial minorities etc. as for example done in [219]. In addition, a variation of this indicator, a ratio that relates directly the [use rates of] groups at the opposing ends of dividing spectrum can be a very effective measure. For example, share of male users over share of female users, share of users with a disability over share of users without a disability etc. The ratio indicator is easily interpreted too – the further the ratio value (based on directly relating relevant subgroups) departs from value one (with 'one' indicating 'no divide'), the bigger the

	particular digital divide is *within* a society (or nation state, EU, etc). Another variation utilises the relative comparisons based on the distance of a specified subgroup from the population average (with this average including the said subgroup). The latter method is mostly used for the purposes of generating a compound indicator (DIDIX) utilising longitudinal data at the EU level elaborated later on. Finally, another set of supplementary indicators capturing main on-line activities of Internet users is very useful regarding exploring digital divide in more depth, going beyond counting how many are on-line. Thus most e-Commerce related on-line activities (on-line banking, purchase of a product or service) are strongly correlated with background socio-economic variables such as age, education terminal age, income level and dynamics etc. suggesting that digital divides in another form still persist, that is to say, that the digital divide is relevant for the population of Internet users. On the other hand, on-line ehealth related activities were less conforming to the above patterns, suggesting that at least this particular aspect of the digital divide could be transcended.
Supplementary indicators	• 'Intra' digital divide - amongst users $CU_{\mathbf{X}}^{cu} = \frac{\text{Computer users amongst at-risk group x}}{\text{Total computer users}} * 100$ • Ratio measure directly relating 'opposing' spectrums within a subgroup of population (e.g. highest income subgroup of computer users versus lowest income subgroup of computer users) $CU_{\mathbf{X}/\neg\mathbf{X}} = \frac{\text{Computer users amongst subgroup x}}{\text{Computer users amongst subgroup } \neg x}$ • Digital divide in relative terms as a distance form population average $D_i = \frac{p_{xj}}{p_j} * 100$ Pxj denotes use rate of a particular subgroup x of population, Pj denotes use rate of general population • Digital divide within the user population • Digital divides regarding patterns of use amongst Internet users (prevalence of particular on-line activities e.g. e-Commerce, ehealth by socio-demographic variables). • Ratio measure directly relating 'opposing' spectrums within a subgroup of population (e.g. highest income Internet users versus lowest Internet income users) • Digital divide in relative terms as a distance form population average

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	3	2

Table 3.1-17: Internet at home access divides

Definition and explanation	Share of people with a home Internet access, in general population (with the focus on groups relatively more likely to be late adopters). $IAH_x = \frac{\text{Internet at home access amongst the general population}}{\text{General population (age} > 16)} * 100$ IAH_x Percentage of people with at home access for the subpopulation group x (here: general population) Value range: $0 \leq IAH_x \leq 100$

Value added and importance	This is not a new indicator, but the relevance of continuous monitoring of this aspect of the digital divide merits its inclusion. Furthermore, it is used as a building block for a composite measure capturing the digital divide..
Sources of data	SIBIS GPS, comparable sources for this indicator include Eurobarometer surveys in Europe [77], [75] and surveys conducted as a part of Falling Through the Net series in the US [218], [219], [220].
Countries and time intervals covered	EU member states, USA 2002 by SIBIS; using the 4 weeks reference period etc.
Question wording	Do you have access to the Internet in your home 1) Yes 2) No 3) DK
Discussion	This indicator is used to ascertain the diffusion rates for at home access, amongst at risk groups (e.g. women, older people, people on relatively low income, people with relatively low educational attainment, people with a disability, the unemployed, people in manual occupation, all of which were utilised in SIBIS. It can be extended to capture the level of use amongst other relevant at risk subgroups, such as members of ethnic and racial minorities etc. In addition, a variation of this indicator, a ratio that relates directly the [availability of access rates of] groups at the opposing ends of dividing spectrum can be a very effective measure. For example, the share of males with home access over the share of females with home access, the share of people with a disability with a home access over the share of people without a disability with a home access etc. The ratio indicator is easily interpreted too – the further the ratio value (based on directly relating relevant subgroups departs from value one (with 'one' indicating 'no divide'), the bigger the particular digital divide is *within* a society (or nation state, EU, etc). Another variation utilises the relative comparisons based on the distance of a specified subgroup from the population average (with this average including the said subgroup).
Supplementary indicators	• Digital divide within the group with at home access $IHA_{x}^{iha} = \frac{At-home\ access\ for\ at-risk\ group\ x}{Total\ at-home\ access\ population} * 100$ • Ratio measure directly relating 'opposing' spectrums within a subgroup of population (e.g. highest income subgroup with at home access versus lowest Income subgroup with at home access • Digital divide in relative terms as a distance form population average $D_i = \frac{p_{xj}}{p_j} * 100$ Pxj denotes at-home access rate of a particular subgroup x of population, Pj denotes at-home access rate of general population • Technical method of accessing the Internet at home • The speed of Internet connection at home

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	3	2

Table 3.1-18: Digital Divide Index (DIDIX)

Definition and explanation	Digital divide between the four identified 'at risk' groups and general population (population on average), at a point in time and over time. This index considers the following aspects of digital divide: access to the Internet, use of the Internet, and use of

a computer. The four at risk groups are differentiated by gender, age, educational level, and income level, as below:

- Women
- People aged 50 and over ('50 +')
- Those with low levels of educational attainment (captured by a proxy indicator – early school leavers – those who finished formal education at an age 15 or earlier)
- Those with low income (those belonging to the lowest quartile relative to the national median income).

This will yield effectively four subindices.

$$(1)\ \text{DIDIX} = \frac{1}{n}\sum_{i=1}^{n} D_i$$

D_i is the Subindex value for each subpopulation group i (i=1,...,4) with

$$(2)\ D_i = \sum_{j=1}^{m} w_j * \frac{p_{ij}}{p_j}$$

where

w_j : Weight of Indicator j (j=1,... m; Σw=1)

p_{ij} : Value of indicator j in subpopulation i (i=1,...,n)

p_j : Value of indicator j for total population.

i	Subpopulation	j	Indicator	Weight
1	Age > 49 Years	1	Computer usage	0.50
2	Gender = female	2	Internet usage	0.30
3	Education –Full time finished At age < 16	3	Internet usage at home	0.20
4	Income = Lowest quartile			
(n=4)		(m=3)		

Each of the indices is weighted according to the following scheme:

- Computer usage (ref. period) – weight 0.50%
- Internet usage (ref. period 4 weeks) – weight 0.30%
- Home Internet access – weight 0.20%

A summary of the following is the following formula:

$$\text{Didix} = \frac{1}{n}\sum_{i}^{n} \sum_{j}^{m} \omega * \frac{P_{ij}}{Pj}$$

Descriptively, the above yields relative access and usage rates for each at risk group, which are weighted and compounded into the DIDIX index being a simple arithmetic mean of the four comprising indices.

Value range: 0 ≤ DIDIX ≤ 100

Value range is the same for subindices and for the compounded DIDIX. Given hat DIDIX inherently measures the digital divide in relative terms (compared to population as a whole) the lower the DIDIX value, the greater the gap between the four at risk groups (or individual group for subindices) and the population average (at the level measured - for example, nation state, EU 15).

Value added and importance

This indicator captures most relevant aspect of the digital divide within advanced industrial nations at a similar level of development. It combines both access to and the use of technology, which is extremely useful given that these issues are sometimes confounded (e.g. access to technology is often equated with the ability to use it, while insufficient attention has also been given to the regularity of use).

Albeit a composite measure, the index is relatively easily interpreted – the closer the value is to 100, the more even access and use rates prevail in a country or in the EU (for a compounded index form) or for a given subgroup of population (for individual

	subindices). It is a useful tool for monitoring the digital divide over time, in a consistent manner. While the interpretation of the findings can benefit from contextual country specific data (e.g. especially relevant for comparing EU 15 with NAS countries), the value of monitoring the digital divide among groups more likely to be late adoptors and population average remains extremely important.			
Sources of data	SIBIS GPS, Eurobarometer 54.0 [114], and Eurobarometer 47.0 [112].			
Countries and time intervals covered	EU 15 member states, 1997, 2000, and 2002. It has been adapted to include NAS countries, based on data from 2003 NAS SIBIS survey.			
Question wording	Questions used from SIBIS GPS are: • "Have you used a PC, Mac, or any other computer, for work or for private purposes – in the last four weeks? • "Have you used the internet at least once in the last four weeks, at home, at school, or work or at any other place?" • "Do you have access to the Internet in your home?" Questions used from Eurobarometer • "Do you use a computer at [different locations given for selection]?" Computer users have been defined as those who use a computer at least at one of the given locations, e.g. "at work", "at home", "at the university". • "Do you use e-Mail and/or the internet at [different locations given for selection]?" • "Do you use e-Mail and/or the internet at home?"			
Discussion	Given that time series data effectively pooled two different data sources, which inevitably raises the issue of compatibility, the following two methodological issues need to be highlighted: • Differential data gathering technique - a third source [Eurobarometer] data for 1997 and 2000 was gathered via Computer Assisted Personal Interviewing (CAPI), while SIBIS project data was gathered via Computer Assisted Telephone Interviewing (CATI) • Differential approach to the emphasis on a regular use – SIBIS prioritises the regular use aspect, hence the reference period of four weeks being introduced, whereas no such distinction was made by Eurobarometer. Consequently, DIDIX (values for 2002) could be considered more a robust measure, at least in terms of capturing [the gaps in] more active participation. In terms of compatibility [with DIDIX 1] though an assumption has to be made that the above mentioned reference period is equally relevant for all 'at risk' subgroups studied. Additional methodological issues concern the fact that at risk groups are not mutually exclusive, confounding delineation of each subgroup somewhat. Also, the calculation of a compounded Index value could be modified to reflect that share of each relevant at risk group i.e. to reflect their share in the general population. The findings regarding the digital divide at the EU level suggest that it remained static over last five years. However, the value of compounded index 'hides' some of the internal dynamics, both at the national level, but also in terms of its comprising divides. Thus for the EU overall the gender divide has decreased since 1997 (and this trend is apparent for most but not all countries). The age divide also shows an overall trend towards decreasing although only of late, after initial increase. The most relevant divide is the educational divide, while the lack of improvement in terms of the Income divide is also apparent.			
Supplementary indicators	None			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	3	2

Utilisation divides

Table 3.1-19: Users according to on-line tenure

Definition and explanation	Share of mature Internet users: Users using the Internet for two or more years as a percentage of all Internet users $TM = \frac{\text{total number of mature Internet users}}{\text{all Interent users}} * 100$ TM Share of total mature Internet users The share of mature Internet users is found by summing the number of mature Internet users and dividing it with the total number of internet users. A mature user is classified as someone who has used the Internet for more than two years. Value range: 0 ≤ TM ≤ 100 (percentages)			
Importance and Value added	Having a high tenure is an important factor not only for this topic area, but for most indicators related to the Information Society development. The more experienced users are, the more likely they are to frequently use on-line services and do on-line transactions, and by extension to benefit from IS developments. They are also more likely to upgrade to broadband, which in turn opens up another set of possibilities.			
Sources of data	SIBIS GPS This indicator, or its close variation, might be easily incorporated in the Eurostat ICT Usage Household or in the Eurobarometer Internet surveys “Internet and the Public at large”. A variation has been used in the US by General Accounting Office - GAO [158].			
Countries and time intervals covered	EU member states, Switzerland and the US for 2002			
Question wording	When did you use the Internet for the first time? (1) < 6 months ago (2) 6 - 12 months ago (3) 1 year - 2 years ago (4) 2 years + ago (5) DK			
Discussion	Data analysis has shown that there are a large proportion of respondents with more than two years experience, this is particularly true in the US and Scandinavian countries. Hence for future an additional category tracking users with 2 to 4 years experience and one for users with more than 4 years experience would be useful.			
Supplementary indicators	In addition to share of mature internet users, indicators measuring the share of novel Internet user (< 6 months experience using the interest) and the share of intermediate users (between six months and two years Internet experience) can be constructed.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1	1	2

Table 3.1-20: Percentage of heavy intensity Internet users

Definition and explanation	The share of heavy Internet users is found by summing the number of high intensity Internet users (those who spend longer than 6 hours per week on-line) and dividing it by the total number of Internet users, expressed in %.

	$HI = \frac{\text{total number of heavy Internet users}}{\text{all Internet users}} * 100$ HI Heavy intensity Internet users Value range: 0 ≤ TM ≤ 100 (percentages)
Importance and Value added	As broadband connection, on-line service provision improvements and flat subscription rates increase across Europe, it is important to track if users spend an increasing amount of time on-line.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the US for 2002
Question wording	How much time do you spend in a typical week on using the Internet? a) More than 6 hours per week b) Between 1 and 5 hours per week d) Less than 1 hour per week
Discussion	Time spent might be influenced not only by the context of use, but also depending on the type of connection used and on the type of subscription package the user is subscribed to. Flat rate 24 hours connection, according to research studies, prompt users to spend longer sessions on the Internet. Time spent on-line is also influenced by the speed and quality of the connection. Thus broadband users can have better on-line experiences than narrowband users in the same (amount of) time.
Supplementary indicators	In addition to the heavy intensity Internet users indicator, similar indicators can be constructed for moderate and light Internet intensity of usage, according to the weekly average time users spend on-line from any location. 'Cannibalisation' effect of the Internet in relation to other media (Jupiter Research indicator [190], version also used by Eurobarometer [188]): Share of users spending less time in other media (TV, press, radio, video, cinema) since using the Internet at home On-line intensity and the type of technical connection / access point Broadband intensity of on-line usage: Under SIBIS WP5 one of the impact indicators portrays how broadband users tend to have longer on-line sessions in a given period compared to narrowband users.
Evaluation results	Benchmarking Value: 2 / Validity: 1 / Reliability: 1 / Availability: 2

Table 3.1-21: Internet dropouts - Internet home access churn

Definition and explanation	Internet home access churn (HAC) denotes share of persons who used to have Internet access at home, and do not have it anymore, or at home dropouts: $HAC = \frac{\text{Individuals with at home Internet access in the past}}{\text{Total population aged 15 and older}} * 100$ Value range: 0 ≤ HAC ≤ 100 (percentages)
Importance and value added	In SIBIS, the rate of Internet dropouts focusing on at home access was prioritised. This indicator then captures the sustainability of at home access, considered important both in terms of providing multiplier benefits since all household members can avail of it, it is also increasingly relevant in terms of accessing and using household oriented information society services and products such as those from the areas of public administration (e-Government), health (e-Health) but also some commercial services (on-line shopping can generate substantive savings for households – e.g. on-line airfares are regularly cheaper than when booked off line). This indicator indirectly considers the issue whether perceived

	benefits of having Internet access for a household apparently outweigh the costs of maintaining this IS communication channel opened (here the costs are understood in a broader sense as an investment of time, money, resources, and increasingly, trust). While at home Internet access could have been substituted by equivalent access from elsewhere in terms of an individual, even assuming that this non-home based access is of similar nature and quality for each individual in question, it is inevitable that home access churn results in a removal of the Internet access from a household. Most relevant supplementary indicator is the level of *real* Internet dropouts, at the individual level, that is to say, those who did not substitute the home access with access point elsewhere. While the rate of *real* Internet dropouts, as define above, is rather low (below 1% for the EU 15 at the population level), it is nevertheless important to monitor this phenomenon given the relevance of home access, both in terms of providing access point for whole household, as well as in terms of accessing the increasing number of 'household oriented' information society services. In addition to being a good proxy indicator for the sustainability of participation, it can also be used to supplement the assessment of the perceived [continued] usefulness of the Internet, providing that access was not discontinued due to the lack of affordability (price) and strictly technical problems that might have occurred (e.g. ISP services disruption). A related issue is whether those who no longer have at home access still continue to use the Internet from an alternative location and if to the same extent (i.e. if and to what extent did they have to reduce their time spent on-line). The issue of Internet dropouts has already been explored in the US [301] [192], but there has been a dearth of research into this phenomenon in Europe.
Sources of data	SIBIS GPS, variations used in the US [301]
Countries and time intervals covered	EU member states, Switzerland and the US for 2002
Question wording	Do you have access to the Internet in your home? *(if not, then*) Did you once have Internet access in your home? Note: supplementary indicator utilises survey questions eliciting if Internet is currently used and / or was used in the previous 12 months; from this it can be arrived at whether at home access dropouts still use the Internet elsewhere - regularly (during the previous 4 weeks) or at least occassionally (in the last 12 month period).
Discussion	The most relevant place of alternative access for at home dropouts appears to be the workplace, with mobile access (for example WAP) likely to become more relevant only in the future. However, it has to be mentioned that workplace based Internet access is becoming more restrictive regarding individual private use, with an increasing number of companies adopting restrictive formal policies in this regard [215]. Overall, while the proportion of dropouts is relatively low, it is a little higher in the US and 'more advanced information societies' in the EU than in the EU taken as an average. Additional evaluation exercise showed that while some variations in home access "drop-outs" by socio-demographic groupings do exist, there were neither immediately striking nor significant patterns. The rate of real Internet dropouts is rather low (below 1% for the EU 15 at the population level), which is an encouraging finding. However, the altenative version of this indicator can use a differnet base – for example using those curently with access and tose who had access to gehter as abase would naturally yierld higher value. Finally, there is a limitation regarding data on real dropouts – those who might have had internet access at home at some point in the past but have not used the Internet at all it in the previous 12 months could not have been captured in SIBIS GPS survey.
Supplementary indicators	• At home dropouts but still Internet users - overall rate and by current access point • 'Real' Internet dropouts rate – those having discontinued at home access and not accessing the Internet from elsewhere during the previous 12 months. • Real, definitive Internet use dropout rate – those who used to be Internet users at some point in time but no longer users, nor likely to return (not captured in SIBIS)

	• Rationale for discontinuing home access			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	3	2

Table 3.1-22: Hypothetical removal of Internet access – impact regarding a sense of inclusion

Definition and explanation	Hypothetical removal of access and impact on perceptions regarding inclusion denotes the share of Internet users who would feel socially excluded were the Internet access removed from them: $HRA = \frac{\text{Individuals who would feel socially excluded}}{\text{Population of Interentusers}} * 100$ Value range: 0 ≤ HAC ≤ 100 (percentages)
Importance and value added	The importance of Internet access regarding social enfranchisement is constantly growing, in parallel to the penetration and utilisation of the Internet into all aspects of everyday life. Thus, from an individual perspective, it can be used for a variety of ends that are relevant for generating a greater sense of inclusion – from supporting the existing and generating new social contacts, to accessing information regarding employment, on-line public information, to, and of more late, participating in various on-line discussion for a that can enhance a sense of political and wider social enfranchisement (e.g. on-line forum with participating public representatives on a wide range of issues). Arguably, all of these are offering new bases for social inclusion via enhanced social participation, and equivalent potential improvements in a wider social and civic participation, and ultimately, wider social cohesion.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the US for 2002
Question wording	[Posed to regular Internet users] "Please tell me how much you agree that if our country were without the Internet for a month you would [item]. Would you say that you would … feel socially excluded?" 1) Agree completely 2) Agree somewhat 3) Do not agree 4) DK
Discussion	While the assessment concerned only the hypothetical situation of non availability of the Internet for current users, and referred only to a one month absence of the Internet, it reveals some important insights. Although in general ratings of the social impact were low, there were nevertheless significant minorities who felt that the absence of the Internet even for a relatively short period of one month would have been detrimental to their perception of social enfranchisement. Higher values were generally found in more advanced 'information societies' (although some variations deserve further exploration), indicating the prominence of and reliance upon, the Internet in this regard. Further improvements regarding validity could be undertaken given that in the pilot version the wording appears somewhat loaded, but this was due to the fact that common meaning had to be arrived at cross-country level. However, using a more positive wording is likely to suffer from a similar validity problems - e.g. whether Internet users feel more integrated due to them having access to the Internet apparently does not discriminate at all resulting in an overwhelming positive response to this type of statement (Eurobarometer, cf. [115]).
Supplementary indicators	• Impact of the removal of Internet upon the frequency of social contacts – operationalised as contact with friends.

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	1	2	2

Table 3.1-23: Supporting existing social contacts via using e-Mail

Definition and explanation	Supporting existing social contact via e-Mail (SESCE) – share of e-Mail users who use e-Mail to communicate with at least ¼ (one quarter) of their friends and relatives. $SESCE = \frac{\sum_1^j EUI}{\sum PEU} * 100$ EUI Individual e- mail use intensity , defined by the frequency of use - share of friends and relatives with whom regular e-Mail correspondence is maintained EUI 1 – e mail users regularly e-Mailing all or nearly all of their friends and relatives EUI 2 - e mail users regularly e-Mailing about ¾ of friends and relatives EUI 3 - e mail users regularly e-Mailing about ½ of friends and relatives EUI 4 – e mail users regularly e-Mailing about ¼ of friends and relatives PEU Population of e-Mail users Value range: 0 ≤ SESCE ≤ 100			
Importance and value added	The importance of utilisation of Internet based modes of communication for social contacts is constantly growing. E-Mail is most ubiquitous mode of communication which lends itself well to maintaining contacts in a relatively inexpensive way (of course, once various access barriers have been surmounted), which in turn makes it suitable for supporting existing social contacts be they individual, community or otherwise oriented . The extent to which its use has become relatively widespread denotes its use to support general social contacts, and this diffusion can be measured for each particular subgroup of population both within and across countries.			
Sources of data	SIBIS GPS, variations used in the Eurobarometer			
Countries and time intervals covered	EU member states, Switzerland and the US for 2002			
Question wording	[Posed to regular e-Mail users] "And with how many of your friends and relatives do you communicate regularly via e-Mail … 1) All or almost all 2) About three quarters 3) About half 4) About one quarter 5) Only few or no-one 6) DK			
Discussion	Internal indicator evaluation showed that majority of e-Mail users were in contact with less than ¼ of friends and relatives (in all countries, with the US being an exception where more than ¾ of email users regularly relying on this channel), this thus being a 'natural' cut off point. This indicator should be considered in conjunction with the e-Mail availability amongst the friends and relatives, being its natural complement.			
Supplementary indicators	Diffusion of e-Mail availability amongst friends, i.e. share of friends and relatives with e-Mail address.			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	3	3

Table 3.1-24: On-line content creation potential

Definition and	Share of Internet users who would possess sufficient skills and resources to potentially

explanation	engage in creation of on-line content, based on the confidence in creating Web/ Internet pages and having broadband Internet access at home. $$CCP = \frac{\sum IU(wpcc \wedge bb)}{\sum PIU} * 100$$ PIU Population of Internet users IU wpcc Internet users confident in creating Internet/web page IUbb Internet users with a broadband access Internet use considered in a 4 weeks reference period or in previous 12 months Value range: 0 ≤ CCP ≤ 100
Importance and value added	The importance of interactivity regarding sustaining and enhancing participation in the Information Society cannot be overstated. Potential of individuals and local communities to actively create content is set to become more important in the future. This issue also relates to participating in the Information Society in a more active way, in order to avoid some pitfalls associated with non interactive technology (e.g. early advent of the TV and some resulting negative implications on social capital [261] [262]. Indeed, the relevance of this indicator and indicators in this field is set to increase in future, given already identified divides such as those *interacting* and those *interacted* ([29] [164]) As a proxy indicator for this potential, the prevalence of potential to create a personal web page is proposed here. This indicator focuses on looking at the [individuals'] potential to create on-line content and thus make an important step towards achieving the potential for reciprocal information flows. The Content Creation Potential (CCP) indicator is comprised of the items measuring infrastructure endowment [broadband home access] and skill endowment [web page creation abilities]. Additional indicators can be considered such as resources (e.g. time) invested which can be conceptualised as maintaining the time spent on-line after obtaining improved / faster access for broadband migrators. The last item is based ion the experience of a focused study of broadband users suggesting that broadband migrators who maintained and / or increased their time on-line are likely to be engaging in some forms of electronic content creation [177]. Thus it is based on the SIBIS GPS indicators: Internet access bandwidth (broadband), time spent on-line after improving connection , and Internet related skills – creating a web page The methodological approach behind this [indicator items selection] stems from the focused study [177].
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the US for 2002
Question wording	Index utilises three SIBIS indicators - [Posed to regular and occasional Internet users] measuring • Whether they have a high speed access / broadband • Whether they possess a sufficient level of skills to put information on-line
Discussion	This indicator is necessarily descriptive. It focuses on looking at the [individuals'] potential to create on-line content and thus make an important step towards achieving the potential for reciprocal information flows. The Content creation potential (CCP) index is comprised of the items measuring infrastructure endowment [broadband access], skill endowment [web page creation abilities], and the time invested conceptualised as the time spent on-line after obtaining improved / faster access. Thus it is based on the SIBIS GPS indicators: Internet access bandwidth (broadband) at home, time spent on-line after 'migrating' i.e. improving connection in a technical sense, and Internet skills – creating a web page. Further versions of this indicator should consider whether the on-line sessions are of sufficient duration and nature to support content creation activity.The methodological approach behind this [indicator items selection] stems from the empirical

	data regarding patterns of broadband users from a focused study of this group of Internet users [177]. SIBIS in this pilot version did not make a distinction regarding the individual rationale for creating a personal web page e.g. strictly for personal, family or local community reasons. In terms of its feasibility and appropriateness, it is true to say that the indicator has been designed with the future outlook in mind, that is to say, its value is expected to increase in the future, not least with the increase of the size of the 'on-line' population, better infrastructure provision, and enhancement of the Internet related skill pool. The suggestion is that the current 'elitist' perception currently associated with this group (especially since broadband access is used as a main building block of this indicator) will become less germane, while, in an inverse relationship, the relevance of this indicator should increase. Thus, it is already possible to see the signs of the increasing usage of the broadband even among those individuals who would not necessarily be considered as most likely broadband users. For example, it was found that relatively lower income population and households have 'unusually' high uptake of broadband [220]			
Supplementary indicators	See also Table 3.2-36: Share of population who feel very confident in communicating over the Internet. Furthermore: • Broadband migration rationale • Broadband migrators (Internet users who have upgraded their connection) • On-line activities of broadband users (Pew Internet, [177])			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	2	1

3.2 Factors determining Internet access and use

3.2.1 Information Security

Introduction

Widespread inclusion in the Information Society (IS) is possible only under conditions of information and network security, which are necessary to foster trust in electronic commerce and e-Government services. As innovative business models are being developed to exploit the positive functionalities provided by these new global communication and information media, concerns about the security and privacy of information infrastructures and services may inhibit their full take-up. Such concerns may hamper users' trust towards these new information and communication instruments.

Citizens are key stakeholders of the European IS and the subjects of e-inclusion. Their perceptions of security and the protection of their privacy on-line have significant impacts on the development of e-Commerce. If individuals are suspicious, and, therefore, reluctant to send the identifying or financial information required for completing transactions over the Internet, the fraction of commercial and societal activities that can benefit from transition to the electronic medium will be significantly restricted. Businesses are also crucial stakeholders. In part businesses have similar concerns and problems as consumers with regard to security. There is, additionally, the issue of guaranteeing privacy on one hand, and wanting to benefit from micro data on customers (such as purchasing behaviours) on the other hand. Whereas collecting such data is attractive in order to target customers and predict market behaviour more accurately, it may backfire, as potential consumers may want to opt out.

From what has been said above, it is clear that enhancements in on-line security are crucial for fostering on-line trust, which in turn is a necessary support for companies' efforts to increase their on-line transaction activities. Hence, the measurement of Business-to-Consumer (B2C) intensity and of security is correlated.

Moreover, information security management as well as technical solutions are necessary conditions for the establishment of a successful and fully compliant on-line commercial activity. It is clear then, that information security is a pivotal element for prompting the delivery of services and goods on-line, as also shown by indicators measuring self-assessed impacts of on-line sales and purchases.

Finally, information security is also essential to support new forms of interactions between employers and employees through processes and applications such as telework or on-line training facilities. Information obtained through security indicators piloted in the SIBIS DMS should be correlated to indicators such as B2B readiness and access availability.

This section proposes indicators for information security, differentiating between two classes of indicators. On the one hand there are actual 'security' indicators, measuring the number, kind and effects of security breaches suffered by organisations, methods adopted to prevent breaches from occurring, and barriers to a successful implementation of information security policies in various establishments. On the other hand, related e-Commerce indicators are presented, which measure the readiness for e-Commerce as well as the barriers to the development of electronic commerce. These indicators are classified into two sub-domains:

- *On-line malicious activities* covers indicators measuring malicious activities such as network intrusion, on-line fraud etc. as well as unplanned downtime, or service delivery breakdowns. It also considers the damages caused by such activities and measures their severity and financial consequences.
- *Prevention of on-line malicious activities and downtime* measures investments of public and private institutions and individuals in enhancing security functionalities (data confidentiality, integrity, availability, authentication and non repudiation) of their on-line activities against malicious activities, as well as unplanned downtime or service delivery breakdowns.
- *Attitude towards security issues* includes indicators which measure to what extent certain elements such as citizens' awareness of on-line interaction facilitators, concerns about on-line security and privacy, security awareness, and the willingness to report suffered on-line violations are present

Most indicators of this section were developed within the SIBIS project (11 out of 14). In three cases an existing source was identified and found relevant for this section. Most indicators presented here, with the exception of the most recent ones, have been analysed in depth in other SIBIS documents, in particular the Topic Reports (WP5.1) and the final Summary Reports (WP5.2), for the topics of Security and Trust and e-Commerce (these reports are available on-line at http://www.sibis-eu.org/sibis).

Besides SIBIS, some new indicators dealing with information security and cyber crime have recently been developed, although it is still hard to find EU focused material. For example recent indicators, such as the '2002 Internet Fraud Report', '2003 Australian Computer Crime and Security Survey', which includes a range of indicators on computer crime and its costs, etc. are now available [11] [37] [38] [49] [57]. On the European side, Flash Eurobarometer 135 is still the most comprehensive source of indicators on citizens' access and problems with the Internet [107]. In the course of this paper some indicators which are not EU focused, but still might be of interest and related to the indicators presented will be mentioned in the 'discussion' part of the indicator description.

The study on 'security and trust' in the information society began with the argument that the specific issue of 'trust' was not suitable for benchmarking. In other words, it did not appear possible to *measure* 'trust' as such as this is a subjective perception on the part of the user. Hence, trust is naturally multidimensional, which in turn prevents us from quantifying it by a single number. Although it is legitimate to assume that information security issues and individual perceptions of access are correlated to the 'trust' individuals feel towards on-line environments, this assumption does not necessarily entail a cause-effect relationship.

As a consequence, SIBIS has neglected any attempt to measure 'trust', identifying and piloting the indicators most relevant to information security and users' perceptions of access barriers instead.

Despite having pinpointed and piloted the key indicators for these areas, more issues have been identified, but within the limitations of the project it was not possible to explore them all in depth. With reference to this section ('Information Security'), additional work is needed especially in identifying specific priorities for the definition of information and network information security policies inside public and private organisations. A second area needing more research refers to estimating the returns on investments in information and network security technologies and processes. In this context, a possibility would be to undertake some stated preference survey exercises to try to assess how information and network technologies induce users to change their use of on-line services.

On-line malicious activities

Table 3.2-1: Security breaches occurred in the organisation

Definition and explanation	Percentage of establishments that suffered at least one security breach (such as identity theft, on-line software application, computer virus or unauthorised entry) in the last 12 months, of all establishments present on-line. $SBO = \frac{\text{Establishm ents present online that have suffered breaches}}{\text{All establishm ents present online}} * 100$ SBO Rate of reported security breaches in organisations Value range: 0 ≤ Percentage suffering information breaches ≤ 100
Importance and value added	This indicator is relevant because, by measuring to what extent establishments in different European countries have experienced breaches, it allows these establishments to be aware of the problem and take action to try to solve it. In addition, the commercial sector is interested in obtaining information about customers and their preferences. However, this is possible only if customers trust the firm and, hence, decide to approach it, which in turn can be assumed to be related to the firm's reputation and vulnerability to external attacks. Although some surveys previous to SIBIS have tried to measure the occurrence of breaches in organisation, these surveys were not specifically targeted to the EU and they were typically held on-line. Moreover, little information was present on different kinds of information security breaches being experienced by European organisation. The supplementary indicators listed below measure these key aspects and are a subset of the main indicator defined here.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	Many establishments are affected by security breaches such as identity theft, on-line fraud, manipulation of software applications, computer viruses or unauthorised entry to internal networks. Have any breaches of your information security occurred in your establishment in the last 12 months? (a) Yes (b) No (c) Don't Know
Discussion	This question addressed only those organisations which put information on-line, for example by means of a website. Hence, the underlying assumption is that firms that are not on-line are not likely to suffer information security breaches. The list of supplementary indicators includes indicators measuring the occurrence of specific sorts of breaches, such as viruses, on-line fraud etc. Because virus infections are the most frequent form of breach suffered by today's organisations (in SIBIS over 90% of organisations that suffered breaches) there is a strong correlation between the occurrence of virus infections and the occurrence of

	breaches.			
Supplementary indicators	– Percentage of establishments that suffered identity theft of all establishments having suffered breaches; – Percentage of establishments that suffered on-line fraud of all establishments having suffered breaches; – Percentage of establishments that suffered manipulation of software applications of all establishments having suffered breaches; – Percentage of establishments that suffered unauthorised entry to internal networks of all establishments having suffered breaches. *Source of data is SIBIS DMS, covering Finland, France, Germany, Greece, Italy, Spain and The United Kingdom for 2002.*			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	0.5	1.33

Table 3.2-2: Damage severity index

Definition and explanation	Mean of five indices weighing the severity of damages caused by different sorts of breaches (identity theft, on-line fraud, manipulation of software applications, computer viruses and unauthorised entry into internal networks) (1) $WDS = \frac{\sum_1^J (\text{Type of breach} * \omega)}{J}$ (2) $\overline{DSI} = \frac{\sum_1^R WDS}{R}$ WDS Weighted Damage Severity J Total number of breaches per type (see below) ω Weights; for each breach:: Very substantial = 10 Rather substantial = 5 Not substantial = 0 Don't Know = 5 R The number of reported types of security breaches suffered per country (in this study 4 or 5, since in two cases not all categories were asked).
Importance and value added	This compound indicator is thought as a way to compare different countries on the severity of damages caused, in national enterprises, by breaches without distinguishing among different sorts of attacks. Under a policy perspective it is important to highlight these differences in order to be able to see how, in different states, organisations address issues of breaches. A high severity of damages could be related to lower consumer/citizen trust in the tools of the information society and could, ultimately, result in detrimental effects on the developments of e-Commerce as well as e-Government services. Indicators previously developed mainly focused on the US
Sources of data	SIBIS DMS
Countries and time intervals covered	FIN, F, D, EL, I, E, UK for 2002
Question wording	How substantial were the consequences of • Identity theft • On-line fraud • Manipulation of software applications • Computer virus infections • Unauthorised entry to internal networks For each

	• Very substantial • Rather substantial • Not substantial • Don't Know
Discussion	A compound indicator can be interpreted as a combination of different yet related indicators. Such combinations are useful to scale measures in order to facilitate comparisons otherwise difficult to perform. Through weighted averaging, compound indicators take care of differences in size, units etc. putting the information on a uniform and 'unitless' footing. Given the low sample, it is necessary to test this indicator outside the tight boundaries of a pilot survey to obtain more meaningful results (although the SIBIS results are consistent with those of other indicators tested throughout the project). Additionally, it must be stressed that the overwhelming occurrence of virus infections as opposed to all other breaches (see also Table 3.2-1) dominates the DSI too, since no 'breach-specific' weighting was given. Other indicators dealing with damages caused by cyber-attack do exist, but are not EU specific. For example, the 2003 Australian Computer Crime Survey developed an indicator on the costs of computer crime. Supplementary indicators listed below measure the percentage of organisations that suffered 'very substantial' damages for each breach used for the development of the DSI.
Supplementary indicators	• Percentage of establishments that suffered 'very substantial' damages because of identity theft, of all establishments having suffered identity theft; • Percentage of establishments that suffered 'very substantial' damages because of on-line fraud, of all establishments having suffered on-line fraud; • Percentage of establishments that suffered 'very substantial' damages because of manipulation of software applications, of all establishments having suffered manipulation of software applications;\ • Percentage of establishments that suffered 'very substantial' damages because of computer virus infections, of all establishments having suffered computer virus infections; • Percentage of establishments that suffered 'very substantial' damages because of unauthorised entry into internal networks, of all establishments having suffered unauthorised entry into internal networks.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1.83	1.25	1	1.33

Table 3.2-3: Threats to on-line security – computer hackers

Definition and explanation	Percentage of establishments having suffered breaches, which consider computer hackers as the largest threat to their on-line security of all establishments suffering breaches. $TOS_{ch} = \frac{\text{Establishments having suffered breaches and considering hackers the major threat}}{\text{All establishments having suffered breaches}}$ TOS_{ch} Fraction of establishments having suffered breaches, considering computer hackers as the major threat Value range: $0 \leq TOS_{ch} \leq 100$
Importance and value added	This indicator is relevant because it highlights organisations' perceptions as on where breaches originate. Under a policy perspective it is important because different perceptions as on where breaches originate lead to different approaches and different policies for information security in different organisations. Also, it

<table>
<tr><td></td><td colspan="4">stresses the perceptions as opposed to the actual source of information (see next indicator) or, even, the actual facts behind a breach</td></tr>
<tr><td>Sources of data</td><td colspan="4">SIBIS DMS</td></tr>
<tr><td>Countries and time intervals covered</td><td colspan="4">Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002</td></tr>
<tr><td>Question wording</td><td colspan="4">Where do you believe these breaches mainly came from? Do you think the largest threat to on-line security came from:
[READ OUT ANSWER CATEGORIES. CODE ALL THAT APPLY]
(a) Customers
(b) Suppliers/competitors
(c) Former employees
(d) Computer hackers
(e) Internal users
(f) Others, not mentioned yet
(g) Don’t Know</td></tr>
<tr><td>Discussion</td><td colspan="4">Although computer viruses are by far the most common breach organisations experience, it is often suggested that hacking or dedicated high scale network intrusion are businesses’ chief concerns [263]. In fact, the pilot survey confirmed this by showing that hackers are considered the prime threat. Because hackers are perceived as the main threat to organisational on-line security, this was chosen as the main indicator (all other options are presented as supplementary indicators). However, caution is needed since the picture is not always as clear and in some cases customers are also perceived as major threats.</td></tr>
<tr><td>Supplementary indicators</td><td colspan="4">- Percentage of establishments having suffered breaches, which consider customers as the largest threat to their on-line security of all establishments suffering breaches
- Percentage of establishments having suffered breaches, which consider supplier/competitors as the largest threat to their on-line security of all establishments suffering breaches
- Percentage of establishments having suffered breaches, which consider former employees as the largest threat to their on-line security of all establishments suffering breaches.
- Percentage of establishments having suffered breaches, which consider internal users as the largest threat to their on-line security of all establishments suffering breaches.</td></tr>
<tr><td rowspan="2">Evaluation results</td><td>Benchmarking Value</td><td>Validity</td><td>Reliability</td><td>Availability</td></tr>
<tr><td>1.66</td><td>1.25</td><td>2</td><td>1.33</td></tr>
</table>

Table 3.2-4: Security issues encountered

Definition and explanation	Percentage of respondents who encountered at least one of the following security problems while on-line: computer virus, fraudulent use of credit card number, unsolicited E-mail (spam) or 'other'. $PI = \frac{\text{Internet users encountering a security problem using the Internet}}{\text{All internet ussers}} * 100$ PI Fraction of citizens who encountered at least one problem accessing the Internet Value range: 0 ≤ PI ≤ 100			
Importance and value added	This indicator (form November 2002) is important because it gives a snapshot of the problems citizens encounter on the internet. The SIBIS indicator on security breaches in European organisations and this one can be seen as complementary. This indicator measures citizens' experiences while the SIBIS indicator "Security breaches occurred in the organisation" (Table 3.2-1) focuses on businesses.			
Sources of data	Flash Eurobarometer 135			
Countries and time intervals covered	EU 15 Countries			
Question wording	While using the Internet, have you ever encountered security problems such as: [Multiple answers possible] (a) A computer virus (b) Fraudulent use of your credit card number (c) Unsolicited E-mail (spamming) (d) (Other security problems: …) (e) (Never experienced Internet security problems) (f) (Don't Know /Not applicable)			
Discussion	The indicator is based on a general population survey which covered 30,292 citizens of the European Union (approximately 2,000 per Member State). As in SIBIS, the sample was polled through telephone-assisted interviews.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2.5	3	2.66

Table 3.2-5: Source of information on occurred breaches – loss of data

Definition and explanation	Percentage of establishments having suffered security breaches, which were made aware of these breaches by damage or loss of data of all establishments suffering breaches $SIB_{ld} = \frac{\text{Establishments having suffered breaches made aware by loss of data}}{\text{All establishments having suffered breaches}} * 100$ SIB_{ld} Fraction of establishments having suffered breaches reporting they were made aware of it by damage or loss of data Value range $0 \leq SIB_{ld} \leq 100$
Importance and value added	This indicator is complementary to 'Threats to on-line security'. It shows who actually gave the information on occurred breaches, as opposed to organisations' perceptions as on where breaches originate.
Sources of data	SIBIS DMS
Countries and time	FIN, F, D, EL, I, E, UK for 2002

intervals covered				
Question wording	How have you learned about these breaches, in most cases? Were you … [item] [INT.: READ OUT, CODE ALL THAT APPLY] (1) Alerted by a customer/supplier (2) Alerted by employees or did you notice yourself (3) Notified by your own information security system (4) Made aware by damage or loss of data (5) Alerted by the providers of outsourced security services (6) In another way (DO NOT READ) (7) Don't Know			
Discussion	Damage or loss of data is the least frequent source of information of occurred breaches in organisations in the 7 surveyed EU countries. This suggests that more often than not, security incidents are detected before they can trigger serious effects. Hence, if the loss of data increases as a source of information on occurred breaches, this can be considered as a negative trend. For this reason it has been considered as one of the two 'main' indicators measuring the source of information on occurred breaches. However, caution is necessary and a cross-comparison with the actual incidence of breaches is always needed. Only establishments that suffered breaches were asked this question and multiple answers were admitted.			
Supplementary indicators	- Percentage of establishments having suffered breaches, which were made aware of these breaches by being alerted by a customer or a supplier of all establishments suffering breaches - Percentage of establishments having suffered breaches, which were made aware of these breaches by being alerted by employees or noticed themselves of all establishments suffering breaches - Percentage of establishments having suffered breaches, which were made aware of these breaches by outsourced security services of all establishments suffering breaches.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1.66	1.25	2	1.33

Table 3.2-6: Source of Information on occurred breaches – notified by their own information security system

Definition and explanation	Percentage of establishments having suffered security breaches, which were made aware of these breaches by notification from their own information security system of all establishments suffering breaches. $SIB_{nis} = \frac{\text{Establishments having suffered breaches made aware by their own information security system}}{\text{All establishments having suffered breaches}}$ SIB_{nis} Fraction of establishments having suffered breaches reporting they were made aware of it by notification from their own information security system Value range $0 \leq SIB_{nis} \leq 100$
Importance and value added	This indicator is complementary to 'Threats to on-line security'. It shows who actually gave the information on occurred breaches, as opposed to organisations' perceptions as on where breaches originate.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	How have you learned about these breaches, in most cases? Were you…[item]

	[READ OUT, CODE ALL THAT APPLY] (a) Alerted by a customer/supplier (b) Alerted by employees or did you notice yourself (c) Notified by your own information security system (d) Made aware by damage or loss of data (e) Alerted by the providers of outsourced security services (f) In another way (DO NOT READ) (g) Don't Know
Discussion	Apparently, the more organisations are alerted of breaches by their own information security system, the better their system works. An increase in this indicator could then be seen as a positive effect. However, caution is necessary and a cross-comparison with the actual incidence of breaches is always needed, to avoid interpreting increased notifications given by information security systems as a sheer effect of an increase in the occurrence of breaches. Only establishments that suffered breaches were asked this question and multiple answers were admitted.
Supplementary indicators	- Percentage of establishments having suffered breaches, which were made aware of these breaches by being alerted by a customer or a supplier of all establishments suffering breaches - Percentage of establishments having suffered breaches, which were made aware of these breaches by being alerted by employees or noticed themselves of all establishments suffering breaches - Percentage of establishments having suffered breaches, which were made aware of these breaches by outsourced security services of all establishments suffering breaches.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1.66	1.25	2	1.33

Prevention of on-line malicious activities and downtime

Table 3.2-7: Presence of information security policies

Definition and explanation	Percentage of establishments with on-line presence which have an information security policy, of all establishments present on-line. $\text{PISP} = \frac{\text{Establishments having an information security policy}}{\text{All establishments present on-line}} * 100$ Value range: 0 ≤ PISP ≤ 100
Importance and value added	It is important to know whether (and how) businesses protect themselves against attacks to their information networks. It is also relevant to know if the organisation adopts a 'formal' information security policy (i.e. stated as a company's official policy). In fact, the protection of the organisations' information is also a key ingredient to obtaining customers' trust and limiting citizens' concerns over privacy and confidentiality, which in turn is crucial for the development of e-Commerce. Before SIBIS no EU-specific indicator on this issue was available.
Sources of data	SIBIS DMS
Countries and time intervals covered	FIN, F, D, EL, I, E and UK for 2002
Question wording	Does your establishment have an information security policy? Answers: (a) Yes

	(b) No (c) Don't Know			
Discussion	This is a Decision Makers' indicator. It would be interesting to actually compare how/if the presence of information security policies in organisations affects citizens' perceptions and concerns as well as their ultimate choice to buy on-line. Other indicators, such as Global security survey's indicators on IT investments, deal, on a larger scale than an EU scale, with the economic efforts taken by organisations in assuring their information security.			
Supplementary indicators	Percentage of establishments with a formal information security policy of all establishments having an information security policy			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2.66	2.5	3	1.33

Table 3.2-8: Barriers to information security

Definition and explanation	Percentage of establishments that consider at least one factor among high costs, lack of staff training, lack of staff time, complexity of the technology or lack of employee co-operation, as a ('very important') barrier to an effective information security in the organisations of all establishments present on-line. $BIS = \frac{\text{Estabishments facing strong barriers to their information security}}{\text{All establishments present on-line}} * 100$ Value range: $0 \leq BIS \leq 100$
Importance and value added	To have an effective information security policy it is also crucial to know which are the barriers which may render its implementation difficult or even prevent it from being implemented. Indicators on barriers to information security on a European level are missing.
Sources of data	SIBIS
Countries and time intervals covered	FIN, F, D, EL, I, E, UK for 2002
Question wording	How important are the following factors as barriers to effective information security inside your establishment? How about ...[item]: Is this factor as a barrier to effective information security inside your establishment... [INT.: READ OUT ANSWER CATEGORIES. ONE ANSWER PER ITEM.] (a) High costs for security measures (b) Lack of staff training (c) Lack of staff time (d) Complexity of the technology (e) Lack of employee co-operation For each: - Very important - Fairly important - Not important - Don't Know
Discussion	This indicator is complementary to the indicator measuring the presence of information security policies (Table 3.2-7). In fact, knowing whether or not a business has an information security policy is important, but equally important is to be aware of the elements (here: barriers) that impede or make difficult for establishments to effectively implement such a policy. For this indicator, the question was asked to all establishments with on-line presence, regardless

	whether they had an information security policy or not. However, it would be of interest to study specifically those establishments who declared not to have an information security policy, or those establishments who declared not to have a formal information security policy. Such an approach, if performed on a large sample, could give stronger information on the reasons for not adopting an information security policy rather than highlighting generic difficulties which, at times, are overcome (as is the case for this specific indicator).			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2.16	1.5	2	1.33

Table 3.2-9: Tools for information security

Definition and explanation	Percentage of establishments that adopt at least one of the following tools for information security : control access to the computer system, cryptography/data encryption, vulnerability/ assessment tools, firewalls, security training and awareness raising activities, intrusion detection systems, end user training classes; of all establishments present on-line. $TIS = \frac{\text{Establishments adopting a specific tool for information security}}{\text{All establishments present on-line}} * 100$ Value range: 0 ≤TIS ≤ 100			
Importance and value added	Knowing the tools used for information security is important because it is useful to assess the most effective ones. This indicator is most useful if compared with the number and sorts of security breaches suffered,			
Sources of data	SIBIS DMS			
Countries and time intervals covered	FIN, F, D, EL, I, E, UK for 2002			
Question wording	Which of the following tools do you use for information security in your establishment? Do you make use of ... [item] INT.: ONE ANSWER PER ITEM. • Control of access to the computer system • Cryptography/ data encryption • Vulnerability Assessment Tools • Firewalls • Security Training and Awareness Raising Activities • Intrusion Detection Systems • End-user Security Training Classes FOR EACH: - Yes - No - Don't Know			
Discussion	A cross-tabulation with the occurrence of breaches (or even of specific breaches) would be useful, since it would give and idea on the actual value of using one of these tools for information security. The SIBIS question addressed all establishments present on-line. The size of the establishment should be not taken into account though a weighting procedure, in order to avoid an over-representation of SMEs. This weighting was done in SIBIS.			
Supplementary indicators	Eurobarometer: Security Systems used			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2.16	1.5	2	1.33

Table 3.2-10: Secure servers per capita

Definition and explanation	This indicator, produced by the American company Netcraft through a search of the Web, published by the OECD, measures the number of secure servers (Secure Socket Layer, SSL survey) per 100,000 inhabitants. $\frac{\text{Secure servers}}{\text{Population}} * 100'000$ Value range: Secure servers per capita ≥ 0			
Importance and value added	The indicator provides a good indication of the importance of devising an information security infrastructure to support e-Commerce or e-Government applications. The use of secure servers also indicates the commitment of organisations to comply with specific information security and privacy regulations since secure servers usually enhance SSL protocols and allow security and privacy in the transfer of both personal and financial data.			
Sources of data	Netcraft (www.netcraft.com), OECD Communications Outlook 2001			
Countries and time intervals covered	OECD countries, 2000			
Question wording	This indicator was collected through an Internet based survey			
Discussion	This is an indicator which favours countries with smaller populations, since a few secure servers can enable a country's infrastructure for e-Commerce even if the density of web sites actually selling on-line is not necessarily high. The SSL protocol developed by Netscape is most commonly used to provide a secure end-to-end link for e-Commerce transactions. This is a key feature for web sites offering e-Commerce services and one of the few indicators of a country's infrastructure readiness to support e-Commerce implementation. Data report the diffusion of secure servers enabled with third-party certification.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2.66	1	0	1.66

Attitudes towards security issues

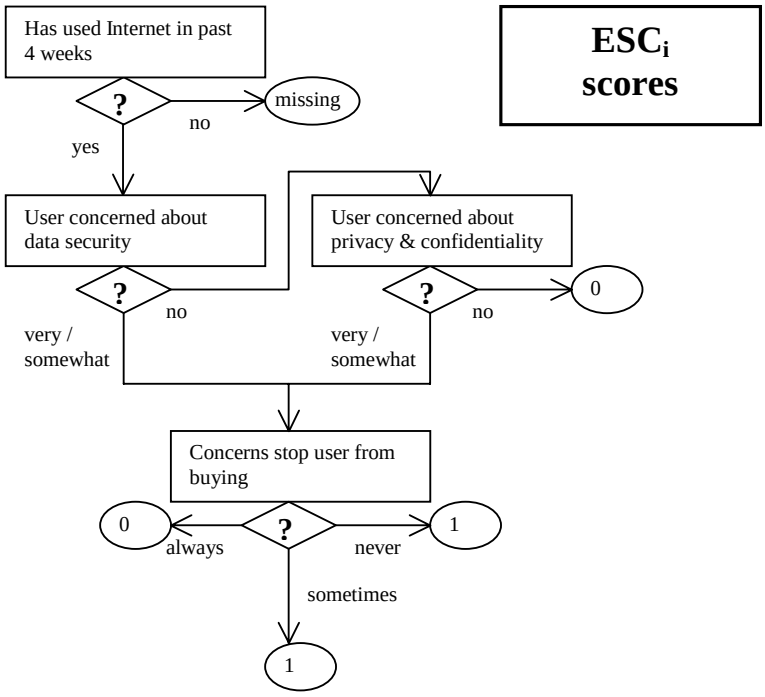
Table 3.2-11: Awareness of security features of Websites

Definition and explanation	Percentage Internet users who are often aware of security features of websites of all Internet users that have used the Internet recently to order a product or conduct on-line banking. $\text{AoSF} = \frac{\text{Customers very aware of on-line security features}}{\text{All customers}} * 100$ Value range: 0 ≤ AoSF ≤ 100
Importance and value added	This indicator measures citizens' awareness of security features of websites while buying or banking on-line. This indicator is of utmost importance because it can be considered as a complement to indicators on citizens' privacy and data security concerns. Although people might be deterred from buying on-line because of their concerns, security features of websites such as the deployment of virus protection software might be a way to redress these concerns. Hence, it is crucial to know whether people are aware of these security features.
Sources of data	SIBIS GPS

Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003			
Question wording	How often are you aware of security features of websites when you use the Internet to buy on-line: often, sometimes or never? Answers: - Often - Sometimes - Never - Don't Know			
Discussion	The question was addressed only to those citizens who declared to buy or bank on-line. An important indicator, which supplements the current one, is the 'importance' of security features of websites. 'Importance of security features of websites' measures whether on-line shoppers and bankers take security feature of websites into account when they purchase on-line. Hence, it goes beyond the awareness of security features. Yet, also for this indicator ('importance of security features of websites') the respondents were all persons who regularly buy or bank on-line.			
Supplementary indicators	Percentage Internet users who often consider security features of websites as important of all Internet users that have used the Internet recently to order a product or conduct on-line banking			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2	2.5	2

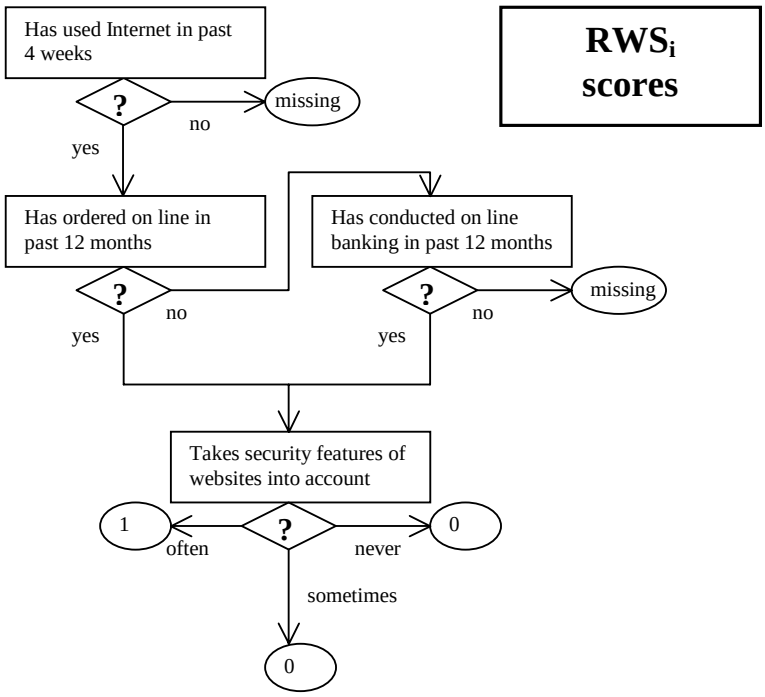
Table 3.2-12: Effects of security concerns on e-Commerce

Definition and explanation	Internet users who are often prevented from buying goods or services on-line because of their security or privacy concerns of all regular Internet users $\overline{ESC} = \frac{\sum_{1}^{I} ESC_i}{\text{All Internet users}}$ ESC_i Effects of security concerns: Internet users prevented from buying goods or services on-line because of their security or privacy concerns $\overline{ESC}$ Percentage of Internet users prevented from buying goods or services on-line because of their security or privacy concerns of all Internet users

	 Value range: $0 \leq \overline{ESC} \leq 100$
Importance and value added	E-Commerce is one of the main effects of the developments of the information society, as well as one of the key opportunities. Hence, it is vital that the potentialities it has and possible advantages it entails are not hindered by citizens' concerns over security or privacy. Measuring the effects of security concerns on e-Commerce in Europe gives a clear picture of the current unresolved divides (mainly a north-south divide) which to this day characterise Europe.
Sources of data	SIBIS
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	Are these [security or privacy] concerns stopping you from using the Internet to buy goods or services on-line: often, sometimes, or never? Answers: - Often - Sometimes - Never - Don't Know
Discussion	Although the question addressed only persons who were very or rather concerned about on-line security and privacy, under scrutiny this choice appeared inadequate. For this reason the denominator has been changed with a more reasonable one (i.e. all regular Internet users). In SIBIS we chose to nest the question as described above. None the less, it can be assumed that who is not concerned is also not stopped from his or her (non-existing) concerns. Hence, using all regular Internet users as a base is likely to give a more realistic picture. The choice of combining the "never" and "sometimes" categories is determined by the desire to have a positive goal orientation for the indicator ("the higher the better") and at the same time provide an acceptable variation between countries. Whilst the indicator is useful in highlighting general user security concerns, it does not, even with elaboration of supplementary indicators, pinpoint marginalized users. Therefore as a standalone indicator it has limited utility for policy makers. Combining the indicator with other technically orientated indicators may enable

	more useful insights into security concerns across profiles of users/social groups etc. SIBIS elaborations identify that out that of the "over-cautious" users, it is not possible to identify them by age, sex or professional status (even if younger users do tend to be less worried). More sophisticated analyses are probably needed to find out their identifying characteristics and solve their problems. It is possible in fact that the simple improvement of web sites security features may not be sufficient, without specific communication and marketing campaigns. Useful input could probably come from marketing research and understanding of cultural specificities accumulated in the financial sector for payment instruments such as credit cards.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	0	2

Table 3.2-13: Relevance of web security features in e-Commerce

Definition and explanation	Internet users taking often or sometimes the security features of web sites into account when deciding about whether to buy on-line as a percentage of all Internet users who have ordered products or services on-line or have undertaken on-line banking $\frac{\text{No resp. taking security features into account}}{\text{Respondents order product/service/conduct online banking}} * 100$  Value range: 0 – 100
Importance and value added	Respondents who have ordered products or services on-line or have undertaken on-line banking were asked whether security features of web sites influenced their purchase decisions. This is an important indicator and illustrates underlying security concerns, since respondents by definition have already carried out commercial transactions on-line; this answer seems to point out that security features are taken in due consideration by experienced users.

Sources of data	SIBIS GPS			
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003			
Question wording	How often do you take security features of websites into account when deciding about whether to buy on-line?			
Discussion	It is interesting to notice that within the SIBIS results the US shows the highest percentage of respondents taking into account security features before a transaction, and at the same time one of the lowest percentages of respondents allowing security concerns to prevent them from buying (see the indicator discussed above). A possible interpretation is that in countries more familiar with e-Commerce security is a practical problem (this may require an assessment by a user, for example, a check if the web sites has the right features, if so then proceed) while in others there is still a fundamental distrust of the virtual market which is expressed in terms of security concerns.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2.66	1	0	2

Table 3.2-14: Reporting of on-line violations

Definition and explanation	Percentage of regular Internet users who would 'always' report violations of their on-line security, privacy and confidentiality to a third independent party, for example a public agency created for this task. $ROV = \frac{\text{Regular Internet users always reporting on-line violations}}{\text{All regular Internet users}} * 100$ Value range: $0 \leq ROV \leq 100$
Importance and value added	Reporting of violations is crucial for policy makers and law enforcement tackle cyber crime. It is, thus, extremely important to measure to what extent Europeans are willing to report undergone violations.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	Would you report violations of your on-line security, privacy and confidentiality to a third independent party, for example a public agency created for this task? [INTERVIEWER: Read out answer categories] Answers: - Yes, very likely - Maybe - No - Don't Know
Discussion	The question was asked only to regular Internet users (who went on-line at least once in the four weeks previous to the SIBIS survey). The propensity to report is rather high, but might have been lower had a larger base been chosen (for example regular and occasional Internet users). The supplementary indicator measures what impact the option of reporting violations anonymously would have. Although this information is interesting, it must be said that the question relative to this indicator addressed all regular Internet users who answered that they would (be very likely and likely to) report, as well as those who would not report, but excluded all those regular Internet users who answered 'I don't know' when asked whether they would be willing to report on-line violations to a third independent

	party. Additionally, the pilot showed that the possibility to remain anonymous when reporting would have no significant impact.			
Supplementary indicators	*Anonymous reporting of on-line violations*: percentage of regular Internet users who would feel facilitated in reporting on-line violations to a third independent party under assurance of anonymity, of all regular Internet users who would *or would not* report on-line violations to a third independent party			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2.66	1.75	2.5	2

3.2.2 Perceptions as possible access barriers

Introduction

Widespread inclusion in the IS (Information Society) is possible only under conditions of information and network security, which are necessary to foster trust in electronic commerce and e-Government services. As innovative business models are being developed to exploit the positive functionalities provided by these new global communication and information media, concerns about the security and privacy of information infrastructures and services may inhibit their full take-up. Such concerns may hamper users' trust towards these new information and communication instruments [26], [32], [171], [263], [218].

It is citizens who are key stakeholders of the European IS and the subjects of e-Inclusion . Because they are often at the receiving end of public and commercial on-line services and tools, it is necessary to assess their perceptions concerning on-line security and trust, and access barriers. Individual concerns about privacy, security, and the use of information about their preferences and activities are important barriers to the formation of an effective and broad-based IS. For example, it is acknowledged that a lack of trust and confidence in services provided electronically is a significant obstacle to the development of e-Government [264], [265]; moreover, as seen in section 3.2.1, electronic commerce is often inhibited by security and privacy concerns. Also the eEurope 2005 Action Plan stresses the importance of on-line security and trust for IS developments [105]. If individuals are suspicious, and, therefore, reluctant to send the identifying or financial information required to complete transactions over the Internet, the fraction of commercial and societal activities that can benefit from transition to the electronic medium will be significantly restricted. Hence, the inclusion of all in the information society strongly depends on people's perceptions of the 'cyber-world'. Moreover, one can argue that the impacts of individual concerns about on-line security and privacy on e-Commerce or e-Government might strengthen the negative implications of other problems such as limited ICT access availability.

This section proposes indicators on perceptions as possible access barriers, differentiating between two groups of indicators, namely those measuring 'concerns regarding security and privacy' and those measuring precisely respondents' perceptions.

Concerns regarding data security and privacy on-line can have a strong impact on the developments of e-Commerce, they can also be symptomatic of people's trust towards on-line environments. Although the development of a single indicator measuring 'trust' has been dismissed because of the multidimensional nature of trust (See SIBIS WP 2.2 for 'Security and Trust' on the SIBIS Website), indicators measuring individual perceptions of security and privacy over the net, or the amount of personal information requested by a website, are significant because indirectly connected to the development of trust in the on-line world. Clearly, concerns about privacy and data security and perceptions of the security and accessibility of a website have implications on citizens' usage of the site. A recent survey by Consumer International, for example, suggests a set of criteria to define 'credibility' of a website and tries to measure 'whether the site provides information that enables the user to make an informed judgement about its value' [45]. Assuming that the integrity of web-content

information is crucial for the promotion of trust in on-line information services, measuring the former is an indirect way to measure 'trust'.

Access barriers are elements which can impede individuals' participation in the IS. However, measuring the relevance and effect of these barriers is extremely hard, because they are primarily perceived as such by the individual alone. Indicators on 'access barriers' presented in this section focus on the perceptions about website accessibility of non-regular Internet users and non-users. Some might consider their lack of skills as the chief impediment to access the net; others will perceive access costs as a burden too high to overcome; others still, might deem the low usability of Websites or the simple fact that 'the Internet is not for me' as a reason for remaining excluded. All these cases have been tested by SIBIS and are presented here, together with a synthetic indicator on Internet access barriers.

Most indicators of this section were developed within the SIBIS project (7 out of 8). The SIBIS indicators presented here, with the exception of the most recent one, have been analysed in depth in other SIBIS products, in particular the Topic Reports (WP5.1) and the final Summary Reports (WP5.2), for the topics of Security and Trust and Social Inclusion (these reports are available on-line at http://www.sibis-eu.org/sibis).

Besides SIBIS, some new indicators dealing with information security and cyber crime have recently been developed, although it is still hard to find EU focused material. For example the 2002 survey carried out by Consumers International on 'Credibility on the Web' [45] defines measurable criteria of 'credibility'. While not suggesting a proper measurement of 'credibility', the individual criteria were tested through apposite questionnaires. These criteria include provision of contact information, site ownership (independently owned, owned by another organisation etc.), claims about the quality of the service etc. If we assume that the integrity web-content information is essential to foster trust and security towards on-line information services, this report indirectly measures this.

The study on 'security and trust' in the information society began with the argument that the specific issue of 'trust' was not suitable for benchmarking. In other words, it did not appear possible to measure 'trust' as such as this is a subjective perception on the part of the user. Hence, trust is naturally multidimensional, which in turn prevents us from quantifying it. Although it is legitimate to assume that information security issues and individual perceptions of access are correlated to the 'trust' individuals feel towards on-line environments, this assumption does not necessarily entail a cause-effect relationship.

As a consequence, SIBIS has neglected any attempt to measure 'trust', identifying and piloting the indicators most relevant to information security and users' perceptions of access barriers instead. Despite having pinpointed and piloted the key indicators for these areas, more issues have been identified, but within the limitations of the project it was not possible to explore them all in depth. With reference to this section ('perceptions of possible access barriers'), additional work is needed especially in trying to correlate SIBIS data with cyber crime statistics, because of the strong impact they can have on individual concerns about privacy and data security. However, this requires that both public and private organisations develop a framework through which they can exchange information as well as data and statistics related to network security.

Concerns regarding security and privacy

Table 3.2-15: Concerns regarding on-line security

Definition and explanation	Percentage of regular Internet users very concerned about data security. $DSC = \frac{\text{Regular Internet users very concerned about data security}}{\text{All regular Internet users}} * 100$ DSC Proportion of regular Internet users concerned about data security on-line Value range: 0 ≤ DSC ≤ 100			
Importance and value added	This indicator is important because people's concerns over data security can sharply affect the information society's developments. Persons who are concerned about using the Internet can withdraw from a number of on-line services, ranging from electronic commerce to e-Government. Hence, in order to ensure wide participation in the information society, policy-makers need to know whether and how concerned their citizens are when going on-line.			
Sources of data	SIBIS GPS			
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003			
Question wording	N/A			
Discussion	This question addressed only regular Internet users (i.e. those who went on-line at least once during the four weeks previous to the survey). The indicator does not cover citizens' on-line 'experience', but their perceptions. Because only regular Internet users were addressed, it is impossible to make speculations about perceptions of occasional users or non-users. However, this would be interesting, since negative perceptions about the Internet and data security might stop people from going on-line. A related indicator measured the effect of these concerns on buying or banking on-line.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1.75	2.5	2.5

Table 3.2-16: Concerns regarding on-line privacy

Definition and explanation	Percentage of regular Internet users very concerned about privacy $PC = \frac{\text{Regular Internet users very concerned about privacy}}{\text{All regular Internet users}} * 100$ PC Proportion of regular Internet users concerned about privacy on-line Value range: 0 ≤ PC ≤ 100
Importance and value added	This indicator is important because people's concerns over privacy can sharply affect information society developments. Persons who are concerned about using the Internet can withdraw from a number of on-line services, ranging from electronic commerce to e-Government. Hence, in order to ensure wide participation in the information society, policy-makers need to know whether and how concerned their citizens are when going on-line.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	N/A

Discussion	This question addressed only regular Internet users (i.e. those who went on-line at least once during the four weeks previous to the survey). The indicator does not cover citizens' on-line 'experience', but their perceptions. Because only regular Internet users were addressed, it is impossible to draw conclusions about perceptions of occasional users or non-users. However, this would be interesting, since negative perceptions about privacy over Internet might stop people from going on-line. SIBIS analysis also showed that people feel more concerned about privacy than data security. A related indicator measured the effect of these concerns on buying or banking on-line. In addition, Consumers International developed indicators which try to assess the 'credibility' of a website [45]. While 'credibility' is not measurable per se, the study identified a number of measurable criteria, which could have an impact on individuals' perceptions as on how credible a site actually is. For example indicators measuring whether: • Personal information is requested by the site, • The site states its commercial interests • Advertising is present on the site • The site provides the source or reference for all information or advice given • The site provides information about its market coverage			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1.75	2.5	2.5

Perceptions as access barriers

Table 3.2-17: Perceived lack of skills as a potential barrier to Internet use

Definition and explanation	Skill access barrier (SAB) denotes the share of Internet slow and late adopters for whom the lack of skills is a potential access barrier. In SIBIS this indicator is conceptualised as the share of non users and non regular users of the Internet who perceive that advanced level of skills is necessary for using the Internet. $$SAB = \frac{SLAasn}{PSLA} * 100$$ SLA Slow and late adopters, conceptualised as non users and non regular (i.e. users in last 12 month but not in last four weeks) SLAasn Slow and late adopters perceiving advanced skills being necessary for accessing and using the Internet. PSLA Population of slow and late adopters Value range: $0 \leq SAB \leq 100$ Note: Those perceiving advanced skills being needed are those that agree completely and those that agree to some extent.
Importance and value added	The indicator is a proxy for the perceived lack of skills amongst those who do not use the Internet or do not use it on a regular basis. The skill issue, i.e. the lack of thereof, has been identified as one of extremely relevant barriers to a wider uptake of the Internet amongst relatively disadvantaged groups within a society [272][164].
Sources of data	SIBIS GPS, based on previous research
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	"Now I will read out a list of statements about the internet. Please tell me for each statement whether you agree completely, agree somewhat or do not agree. The

	internet …requires advanced computer skills." Answer categories: 1) agree completely; 2) agree somewhat; 3) do not agree 4) DK			
Discussion	The findings from SIBIS suggest this is one of the most relevant barriers to participation in the Information Society via its most popular medium – the Internet.			
Supplementary indicators	• Difference between non- users and occasional users with regard to the advanced skill requirement • Differences by socio-economic background variables			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	2	2	1

Table 3.2-18: Perceptions regarding lack of ease of access regarding the Internet

Definition and explanation	Ease of access barrier (EAB) denotes the share of Internet slow and late adoptors for whom access appears hindered. In SIBIS this indicator is conceptualised as the share of non users and non regular users of the Internet who perceive that the Interent is not easy enough to get access to. $EAB = \frac{SLAane}{PSLA} * 100$ SLA Slow and late adopters, conceptualised as non users and non regular (i.e. users in last 12 month but not in last four weeks) SLAane Slow and late adopters perceiving access not easy enough. PSLA Population of slow and late adopters Value range: $0 \leq EAB \leq 100$ Note: Those perceiving advanced access hindered / not easy enough are those that agree completely and those that agree to some extent.
Importance and value added	Indicator is based on individual perceptions regarding the ease of obtaining access to the Internet. This indicator can be used to ascertain additional Internet access barriers, since once accessing the Internet is perceived as not sufficiently easy and straight forward, many potential users and participates in the Information Society via its most popular medium can be unduly left out.
Sources of data	SIBIS GPS, based on previous research
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	Now I will read out a list of statements about the internet. Please tell me for each statement whether you agree completely, agree somewhat or do not agree. The internet …is not easy enough to get access to. Answer categories: 1) agree completely; 2) agree somewhat; 3) do not agree 4) DK
Discussion	Access to the Internet can be hindered by a number of factors – e.g. insufficient service provision Internet service providers, insufficient number of access possibilities (at work, at home, at a community level) but can also reflect insufficient level of awareness among segments of general population who have not embraced the Internet at all and / or have not integrated it into their lives.
Supplementary	• Difference between non- users and occasional users with regard to the ease of access

indicators	perceptions. • Differences by socio-economic background variables			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	2	2	1

Table 3.2-19: Perception regarding efficiency of the Internet – the time aspect

Definition and explanation	Time consuming aspect of access barrier (TAB) denotes the share of Internet slow and late adopters for whom the Internet appears as not sufficiently efficient a tool in terms of time perceived to be required. In SIBIS this indicator is conceptualised as the share of non users and non regular users of the Internet who perceive that the Internet too time consuming, yielding the share of non regular and non users of the Internet considering it to be too time consuming. $TAB = \frac{SLAttc}{PSLA} * 100$ SLA Slow and late adopters, conceptualised as non users and non regular (i.e. users in last 12 month but not in last four weeks) SLAattc Slow and late adopters perceiving the Internet as too time consuming PSLA Population of slow and late adopters Value range: $0 \leq TAB \leq 100$ Note: Those perceiving the Internet as too time consuming are those that agree completely and those that agree to some extent.			
Importance and value added	Efficiency of using the Internet can be hindered by a number of factors – e.g. insufficient service provision Internet service providers, insufficient level of skills, and insufficiency of the technical aspects of access modes in relation to use requirements. However, all reflect the level of perceived return regarding the amount of time 'invested'.			
Sources of data	SIBIS GPS, based on previous research			
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003			
Question wording	Now I will read out a list of statements about the internet. Please tell me for each statement whether you agree completely, agree somewhat or do not agree. The Internet …is too time-consuming. Answer categories: 1) agree completely; 2) agree somewhat; 3) do not agree 4) DK			
Discussion	This indicator can be used to ascertain additional Internet access barriers, since if accessing and using the Internet is perceived as not sufficiently cost-beneficial in terms of time invested, this can be a significant barrier. Indirectly, the level of awareness regarding the Internet capabilities is also gauged by this indicator.			
Supplementary indicators	• Difference between non- users and occasional users with regard to the advanced skill requirement			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	2	1

Table 3.2-20: Perception regarding affordability of the Internet

Definition and explanation	Affordability as an access barrier (AAB) denotes the share of Internet slow and late adopters considering it to be too expensive. In SIBIS this indicator is conceptualised as the share of non users and non regular users of the Internet who perceive that the Internet too expensive. $AAB = \frac{SLAte}{PSLA} * 100$ SLA Slow and late adopters, conceptualised as non users and non regular (i.e. users in last 12 month but not in last four weeks) SLAte Slow and late adopters perceiving the Internet as too expensive PSLA Population of slow and late adopters Value range: $0 \leq AAB \leq 100$ Note: Those perceiving the Internet as too expensive are those that agree completely and those that agree to some extent.			
Importance and value added	The indicator is a close proxy for the lack of affordability the Internet home access amongst those who do not use the Internet or do not use it on a regular basis. Affordability issue, i.e. the lack of thereof, has been identified as one of relevant barriers to wider uptake of the Internet amongst relatively disadvantaged groups within a society. While the cost of the Internet access and use has been reducing in the EU, this issue is nevertheless still a relevant barrier for many less well off members of a society.			
Sources of data	SIBIS GPS, based on previous research			
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003			
Question wording	Now I will read out a list of statements about the internet. Please tell me for each statement whether you agree completely, agree somewhat or do not agree. The Internet …is too expensive to use. Answer categories: 1) agree completely; 2) agree somewhat; 3) do not agree 4) DK			
Discussion	This indicator can be used to ascertain additional Internet access barriers, since the lack of affordability is still a relevant issue. However, the findings from SIBIS suggest that other often less tangible barriers have become more relevant.			
Supplementary indicators	• Difference between non- users and occasional users with regard to access being too expensive • Affordability perceptions by socio-demographic variables			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	2	1

Table 3.2-21: Perceived lack of usefulness of the Internet as a barrier to access

Definition and explanation	The perceived lack of relevance of the Internet to individual needs as an access barrier (RAB). It denotes the share of Internet slow and late adoptors considering it to be lacking useful or interesting information. $RAB = \frac{SLAir}{PSLA} * 100$ SLA Slow and late adopters, conceptualised as non users and non regular (i.e. users in last 12 month but not in last four weeks)

	SLAte Slow and late adopters perceiving the Internet to be insufficiently relevant PSLA Population of slow and late adopters Value range: $0 \leq RAB \leq 100$ Note: Those perceiving the Internet as insufficiently relevant are those that agree completely and those that agree to some extent.
Importance and value added	This indicator considers the relevance of the Internet from the viewpoint of an individual. The relevance of socially useful on-line content notwithstanding, the individual perspective is very useful. The indicator does not distinguish between individual potential aspects of usefulness in terms of, for example, financial gain, reduction of effort, or entertainment.
Sources of data	SIBIS GPS, conceptually based on previous research (e.g. Eurobarometer)
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	Now I will read out a list of statements about the internet. Please tell me for each statement whether you agree completely, agree somewhat or do not agree. The Internet…lack useful or interesting information Answer categories : 1) agree completely; 2) agree somewhat; 3) do not agree 4) DK
Discussion	The indicator apparently confounds two concepts - usefulness of information thought to be available on-line and whether that information is / would be interesting for an individual. These concepts are sufficiently related tough to warrant their simultaneous use in one survey question. The issue that deserves some elaboration concerns the fact that the question is relatively demanding given that it is posed to non users and non regular users (and this issue is relevant to all access barrier questions above). As such, it inevitably to some extent deals with the individual perceptions regarding what information is available on the Internet. The issue of how these perceptions have been formed is not captured by this indicator, since it both relates to external factors (e.g. awareness, level of availability of good quality on-line content) as well as factors pertinent to each individual (e.g. preferences)
Supplementary indicators	None

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	2	1

Table 3.2-22: Psychosocial barriers to Internet use

Definition and explanation	The perceived individual psychosocial barriers as an access barrier (PSAB) to the Internet. In SIBIS it is conceptualised to denote the share of Internet slow and late adopters considering it to be something that is not for them. $$PSAB = \frac{SLAps}{PSLA} * 100$$ SLA Slow and late adopters, conceptualised as non users and non regular (i.e. users in last 12 month but not in last four weeks) SLAps Slow and late adopters perceiving the Internet as something not for them PSLA Population of slow and late adopters Value range: $0 \leq PSAB \leq 100$ Note: Those perceiving the Internet as something not for them are those that agree completely and those that agree to some extent.
Importance and value	The indicator captures barriers to going (and remaining) on-line that are not always

added	tangible and straightforward.
Sources of data	SIBIS GPS, based on previous research
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	Now I will read out a list of statements about the internet. Please tell me for each statement whether you agree completely, agree somewhat or do not agree. The Internet …is not something for me. Answer categories: 1) agree completely; 2) agree somewhat; 3) do not agree 4) DK
Discussion	Eliciting reasons for not using the Internet and not using it to a considerable degree is extremely difficult, especially in surveys. This indicator can be used to ascertain additional Internet access barriers, and it also covers an additional phenomenon of voluntary self-exclusion from the Information Society that can be traced to the concept of the 'revolt of elites' where more affluent groups of society choose to withdraw from the mainstream of society (e.g. see Anthony Giddens cited in [164]). While psychosocial barriers indeed include the concept of self-exclusion, the social and economic aspects of diffusion of the new technologies is nevertheless relevant, not least for impacting on the very process of formation of psycho social cognisance. Thus additional validation of this indicator confirmed the interaction with age, education terminal age and income levels. Hence the indicator is more relevant for capturing those who consider that the investment in gaining access to and using the internet is not sufficiently rewarding to justify their investment in time, resources, expenses as opposed to perceived benefits expected to accrue to them. Finally, and a corollary to all above, findings identifying relatively high rates in more advanced information societies suggest that there may well be limitations to the internet penetration and growth.
Supplementary indicators	• Difference between non- users and occasional users • Differences between various socio-economic groups • Voluntary self-exclusion from the Internet based on lifestyle choices – prevalence of

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	2	2	1

Table 3.2-23: Internet access barriers index

Definition and explanation	Access Barrier Index (ABI) is a composite measure summarising all potential barriers to the Internet that have been identified in the SIBIS GPS survey, as well as the intensity of perceptions regarding these barriers. (1) $IABI_p = \frac{\sum_1^J ABP_j}{J}$ (2) $CABI = \frac{\sum_1^{Psla} IABI_p}{Psla}$ ABP Access barriers perceptions (In SIBIS, the focus was on the following Internet barriers: skills, ease of access, time aspect, affordability, usefulness and psychosocial barriers) IABI Average access barriers index per individual p CABI Average access barrier index per country ω Weights 0 do not agree; 0.833 agree somewhat

	1.666 agree completely J Denotes access barriers j for which data was gathered in SIBIS (J = 6) PSLA Population of slow and late adopters Value range: $0 \leq ABI \leq 10$
Importance and value added	This composite measure combines all access / wider uptake barriers quantified individually. Although analysis of each single perceived/actual barrier is a rewarding exercise in itself, lack of Internet access is a complex concept best captured by a composite measure based on relevant variables. Hence the creation of an access barrier index (ABI), considered best suited for capturing individual perceptions regarding access to the Internet, but inherently at the same time, individual attitudes towards complex phenomena such as the Internet. The measure can be used for comparing groups and individuals, as well as countries.
Sources of data	SIBIS GPS, some comprising items are based on previous research
Countries and time intervals covered	EU member states, CH and the US for 2002, NAS for 2003
Question wording	Now I will read out a list of statements about the internet. Please tell me for each statement whether you agree completely, agree somewhat or do not agree. The internet: a) requires advanced computer skills b) is not easy enough to get access to c) is too time consuming d) is too expensive to use e) lacks useful and interesting information f) is not something for me.
Discussion	This indicator can be used to ascertain all relevant Internet access barriers. Although not all barriers are equally relevant for all individuals, 'default' weighting has been used in this index, with the answer categories of 'agree completely' receiving double weighting in relation to agree somewhat' categories. DK answers were excluded from analysis, and only individuals who answered all index items questions were included. While this approach might appear somewhat rigid and lead to some loss of information, it is considered best in terms of maintaining consistency. The issue of ability of respondents to provide answers is relevant for this indicator. Eliciting responses from non users is more demanding on them, since occasional users are arguably better positioned to provide answers. However, perceptions of non users are relevant since the way in which these are formed is extremely relevant for their future participation (or lack of it) in the Information Society. In terms of interpreting the indicator, those perceiving most barriers will score higher on the index (based on those who answered all 'barriers' questions listed above). This logical scoring was achieved by inverting original response categories, which was a straightforward task given that all variables were unidirectional.
Supplementary indicators	• Difference in score between non- users and occasional users • Difference in score by socio-economic background variables

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	2	1

3.2.3 Digital literacy, learning and training

Introduction

New technologies such as ICT, and the applications and production systems based on them, lead to requirements for new skills in order to develop, operate and maintain hardware and software and to make best use of their capabilities. Consequently, discussions around the Information Society have focussed on the need to reassess and, if necessary, revise the systems and activities with which skills and learning capabilities are provided and acquired.

There is widespread agreement that the introduction of ICTs as workplace technologies and into all types of everyday applications require users to apply a new set of basic skills, generally referred to as "digital literacy" or "digital literacy skills". In today's economic and technological environment, each society must implement the learning and training systems which are able to provide and support these basic skills (together with the more specialist skills of IT professionals and related occupations in applier industries) in the short as well as medium and long term. Statistical indicators are needed to support decision makers in this area. Indicators must cover the extent to which certain skills are existing in the current population; the development of skill profiles in time; the extent and development of demand for skills by industry as well as non-commercial organisations; the extent and nature of any existing mismatches between demand and supply of skills in a given population; the systems of education and training which supply certain skills; informal ways of skill acquisition; relationship between skill stocks and economic outcomes in particular as well as social outcomes in general; and so forth.

This section of the handbook deals with indicators on learning and training that take place *after* the (more or less continuous) pre-Work phase of mostly full-time education (usually consisting of nursery, primary and secondary school, and maybe vocational training, graduate school or university, etc.) has been completed. The focus is therefore on "lifelong learning" activities that help adult learners to refresh or improve their job-related skills throughout their working life, or to prepare for new careers in different areas of the job market. The topic area is also limited to include only ICT-related learning/training activities and their outcomes, which means either learning/training that has ICT as the subject; or learning/training that uses (on-line) ICTs as a tool for acquiring skills.

With regard to the *types of skills* considered, SIBIS has not dealt with professional ICT skills since indicators on these – together with curricula which meet the demands of present-day industry – are being developed currently in a number of projects with involvement of the European Commission [28] [103]. Rather, the focus of SIBIS in this area is on ICT skills of non ICT-professionals – certainly the much larger, but until now not sufficiently researched group of ICT users in the labour force.

For the purpose of identification and classification of existent indicators and indicators to be developed, SIBIS suggests to distinguish between acquisition of skills (in formal or less formal settings), provision of skills (i.e. the skill supply on the labour market) and skill requirements (i.e. the demand for skills on the labour market).

Acquisition of skills takes place either in the formal education system (mainly comprised of elementary and secondary schools as well as third level institutions such as universities), as non-formal learning/education (which includes further training measures provided by the state, mostly to the unemployed, as well as apprenticeship schemes and other certificated training schemes which often are provided by companies) or as informal learning, e.g. self-directed learning, "training on the job" etc. Of importance in this respect are also the *means* with which skills are acquired. Here, ICT-based training technologies (e-learning) may substitute or supplement traditional training methods. The provision of skills and mismatches between supply of skills on the labour market and the skill requirements of national economies have been at the centre of a public debate on the shortcomings of today's education systems. In particular, data on IT-skills in not directly ICT-related professions (non-specialist ICT skills of students) is scarce. This applies also to the population in general.

Basic indicators on students, teaching staff, graduates, expenditure etc. in the primary, secondary and tertiary level education systems of Member States originate from administrative data collections carried out by Member States and are harmonised by Eurostat in coordination with UNESCO and the OECD. These statistics do not suffice to reflect the Information Society-related changes which are the subject of current scientific debate and political interest. They are, in particular, insufficient to cover training and learning activities which occur outside the initial phase of continuous education. For this purpose, some data is available from the Community Labour Force Survey (LFS) which, for example,

is the source of the Structural Indicator on lifelong learning. Other important sources include the Vocational Education and Training Survey (VET, an administrative data collection), the Continuing Vocational Training Survey (CVTS, a survey of employers), the European Community Household Panel (ECHP) which surveys training activities undertaken by private persons.

All of these are long-established instruments which, although being revised regularly, offer limited flexibility when it comes to the inclusion of new issues and concepts, such as the use of ICTs for learning and training purposes. Both the LFS and the ECHP feature so-called "ad-hoc question modules" on selected themes which annually change and must be agreed upon years in advance by the National Statistical Institutes. In 2003, the LFS contains an ad-hoc module on lifelong learning. Such data is not readily suitable for time-series construction.

The European Commission and other main parties which rely upon up-to-date statistics have, for these reasons, tried to provide data by using more flexible instruments such as Eurobarometer Flash surveys and dedicated initiatives for decentralised data collection such as Eurydice [89]. Although their statistical reliability is debatable, these sources provide important testing ground for innovative indicators; SIBIS understands Eurobarometer as a first step towards the provision of continuous, highly relevant and high-quality data, and has made best use of this experience.

Of course, some individual Member States are much more advanced in their indicator development activities, as demonstrated by U.K.'s recent skill surveys at employers and the working population (see [142] [145]).

An important source for classifications and typologies on issues related to lifelong learning is the report of the Eurostat taskforce on measuring lifelong learning [126]. However, this research is marred by a lack of taking into account the costs of suggested statistical provisions, which makes them seem infeasible from a practical viewpoint.

The demand for research on indicators in this topic area is huge, which means that even considering the high number of ongoing indicator development activities, a lot of work still needs to be done. The most important areas for future research include:

- *International classifications of learning activities which include informal learning* – Classifications in this field must encompass the whole variety of existing training environments to be found in present-day reality. The shifts away from state-provided towards company- and self-provided training, and from full-time education towards continuous supplementary education, have not been adequately represented in available classifications and, as a consequence, also not reflected by indicators.
- *Intangible investments in training activities by companies* – this may "may provide the link for measuring return to investment in learning by enterprises" ([126]:14) which would be of high importance for supporting current policies in the area.
- *Stronger emphasis on measuring outcomes of learning activities rather than investments* – There is much evidence to suggest that the acquisition of ICT-related skills in many cases takes place outside of formal or non-formal training courses. Arguably, younger generations acquire most of their skills in using ICTs from every-day usage and learning-by-doing. The International Adult Literacy and Life Skills Survey (ALL), an extension of the International Adult Literacy Survey (IALS) suggested by Statistics Canada and currently being piloted, will be an important step in this direction [204].
- *ICT training in not ICT-related professions* – SIBIS has pointed out that there is scant acknowledgement in available indicators, especially those used for benchmarking (see e.g. [106]), of ICT training available for students in non-ICT courses of study. A survey specifically targeted at students may help out here.
- *Cross-country indicators on skill requirements* – Indicators in this area are still highly tailored to national statistical systems and data sources, and often make use of occupational classifications which are outdated and/or incompatible. An EU-wide survey on skill requirements seems all the more pressing since Europe is competing with other trade areas on the global market for scarce IT skills, whereas national markets for high-qualified personnel gradually lose relevance.

Skill acquisition

Table 3.2-24: Participation in ICT-related training

Definition and explanation	Persons who have participated in ICT-related training [taught learning] activities in the 12 months prior to the survey, as share of all persons in the labour force: $\frac{\text{Persons who participated in ICT-related training}}{\text{All persons in labour force}} * 100$ Value range: 0 – 100.
Value added and importance	The use of ICTs at the workplace means that workers are frequently being faced with the requirement to get accustomed with new hardware tools and, in particular, new or updated software applications. The great speed with which new technologies are being introduced in this area distinguishes ICTs from earlier workplace technologies. Moreover, ICTs have also changed work routines and continue to do so. All of this results in the need of frequent if not regular learning activities on the part of the employees (and, even more so, those seeking work) to avoid that skills become out of sync with technological developments. This indicator measures at country level to what extent training (i.e. taught learning) *which has ICTs as their subject* is carried out. Together with the indicator on self-learning (see Table 3.2-27) it intends to cover all ICT-related learning activities. Comparing country performance in regard to technical development and training activities might reveal mismatches of both. For this purpose internationally comparable indicators on training are needed which have not been available so far. For the time being we assume that the higher the ratio of ICT-related training, the better the country performance, as in all European countries the technological upgrading in connection with ICT at the workplace has been rapid in the past. However, in principle also too much training is possible – in economic terms a misallocation of resources to human capital instead of real capital.
Sources of data	SIBIS GPS piloted the basic module required for this indicator, without enquiring for the subject of the training activity (ICT-related or not). The same indicator (with very similar wording) will be incorporated in the Eurostat ICT Usage Household Survey from 2003 on.
Countries and time intervals covered	Not available yet (Basic module: EU Member States, CH and USA for 2002; NAS10 for 2003)
Question wording	• [IF IN EMPLOYMENT] Did you participate in some kind of training activities (e.g. a training course) that were provided either by your company or by an other organisation, in the last 12 months? • [IF UNEMPLOYED] Did you participate in some kind of training activities (e.g. a training course) that were provided either by a public institution or by an other organisation, in the last 12 months? • [BOTH, IF YES] Did some of this training have computers or computer applications as its subject? Alternatively (from ICT Usage Household Survey 2003 [131]: Have you taken any training courses (of ½ day or longer) on any aspect of computer use? Answer options: a) in the last 12 months b) more than one year ago c) No training courses taken.
Discussion	This indicator covers training provided by others, mostly in formal settings such as training courses or lectures, but not self-learning as this is not “provided” by anyone. The latter is captured by a different indicator (see Table 3.2-27). Using population survey-based data for this indicator means that it is left to the respondent to decide whether a training activity has computers as their subject, or

	not. For the future it has to be checked whether this will still be possible the more computer applications diffuse into everyday working and living environments. The indicator has the advantage of being equally applicable in all EU Member States. The data from the LFS on Lifelong Learning, on the other hand, is an example of a different method where data is captured by documenting all training activities the respondent has been involved in in the reference period, which allows for greater detail, but usually leads to non-formal and informal training activities being underreported. While Eurostat chooses a reference period of 4 weeks for the indicator on Lifelong Learning, we suggest to use 12 months as the reference for ICT-related learning since it can be assumed that in one year (but not four weeks) about every worker at a computer workplace will have been faced with new hardware or software applications for which training is to be recommended [141]. This makes an interpretation of the indicator value easier.			
Supplementary indicators	The indicator should if possible be supplemented by a question about the training organisation and by the delivery method (see [126]).			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	0	0	0 (2)[5]

Table 3.2-25: Participation of the unemployed in ICT-related training

Definition and explanation	Percentage of all unemployed persons who have participated in ICT-related training [taught learning] activities in the 12 months prior to the survey: $\frac{\text{Unemployed who participated in ICT-related training}}{\text{All unemployed persons}} * 100$ Value range: 0 – 100.			
Value added and importance	See Table 3.2-24. Because of the importance of measures to get the unemployed back into employment, a separate indicator looking only at ICT training for the unemployed is vindicated.			
Sources of data	Although the data could in principle be derived from the Eurostat ICT Usage Household Survey (from 2003 on), sample sizes per country will be too small to enable analysis for the group of unemployed persons only. This means that either the unemployed need to be over-sampled or that a different survey instrument needs to be deployed (e.g. LFS). The one-off European Survey on Employment Options for the Future presents an example of such a survey [10].			
Countries and time intervals covered	Not available yet (Basic module: EU Member States, CH and USA for 2002; NAS10 for 2003)			
Question wording	• Did you participate in some kind of training activities (e.g. a training course) that were provided either by a public institution or by another organisation, in the last 12 months? • [IF YES] Did some of this training have computers or computer applications as its subject? Alternatively (from ICT Usage Household Survey 2003 [131]): Have you taken any training courses (of ½ day or longer) on any aspect of computer use? Answer options: a) in the last 12 months b) more than one year ago c) No training courses taken.			
Discussion	See Table 3.2-24.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability

[5] Will become available after 2003 Eurostat ICT surveys have been carried out.

	3	0	0	0

Table 3.2-26: Intensity of ICT-related training

Definition and explanation	Average numbers of hours spent on ICT-related taught learning in the last 12 months by all persons which took part in ICT-related training in last 12 months $\frac{\text{Sum of all total hours spent on receiving ICT - training}}{\text{Number of persons who participat ed in ICT - training}}$ Value range: 0 – ~2500 A value of, e.g., 10 means that on average, persons who participated in ICT-related training spend a total amount of 10 hours on these activities in the last 12 months.			
Value added and importance	In addition to statistics about the number of persons involved in training, policy needs an indicator about the degree of training per head, as there can be assumed to be huge differences between employers who receive once a year a half-day training unit and other who have regular weekly training sessions. This indicator measures at country level how much time participants spend *on average* per year on ICT training measures, e.g. courses. We assume that the higher the average amount of ICT-related training, the better the country performance. However, this indicator needs to be interpreted together with the first indicator (see Table 3.2-24) since – taken on its own – a high value in this indicator does not say anything about the number of people involved in training.			
Sources of data	Not available yet. This indicator might be incorporated in the Eurostat ICT Usage Household Survey or a Lifelong Learning Survey.			
Countries and time intervals covered	Not available yet.			
Question wording	• How many hours/days/months have you spent on computer-related training activities in the last 12 months, altogether?			
Discussion	Problems with the indicator are related to the reliability of "time spent on education and training" as an indicator for training intensity. Drymoussis ([63] p. 9) states that "reservations may be expressed on whether the number of hours in training for all forms of training is a reliable measure of intensity." Other possible measures which could be used to check the benchmarking value of the indicator include (monetary) investments of private households for learning in general, and ICT-related learning in special. Calculation of the indicator in hours requires a common conversion rate between months, days and hours per country.			
Supplementary indicators	In order to combine this indicator with information on the share of workers involved in training, it might be advisable to construct a synthetic indicator including both measures. [Average duration of ICT-related training undertaken by employed adults, in hours per year and per person trained] * [rate of participation in ICT-related training in % of all employed].			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	0	0	0

Table 3.2-27: Participation in ICT-related self-learning

Definition and explanation	Share of persons who have engaged in ICT-related self-directed learning activities

	in the 12 months prior to the survey, as a share of all persons in employment: $\frac{\text{Persons in ICT-related self-learning}}{\text{All persons in employment}} * 100$ Value range: 0 – 100
Value added and importance	The shortening of skill life cycles has resulted in skill requirements not being in sync anymore with the traditional working life cycles of individuals. Workers can to a much smaller extent rely on being able to market the skills they have acquired in the early stages of their life throughout their lifetime. Rather, they have to constantly adapt them to the demands of their job, and the labour market. This applies, of course, especially to ICT-related skills In this context, self-directed learning activities are a key component of the concept of Lifelong Learning as it is being promoted by the European Commission. This indicator attempts to measure whether respondents have been engaged in self-learning in the reference period, with learning subjects being limited to computers and computer applications. We assume that the higher the share of workers involved in ICT-related self-directed learning, the better a country's workforce is prepared to adapt to changes in technological and techno-economic environments.
Sources of data	SIBIS GPS (only basic module). This indicator might be incorporated in the Eurostat ICT Usage Household Survey. However, see "Discussion".
Countries and time intervals covered	Not available yet (Basic module: EU Member States, CH and USA for 2002; NAS10 for 2003)
Question wording	• Did you engage is some kind of self-learning about computers or computer applications, in the last 12 months? [... • What was the field you learned about? [OPEN] *(optional, for plausibility checks)* • How many weeks, days or hours have you spent on this self-learning in the last 12 months – altogether?
Discussion	Even more than for training provided by others (see Table 3.2-24), self-directed learning tends to be elusive, which means that some self-directed learning might not be recognised as such, and therefore might not be reported in the context of a survey interview (e.g. "learning by doing" which might indeed be the most effective way to learn). If cultural settings in which self-directed learning takes place differ between countries, this is likely to have an effect on country comparisons. In-depth studies of learning activities, based on direct observation or time-use surveys, should be deployed to reveal the extent to which such differences exist between the Member States. From a conceptual point of view, it is difficult to distinguish learning activities from other human activities since all human behaviour results in the (mostly unconscious) acquisition of experience, i.e. learning. For this reason it appears logical to let respondents judge themselves whether an activity constituted learning, and whether this was related to computers. Alternatively, one would have to enquire further about the subject of learning activities, and then code these according to a predefined list of learning subjects which are considered to be computer-related. For the time being, results from this indicator should be treated with care. For note on reference period, see Table 3.2-24. Note: Piloting of the basic question resulted in comparatively high "DK" replies in Switzerland (5.6%). In the other countries, the share of DK was between 0% and 1.6%.
Supplementary indicators	• Participation of total labour force (including unemployed) who engage in ICT-

	related, self-directed learning • Participation of the unemployed in ICT-related, self-directed learning			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	0	0	0

Table 3.2-28: Lack of adequate supply as obstacle to participation in ICT training

Definition and explanation	Number of persons who state supply-related reasons for not being involved in ICT-related training or self-learning, as a share of all persons in employment who have not participated in ICT-related learning in the last 12 months. $\frac{\text{Persons w. supply - related reasons for not being involved in ICT training}}{\text{All persons who did not participate in ICT training}} * 100$ Value range: 0 – 100 A high value indicates that a large number of those in the labour force who have not participated in ICT training regard inadequate or lack of training offers as important obstacles.
Value added and importance	While increasing the participation of the workforce in lifelong learning is a key objective of a number of policies of the European Commission (see [82] [82]), the progress in this respect has been unsatisfactory [109]. Indicators on obstacles and barriers to participation in ICT and other training are therefore in high demand [126]. Data which allows country comparisons will enable EU and national policy-makers to identify how different regulatory regimes and business cultures impact on the willingness and/or possibility of workers to participate in lifelong learning in this important area. This indicator highlights deficiencies in the supply of training offers as opposed to other potential reasons which are demand-related (see reply options a, b, i) or related to a lack of information (g). We assume that the higher the share of respondents who cite supply-related reasons as an obstacle to participating in ICT-related self-learning in comparison to other possible barriers and to other countries, the stronger the need to better tailor training provision to the requirements and preferences of potential participants (policy-oriented indicator).
Sources of data	This indicator might be incorporated in a dedicated survey on learning and training as suggested by [126].
Countries and time intervals covered	Not piloted yet.
Question wording	[TO RESPONDENTS WHO HAVE NOT ENGAGED IN ICT-RELATED LEARNING (see Table 3.2-24 and Table 3.2-27) IN THE LAST 12 MONTHS] You said that you did not practise ICT-related learning in the last 12 months. How important were the following factors as reasons for not practising ICT-related learning? Scale 1-3 (very important – somewhat important – not important) (a) did not need computers at your workplace (b) did have all the computer knowledge required already (c) have not been offered adequate training (d) did not have the time (e) thought it would have been too expensive (f) did not find training offers attractive; (g) did not know enough about training offers available; (h) thought it would have been too much effort to reach training sites; (i) have regarded other things as more important
Discussion	Problems resulting from social desirability should be taken into account when

<table>
<tr><td></td><td colspan="4">interpreting the data from this indicator. The base might be extended to also include the unemployed. Answer categories may be modified as a result of pretesting.
As an alternative to choose only those persons who have not at all participated in ICT training in the reference period, one might choose to define a threshold of hours spent for training per year under which it can be assumed that the amount of training was negligible. In these cases the question wording could be changed to “You said that you did practise xxx hours of ICT-related learning in the last 12 months. How important were the following factors as reasons for not practising more ICT-related learning?”
As it is the case in general with questions that enquire about reasons for personal behaviour, It might be questioned whether respondents are able to give replies to this question which adequately reflect reality [251].
No data available for validation.</td></tr>
<tr><td>Supplementary indicators</td><td colspan="4">None</td></tr>
<tr><td rowspan="2">Evaluation results</td><td>Benchmarking Value</td><td>Validity</td><td>Reliability</td><td>Availability</td></tr>
<tr><td>2</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Table 3.2-29: Establishments providing ICT training

Definition and explanation	Share of establishments that provide ICT-related training to their staff, as a share of all establishments: $\frac{\text{Establishments providing ICT training to their staff}}{\text{All establishments}} * 100$ Value range: 0 – 100
Value added and importance	The speed with which ICT-related skills become outdated implies that employers need to a bigger extent than before provide learning opportunities to their staff if skill stocks are to stay adapted to current skill requirements. This becomes clear in face of estimates which put the average half-life for technical knowledge at 3-5 years and estimate that complete obsolescence sets in after 6-10 years ([144]: 5). A main way of providing skills is via training courses. This indicator measures how many of a country's establishments are offering training courses about computer applications (such as computer hardware and software). The higher the value, the larger the share of establishments providing ICT training, which can be caused by - a high degree of training activities in the face of given skill requirements or - differences in skill requirements (a country in which companies have below average numbers of computer workplaces will need less computer skills than the average). Because the latter is being interpreted as a sign of backwardness by EC policy, high indicator values are assumed to be positive from a benchmarking point of view.
Sources of data	This indicator has been piloted in the BISER 28 Regions Survey. Continuous data collection would require a survey of human resources managers. Eurostat E-Commerce might be used, too, but reliability of results would be limited if IT managers are the target persons.
Question wording	• Does your establishment offer training courses to your staff, disregarding whether they are done internally or externally - but apart from basic vocational training or traineeships? • [IF YES] Do training courses include computer-related training?
Discussion	As skill requirements differ between sectors, company sizes and, by implication, between countries, there is a case here for controlling for the factors size and sector. This can be done by breaking down results by sector and size-class (see [130]).

Supplementary indicators	Mode of delivery (from Leonardo da Vinci I – "off the job training", except for (distance learning), see [126]):
	Do you train your staff in obtaining ICT skills?
	Which of these types of ICT training do you provide?
	- Classroom instruction
	- Group or project work
	- Workshops or seminars
	- Participation in conferences or external lectures
	- Visits to exhibitions/trade fairs
	- Distance learning
	  - using paper teaching materials
	  - using electronic on-line teaching materials, e.g. on the Internet or Intranet
	  - using electronic offline teaching materials such as CD-ROMs
	Reasons for not providing ICT training. Answer categories (from [131]):

	- No need - No time - Too expensive - People recruited with the skills needed - Initial training sufficient - Investment recently made; no need this year - Difficult to assess enterprise's needs			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	0	0	0

Table 3.2-30: Use of e-learning tools for work-related learning

Definition and explanation	Number of persons who used e-learning technologies for work-related learning in the 4 weeks prior to the survey, as a share of the labour force. $$\frac{\text{E - learning users}}{\text{Labour force}} * 100$$ Value range: 0 – 100
Value added and importance	Indicators on e-learning as an innovative way of skill acquisition are almost totally missing until now [58][6]. e-Learning can help meeting the challenge posed by the Information Society, since it can be adapted to the specific needs and characteristics of the learner. As e-learning plays an important role in the European Commission's strategy for knowledge dissemination [100], data on current usage need to be available. High shares of workers who use e-learning for work-related learning can generally be considered to be beneficial for a country for several reasons, among them: - e-learning enables persons to take part in learning activities who would otherwise have to overcome severe obstacles resulting e.g. from lack of free time and remoteness to locations of training courses. - e-learning products are considered to be an important market of the future (see [67]). Countries which have high numbers of users are more likely to gather the user experience required for successful participation or even leadership in this market. - users of e-learning also learn more about computer applications in general which benefits them e.g. by giving a competitive advantage on the labour market. It is worthwhile to remember, however, that e-learning technologies are only tools, and that it may be possible for a country to reach the same or even higher degree of skill transfer while using traditional means only, if these are effectively applied.
Sources of data	SIBIS GPS. The indicator is suitable for inclusion in the Eurostat ICT Usage Household Survey.
Countries and time intervals covered	EU Member States, CH and USA for 2002; NAS10 for 2003
Question wording	• Did you use, in the course of your training and learning in the last 12 months, electronic learning materials such as learning programmes on CD-ROM, in company-internal computer systems or on the Internet? • What did you use? Did you use CD-ROMs or other so-called offline media such as diskettes, audio or video tapes etc.?

[6] CEDEFOP has issued results from a number of surveys on the subject carried out since 2000 (see for example [31]). While these provide interesting testing ground for questionnaire design, the indicators themselves are not reliable since the sample is based on self-selection by visitors of the CEDEFOP website.

	• Did you use on-line learning materials provided on the internal computer system of your organisation or through the Internet?
Discussion	The focus here is on learning materials, as opposed to using the Internet at all (compare next indicator in Table 3.2-31). E-learning is also delimited here as only such learning which has a relation to the current or future work of the respondent. This restriction seems necessary here as non-work-related learning cannot satisfyingly be distinguished from other activities which make use of the same technology (such as computer games, encyclopaedias). While the European Commission uses a very broad understanding of the term "e-learning" (compare [100]), it is sometimes understood as only including access to learning materials via the Internet or other computer networks. Since an indicator on on-line e-learning can be constructed using the SIBIS question module, data gathered now will allow time-series construction for the narrow definition in future. The reference period is chosen to be comparatively short in order to focus on regular/current e-learning users, and to be compatible with Eurostat's Structural Indicator on lifelong learning which also refers to the 4 weeks prior to the survey. Note: Piloting resulted in comparatively high "DK" replies in Belgium (3.4%) and Luxembourg (2.7%). In the other countries, the share of DK was between 0% and 0.5%. No data available for external validation.
Supplementary indicators	• Use of offline e-learning tools for work-related training/learning • Use of on-line e-learning tools for work-related training/learning^ • Use of e-learning tools for learning by persons who have participated in work-related learning in the four weeks prior to the survey

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1	0	1

Table 3.2-31: Use of the Internet for learning

Definition and explanation	Persons who use the Internet for improving their education or training, as a share of the labour force. $\frac{\text{Users of the Internet for education or training}}{\text{Labour force}} * 100$ Value range: $0 \leq \text{value} \leq 100$
Value added and importance	This indicator makes use of a wider interpretation of the concept of e-learning, namely using the Internet for work-related learning purposes. Due to its capability to make information available with very low (marginal) costs to the learner compared to traditional media (e.g. books in libraries), the Internet can considerably increase the efficiency and effectiveness of the learning process [157]. The indicator is, therefore, a measure of how many inhabitants use the Internet for the purpose of improving and also enriching the learning experience.
Sources of data	Eurobarometer "Internet and the Public at large" (five rounds since 10/2000). A similar indicator is included in the list of eEurope 2005 Benchmarking Indicators and has been incorporated in the 2003 Eurostat ICT Usage Household Survey. They differ by covering Internet use for training and education only in the context of "formalised educational activities", "post educational courses", or "other educational courses related specifically to employment opportunities". See also National Adult Learning Survey in the U.K. [145].
Countries and time intervals covered	EU15. NALS 2002: Data only available for the UK and 2002 (not comparable to earlier

	survey rounds because of change of methodology).
Question wording	For your private use do you [...] use the Internet to ... - improve your training or education.
Discussion	This indicator measures the use of the Internet as a tool for any type of learning, without requiring learning material/programmes to be transmitted electronically (compare Table 3.2-30). It is therefore to be expected that higher percentages of the population will be covered. Learning activities here include all activities considered to be improving "training or education" by the respondents. It may, however, be necessary to delimit learning to include only such activities which have a relation to the current or future work of the respondent (compare Table 3.2-30), because it might not be possible to distinguish non-work-related learning from other activities which make use of the same technology (such as computer games, encyclopaedias). The data from the EB-F surveys was not available to SIBIS for carrying out quality checks. No data available for external validation.
Supplementary indicators	None
Evaluation results	Benchmarking Value: 1 | Validity: 1 | Reliability: 2 | Availability: 3

Table 3.2-32: Establishments providing e-learning

Definition and explanation	Number of establishments that provide training to their staff via e-learning technologies (CD-Roms, Intranet, Internet), as a share of all establishments: $\frac{\text{Establishments providing e-learning to their staff}}{\text{All establishments}} * 100$ Value range: $0 \leq \text{value} \leq 100$
Value added and importance	ICTs are not only a major cause for new skill requirements, but they also provide solutions for meeting them. E-learning is one of them. It is discussed in the context of providing tools for learning in the traditional system of institutionalised education (schools, universities), but also as a means to enable companies to provide continuous training to their staff. In the business environment e-learning can – in some cases – increase the cost-efficiency of learning and therefore increase the overall extent to which companies provide learning opportunities to their employees [144]. This indicator adds insight to the current knowledge on businesses' use of ICTs and the Internet, and it reflects to some extent how businesses support human capital formation. e-learning is an essential ingredient of the Commission's policy on the Information Society, as manifested in the eLearning Programme 2004-2006 for the "implementation of the objectives of the eLearning Action Plan from an educational perspective" which is organised as part of the eEurope 2005 Initiative [105].
Sources of data	Piloted in the BISER 28 regions survey (data not available yet). Data for this indicator would ideally be collected through a dedicated survey targeted at HR managers in companies, such as the Cranfield European Human Resource Management Survey [21]. Alternatively existing Eurostat surveys could be deployed such as the Survey on E-commerce. However, as the latter is targeted at IT managers, it can be assumed that the use of ICT for training purposes would be underreported, since IT managers might not be aware of such use. Moreover, HR managers would be the only ones qualified to answer questions on the effects

	of e-learning.

Question wording	• Do you, for the purpose of providing training to your staff, use any of the following electronic learning materials?
	  • computer programmes on CD-ROMs or other digital data storage
	  • learning content provided via an internal computer network
	  • learning content provided via the Internet

Discussion	Currently, for example in the Communications of the EC on e-learning [100], the term is used widely to include off-line as well as on-line technologies. This is reflected in the design of this indicator. However, it can be foreseen that in the near future, the meaning of "e-learning" will evolve towards including learning over the Internet only, which means that indicator operationalisation has to enable distinction between offline and on-line-usage (which is the case here) in order to allow for time series analysis. An indicator has been agreed upon by Member States to measure the progress of e-learning provision by companies: "Percentage of enterprises using e-learning applications for training and education of employees". However, according to the final version of the questionnaire for the 2003 Eurostat e-Commerce Survey [129] the operationalisation of this indicator leads to all enterprises which state "training and education" as a purpose of Internet use as "using e-learning applications". The SIBIS indicator provides an alternative which arguably is better in line with the objectives of the Action-line, since the prime focus should be on making e-learning applications available to staff rather than usage of the Internet which somehow relates to training and education in general.
Supplementary indicators	It must be taken into account that some e-learning takes place in companies which is initiated by employees themselves, and might not be covered using this indicator. It should, therefore, be supplemented by an indicator on workers' usage of e-learning (see Table 3.2-30).
Evaluation results	Benchmarking Value: 2 | Validity: 0 | Reliability: 0 | Availability: 0.5

Table 3.2-33: Establishments using an Intranet for staff training

Definition and explanation	Establishments that have an Intranet and (intentionally) use it for enabling self-learning by their staff, as a share of all establishments: $\frac{\text{Establishments using Intranet for enabling learning}}{\text{All establishments}} * 100$ Value range: 0 – 100
Value added and importance	Effective management of knowledge has been identified as a key requirement for companies in knowledge-intensive sectors [225][270]. Internal computer networks with user-friendly interfaces (mainly Intranets which run on the Internet protocol) play an important role in this respect, since they make it possible to cheaply and effectively provide staff with the required information (on a "pull" rather than "push" basis). The concept of the learning organisation has been developed to describe the capability of companies that successfully use new technology to enhance the skills of the staff via demand-specific knowledge diffusion. We assume that the higher the share of establishments using an Intranet for staff training, the more effective is knowledge being transferred inside of the basic units which make up a country's economic base.
Sources of data	Not piloted yet. Suitable for the Eurostat survey on E-commerce.
Question wording	• Does your establishment have an Intranet (i.e. an internal computer network that runs on the Internet protocol)? • For what purposes is the Intranet used in your establishment? Is it being used

	for ... • providing staff with material for self-learning			
Discussion	Other ways to supply similar information should be taken into account (e.g. business TV which, however, is only relevant for larger companies). In order to be comprehensive, additional questions/items about other knowledge diffusion technologies might therefore be necessary. The indicator wording (i.e. the translation of used concepts into other language) needs to be very specific to ensure that the question is answered positively by users of all kinds of *training content*, be they produced by the enterprise itself, produced by a supplier, purchased on the market, or accessed for free on the Internet. Since intranet take-up strongly correlates with company size [68], it is advisable to break down the data by size class before application for benchmarking.			
Supplementary indicators	None.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	0	0	0

Table 3.2-34: Establishments supporting ICT-related self-learning of their staff

Definition and explanation	Share of companies who foster ICT-related self-learning by their staff e.g. by providing learning tools, financial support or release from work for learning purposes. $\frac{\text{Establishments that support ICT self-learning of their staff}}{\text{All establishments}} * 100$ Value range: 0 – 100
Value added and importance	As far as it is realised that workers have to bear some of the burden created by the need for ICT-related and Lifelong Learning [82], attention is drawn to possibilities in supporting them for this purpose. Companies play a key role here since they have a self-interest in improving the technical skills of their staff. Recent initiatives of major companies which provided home computers and Internet access free to their employees (for example in Denmark, see [82]) have demonstrated the range of options available, and the willingness of companies to invest in lifelong learning activities of their staff. The indicator is of special relevance for policy-making since results of benchmarking between countries will show in which areas supportive policy measures are required.
Sources of data	This indicator requires a survey which is targeted specifically at HR managers in establishments, such as the Cranfield HR Management Survey. In smaller businesses (up to a size of 50 staff), the CEO, owner, general manager etc should be sufficient.
Countries and time intervals covered	Not piloted yet.

Question wording	• Some companies support their staff's own-initiative learning, e.g. by providing learning tools, financial support or release from work for learning purposes. Which of the following types of support do you make available to your staff for ICT-related learning?
	  • (a) financial support
	  • (i) contribution to costs of home IT equipment
	  • (ii) contribution to costs of learning materials
	  • (iii) contribution to payments for courses, events etc.
	  • (b) provision of teaching material

	• (i) on paper or audiovisual media (e.g. video) • (ii) on CD-ROM or other digital media • (iii) in Intranet • (iii) via business TV • (iv) other, which ... • (c) other support • (i) release from work for learning activities, workshop and conference visits etc. • (ii) advice & consultancy • (iii) job-rotation • (iv) other, which ...
Discussion	Alternatively, a more narrow definition would include only those enterprises which make the respective supportive measure available to the majority of their staff. This would have to be enquired in a subsequent question, individually for each type of support which is provided. Analysis of this indicator should try to establish correlations with indicators on outcomes and on participation.
Supplementary indicators	None

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	0	0	0

Table 3.2-35: Share of establishments giving staff access to the Internet

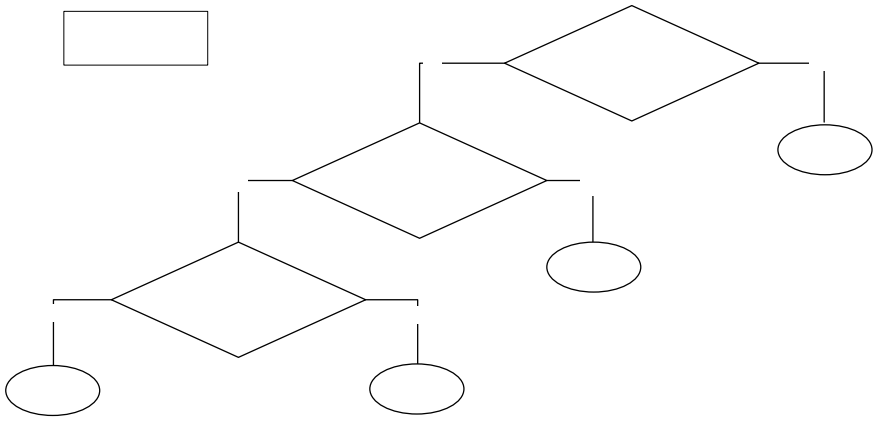
Definition and explanation	Share of establishments that give the majority of their office workers access to the Internet $\frac{\text{Establishments that give their staff access to the Internet}}{\text{All establishments}} * 100$ Value range: 0 – 100
Value added and importance	Statistics about the extent to which establishments equip workplaces with access to ICTs give an impression about the contribution which businesses make for providing “learning by doing” opportunities to their staff. Much of the evidence available shows that people who got in contact with ICTs at the workplace are more inclined to use them for private purposes as well, thereby leading to a virtuous circle of skills improvement [226]. For older persons confrontation with computers and the Internet at the workplace is certainly the main way towards overcoming the generation gap in computer user know-how [271] . It is not self-evident that companies benefit from giving their staff ready access to e-Mail and the Internet, as these technologies make control of staff harder. E-mail and the Internet can easily be used for private purposes as well (thereby undermining working morale) and are also prone to misuse leading to virus infections etc. For this reason companies face a trade-off between supplying their staff with effective working tools which support the development of media competence on the one hand, and cost control on the other hand. From the viewpoint of skill acquisition of workers, however, much evidence point towards countries performing the better the higher their share of establishment which grant access to these ICTs.
Sources of data	SIBIS DMS, EC-KMU2 [69], ECaTT DMS [97]. Suitable for inclusion in Eurostat e-Commerce Survey.
Countries and time intervals covered	DK, FIN, F, D, I, IRL, NL, E, SE, UK for 1999 FIN, F, D, EL, I, E, UK for 2002

	FIN, D, I, UK, USA for 2001			
Question wording	Which applications can be accessed by the majority of your office workers? Can the majority of your office workers browse Internet sites? Alternatively: How many percent of your staff who mainly work at a desk can access the Internet?			
Discussion	Since Internet access is (today) mainly limited to those who work in office environments, the indicator refers to the majority of office staff. This means that, for example, a retail outlet in which most staff work on the shop floor without access to a personal computer can nevertheless be an establishment where the majority of office staff are given access to the Internet. Establishment data is weighted by employment. This means that the indicator can be read alternatively as the share of the workforce working in establishments in which the majority are given access to the Internet. Comparison with the data from 1999's ECaTT [92] and 2001's EC-KMU2 [100] projects shows a gradual increase of the indicator figure for the majority of countries, with stagnating figures for the UK and I between the 2001 and 2002 surveys. These results are plausible when comparing against other empirical data. No data from other sources available for validation.			
Supplementary indicators	• Share of establishments that give the majority of their office workers access to e-Mail • Share of establishments that give the majority of their office workers access to an Intranet			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	2	0.5

Skill provision (Skill stocks)

Table 3.2-36: Share of population who feel very confident in communicating over the Internet

Definition and explanation	Share of population who feel very confident in using at least one of three types of Internet-based media: • Using e-Mail • Using Internet chat-rooms • creating a personal web/Internet page $R_{vcom} = 1$ if $c_i = 1 \cap c_j = 1 \cap c_k = 1$ $\quad c_{i,j,k} \in [1;5]$, $R_{vcom} \in [0;1]$ $R_{vcom} = 0$ if $c_{i,j,k} \neq 1$ This can be illustrated in the following diagram:

	 $C_{vcom} = \frac{\sum R_{vcom}}{\sum R} * 100$ with: R Total population c_i degree of confidence in using e-Mail c_j degree of confidence in using chat rooms c_k degree of confidence in creating a web page R_{vcom} Number of respondents very confident in communicating via the Internet C_{vcom} Percentage of respondents very confident in communicating via the Internet of all respondents The share of respondents very confident in communicating through the Internet is found by summing the number of respondents who declare themselves as very confident in at least one of the following three activities: using e-Mail, using chat-room or creating a personal web page. The number of respondents who are very confident in at least one activity (e.g. 44 in a country) is divided with the total population of respondents (e.g. 99). This is expressed in %. $C_{vcom} = \frac{44}{99} * 100 = 44{,}4\%$ Value range: $0\% \leq C_c \leq 100\%$
Importance and value added	The ability to communicate with others via the Internet is a precondition for exploiting the potential of the Internet in Europe as an Information Society. Communication can take place via various media. This indicator measures general confidence in communication by using at least one of three media: the widespread e-Mail, and possibly growing media chat room, and personal web page. The ability to communicate with others via the Internet is one of the skills of Digital Literacy, defined in the SIBIS project in line with the EC Digital Literacy workshop [93]. Digital Literacy is a central objective in the eLearning Action Plan [100] and in eEurope 2005 [105]. A high level of skills in communicating by using at least one of three media (e-Mail, chat room and personal Internet/web page) indicates a high potential for exploiting the two-way (dialogue) communicative potential of the Internet. An increase in the share of respondents who are very confident in communicating with others by using at least one of three Internet media should be interpreted as an increase in the general level of Internet-based communication skills.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the USA for 2002, NAS-10 for 2003.
Question wording	I would like to ask you a few questions about your skills in using the Internet. How

	confident would you feel in: (c) using e-Mail to communicate with others (d) using Internet chat-rooms to contact other people (f) creating a personal web/Internet page Please tell me whether you feel: (1) very confident (2) fairly confident (3) not confident (4) Do not know what this means [DO NOT READ OUT] (5) Don't know
Discussion	The general communication indication is based on the highest degree of confidence in using at least one of the media. Being very confident in communicating in one of the media, and fairly or not confident in the rest results in a score as 'very confident' in the general indicator. In this way the general ability to use the communicative potential of the Internet is measured, and not a specific media, which can diffuse differently in social and national groups. Equally an indicator, which is based on (confidence in) communication rather than a certain technology (e.g. e-Mail), will have relevance, even when this technology might be outdated by other technologies. In the short term, these other technologies can be chat rooms or web pages. In the long term, communication technologies can be implemented in measurement of confidence in communication via the Internet. The share of all persons who are very confident in using at least one of the chosen technologies is chosen as an indicator. An alternative calculation has been considered and analysed based on the SIBIS survey. Indication of confidence in using various communication technologies, with a sum of the score of the three technologies, weighted with a value of 10 to 'very confident' and 5 to 'fairly confident' has been considered. This weighting highlights the confidence in using various forms of communication technologies on the Internet, but loses the flexibility of a general communication indicator described above. The differences in benchmarking results of the two indicators have been analysed based on the SIBIS GPS data (for the sub-group of "students"): • The differences between the highest scoring country and the lowest scoring country, and thus the benchmarking variance, drop by using the weighting calculation. The variance drops from a factor 4.7 to 3.1, which is not critical. • The ranking within the 17 countries in the SIBIS GPS only changes slightly from the indication of persons very confident in at least one technology to the indication of total confidence. Most countries keep the same place in the ranking or change one step. One country takes four steps up of the ranking by having a group of persons being 'super communicators' (very confident in two or three technologies) and a rather huge group not being confident in using communication technologies. Another country drops four steps by having few super communicators, and a sizeable part of the population being confident in using only one of the proposed communication technologies The degree of confidence is based on a general self-evaluation of competence. This opens for a bias regarding understanding of own competencies. In the SIBIS survey, this is reduced by asking a question of actual use of the Internet within the last 12 months as a filter. Nevertheless, there might be systematic biases regarding national differences as well as gender differences. These possible biases are, however, regarded as minimal. This assessment is based on validation of the question regarding confidence in communicating via e-Mail by 'use' of e-Mail, which is surveyed in the Eurobarometer flash [77], and by Statistics Denmark [53].The focus on 'use' in stead of 'confidence' minimises the possible bias from differences in self-evaluation. Though the surveys of 'use' of e-Mail are not directly comparable to the confidence in use of e-Mail, nevertheless

	the ranking between the EU-15 countries in the Eurobarometer Flash survey and the SIBIS confidence indicator only show few differences. This indicates that any nationally based bias from general over- or under estimation of skills is minimal. The self-evaluation approach further allows assessment of the level of confidence (not, fairly, and very confident), indicating the potential for upgrading the skills level of the population. The basis for the indication from the SIBIS survey is all respondents (including Internet non-users).			
Supplementary indicators	Similar indicators can be constructed for calculating the shares of fairly confident and not confident Internet users. The indicator can be divided into three sub-indicators: • confidence in using e-Mail • confidence in using Internet chat-rooms and • confidence in creating a personal web/Internet page (see Table 3.1-24: On-line content creation potential) The indicator can be adjusted to various purposes, depending on the respondent group. • Youth (16 to 25 years) and the rest of the population (age over 25 years): Measuring the actual skills level in the population and the level of skills in the generation to grow up. • Preferably, certain school levels for international benchmarking. Due to differences in educational systems, the general method is to compare persons of the same age (e.g. 15 years such as in the PISA project [239]). In many countries, youth are by law protected from being surveyed in e.g. CATI or PAPI surveys. Other methods to survey these age groups would be needed - by tests at the schools or by letting teachers asses the pupils' qualifications. In that case, a reformulation of the questions would be necessary.			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	2 (1.5)	0	2

Table 3.2-37: Share of population who feel very confident in obtaining and installing computer software

Definition and explanation	Share of all respondents who are very confident in obtaining and installing computer software $\frac{\text{Internet users very confident in obtaining and installing computer software}}{\text{Total population}} * 100$ Value range: 0 – 100 (percentages)
Importance and value added	Updating and developing the software in the personal computer as an operating tool for computer and Internet users. Being able to find, download and install digital tools and programs (completely new programs or supplements to the large programs) allows the individual to develop a digital toolbox for his or her own purposes. The ability to download and install is one of the skills of Digital Literacy, defined in the SIBIS project in line with the EC Digital Literacy workshop [93]. Digital Literacy is a central objective in the eLearning Action Plan [100] and in eEurope 2005 [105]. A high level of skills in obtaining and installing software among respondents indicates a high potential for continuous adjustment of the computer as a central operating tool. An increase in the share of respondents who are very confident in

	obtaining and installing software should be interpreted as an increase in the general level of Internet-based communication skills.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the USA for 2002, NAS-10 for 2003.
Question wording	I would like to ask you a few questions about your skills in using the Internet. How confident would you feel in: (g) downloading and installing software onto a computer Please tell me whether you feel: (1) very confident (2) fairly confident (3) not confident (4) Do not know what this means [DO NOT READ OUT] (5) Don't know
Discussion	A simple indication based on the share of the whole population being very confident in obtaining and installing tools is chosen. Alternative calculations have been considered and analysed based on the SIBIS survey. Various alternatives are possible, but especially the alternative of a weighting the value of 10 to 'very confident' and 5 to 'fairly confident' has been considered. Using weighting it is possible to highlight the potential in persons with some confidence in the skill, and differentiate from persons without confidence in the skill. It will take much more effort to upgrade the latter group to the 'very confident' level. The differences in benchmarking results of the two indicators have been analysed based on the SIBIS GPS data (for the sub-group of "students"): • The differences between the highest scoring country and the lowest scoring country, and thus the benchmarking variance, drop by using the weighting calculation. The variance drops from a factor 4 to 3.5, which still makes benchmarking possible, though not so varied. • The ranking within the 17 countries in the SIBIS GPS only changes slightly from the simple calculation of share of very confident persons to the weighted value. Most countries keep the same place in the ranking. A few countries change one or two ranks, four of the 17 countries change two to four steps in ranking. Based on this analysis the share of the population that is very confident in the skill is chosen as an indicator in order to get the best variance and a simple calculation. The degree of confidence is based on a general self-evaluation of competence. This opens for a bias regarding understanding of one's own competencies. In the SIBIS survey, this is reduced by using a question of actual use of the Internet within the last 12 months as a filter. Still there may be systematic biases regarding national differences as well as gender differences. These possible biases are, however, regarded as minimal (see Table 3.2-36). The self-evaluation approach further allows assessment of the level of confidence (not, fairly, and very confident) indicating the potential for upgrading the skills level of the population. The basis for the indication from the SIBIS survey is all respondents (including Internet non-users).
Supplementary indicators	Similar indicators can be constructed for calculating the shares of fairly confident and not confident Internet users among respondents. The indicators can be adjusted to various purposes, depending on the respondent group. • Youth (16 to 25 years) and the rest of the population (age over 25 years): Measuring the actual skills level in the population and the level of skills in the generation to grow up.

	• Preferably, certain school levels for international benchmarking. Due to differences in educational systems, the general method is to compare persons of the same age (e.g. 15 years such as in the PISA project [239]). In many countries, youth are by law protected from being surveyed in e.g. CATI or PAPI surveys. Other methods to survey these age groups would be needed - by tests at the schools or by letting teachers asses the pupils' qualifications. In that case, a reformulation of the questions would be necessary.			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	1	0	2

Table 3.2-38: Share of population who feel very confident in identifying the source of information on the Internet

Definition and explanation	Share of population who feel very confident in identifying the source of information found on the Internet (e.g. identifying any individuals or organisations that have placed the information on the Internet like the owner of homepage where it is found or downloaded). $\frac{\text{Internet users who feel very confident in identifying the source}}{\text{Total population}} * 100$ Value range: 0 – 100 (percentages)
Importance and value added	In using the Internet, it is necessary to be able to select among the huge amounts of information available. The skill to be critical in relation to the information on the Internet is therefore important in an individual perspective as well as in a societal perspective. Questioning information search results is operationalised as confidence in identifying the source of information on the Internet. This is a precondition for evaluating the reliability of the information. The ability to identify the source of information on the Internet is one of the skills of Digital Literacy, defined in the SIBIS project in line with the EC Digital Literacy workshop [93]. Digital Literacy is a central objective in the eLearning Action Plan [100] and in eEurope 2005 [105]. A high level of the skills for identifying the source of information on the Internet among respondents indicates a high potential for being selective and critical about information from the Internet (and possibly other sources). This is a general skill, which is actualised in the Information Society, also beyond the pure ICT coupling. An increase in the share of respondents who are very confident in identifying the source of Internet provided information should be interpreted as an increase in the general level of skills for the Information Society.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the USA for 2002, NAS-10 for 2003.
Question wording	I would like to ask you a few questions about your skills in using the Internet. How confident would you feel in: (b) identifying the source of information provided on the Internet Please tell me whether you feel: (1) very confident (2) fairly confident (3) not confident (4) Do not know what this means [DO NOT READ OUT] (5) Don't know
Discussion	The skill of being critical about information is highly actualised in the Information

	Society. Being critical about information is decisive for distinguishing between relevant and irrelevant and trustworthy and untrustworthy, which is important in a personal, a work related and a societal perspective. This indicator measures a skill that is a prerequisite for being critical about the reliability of information - namely being able to identify the source of information. The question is not totally clear in defining the 'source'. This could be the URL as well as the author of the Internet page. The first is relatively simple as the information (depending on configuration) is on the page. The second interpretation is more complex, as the URL needs to be decoded and any research must be identified. The question could be developed with an explanation: "e.g. the organisation or private person writing the WWW-page". A simple indication based on the share of whole population being very confident in identifying the source of information on the Internet is chosen. Alternative calculations have been considered and analysed based on the SIBIS survey. Various alternatives are possible, but especially the alternative of a weighting value of 10 to 'very confident' and 5 to 'fairly confident' has been considered. Using weighting it is possible to highlight the potential in persons with some confidence in the skill, and differentiate from persons without confidence in the skill. It will take much more effort to upgrade the latter group to the 'very confident' level. The differences in benchmarking results of the two types of indicators have been analysed based on the SIBIS GPS data (for the original question wording and for the sub-group of "students"): • The differences between the highest scoring country and the lowest scoring country, and thus the benchmarking variance, drops by using the weighting calculation. The variance drops from a factor 6 to 3, which still makes benchmarking possible, though not so varied. • The ranking within the 17 countries in the SIBIS GPS only changes slightly from the simple calculation of share of very confident persons to the weighted value. Most countries keep the same place in the ranking. A few countries change one or two steps in the ranking, and one country changes three steps. Based on this analysis the share of the population that is very confident in identifying the source of information is chosen as indicator in order to get the best variance and a simple calculation. The degree of confidence is based on a general self-evaluation of competence. This opens for a bias regarding understanding of one's own competencies. In the SIBIS survey, this is reduced by using a question of actual use of the Internet within the last 12 months as a filter. Still there may be systematic biases regarding national differences as well as gender differences. These possible biases are, however, regarded as minimal (see Table 3.2-36). The self-evaluation approach further allows assessment of the level of confidence (not, fairly, and very confident) indicating the potential for upgrading the skills level of the population. The basis for the indication from the SIBIS survey is all respondents (including Internet non-users). The basis for the indication from the SIBIS survey is all respondents (including Internet non-users).
Supplementary indicators	See Table 3.2-37

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	1 (0.5)	0	2

Table 3.2-39: Share of population who feel very confident in using an Internet search engine

Definition and explanation	Share of Internet users who feel very confident in using Internet search engines

	$\frac{\text{Internet users who feel very confident in using search engines}}{\text{Total population}} * 100$ Value range: 0 – 100 (percentages)
Importance and value added	An enormous amount of information is available on the Internet. To be able to use the information effectively skills for finding the wanted and required information is necessary. This is operationalised by confidence in finding the required information in a specific topic on the Internet. The ability to find required information on the Internet is one of the skills of Digital Literacy, defined in the SIBIS project in line with the EC Digital Literacy workshop [93]. Digital Literacy is a central objective in the eLearning Action Plan [100] and in eEurope 2005 [105]. A high level of the skill of finding the required information on a specific topic on the Internet among respondents indicates a high potential for exploiting the information available on the Internet, which is important in the study and work life, not least in an approach of lifelong learning and responsibility for own learning. An increase in the share of respondents who are very confident in finding the required information should be interpreted as an increase in the general level of skills for the Information Society.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the USA for 2002, NAS-10 for 2003.
Question wording	I would like to ask you a few questions about your skills in using the Internet. How confident would you feel in: ( ) finding information on the Internet on a specific topic, of which your interest is raised somehow Please tell me whether you feel: (1) very confident (2) fairly confident (3) not confident (4) Do not know what this means [DO NOT READ OUT] (5) Don't know
Discussion	This indicator is a revisited paraphrasing of a question that was tested in the SIBIS GPS: "I would like to ask you a few questions about your skills in using the Internet. How confident would you feel in: using a search engine (such as Google or Yahoo) to find information on the Internet [TRANSLATORS: List two most widely used search engine brands in your country]". The GPS survey showed a generally low level concerning this skill, and furthermore a slightly higher level of 'don't know' and 'don't understand the question'-answers than the other questions (still below 2% of the Internet users). It is therefore considered that other strategies are being used to find the required information. The actual, though not tested, paraphrasing therefore includes the possibility of using other strategies than search engines to find the required information on the Internet. A simple indication based on the share of whole population being very confident in finding the required information on the Internet is chosen. Alternative calculations have been considered and analysed based on the SIBIS survey. Various alternatives are possible, but especially the alternative of a weighting value of 10 to 'very confident' and 5 to 'fairly confident' has been considered. Using this weighting it is possible to highlight the potential in persons with some confidence in the skill, and differentiate from persons without confidence in the skill. It will take much more effort to upgrade the latter group to the 'very confident' level. The

	differences in benchmarking results of the two types of indicators have been analysed based on the SIBIS GPS data (for the sub-group of "students" and the original question wording of "use of search engine"): • The differences between the highest scoring country and the lowest scoring country, and thus the benchmarking variance, drops by using the weighting calculation. The variance drops from a factor 5 to 3, which still makes benchmarking possible, though not so varied. • The ranking within the 17 countries in the SIBIS GPS only changes slightly from the simple calculation of share of very confident persons to the weighted value. Most countries keep the same place in the ranking or change one step. Two countries change two steps in the ranking. The differences in benchmarking ranks are very little. Based on this analysis the share of the population that is very confident in finding the required information is chosen as an indicator to get the best variance and a simple calculation. The degree of confidence is based on a general self-evaluation of competence. This opens for a bias regarding understanding of one's own competencies. In the SIBIS survey, this is reduced by using a question of actual use of the Internet within the last 12 months as a filter. Still there may be systematic biases regarding national differences as well as gender differences. These possible biases are, however, regarded as minimal (see Table 3.2-36). The self-evaluation approach further allows assessment of the level of confidence (not, fairly, and very confident) indicating the potential for upgrading the skills level of the population. The basis for the indication from the SIBIS survey is all respondents (including Internet non-users).
Supplementary indicators	See Table 3.2-37 and: • Share of users who expect to find information on the Internet [176] • Share of Internet non-users who will turn to the Internet (as a first port of call) next time they seek information they need [176] • Reasons for using search engine amongst population of Internet users [148] • Ability to cross-check / identify the source of information on the Internet

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2 (2.33)	0	0	0

Table 3.2-40: Digital literacy (COQS-Index)

Definition and explanation	Digital literacy as measured by the COQS-index of digital literacy (Communicate, Obtain, Question, Search), an index measuring the general level of digital literacy in a survey population. The value of the index is based on valuation of the confidence level in each of the following four indicators: ▪ Communication with others on the Internet (see Table 3.2-36 ▪ Obtaining (or download) and install software on a computer (see Table 3.2-37) • Questioning source of information search on the Internet (see • • Table 3.2-38) • Search for the required information on the Internet (see Table 3.2-39) (1) $COQS_r = \frac{\sum_1^J (\text{Skill type} * \omega)_j}{J}$

	(2) $\overline{COQS} = \frac{\sum_1^R COQS_r}{R}$ $COQS_r$ Average value in Digital Literacy (**C**ommunicate, **O**btain, **Q**uestion, **S**earch) per individual respondent r J Total of skill types (Communicate, Obtain, Question, Search - see also below) $\overline{COQS}$ Average COQS value per country R Size of population (here: all respondents) ω Weights; the statement of the influence of confidence in the actual skill … 0 Not confident 5 Fairly confident 10 Very confident Value range: $0 \leq \overline{COQS} \leq 10$ Each skill type (Communicate, Obtain, Question, and Search) receives weighting between 0 and 10 corresponding to the extent to which it applies. The weighted influence categories are first added up for each respondent and an average value is calculated (1). Second the average value is calculated (2).
Importance and value added	Digital Literacy is a central objective in the eLearning Action Plan [100], and in the eEurope 2005 [105]. This indicator indicates the level of the skills of Digital Literacy, as it is defined in the SIBIS project in line with the EC Digital Literacy workshop [93]. A high score on this index indicates a high general level of skills in communication and information search via the Internet. These are important skills for exploiting the potential of the Internet in relation to the actual study and further activity in the Information Society. An increase in the index value (COQS value) should be interpreted as an increase in the general level of Digital Literacy.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland and the USA for 2002, NAS-10 for 2003.
Question wording	Compound indicator – based on indicators in Table 3.2-36 to Table 3.2-39. The wording was as follows: I would like to ask you a few questions about your skills in using the Internet. How confident would you feel in: (b) identifying the source of information provided on the Internet (c) using e-Mail to communicate with others (d) using Internet chat-rooms to contact other people (f) creating a personal web/Internet page (c,d and f is the base for S_{com}, as shown in Table 3.2-36) (g) downloading and installing software onto a computer (not tested) finding information on the Internet on a specific topic, of which your interest is raised somehow Please tell me whether you feel: (1) very confident (2) fairly confident (3) not confident (4) Do not know what this means [DO NOT READ OUT] (5) Don't know
Discussion	The definition of digital literacy is mainly based on an operationalisation of the understanding at the Digital Literacy workshop [93].

	The degree of confidence is weighted in order to capture differences in the level of skills among the respondents. The non-users are included in the denominator to get a comparable national level of literacy. The values are chosen to clarify the qualitative level between being very and fairly confident, as the actual usefulness of skills at the two levels is considerable. The current version of the index does not include any differentiated weighting between the sub-indicators (skills). However, the different activities require different types and probably levels of skills which, in a more sophisticated version, could be basis for differentiated weighting between the skills (e.g. skills in obtaining and installing software and to question source of information appear to be more complicated than the others). As this would require more than the available knowledge about the efforts necessary for reaching the more sophisticated skills levels to calculate proper weighting, this version of the COQS is not weighted. The degree of confidence is based on a general self-evaluation of competence. This opens for a bias regarding understanding of one's own competencies. In the SIBIS survey, this is reduced by using a question of actual use of the Internet within the last 12 months as a filter. Still there may be systematic biases regarding national differences as well as gender differences. These possible biases are, however, regarded as minimal (see Table 3.2-36). The self-evaluation approach further allows assessment of the level of confidence (not, fairly, and very confident) indicating the potential for upgrading the skills level of the population. A national Norwegian survey focuses on ICT competencies among teachers and pupils/students (primary and secondary/tertiary level). The survey cannot validate the current data due to differences in target groups (Norway is not included in the SIBIS survey, and the age groups are only partly represented in the SIBIS survey) [288].
Supplementary indicators	Digital literacy in the labour reserve: This supplementary indicator would support EU policy making in relation to the European Employment Policy which puts a strong emphasis on increasing labour force participation, especially among women and the elderly. Knowledge about the types of skills, including digital literacy skills, in the labour reserve would enable to estimate what effect rising employment rates would have on existing skill mismatches on the labour market.

Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	1	0	0

Table 3.2-41: ICT training qualifications

Definition and explanation	Persons who have formal ICT-related training qualifications, as a share of all persons in the labour force. $\frac{\text{Persons with formal computer qualification}}{\text{All persons in labour force}} * 100$ Value range: 0 – 100
Importance and value added	There is a general consensus among policy-makers that ICT-related skills are in very high demand in today's labour market [91]. Moreover, they are also increasingly required for participation in public life and civil society, as the debate on digital literacy and the so-called digital divide have demonstrated (source). The measurement of skills, however, poses severe problems. Qualifications (in the sense of certificates) can be used as a proxy since they also play an important role as signifiers on the labour market, i.e. skill scarcities on the labour market are usually associated with a lack of workers with certain certified qualifications. It is assumed that the higher the share of the labour force that has a formal

	computer qualification, the better a country's labour market is prepared to match the skill requirements of the sectors and economic activities which are considered growth areas. An oversupply of formal ICT skills on the labour market is imaginable and has been observed at certain points in time in some Member States, but in the medium to long term this is not likely to have a significant negative effect on economic performance.
Sources of data	Eurobarometer 54.0
Countries and time intervals covered	EU15, Oct-Nov 2000 (no time series yet)
Question wording	Which, if any, of these computer training qualifications do you have? - Degree in computer science - School certificate in the use of computers - Certificate in the use of computers from a public training institution - Certificate in the use of computers from a private company - Certificate in the use of computers as a result of distance learning - Other (SPONTANEOUS) - None
Discussion	"Computers" might have to be specified as computer technology spreads further into everyday life and PC and other IT devices converge. If the ECDL will find greater application in all EU Member States, the number of ECDL holders would be a better comparable alternative (see Table 3.2-42). The value for benchmarking might be limited because of national differences in the granting of certificates for training qualifications. It can be assumed that a large share if not the majority of holders of advances ICT skills do not have any official certificate, at least in some countries. Moreover, this indicator might be misinterpreted since it implies that persons with certified ICT qualifications have advanced skills in ICT usage. This is only true if we can assume that skills from ICT training do not outdate. The rapid pace of developments in hardware and software applications, however, means that the skills from ICT training outdate even much faster than it is the case for most other training. In any case, a very careful adaptation of the master questionnaire to the specific situation in a country (taking into account all relevant types of qualifications which can be acquired) must take place.
Supplementary indicators	None.
Evaluation results	Benchmarking Value: 1 | Validity: 1 | Reliability: 0 | Availability: 1

Table 3.2-42: European Computer Driving Licences

Definition and explanation	Number of ECDL issued across EU Member States, as a share of the total population aged 15 and older. $\frac{\text{Persons with ECDL certificate}}{\text{Population aged} > 15} * 100$ Value range: 0 – 100
Importance and value added	See Table 3.2-41. The ECDL is by far the most important European initiative to provide certificates for basic computer training outside of the working place. Local ECDL initiatives have been integrated into the national Information Society strategy of many countries. It is assumed that the higher the share of ECDL holders, the better a country's

	labour market is prepared to match the skill requirements of the labour market as well as the civil society.
Sources of data	ECDL registers.
Countries and time intervals covered	Registers are available on demand. Current members of the ECDL: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Netherlands, Norway, Poland, Portugal, Slovenia, Spain, Sweden, Switzerland and the UK.
Question wording	Not based on survey.
Discussion	ECDL holders as share of total adult population can be calculated easily. The current and future value of the indicator heavily depends on the acceptance of ECDL as main national training/assessment scheme in the EU Member States. The curriculum is being updated regularly to account for technological developments and changes in user requirements.
Supplementary indicators	None.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	3	3	2.5

Table 3.2-43: ICT user experience in the labour force

Definition and explanation	Persons who have advanced experience in using computer related activities, as share of all persons in the labour force. $\frac{\text{Persons with advanced experience in computer use}}{\text{All persons in the labour force}} * 100$ Value range: 0 – 100
Importance and value added	Boosting digital literacy (see Table 3.2-40) and computer skills is a key policy objective of the European Commission as well as all Member States governments. By measuring the knowledge in practical computer use, this indicator is of high relevance for policy making. It presents an alternative to directly enquiring about the knowledge of or confidence in certain computer related activities (see Table 3.2-40), as it only asks whether respondents have already carried out certain tasks at the computer. Interpreting this as an indicator for knowledge means assuming that persons who already carried out such tasks must have the knowledge required for this. This assumption has a high plausibility (even taking into account that some persons might have carried out the respective task with guidance by a teacher or friend, and might not be able to do it again by their own). The higher the share of persons with advanced user experience in this indicator, the better a country's labour force is adapted to current skill requirements in the economy.
Sources of data	Eurostat ICT Usage Household Survey (from 2003).
Countries and time intervals covered	EU25 (from 2003)
Question wording	Which of the following computer-related activities have you already carried out? (MULTIPLE CHOICE): (a) Using icons and windowing interface to launch applications (b) Copying a file (c) Using copy and paste tools to duplicate information within a document (d) Using basic arithmetic formulas to add, subtract, multiply or divide figures in a spreadsheet (e) Merging a mailing list with a letter document or a label document (f) Creating a website

	(g) Writing a computer program			
Discussion	It is not known yet by the authors how exactly Eurostat and the NSIs are planning to analyse the data from this question in the ICT Usage Household Survey. We suggest a synthetic indicator which defines two stages of ICT user experience: basic experience is defined as being given when replies to (a), (b) *and* (c) are YES. Advanced experience is given when replies to (e), (f) *or* (g) are YES. This indicator is affected by technical developments (such as the introduction of plug-and-play solutions, very easy-to-use applications for the creation of a website) which decrease the sophistication of the skills needed for carrying out tasks at the computer. More and more tasks are becoming automated to an extent that no advanced knowledge is needed anymore (e.g. plug and play hardware). For these reasons the list of items should be further tested and developed to include only generic tasks which are likely to require a minimum of specialist know-how even in the future. Compare BISER GPS 2002 and [226].			
Supplementary indicators	Share of persons with basic experience in computer usage.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	0	0	0 (2)

Skill requirements

Table 3.2-44: Deficiencies in basic ICT skills in establishments

Definition and explanation	Establishments which report that a significant proportion of the workforce are not fully proficient in the area of basic computing (= internal skill gaps), as share of all establishments . $\frac{\text{Establishments with internal skill gaps in basic computing}}{\text{All establishments}} * 100$ Value range: 0 – 100 A “significant proportion” is defined as a third or more of the staff not being fully proficient in the area of basic computing (as perceived by the employer). Alternatively, the question can be asked openly.
Importance and value added	The rapid diffusion of ICT-based business processes and working practices in EU Member States results not only in a high demand for specialist ICT skills, but also in IT-skills in *not* directly ICT-related professions (non-specialist ICT skills or basic ICT skills). Because such skills are often not certified but part of general education and training, they are harder to measure than specialist ICT skills. They are, however, not less important for economic performance, which is due to the character of ICTs as a cross-sectional technology which affects workplaces in all occupations and economic sectors. Since almost all establishments in the EU (at least in the size categories larger than 4 employees) can be expected to need basic computing skills, this indicator is suitable for benchmarking countries. We assume that the smaller the share of establishments with internal skill gaps in basic ICT, the better a country is performing.
Sources of data	Data from similar indicator available from Employers Skill Survey (UK), see [173]
Countries and time intervals covered	UK only for 1999, 2001.
Question wording	- What proportion of your existing staff at this establishment in [a particular occupation] would you regard as being fully proficient in basic computing: all,

	nearly all, over half, some but under half, very few, none? Alternative question: - Are there any of your existing staff at this establishment whose skills in basic computing you feel need improving? - [IF YES] What proportion of your existing staff at this establishment would you say need improving in basic computing skills? (Classes for answer options to be devised after piloting)
Discussion	This is based on a question module from the U.K. Employers Skill Survey [173]. This is very complex and might prove particularly hard to transfer to other contexts regarding language and HR management contexts. For these reason, SIBIS recommends a simplified version as described here.
Supplementary indicators	(a) Perceived reasons for internal skill gaps: Establishments which cite certain barriers as reasons for staff not being fully proficient, as share of all establishments. Items: - Lack of funding for training - Lack of suitable courses relevant to this grade of staff - Lack of suitable courses in area/locality - Unwillingness of staff to undertake training - High labour turnover - Lack of time for training - Lack of cover for training - No barriers (b) Perceived impact of skill-shortage vacancies on establishment performance. Items: - Loss of orders - Delays developing new products - Withdraw products - Difficulties with customer service - Difficulties with quality - Increased operating costs - Difficulties with technological change - Difficulties introducing new working practices

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	0	0	0

Table 3.2-45: Jobs for which access to the Internet is of high importance

Definition and explanation	Number of persons stating that the Internet is essential or very important in their job, as share of persons in employment. $\frac{\text{Persons in whose job the Internet is essential or very important}}{\text{Persons in employment}} * 100$ Value range: 0 – 100
Importance and value added	This indicator measures the share of jobs which are perceived as being characterised by a high importance of the Internet as a work tool. We assume that the higher the number of persons with jobs in which the Internet is important, the more a country's working population is integrated in the informational economy, which is in general regarded as a sign of a strong orientation towards sectors and economic activities with high current and future growth potential.
Sources of data	2001 Skills Survey of working individuals in Britain; see [142]

Countries and time intervals covered	UK only for 1997, 2001.			
Question wording	How important would you say is the Internet for your current job? Answer scale (1-5): essential, very Important, fairly important, not very important, not at all important			
Discussion	The validity of this indicator for time series comparisons may be affected by shifts regarding the perception of importance, which might change along with the gradual transformation of the Internet from a highly visible innovation "sitting on the workdesk" to a more or less invisible background technology or "ambient intelligence". The data from the survey was not available to SIBIS for carrying out quality checks. However, a extensive methodological report is available from ONS (the NSI of the U.K.).			
Supplementary indicators	Importance of use of PC or other computerised equipment in the job, as perceived by working individuals.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2.5	2	1	0

3.3 On-line purposes

3.3.1 E-Commerce

Introduction

Project SIBIS adopted for e-Commerce the definition endorsed by OECD in April 2000, which is now widely used by researchers and national statistical offices, as well as Eurostat. The definition focuses on the implementation of electronic transactions, either on Internet networks (Narrow definition) or over any type of computer-mediated network (broad definition). The *method by which the order is placed or received*, not the payment or the channel of delivery, determines whether the transaction is an Internet transaction (conducted over the Internet) or an electronic transaction (conducted over computer-mediated networks). Guidelines for the interpretation of these definitions were defined by the OECD Working Party on Indicators for the Information Society (WPIIS) in April 2001.

Figure: The OECD definitions of electronic commerce transactions and proposed guidelines for their interpretation

E-commerce transactions	OECD definitions	Guidelines for the Interpretation of the Definitions (WPIIS proposal April 2001)
BROAD definition	An **electronic transaction** is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over **computer-mediated networks**. The goods and services are ordered over those networks, but the payment and the ultimate delivery of the good or service may be conducted on or off-line.	**Include**: orders received or placed on any online application used in automated transactions such as Internet applications, EDI, Minitel or interactive telephone systems.
NARROW definition	An **Internet transaction** is the sale or purchase of goods or services, whether between businesses, households, individuals, governments, and other public or private organisations, conducted over the **Internet**. The goods and services are ordered over the Internet, but the payment and the ultimate delivery of the good or service may be conducted on or off-line.	**Include**:orders received or placed on any Internet application used in automated transactions such as Web pages, Extranets and other applications that run over the Internet, such as EDI over the Internet, Minitel over the Internet, or over any other Web enabled application regardless of how the Web is accessed (e.g. through a mobile or a TV set, etc.) **Exclude**: orders received or placed by telephone, facsimile, or conventional e-mail.

Source: OECD IT Outlook 2002, chap.4

These definitions imply that the simple process of gathering information on-line does not constitute electronic commerce: in order for electronic transactions to take place, it is necessary that at least the ordering step is carried out.

SIBIS analysis focused on the main domains of e-Commerce which are defined as follows:

- *Business to Consumers electronic commerce (B2C)*)corresponds to "electronic retailing", i.e. any electronic trading transaction where the purchaser is the end user of the products and services procured.
- *Business to Business electronic commerce (B2B)* refers to the implementation of electronic transactions between firms, The term B2B is however also used very often to refer to on-line interactions between firms in a broader sense (e-Business) including the management of various business processes (from planning and marketing to inventory control to ordering). The boundaries between e-Commerce and e-Business in reality are not so clearly defined.

The OECD developed a useful framework defining three areas of e-Commerce measurement based on policy makers and other users needs, along the S-shaped diffusion path of new technologies: *readiness, intensity and impact*. SIBIS decided to follow this framework which is useful to outline the gaps between existing indicators and needs for innovative ones.

Readiness indicators concern enabling factors (technological and socio-economic infrastructures) and barriers for the implementation of electronic commerce. The technological infrastructure refers to the availability of ICT hardware and the existence of (as opposed to usage of) ICT networks. The socio-economic infrastructure is made up by attitudes towards ICT as well as by ICT skills – i.e. the willingness and ability to use e-Commerce.

Intensity indicators measure the nature, volume and growth of e-Commerce transactions and are needed to enable policy makers to address imbalances. Intensity indicators have emerged more

recently, thanks to the growth of e-Commerce (which allows more in-depth analysis) and have usually been proposed by country-specific statistical documents. The aspects analysed include:

- frequency and repetitiveness of purchase/sales;
- phase of the transaction in which e-Commerce is used (information gathering, ordering, payment, delivery etc.);
- actors involved and their profiles (businesses, consumers, government agencies);
- products and services involved (with specific attention to the differences between material and immaterial goods);
- scope of the transaction: domestic, international, urban or rural.

Impact indicators measure the social and economic impact of electronic commerce, which means to devise ways to measure and scale up possible impacts from the micro level (single companies, individual users) to the meso level (industry sector, user segments) and the macro level (the economic and social system). Moreover, there are no simple causal relationships in this area. Therefore, impact indicators are very rare and research so far has suffered from a severe lack of data, especially from Europe.

Demand for statistics measuring e-Commerce has generated a multiplication of surveys and estimates not easily comparable. According to the OECD, in June 2002 "Despite very recent efforts by national statistical offices, international comparable statistics measuring the level, growth and composition of e-Commerce transactions are not yet available." [243]. The agreement by OECD member countries on the definitions outlined above represent a definite progress, as well as the adoption of a model questionnaire inspiring the Eurostat pilot surveys implemented in 2001 and 2002.

Most indicators in this section were developed within the SIBIS project. Other supplementary (to SIBIS) indicators are those based on the work carried out within the e-Business Watch initiative, which analysed e-Business development within companies active in 15 sectors all over Europe.[7]

In order to check the completeness of the indicator system for e-Commerce, the International e-Commerce Benchmarking Experimental Statistics Database (available at http://www.statistics.gov.uk) was largely consulted.

The results of SIBIS survey elaborations by sector and by stage of e-Commerce development are interesting enough to show that it would be useful to pursue this path, by increasing the level of segmentation and in-depth analysis. But the most relevant difficulty is the size and level of segmentation of the sample needed to gather statistically reliable data. A possible way out of this dilemma is to combine field surveys on e-Commerce and innovation diffusion with existing statistical databases that contain micro data enterprises.

SIBIS selected recent studies by ONS-UK and ISTAT-Italy based on this approach, which find interesting correlations between a firm's adoption of e-Commerce, their innovation capability, their profitability and even their employment dynamics. Whilst these studies are limited to one country only, they did show the potential of this type of approach.

Directions of future research should include:

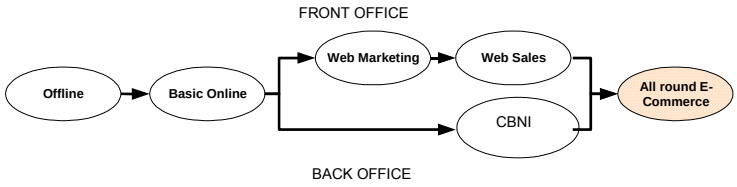
- Measures of the intensity of development of e-Commerce by sector and by business size and the integration of the technology with business practices. The e-Commerce typology proposed by SIBIS is a start but much can be done to improve it.
- Measures of impacts on turnover, profitability and productivity.

[7] E-Business market watch was launched by the European Commission, Enterprise Directorate General, with the aim to monitor the growing maturity of electronic business across different sectors of the economy in the European Union. Since January 20002 e-Business Watch has been covering seven manufacturing and eight financial and service sectors. Results and information are available at www.ebusiness-watch.org and [64][65]. The e-Business watch is being implemented on behalf of the European Commission by a consortium of partners which include two partners of the SIBIS project, empirica and Databank Consulting.

- Indicators of impacts on employment and the workforce, both qualitative and quantitative. Most firms report changes in the up-skilling and composition of the workforce. The relation between e-Commerce and employment is complex; good management of human resources is a key success factor. It is important to understand this more, because this has implications for training and education policy as well as the employment policy.

General e-Commerce indicators

Table 3.3-1: Share of establishments involved in "All round e-Commerce"

Definition and explanation	 A classification of enterprises based on the type of transactions they carry out over the Internet and the type of ICT services they employ (e-Commerce typology) as follows: • *Offline*: Establishments without access to the Internet, e-Mail and without a Website • *Basic on-line*: Establishments without a presence on the Internet (e.g. Website), but with access to the Internet or e-Mail. • *Web marketing*: Establishments with a presence on the Internet (e.g. Website), but none of the following • *Web sales*: Establishments that sell goods or services via the Internet (through own Website and/or via e-marketplaces), but none of the following • *CBNI - Closed Business Network Integration*: Establishments that use EDI or Extranets for communication with forward or backward linkages in the communication network, but none of the following • ***All round e-Commerce***: Establishments that sell on-line as well as practice value chain integration SVCI Supply Value Chain Integration: EDI, Extranet, Access to supplier's extranet MPS Marketplace sales: catalogue-based offering of products or services on e-marketplace, participation in auctions as a seller on e-marketplace, answering calls for tenders on e-marketplace WS Web sales: Sales through own site, MPS $\text{CBNI} = \frac{\text{Establishments having SVCI and WS}}{\text{All establishments}} * 100$ Value Range: 0 ≤ CBNI ≤100
Importance and value added	SIBIS developed a classification of enterprises based on the type of transactions they carry out over the Internet and the type of ICT services they employ (e-Commerce typology). This classification is useful to map the stage of development of B2B by country or by sector. The classification defines all the stages of development of e-Commerce by a business, starting from complete absence of Internet connectivity (offline) and simple use of email (Basic on-line type). The development process then takes two different paths, which can be exploited separately or in parallel. As shown in the chart below, Internet technologies can be exploited in marketing and sales (by

	introducing web marketing and eventually e-sales): this is defined as the front-office development path of e-Commerce, since it involves dealing on-line with final customers. Integration of closed business networks, involving suppliers and distribution networks, is defined as the back-office development path. The next step is integration of applications and exploiting processes synergies. This last stage has been named "the all round e-Commerce". Each establishment is classified in only one typology. To some extent, this classification reflects the development path a business is likely to follow, as it proceeds in the learning curve of ICT adoption and it reorganises to exploit the opportunities offered by interactive networks. But this is not always true. Some businesses in some sectors may never proceed to the stage of full integration of applications. Others may choose to limit e-Commerce to specific functions in the company, and still achieve remarkable efficiency and effectiveness benefits. In some sectors (retail sales, financial, travel and tourism, music…) Web marketing is already a major competitive tool. In others, especially in manufacturing, supply chain integration through Internet technologies procures evident benefits while Web marketing may not be relevant.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	• Does your establishment use EDI, i.e. electronic data interchange using the EDI standard? • Does your establishment have an EXTRANET, i.e. a private, secure network running on the Internet protocol and accessible for selected external users? • Do you have access to the Extranet of one of your supplier, partner or customer organisations? • Do you sell goods or services via the Internet? • Does your establishment trade goods or services through an e-marketplace? By e-marketplace I mean a business-to-business Internet trading forum in which multiple buyers and sellers exchange goods and services within an industry group or geographic region. • On e-marketplaces, different types of business transactions can be accomplished. In which of the following types is your establishment actively involved?
Discussion	This typology excludes e-procurement by choice, for methodological and practical reasons. The percentage of businesses buying on-line is rather high, and it intersects the other typologies in a complex way. While implementing on-line sales, even on a small scale, requires some investment and organisation, e-purchases may be experimented with low-cost applications and for non-sensitive goods and services, without affecting the rest of the organisation. The SIBIS survey question on e-purchases did not allow a distinction between marginal or strategic e-procurement implementations. A separate elaboration has been carried out to check how many enterprises for each typology make purchases on-line. The All round e-Commerce typology was chosen as an indicator on the basis of a better goal orientation than its alternatives (the other typologies).[8]
Supplementary indicators	To complete the e-Commerce typology, it was decided to compute separately the incidence of establishments purchasing on-line for every type and every macro sector: Macro sector 1 – Manufacturing, energy, mining construction; Macro sector 2 – Distribution, catering, communication & transport;

[8] The CNBI typology would have been chosen on the basis of discriminating power (between countries). However, any value of establishments involved in CNBI does not reveal how many establishments are “behind” and how many are “ahead” on the path to all round e-Commerce.

	Macro sector 3 – Financial and business services; Macro sector 4 – Public administration, health, education, other social/personal services The variations of the e-Commerce typology by sector provided very interesting results. For specific policy analysis the four sectors could be replaced by specific NACE sub-groups or organisational size classes. This again, through the SIBS classification, would provide interesting insight.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	0	2

Table 3.3-2: Share of businesses selling on-line

Definition and explanation	Share of establishments that sell goods or services via the Internet in percent of all establishments. $BSO = \frac{\text{Establishments selling goods or services online}}{\text{All establisments}} * 100$ Value range: $0 \leq BSO \leq 100$			
Importance and value added	This is not, by itself, an innovative indicator, but the number of businesses which sell on-line is a basic indicator necessary to measure the relevance of e-Commerce.			
Sources of data	SIBIS DMS			
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002			
Question wording	Do you sell goods or services via the Internet?			
Discussion	SIBIS results correspond roughly to the estimate of 19% of businesses selling on-line given by Eurostat in 2001, which however referred to companies with more than 10 employees (while the SIBIS sample includes all companies). The Eurostat average results from a share of 42% of on-line sellers among large enterprises (over 250 employees), which drops to 17% for Small and Medium Enterprises (SMEs, between 10 and 249 employees). But the Eurostat survey includes a different group of countries and sectors than SIBIS (for example in many countries it excludes the financial sector, which is very active in e-Commerce), and as SIBIS includes enterprises of 1 or above, precise comparisons are difficult to make. Moreover, these data were gathered one year earlier than SIBIS ones, in a period when e-Commerce was still growing very fast, so that it is acceptable that our survey would show higher values. On-line selling, and indeed selling, is something that is done at company level rather than establishment level. Therefore, the index may be slightly biased for larger companies. Overall, different sampling and weighting schemes cause considerable variation.			
Supplementary indicators	Percentage of enterprises that offer on-line reservations via the Internet.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2	2	2.66

Table 3.3-3: Share of businesses participating in e-marketplaces

Definition and explanation	Share of establishments which participate in an e-Marketplace of all establishments. $BMP = \frac{\text{Establishm ents participating in e-marketplaces}}{\text{All establisments}} * 100$

	Value Range: $0 \leq BPMP \leq 100$
Importance and value added	A lot of attention has been paid to the emergence of electronic marketplaces. Collected figures, however, seem to demonstrate that the actual diffusion of this activity is still low. This is probably related to the fact that the expected benefits, are not easily materialising as companies realised that substantial reorganisations of the relationships between suppliers and customers were required. Potential efficiency and effectiveness gains, on the other hand, remain high and companies will probably keep experimenting with them. The indicator is relevant in measuring the spread of e-Commerce. However the participation to e-marketplace is often associated to very low level of activity. Therefore, meaningful results require that this indicator is associated with the type and amount of activity (to avoid including temporary or minimal users)
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	Does your establishment trade goods or services through an e-marketplace? By e-marketplace I mean a business-to-business Internet trading forum in which multiple buyers and sellers exchange goods and services within an industry group or geographic region.
Discussion	This indicator doesn't pose any methodological challenge. The definition of e-marketplace may result ambiguous thus impacting on the quality of the results. It is not clear whether a high value of the indicator intrinsically indicates maturity or backwardness.
Supplementary indicators	Indicators providing data on the type of activity that businesses participating in e-marketplaces engage in. The activities listed include: catalogue based offering and purchasing of products and services, auctions as a seller and as a bidder, launching call for tenders, answering calls for tenders, power buying. Data reported include only catalogue based offering and purchasing. The activities listed include: catalogue based offering and purchasing of products and services, auctions as a seller and as a bidder, launching call for tenders, answering calls for tenders, power buying. Data reported include only catalogue based offering and purchasing. Considerable differences between industry sectors suggest that this breakdown has to be considered

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	1	3

Table 3.3-4: Barriers to on-line selling

Definition and explanation	Barriers to on-line selling perceived by establishments which do not currently sell on-line. (1) $BS_i = \frac{\sum_{j}^{J} barrier_j}{J}$ (2) $\overline{BS} = \frac{\sum_{1}^{E} BS_i}{E}$ BS_i Average barriers to on-line selling perceived by establishment i $Barrier_j$: Score on barrier item (see below): 0 does not agree 5 agrees somewhat or don't know 10 agrees completely.

	J Different types of barriers j (here: 8 in total) E Total number of establishments which do not sell on-line. Value Range: $0 \leq \overline{BS} \leq 10$ For a given barrier, e.g. "Adapting corporate culture to e-Commerce is difficult" this indicator provides the percentage of companies which agree completely, somewhat, do not agree, do not know with the statement that "adapting corporate culture to e-Commerce is difficult" This indicator aims at assessing the barriers as they are perceived by companies, using a semantic scale based on the degree of agreement with a set of statements. This indicator is based on the work carried out within the eBusiness Watch initiative [64], which took into account barriers to selling on-line and to procuring on-line among companies active in 15 sectors all over Europe.
Importance and value added	Most e-Commerce surveys include questions on barriers to adoption of e-Commerce, both for consumers and businesses. e-Commerce is a major business innovation which is successful when led more by commercial than technological considerations. The results from SIBIS show that there still are barriers hampering the usage of on-line applications in general. It was therefore important to add this indicator which investigates specifically the factors hindering the e-Commerce usage within organisations. With respect to other currently available surveys, the one carried out within e-Business Watch makes a distinction between barriers to selling and barriers to procuring. These two activities present, in fact, quite different features and degree of development among enterprises. On the sell side, the results show that the main reason for not selling on-line is simply that goods or services do not lend themselves
Sources of data	e-Business Watch [65], OECD [243], ONS [35]
Countries and time intervals covered	Germany, France, Italy and UK for 2002, 2003
Question wording	Please tell me whether you agree completely, somewhat or do not agree that the following are significant barriers as experienced by your company: a) Selling our products and services requires face-to-face interaction with customers. b) The necessary technology is expensive c) The costs for the promotion of the on-line offer are high d) The revenue potential of on-line sales is low e) Customers might be concerned about data protection or security issues f) Adapting corporate culture to e-Commerce is difficult g) The necessary skills are not readily available h) Handling the delivery process causes problems
Discussion	SIBIS did not investigate directly barriers affecting B2B. In this respect, however, various sources can be used for broadening the scope of the analysis to these important issues. According to OECD, the taking up of e-Commerce transactions among businesses is likely to be discouraged by existing transaction models or tight links with customers and suppliers along the value chain. There could also be a matter of security or reliability of systems, as well as of recognition of on-line signatures, although this barrier is being overcome by the current legislation in most Member States. The ONS "e-Commerce Inquiry to Businesses" [247], asked respondents to indicate which, among a number of suggested reasons, were to be considered barriers in using the Internet. Being Internet usage and e-Commerce closely related, is therefore important to mention what were the main reasons quoted. The barrier that was of most importance was the lack of security, followed by the cost

	of provision and access charges. The items composing the index are mostly uncorrelated in the SIBIS DMS data, indicating low redundancy. Exceptions are items b) and c) (r=0.425) and items f) and g) (r=0.317). In fact, eliminating items c) and g) even slightly improves the discriminating power of the index across countries.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	0	2

Table 3.3-5: Barriers to on-line purchasing

Definition and explanation	Barriers to on-line purchasing perceived by establishments which do not currently purchase on-line. (1) $BP_i = \frac{\sum_{j}^{J} barrier_j}{J}$ (2) $\overline{BP} = \frac{\sum_{1}^{E} BP_i}{E}$ BP_i Average barriers to on-line purchasing perceived by establishment i $Barrier_j$: Score on barrier item (see below): 0 does not agree 5 agrees somewhat or don't know 10 agrees completely. J Different types of barriers j (here: 8 in total) E Total number of establishments which do not sell on-line. Value Range: $0 \leq \overline{BP} \leq 10$ For a given barrier, e.g. "Concerns about data security" this indicator provides the percentage of companies which agree completely, somewhat, do not agree, do not know with the statement that "they are concerned about data protection and security issues". This indicator aims at assessing the barriersas they are perceived by companies, using a semantic scale based on the degree of agreement with a set of statements. This indicator is based on the work carried out within the eBusiness Watch initiative [64][65], which took into account barriers to selling on-line and to procuring on-line among companies active in 15 sectors all over Europe.
Importance and value added	Most e-Commerce surveys include questions on barriers to adoption of e-Commerce, both for consumers and businesses. e-Commerce is a major business innovation which is successful when led more by commercial than technological considerations. The results from SIBIS show that there still are barriers hampering the usage of on-line applications in general. It was therefore important to add this indicator which investigates specifically the factors hindering the e-Commerce usage within organisations. With respect to other currently available surveys, the one carried out within e-Business Watch makes a distinction between barriers to selling and barriers to procuring. These two activities present, in fact, quite different features and degree of development among enterprises. On the sell side, the results show that the main reason for not selling on-line is simply that goods or services do not lend themselves

Sources of data	e-Business Watch [65], OECD [243], ONS [35]			
Countries and time intervals covered	Germany, France, Italy and UK for 2002, 2003			
Question wording	Please tell me whether you agree completely, somewhat or do not agree that the following are significant barriers as experienced by your company: a) Purchasing procurement products or services requires face-to-face interaction with suppliers b) Our suppliers do not sell on-line c) The necessary technology is expensive d) The cost advantage is negligible e) We are concerned about data protection or security issues f) The legal protection of on-line contracts is not sufficient g) The necessary skills are not readily available h) Suppliers´ technical systems are not compatible with ours.			
Discussion	SIBIS did not investigate directly barriers affecting B2B. In this respect, however, various sources can be used for broadening the scope of the analysis to these important issues. According to OECD, the taking up of e-Commerce transactions among businesses is likely to be discouraged by existing transaction models or tight links with customers and suppliers along the value chain. There could also be a matter of security or reliability of systems, as well as of recognition of on-line signatures, although this barrier is being overcome by the current legislation in most Member States. The ONS "e-Commerce Inquiry to Businesses" [247], asked respondents to indicate which, among a number of suggested reasons, were to be considered barriers in using the Internet. Being Internet usage and e-Commerce closely related, is therefore important to mention what were the main reasons quoted. The barrier that was of most importance was the lack of security, followed by the cost of provision and access charges. The items composing the index are mostly uncorrelated in the SIBIS DMS data, indicating low redundancy.			
Supplementary indicators	None			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	0	2

Business to Consumer e-Commerce

Table 3.3-6: Internet usage for on-line banking

Definition and explanation	Share of Internet users who conduct on-line banking (OLB) of all Internet users. $\text{OLB} = \frac{\text{Users of on-line banking}}{\text{All Internet users}} * 100$ Value range: $0 \leq \text{OLB} \leq 100$
Importance and value added	The incidence of Internet users conducting on-line banking is a good marker for e-Commerce uptake. Once a customer trusts the security features supporting on-line banking, he/she is more likely to approach the on-line channel for other types of transactions.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU member states, Switzerland, USA for 2002; NAS 10 for 2003

Question wording	For your private purposes, have you used the Internet in the last 12 months to conduct on-line banking?			
Discussion	The share of respondents of e-Commerce buyers by country is a fundamental indicator, and is available through a number of sources. To supplement this indicator, SIBIS examined both other interactive applications, such as order products, buy financial products and some very basic, but none the less interesting, socio-demographic characteristics. Since e-Commerce is after all a new type of retail sales, the significant factors affecting consumers behaviours and choices should probably be searched among factors affecting lifestyles and purchasing behaviours. Unfortunately it is very difficult to find this type of research for comparable European data.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	3	3	3

Table 3.3-7: Usage of mobile phones for e-Commerce

Definition and explanation	Share of frequent WAP access users who purchase through WAP $MPC = \frac{WP}{WA} * 100 \ [WP < WA]$ $MPC = 100 \ [WP \geq WA]$ MPC Mobile phone commerce WP Having used a WAP phone to make on-line purchases in the last 12 months WA Having accessed the web via a WAP phone in the last 4 weeks Value range: $0 \leq MPC \leq 100$
Importance and value added	Mobile e-Commerce is an important aspect of extending ICT access, as well as providing further permutations of e-Commerce. Whilst WAP phones have a small uptake, and their use is limited in terms of reading webpages/ email), e-Commerce is taking hold through mobile telephones. It may be that on-line purchasing of "pay as you go", or "top up cards" are undertaken on-line, but nonetheless familiarity of undertaking this type of transaction on-line will undoubtedly spur increased on-line trading, especially by certain users (the young etc.), over the long-term.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU Member States, Switzerland, USA for 2002; NAS countries for 2003
Question wording	Have you used your mobile phone to view web pages or WAP pages or to read your email, at least once in the last 4 weeks? Have you used your mobile phone at least once in the last 12 months to make any purchases in the Internet, to download on-line information you are charged for or to make on-line payments?
Discussion	Mobile phone users who accessed the Internet in the last four weeks (viewing WAP, wireless access protocol - pages specially formatted for access with mobile phones) are less than 10% on average of WAP phone holders. Out of these users, less than 10% (a few units) actually bought something. It is well known that mobile commerce is not widespread, especially WAP access to the Internet, as it is presently too cumbersome to be accepted by users. The SIBIS survey clearly confirms this. In terms of the survey, in statistical terms, it means that the results are almost meaningless. Nevertheless, this is not to say that in the future this indicator will not yield useful or meaningful results, consequently these indicators should be monitored to map continued evolution of access via these types of technology. It may also be appropriate that other surveys take into consideration

	other mobile devices which can access the Internet (other than laptop PCs), such as handheld devices. Also, the survey asked users whether they had accessed this service in the last 4 weeks, it may be more appropriate to consider a longer time period of 3 months, especially as usage is so low.			
Supplementary indicators	Supplementary indicators could include breakdown by gender, age group and other socio-demographic variables.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	3	2	3

Table 3.3-8: Businesses' sales to consumers

Definition and explanation	This indicator aims at assessing how large is the share of on-line sales to consumers. Although the absolute number of business selling on-line is now relevant (according to SIBIS, 30% of the enterprises having a web site sell on-line) the incidence of on-line share is very limited, for most of the companies it is below 5%. $BSC = \frac{\text{establishments doing at least 5\% of consumer sales online}}{\text{establishments selling on line to consumers}} \times 100$ BSC Businesses' sales to consumers Value Range: 0≤ BSC ≤100			
Importance and value added	The valued added relies in that it is important to monitor the actual spread of e-Commerce and the relevance it has within organisations.			
Sources of data	SIBIS DMS			
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002			
Question wording	How large a share of your sales to consumers is conducted on-line?			
Discussion	The question was asked to those establishments selling on-line to consumers. It does not pose methodological challenges			
Supplementary indicators	B2C Internet sales			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	3	2	3

Business to Business e-Commerce

Table 3.3-9: Share of businesses procuring on-line

Definition and explanation	Share of enterprises that purchase goods or services via the Internet (%). $BPO = \frac{\text{Establishments purchasing on-line}}{\text{All establishments}} * 100$ BPO Businesses procuring on-line Value range: 0 ≤ BPO ≤ 100
Importance and value added	This is not, by itself, an innovative indicator, but the number of businesses who purchase on-line is a basic indicator necessary to measure the relevance of e-Commerce
Sources of data	SIBIS DMS

Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002			
Question wording	Do you use the Internet or other on-line services to purchase goods or services?			
Discussion	e-Procurement indicators are relevant both in absolute terms and because data from different source, such as the British ONS [35] show that major productivity impacts of e-Commerce are related to buying (more than to selling)			
Supplementary indicators	The on-line purchasing activity can be split among the various typologies of goods and services purchased on-line: maintenance, repair and organisation goods. Related indicator also refer to the share of on-line purchase on total purchase			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	3	2	2.66

Table 3.3-10: Businesses' sales to businesses

Definition and explanation	This indicator aims at assessing how large is the share of on-line sales to businesses. For most of the companies it is below 5%. $BSB = \frac{\text{Establishments doing at least 5\% of business sales online}}{\text{Establishments selling on line to businesses}} \times 100$ BSB Business sales to businesses Value range: $0 \leq BSB \leq 100$			
Importance and value added	This indicator illustrates the intensity of companies selling on-line to businesses, as a marker of B2B development			
Sources of data	SIBIS DMS			
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002			
Question wording	Do you sell goods or services via the Internet? Are some of your on-line sales to businesses? How large a share of your total sales to businesses are conducted on-line?			
Discussion	This indicator does not pose any major challenge as for methodology or validity. However in interpreting the results, it should be in conjunction with the readiness indicator "Share of businesses selling on-line".			
Supplementary indicators	None.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	3	2	3

Table 3.3-11: Self-assessed impacts of on-line sales

Definition and explanation	Respondents were asked to assess the impact of e-sales on their sales, costs, sales area, on the quality of their customer services, on the efficiency of their business processes according to a scale in 5 steps (from "very negative" to "very positive"). This indicator analyses the impacts of on-line sales as perceived by the interviewed. This indicator has been calculated for all the establishments selling goods or services via the Internet. Data weighted by employment.) (1) $SI_i = \frac{\sum_{j}^{J} \text{impact}_j}{J}$ (2) $\overline{SI} = \frac{\sum_{1}^{E} SI_i}{E}$

	SI_i Average impact of e-sales perceived by establishment i $Impact_j$: Score on impact item j (see below): 0 very negative 2.5 rather negative 5 neither positive nor negative, or don't know 7.5 rather positive 10 very positive J Different types of impacts j (here: 5 in total) E Total number of establishments which sell on-line Value Range: $0 \leq \overline{SI} \leq 10$
Importance and value added	According to SIBIS survey, main impacts concern first of all the quality of customer service, then the efficiency of business processes, the level of sales, and the extension of the sales area. Impacts on costs are mentioned last, by a smaller share of respondents. This corresponds to the results of existing surveys, which also point to benefits for customers reach and service as the most frequent consequences of the introduction of e-Commerce. It is interesting to notice that one of ten of respondents claims not to be able to measure impacts. But more than a third of respondents declare that impacts are neutral, neither positive nor negative. This could be a consequence of the low level of e-Commerce sales until now, but also of the difficulty to measure impacts.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	According to your experience, what effect has selling on-line on: (a) your sales (b) your costs (c) your sales area (d) the quality of your customer service (e) the efficiency of your internal business processes. Would you say the effect is • very positive • rather positive • neither positive nor negative • rather negative • very negative • don't know?
Discussion	In the absence of objective measurements of the consequences of on-line sales on company performance, impacts can only be estimated on the basis of the opinions of managers. A considerable amount of redundancy is present in the SIBIS DMS data for the items composing the index. In fact, they may be considered a scale.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	2	3

Table 3.3-12: Self assessed impacts of on-line purchases

Definition and explanation	Respondents were asked to assess the impact of e-purchases on their procurement costs, stock keeping of MRO goods, of the number of suppliers and relationship with suppliers and efficiency of internal business processes according to a scale in 5 steps, from "very negative" to "very positive". This indicator has been calculated for all the establishments using the Internet or other on-line

	services to purchase goods or services. Data are weighted by employment.) (1) $SP_i = \frac{\sum_{j}^{J} impact_j}{J}$ (2) $\overline{SP} = \frac{\sum_{1}^{E} SP_i}{E}$ SP_i Average impact of e-procurement perceived by establishment i $Impact_j$: Score on impact item j (see below): 0 very negative 2.5 rather negative 5 neither positive nor negative, or don't know 7.5 rather positive 10 very positive J Different types of impacts j (here: 5 in total) E Total number of establishments which purchase on-line Value Range: $0 \leq \overline{SP} \leq 10$
Importance and value added	Establishments engaged in e-procurement are more numerous than those selling on-line, but their assessment of impacts is in many ways similar.
Sources of data	SIBIS DMS
Countries and time intervals covered	Finland, France, Germany, Greece, Italy, Spain, U.K. for 2002
Question wording	According to your experience, what effect has on-line procurement on: (a) your procurement costs (b) stock-keeping of maintenance, repair and organisation goods (c) the number of suppliers (d) your relations to suppliers (e) the efficiency of your internal business processes Would you say the effect is • very positive • rather positive • neither positive nor negative • rather negative • very negative • don't know?
Discussion	Establishments engaged in e-procurement are more numerous than those selling on-line, but their assessment of impacts is in many ways similar. As for e-sales, more than a third of the sample declares impacts are neutral, a tenth does not know, very few point to negative effects and about half of respondents claim positive or rather positive impacts. Self assessed impact of on-line purchases (%) on enterprises. Data segmented by: impact on procurement costs; stock keeping of MRO; number of suppliers; efficiency of business processes. Responses rated from very negative to very positive (5 point scale). Analysis of the impacts of on-line purchases as perceived by the interviewed.
Supplementary indicators	None.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	2	3

3.3.2 E-Work

Introduction

Changes in the field of work content, work arrangements and the labour market are, of course, central to the Information Society concept as it is being discussed by policy-makers, researchers and statisticians. Work is defined here as aimed productive activity for remuneration, in other words gainful occupation. As a rule, gainful occupation takes place in an organisation such as an enterprise or a public establishment. There, individual work is embedded in a larger context and is subject to a certain kind of work organisation. Thus, organisational aspects of work, that is to say the co-ordination of employees in the course of division of labour, and the way these aspects are regulated in the form of contracts, are subjects at the centre of efforts to develop and establish new indicators.

ICTs are one of the main enabling forces accompanying the profound changes that have affected the organisation of work at all levels of analysis over the last three decades. The ability of individual countries to adapt to these changes appears to affect their success in securing sustained economic development. This relates closely to the dominance of the concept of flexibility in public discourse about the Information Society, and especially the application of ICTs. New types of work organisation at the workplace level are being promoted. Many of the so-called "new ways of working" involve applications of ICTs that have made possible totally new models of how to organise the work process in space and time, as well as new contractual employment forms and changes to the basic work content.

The section on e-Work in this handbook focuses on indicators that attempt to measure changes to the flexibility of work organisation via the application of ICTs.

On a conceptual level the dimensions to be considered when analysing flexibility developments regarding work organisation are working time, the place of work, the type of contract and the work content, i.e. the skills that are applied in the production process (see [172]). SIBIS integrated these dimension into a framework for developing indicators that cover current changes in the organisation of work and in the structure of labour markets.

This handbook contains indicators that consider the two dimensions in the organisation of work which arguably show the strongest influence of ICTs: the location of work and the contractual underpinning of work. The first of these is affected by applications of ICTs that enable the large-scale spatial separation of the place where work is carried out from the place where the work products are being integrated into the production process. Telework, mobile work and tele-cooperation are examples of this development. Regarding the contractual dimension of work relationships, the advent of the Internet has given rise to observations that traditional employment relationships might become superfluous since transaction costs on the labour market are assumed to have fallen dramatically. Electronic labour markets are certainly gaining in importance. Indicators are needed to produce evidence to what extent such developments are taking place as these would have far-reaching implications for the provision of social security in all EU Member States, and many other policy fields.

The main EU source for employment-related data are the Community Labour Force Survey (LFS) and the Eurostat Benchmark Employment Series which is considered the best available measure of (changes in) the total employed in individual Member States. The LFS includes indicators on lifelong learning which are, however, criticised as being of limited use for country comparisons. Ad-hoc modules on the flexibility of labour relationships and lifelong learning provide much more expressive indicators which also better reflect the state of the art in research and policy development, but they only conducted one time (one-off) and are therefore not suitable for producing time-series data.

The European Community Household Panel (ECHP), conducted annually, was established to better understand the full range of labour market transitions in the EU. It includes some questions on education, and a small number of questions on training. The instrument gives priority to high quality

cross-sectional data, while the longitudinal dimension is limited to income and some social exclusion indicators.

Many existing indicators stems from other sources than Eurostat. Very useful are the data provided by the European Foundation for the Improvement of Living and Working Conditions, a European Union body which is responsible for the pan-European surveys on working conditions (3 rounds of surveys 1990, 1995 and 2000), and one-off surveys on employment preferences and options (1998) and on employee participation and team-working (1996).

Work-related data which is collected from businesses across the EU are scarcer. DG Enterprise is conducting the Community Innovation Survey (CIS) which deals, in particular, with investments in R&D and innovative performance. This is also a source for indicators on innovative ways of organising work as well as training of staff.

Additional data sources are available covering the area of education statistics with an emphasis on further education and lifelong learning, among them the Continuing Vocational Training Survey (CVTS) as well as the Vocational Education and Training Survey (VET). They are conducted on an annual basis and have a heavy emphasis on non-formal training, but not covering informal learning such as self-directed learning.

Continuing efforts to develop and update indicators for best possible coverage of work-related aspects of the Information Society are needed. Of particular importance are the following issues:

- Changes in working methods that have been enabled by the use of ICTs have attracted much less attention than the take-up of ICTs themselves. This is unfortunate, as the focus on ICT tools may cover up large differences in the way these new technologies are used, and in impacts on employee's control over their work contents.
- Research now acknowledges that home-based telework is only one aspect of an increasing variety of locationally flexible ways to work [155]. This means that indicators should move away from the traditional concept of telework and rather measure ICT-enabled multilocational work in general. The STILE project has developed a module to be included in the Labour Force Surveys of a number of countries for this purpose [277]. Based on this BISER, another EC-supported research project, has piloted a questionnaire module in a population survey in all EU Member States except Luxemburg [19]. The results of these research efforts should be used to update instruments of e.g. the Eurostat ICT Usage Household Survey.
- Additional indicators are also needed to make sense of electronic labour markets and their effects on patterns of employment and labour market outcomes. While labour market-related data traditionally stems mainly from national Public Employment Services (PES), electronic labour markets are to a large extent provided by private companies such as jobsite operators. Additionally, PES data is usually not comparable between countries because of differences in labour market regulation, and applicable classifications. For these reasons, a totally new approach is needed to provide the required indicators about electronic labour markets. Probability samples (such as those used by national PES for research into mismatches between supply of and demand for specific qualifications) might have to be deployed.
- While often (more or less explicitly) being discussed by policy makers, statistics about ICT-related self-employment are scarce. This also applies to ICT penetration and usage patterns in micro enterprises (less than 5 employees), especially across countries. The main reason for this is the lack of suitable sampling frames. Efforts to provide such sampling frames and harmonise them across Member States need urgently to be taken, all the more since small and micro companies have been identified as being of prime importance for the economic prosperity of individual countries and Europe as a whole [89].

Work organization

Table 3.3-13: Share of home-based teleworkers

Definition and explanation	Share of alternating or permanent home-based teleworkers of all persons in employment $\frac{\text{Alternating or permanent home-based teleworkers}}{\text{All persons in employment}} * 100$ Value range: 0 – 100 Self-employed who mainly work from home or the same grounds as their home, or at different locations with the home as their base are not included in the numerator, but are included in the denominator.
Value added and importance	Fostering the spread of telework is a major policy objective of the European Commission as well as individual Member States [28] [96] [89]. At the same time, telework has been identified as an area in which existing indicators (such as those which were used for the eEurope 2002 benchmarking exercise [103]) are not adequately representing the nature of ICT-enabled changes to working locations. This indicator addresses the short-comings of previous cross-country comparisons. A high share of teleworkers is associated with more flexibility with regard to time and content of work. There is growing evidence that mobile and alternating home-based telework especially lead to increases of productivity deriving, in particular, from an increase in employee self-responsibility, but also reductions of cost e.g. for office space [82]. While there are reasons to believe that there is a limit to the share of the labour force for which teleworking would increase efficiency, current levels of penetration are believed to be much below the economically viable potential [81].
Sources of data	SIBIS GPS
Countries and time intervals covered	EU Member States, CH and USA for 2002; NAS10 for 2003
Question wording	• With the help of telephone, fax and computer, many types of work can be done from home. If work results are transferred electronically, this is sometimes called telework. Do you presently telework from home, for at least some of your working time? • [IF YES] Do you spend, on average, at least one full working day a week teleworking from home? • You indicated before that you work on average [Insert result earlier question] hours per week. How many of these do you spend at home in a typical week?
Discussion	An indicator on home-based and other telework is also part of the eEurope 2005 benchmarking exercise [106], and will be included in Eurostat's ICT Usage Household Survey 2003 [131] but this does only cover telework if the Internet is used. However, much teleworking today does not take place over the Internet, but over direct connections via, for example, ISDN. Arguably therefore, the eEurope indicator is too much focused on the technology (Internet) rather than the process (transmission of work results via on-line ICTs). The results of the SIBIS indicator have been compared with questions on • (a) use of PC in last 4 weeks • (b) tele-cooperation • (c) main place of work Results of (a) indicate that telework is still equated by some with traditional home work, since these respondents do not use a PC but state they are teleworking. Adjustment by dropping non-PC users from telework numbers is advisable. Results of (b) and (c) indicate that approximately half of all self-employed workers who tele-cooperate with external work partners and clients do not regard themselves as teleworkers. These are predominantly self-employed persons who have their main place of work at home, on the same grounds as their home or at different places with the home as their base. For measuring telework by self-

	employed in so-called SOHOs, it is therefore not advisable to use ”telework” as part of the question wording (as has been tried by the Eurobarometer survey), but rather derive data using the tele-cooperation module (seeTable 3.3-22). TELDET 1994 (see [196]) and ECATT 1999 (see [81] [68]) can after minor harmonisation be used to construct time-series data. The comparison is slightly hampered by the fact that the working definition of home-based telework used in SIBIS differs slightly from the one used in the TELDET and ECaTT studies: In the latter there was no mentioning that telecommunications links (phone/ fax/ e-Mail) must be used to transfer work results. Comparison of the results against other sources available for validation (see below), indicates, however, that this difference does not affect the comparability of 1999 against 2002 data significantly. The main other point for comparison is the Eurobarometer 56.0 (August-September 2001), which used the following definition to identify teleworkers: Teleworkers here are those that “work away from normal places of activity, usually from home, all or part of their working time”. The results of the comparison indicate a high degree of congruence, with the Eurobarometer figures in general higher than the SIBIS figures for alternating/permanent teleworkers, but lower than the SIBIS figures for all types of home-based teleworking. The 1999 data from ECATT has also been compared to national data collected and harmonised by the European Telework Development Initiative (latest available for 1998), see [81], also showing much congruence.
Supplementary indicators	• Intensity of home-based teleworking. This indicator allows to differentiate between 3 groups of home-based teleworkers: permanent, alternating and supplementary teleworkers. It also allows to separate persons who only spend unpaid overtime and personal preparation time from those who spend paid working time at home.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	2	1

Table 3.3-14: Share of jobs which are perceived feasible for telework

Definition and explanation	Share of persons in employment who consider their current job feasible for alternating home-based telework. $\frac{\text{Job feasible for telework}}{\text{All persons in employment}} * 100$ Value range: 0 – 100
Value added and importance	In addition to indicators about the spread of (home-based) telework and interest in telework (see Table 3.3-13), the extent to which current jobs are perceived feasible for telework is a vital factor for assessing the future spread of this way of working.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU Member States, CH and USA for 2002, NAS10 for 2003
Question wording	Would you say that your job is feasible for telework, under the assumption that you spend at least one full working day per week at home?
Discussion	Perceived feasibility is likely to be influenced by two main factors: the existence of real barriers and the ability or willingness of the respondent to think beyond their current work situation, i.e. to envisage what it would take to carry out part of a traditional job in a teleworking situation. Since these factors cannot be separated in the resulting data, care has to be taken when using it for comparisons. The question wording for this indicator intends to measure the feasibility of the current job of the respondent for alternating telework, not their occupation/field of work in general. This should make sure that respondents do refer to their current

	job conditions (including the employer's and/or superior's general attitude towards working from home). No data available for validation. The EMERGENCE project has calculated data for telework potential based on LFS data on sectors and UK-LFS data on telework penetration in sectors of the economy (see [180] [181]), but because of the totally different approach these data are not suitable for validation of SIBIS data on this indicator.			
Supplementary indicators	• Main reasons for jobs not perceived as feasible			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	1	0	0

Table 3.3-15: Effect of telework on work performance

Definition and explanation	Teleworkers who report ("fully agree") that they could not do their job as well if they could not telework from home, as a share of all persons in employment. $\frac{\text{Teleworkers reporting positive effect on job performance}}{\text{Persons in employment}} * 100$ Value range: 0 – 100
Value added and importance	The driving forces behind the implementation of telework are still not understood in their entirety [81], [161]. The main reason for this is that most scientific evidence on telework is being collected in case-study based research which means that the degree to which research results are representative for the entirety of teleworkers is unknown. Case studies often involve telework practice in companies which run trials or schemes that are publicly announced. According to all evidence available, however, most telework takes place outside of formal schemes [68]. There are many reasons to assume that telework inside and outside of formal schemes differ significantly with regard to characteristics and outcomes of this way of working. Indicators on outcomes of telework which are based on probability samples of the entire working population are needed, in particular, because of the degree of political support which has been devoted to telework promotion in recent years. This indicator can be interpreted as a measure of the productivity effect of telework. We assume that the higher the indicator value, the bigger is the contribution of telework to labour productivity in a country.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU Member States, CH, USA for 2002
Question wording	Most working people are not allowed to work from home. Please consider you would not be allowed to telework from home, for whatever reasons. What would that mean for your ability to do your job? Would it mean that you...[item]. • ... (four items, among them:) • could not do your job as well as with telework Answer categories: (1) agree completely, (2) agree somewhat, (3) do not agree, (4) DK
Discussion	From focus group discussions and pre-tests we follow that this kind of question will produce reliable results in spite of the general problems associated with hypothetical questions in surveys. As most home-based workers today are (still) very much aware of the fact that working at home is something extraordinary, they prove to be able to compare their own working conditions with the situation in more traditional, e.g. central office-based work settings. A hypothetical question

	has been preferred against a more direct question asking for the effects of starting to telework, as it cannot be assumed anymore that today's teleworkers have recently (or ever) worked in a traditional work setting. Only workers who have changed their work location, e.g. from central office-based to the home, would be able to answer a question such as "What effect has telework had on your work performance?" Numbers of DK responses were between 2.9% and 3.9% of all respondents, which can be considered a small number for this type of question. No data available for external validation.			
Supplementary indicators	None.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1	0	0

Table 3.3-16: Effect of telework on working hours

Definition and explanation	Teleworkers who report ("fully agree") that they would have to reduce working hours per week if they could not telework from home, as a share of all persons in employment. $\frac{\text{Teleworker s reporting effect on working hours}}{\text{Persons in employment}} * 100$ Value range: 0 – 100			
Value added and importance	See Table 3.3-15. Involuntary part-time work can be caused by a number of reasons, one of them being the inability to combine a full-time job with private duties, such as (typically) looking after a child or a person in need of care. Since both of these are tasks which are often in the responsibility of women, political measures which improve the ability of women to fully participate in working life are part of the efforts in gender mainstreaming which make up one of the pillars of the European Employment Policy. This indicator can also be interpreted as a measure of the income effect of telework. We assume that the higher the indicator value, the bigger is the contribution of telework to gender mainstreaming and income derived from paid work in a country.			
Sources of data	SIBIS GPS			
Countries and time intervals covered	EU Member States, CH, USA for 2002			
Question wording	Most working people are not allowed to work from home. Please consider you would not be allowed to telework from home, for whatever reasons. What would that mean for your ability to do your job? Would it mean that you...[item]. • ... (four items, among them:) • would have to reduce your working hours per week Answer categories: (1) agree completely, (2) agree somewhat, (3) do not agree, (4) DK			
Discussion	See Table 3.3-15.			
Supplementary indicators	None.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	0	0

Table 3.3-17: Effect of telework on work location

Definition and explanation	Teleworkers who report ("fully agree") that they would have to look for another job which is located closer to their home if they could not telework from home, as a share of all persons in employment. $\frac{\text{Teleworkers reporting positive effect on distance to workplace}}{\text{Persons in employment}} * 100$ Value range: 0 - 100			
Value added and importance	See Table 3.3-15. This indicator can be interpreted as a measure of the effect of telework on the regional match between supply and demand on the labour market. We assume that the higher the indicator value, the bigger is the contribution of telework to improving the regional match of supply and demand in a country's labour market.			
Sources of data	SIBIS GPS			
Countries and time intervals covered	EU Member States, CH, USA for 2002			
Question wording	Most working people are not allowed to work from home. Please consider you would not be allowed to telework from home, for whatever reasons. What would that mean for your ability to do your job? Would it mean that you... [item] • would have to look for another job which is located closer to your home Answer categories: (1) agree completely, (2) agree somewhat, (3) do not agree, (4) DK			
Discussion	See Table 3.3-15.			
Supplementary indicators	None.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	2	0	0

Table 3.3-18: Telework-enabled labour force participation

Definition and explanation	Teleworkers who report ("fully agree") that they could not be in paid work if they could not telework from home, as a share of all persons in employment. $\frac{\text{Telework-enabled labour force participants}}{\text{Persons in employment}} * 100$ Value range: 0 – 100
Value added and importance	Increasing participation in the labour market is one of the primary goals of the European Employment Policy. New ways of working are seen as one possible solution to this challenge [83]. This indicator intends to enable (necessarily tentative) estimates of quantitative effects of telework on labour market parameters such as labour market participation. Knowledge of the number of workers who, according to their own assessment, could not participate in paid employment without the possibility to telework can be used for this purpose. A high value indicates that telework can be estimated to have a significant impact on participation rates.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU Member States, CH, USA for 2002
Question wording	Most working people are not allowed to work from home. Please consider you would not be allowed to telework from home, for whatever reasons. What would

	that mean for your ability to do your job? Would it mean that you... [item] • could not be in paid work at all Answer categories: (1) agree completely, (2) agree somewhat, (3) do not agree, (4) DK
Discussion	See Table 3.3-15. The validity of this indicator rests on the degree to which respondents are able and willing to judge realistically whether they would be participating in the labour market even if they had to commute to a workplace every working day, or not. However, as the same method is being applied in the LFS, for example, to distinguish voluntary from involuntary part-time work, it seems feasible to use this indicator. Nevertheless much care has to be taken before statements about the effect of telework on employment rates in the EU can be based on data from this indicator. It can only act as a rough measure. No data available for validation.
Supplementary indicators	None.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	0	0

Table 3.3-19: Share of mobile teleworkers

Definition and explanation	Mobile teleworkers as share of all persons in employment. $$\frac{\text{Mobile teleworkers}}{\text{All persons in employment}} * 100$$ Value range: $0 \leq \text{value} \leq 100$
Value added and importance	Whereas telework in the early years of the use of the term meant almost always home-based working with ICTs, the fast spread of mobile computer technology and mobile telephony/data transfer along with economic pressure towards greater (geographical) proximity to customers [155] have meant that mobile teleworking has gradually gained in attention. This has also been acknowledged by policy [89], [81]. It is, however, not advisable to try to capture all types of telework (home-based, mobile, by self-employed) with only one indicator, since working conditions, social and economic preconditions as well as effects are believed to differ hugely between them [89]. A high share of mobile teleworkers might reflect two (interrelated) aspects: Firstly a large share of mobile workers, and secondly a large proportion of mobile workers that use on-line connections when travelling. Both are generally considered to be conducive to economic development.
Sources of data	SIBIS GPS, ECATT 1999 (see [68])
Countries and time intervals covered	EU Member States, CH, USA for 2002; NAS10 for 2003; DK, FIN, F, D, I, IRL, NL, E, SE, UK for 1999
Question wording	• In the last four weeks, have you spent any of your working time away from your home and from your main place of work, e.g. on business trips, in the field, travelling or on customer's premises? • You indicated before that you work on average [...] hours per week. How many of these do you spend away from home and your main place of work? • In the last four weeks, have you used on-line computer connections when travelling? By this I mean have you accessed the Internet for business purposes, or electronically transferred data to colleagues?
Discussion	The threshold of 10 hours per week was chosen as to include only those

	individuals in the definition of mobile teleworkers who are mobile regularly and for a considerable share of their working time. This means that occasional travellers are excluded. The indicator does not take into account the intensity of use of on-line computer connections during travels. This is intentional, as the importance of having access to the Internet or the company's LAN to a person can arguably not be assessed by measuring, for example, the time spent on-line. The results from the SIBIS pilot indicate that the large majority of mobile teleworkers use e-Mail when away from their main place of work. In the future it may become necessary to devise an additional indicator measuring the share of business travellers who remain on-line constantly, eg by using 2.5G or 3G mobile phone technology. Comparison with the ECaTT 1999 data shows an increase in the share of mobile workers, with relative country performance (ranking) remaining largely stable. This supports the reliability of the measure.			
Supplementary indicators	• Purpose for which on-line connections are used (access the Internet, send or read e-Mails, connect to your company's internal computer system) • Place where on-line computer connections are used (hotel, conference site or similar location; another company's premises; Internet café or an other commercial teleservice centre; on the move, using a mobile device for data transfer)			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	2	1

Table 3.3-20: Establishments with Remote Access

Definition and explanation	Percentage of establishments where (some) employees can access the computer system remotely from a non-business location, for instance from home or from a hotel. $\frac{\text{Establishments with Remote Access}}{\text{All establishments}} * 100$ Value range: 0 – 100			
Value added and importance	This indicator is a measure of the extent to which a country's establishments have the technological preconditions in place for telework and multi-locational work in general. A higher value indicates that more of a country's establishments are well places to deploy staff independently from the location of the central office. This can be regarded as a precondition for quickly adapting labour input to the requirements posed by changes in market conditions and business strategy.			
Sources of data	eBusiness MarketWatch [64]			
Countries and time intervals covered	2002, 2003 (only selected sectors and EU Member States)			
Question wording	• Can employees of your company access your computer system remotely from a non-business location, for instance from home or from a hotel?			
Discussion	This indicator can be validated by comparing with the DTI International Benchmarking Study. Here the question wording is: "Can your employees access your computer system remotely from non-company sites? IF YES: How often is remote access used (rarely/occasionally/quite often/frequently)?". The comparison shows a high degree of congruence between results.			
Supplementary indicators	• Establishments giving staff remote access via wireless devices			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1	1	0

Table 3.3-21: Enterprises practising telework

Definition and explanation	Enterprises with at least 5 percentage of employed persons teleworking regularly, as share of all enterprises. $\frac{\text{Enterprises with at least 5\% teleworkers}}{\text{All enterprises}} * 100$ Value range: 0 – 100			
Value added and importance	See Table 3.3-13. A similar indicator is part of the eEurope 2005 benchmarking exercise.			
Sources of data	Not available yet. (Pilot results from 1999 establishment survey available from ECaTT [68])			
Countries and time intervals covered	Eurostat: from 2003 for all EU Member States and NAS. 1994: D, E, F, I, UK 1999: EU Member States excl. A, B, EL, LUX, P			
Question wording	• Does your enterprise have employed persons who regularly work part of their time (half a day peer week or more) away from your premises and who use electronic networks to communicate with the enterprise's IT system? • How many of the employed persons in your enterprise telework regularly, as percentage of total staff? (OPEN OR CLASSES AS REPLY OPTIONS)			
Discussion	The eEurope benchmarking indicator as suggested in [106] is simply a measure of the experience establishments are collecting with telework. Available data e.g. from the ECATT survey 1999 suggests that most enterprises (especially in the size classes covered by the Eurostat e-Commerce Survey) employ teleworkers, but only very small numbers. This reflects the finding, supported by much empirical evidence, that it is hardly the technical challenge of giving teleworkers access to company IT systems which determines the spread of telework, but rather organisational issues in relation to management of staff at a distance. For this reason, in order to give information about the diffusion of teleworking among companies, data about the relative weight of teleworkers in comparison to traditional co-located workers are required, as suggested here. Anecdotal evidence suggests that if enterprises have less than 5% of their staff teleworking they are most likely still in a stage of experimenting, without real commitment to locationally flexible work [68]. This indicator has been piloted already in 1999 as part of the ECATT surveys [68]. Results from that survey suggest that the observation unit should optimally be the establishment rather than the enterprise, since knowledge about personnel matters in other locations of the same company is often very insufficient. Results also indicated that the share of establishments that have at least 5% of their staff teleworking is still modest.			
Supplementary indicators	None.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	0	0	0 (2)

Table 3.3-22: Share of workforce practising tele-cooperation

Definition and explanation	Share of persons in employment who use e-Mail, video conferencing or electronic data transfer when communicating with external contacts (tele-cooperation). $\frac{\text{Persons practising tele-cooperation}}{\text{All persons in employment}} * 100$ Value range: 0 – 100			
Value added and importance	While teleworking means changing the location of work, ICTs can also considerably change ways of working without a change of place. Through ICTs it has become possible that teams of workers can co-operate in real time regardless of the geographical distance which lies between them. Evidence suggests that tele-cooperation boosts worker productivity and innovative performance throughout the EU economy by allowing flexible configurations of human capital without actually moving people from one place to the other [266]. It is operationalised here by asking workers how often they use e-Mail, the Internet and electronic data transfer for communicating with external business contacts (suppliers, customers, etc). A high value indicates an economy which makes much use of modern (net)working tools, and is therefore regarded as beneficial.			
Sources of data	SIBIS GPS			
Countries and time intervals covered	EU Member States, CH, USA for 2002, NAS10 for 2003			
Question wording	• When you communicate with external contacts, do you sometimes use e-Mail, video conference or electronic data transfer? By external persons we mean customers, clients, suppliers, other business contacts, but also colleagues working at other locations of the same company.			
Discussion	Cooperation is here understood in a very wide sense including all kinds of interaction between the worker (respondent) and customers or work partners at other locations. The feasibility of the initial question can be checked using data from the supplementary questions which ask about the intensity of usage of selected ICTs. According to these data, 97% of persons classified as tele-cooperating use e-Mail for this purpose, 82% electronic data transfer, 19% video-conferencing. This may be compared with data from ECATT 1999 which used an earlier version of the module for tele-cooperation. Results indicate an overall increase in tele-cooperation in all Member States, with relative performance of countries showing a high degree of stability, which corresponds with empirical evidence from other sources.			
Supplementary indicators	• Frequency of usage of e-Mail, video-conferencing and electronic data transfer for communicating with external contacts			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1	1	1

Table 3.3-23: Share of self-employed teleworkers in SOHOs

Definition and explanation	Share of self-employed workers who work from home, the same grounds as their home or from different places with their home as a base, and use e-Mail, video conferencing or electronic data transfer for communicating with external contacts.) $\frac{\text{Self-employed teleworkers in SOHOs}}{\text{All persons in employment}} * 100$

	Value range: 0 – 100
Value added and importance	The self-employed, especially freelancers and other "own account self-employed", often work from a home base. By using ICTs for tele-cooperation with clients, collaborators and suppliers, many of such home workplaces have evolved into what is called SOHOs, i.e. ICT-enhanced workplaces for self-employed teleworkers. These are believed to play a vital role in entrepreneurial activity especially in the most dynamic sections of the economy, such as advanced business services and the ICT sector. In order to cover self-employed teleworkers which work from their home (SOHO), it is necessary to use a separate question module.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU Member States, CH, USA for 2002, NAS10 for 2003
Question wording	Work location: • Do you work mainly (a) in your own home, (b) in the same grounds or buildings as your home (c) in different places using home as a base (e.g. travelling salesman, free insurance agent etc.) (d) somewhere quite separate from home (e) DK Usage of ICTs for communicating with external contacts: • When you communicate with external contacts, do you sometimes use e-Mail, video conference or electronic data transfer? By external persons we mean customers, clients, suppliers, other business contacts, but also colleagues working at other locations of the same company.
Discussion	This may be compared with data from ECATT 1999 which used an earlier version of the module for tele-cooperation. Results indicate an increase in telework in SOHOs in all Member States, with relative performance of countries showing a high degree of stability. No other data available for validation.
Supplementary indicators	Frequency of usage of e-Mail, video-conferencing and electronic data transfer for communicating with external contacts

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	1	1	1

Table 3.3-24: Spread of e-Lancing

Definition and explanation	Share of the self-employed whose work features a number of characteristics which indicate e-Lancing: • attracting new business through the Internet; • delivering work results through the Internet; • communicating with clients or customers exclusively by electronic means. $\frac{\text{e-lancing starters / advanced e-lancing users / occasional e-lancers}}{\text{All self-employed}} * 100$ Value range: 0 – 100
Value added and importance	The concept of the e-lancer goes beyond that of the teleworker as it describes workers who are - at least in theory - totally detached from the need to be located in proximity to their clients, but instead work "on the Net" [157]. The scarcity of data on this phenomenon is diametrically opposed to the prominence it has gained in the political debate. Most often, data on own-account self-employed (outside of the farming sector) is being used to indicate the potential of e-lancers. Others make use of data on so-called “free agents” which they regard as a

	preliminary stage in the development towards e-Lancing [204]. A more realistic view of the e-Lancing phenomenon is clearly in demand, given the degree to which the public debate has been focussing on e-lancers as spearheading a general trend towards self-employment becoming the common contractual mode of working.
Sources of data	SIBIS GPS
Countries and time intervals covered	EU Member States, CH, USA for 2002
Question wording	I would like to know about the role the Internet plays in your business. • Do you sometimes attract new business through the Internet or via e-Mail? • Do you sometimes deliver work results to your clients or customers through the Internet or via e-Mail? • Does it sometimes happen that you communicate with clients or customers exclusively by electronic means, i.e. via Internet, e-Mail, phone or fax and without meeting face-to-face?
Discussion	This indicator does not identify "e-lancers" as such, as recent research (see [154]) has shown that their number is too small to be statistically relevant yet. Instead, the indicator gives the share for self-employed workers who "sometimes" engage in work practises which are suggested as being characteristics of e-Lancing. In order to distinguish between different degrees of e-Lancing activity, three groups can be created: • e-Lancing starters are self-employed workers who either attract (some) new business through the Internet or via e-Mail or (sometimes) deliver all work results to clients/customers through the Internet or via e-Mail • advanced e-Lancing users are self-employed workers who attract (some) new business through the Internet or via e-Mail and (sometimes) deliver all work results to clients/customers through the Internet or via e-Mail • (Occasional) e-lancers are self-employed workers who communicate with (some) clients/customers exclusively by electronic means, i.e. via Internet, e-Mail, phone or fax, but without meeting face-to-face. No data available for external validation.
Supplementary indicators	None.
Evaluation results	Benchmarking Value: 1 | Validity: 1 | Reliability: 0 | Availability: 0

Table 3.3-25: Use of the Internet for job seeking

Definition and explanation	Persons using the Internet for job-seeking, as share of all persons in employment. $\frac{\text{Internet job seeker}}{\text{All persons in employment}} * 100$ Value range: 0 – 100
Value added and importance	The share of job-searchers which use modern, highly efficient tools for job-seeking [157] is an indicator for the extent to which ICTs potential for improving the job-matching function of the labour market is exploited. Since, in general, geographical mobility of workers in the EU is low [228], which is partly caused by the lack of knowledge about job opportunities and candidates in other regions [157], the move towards electronic job listing presents the possibility to improve the matching function of labour markets by easing the transfer of labour market data between recruiters and job-searchers. It must be assumed that countries whose workers make more use of electronic labour markets will in the future be better placed to meet the skill requirements of

	their economy, and the demand for adequate jobs.			
Sources of data	SIBIS GPS			
Countries and time intervals covered	EU Member States, CH, USA for 2002; NAS10 for 2003			
Question wording	• For your private purposes, have you used the Internet in the last 12 months to look for a job?			
Discussion	This indicator is influenced by the general extent to which the labour force is engaged in job searching. In the USA, for example, comparatively low job tenure and high job turnover may result in a high share of the workforce looking for a job although currently in employment, while in countries with longer job tenure job searching might in general be less common. These country differences are not controlled for in this indicator. It is therefore properly interpreted as a measure of on-line job search activity, but not as a measure of how much of existing job search activity is being transferred to the Internet. As such the indicator is of high relevance for the assessment of (potential) labour mobility since lack of knowledge of employment alternatives is believed to be one of the main constraints to (primarily geographical) labour mobility. No data for validation available.			
Supplementary indicators	None.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	2	1	0

Table 3.3-26: Establishments advertising vacancies on the Internet

Definition and explanation	Percentage of establishments that put job adverts on the Internet $\frac{\text{Establishments that put job adverts on the Web}}{\text{All establishments}} * 100$ Value range: 0 – 100
Value added and importance	The Internet opens up new possibilities to make job matching more efficient. Public Employment Services in the EU have begun to make use of the Internet to publish vacancies. They face competition in private labour market intermediaries that charge companies for job advertisements that are placed on websites with sophisticated job and candidate search engines. All of this is highly likely to improve the matching function of labour markets in a sectoral, occupational and regional sense [157]. Establishments that advertise vacancies on the Internet can be assumed to have better access to scarce skills, in particular from other regions. We assume that the higher the share of establishments that announce job adverts on the web, the more efficient is the matching between supply and demand in a country's labour market.
Sources of data	BISER 28 Regions Survey (pilot) Ideally needs a survey of HR managers in establishments/companies.
Countries and time intervals covered	2003 (only selected NUTS 2 regions across EU)
Question wording	• Does your establishment put job adverts on the Internet?
Discussion	The question wording might be extended to ask for different ways of using the Internet for this purpose: - by putting job adverts on the organisation's own website - by announcing vacancies through the website of the PES - by using the services of commercial jobsites/ job exchanges

	- by using other websites It should be taken into account that vacancies which are reported to the PES might be made public on the PES's website without the organisation being aware of this. The same holds true for job adverts in newspapers and magazines which are often also published on the Website, so that the distinction between different media to advertise vacancies has become increasingly difficult. It should also be noted that the proposed question would only cover recruitment activities through a company's website (passive use). Active recruitment, i.e. HR staff searching the web for skilled staff, is not covered.			
Supplementary indicators	- Percentage of establishments which report that more than x % of their recruitments resulted from Internet-based matching (classes: 0%, -10%, -25%, -50%, >50%) - Share of recruitments resulting from Internet-based matching (would need a very high sample size to allow for reliable estimates)			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	0	0	0

3.3.3 E-Science

Introduction

Three different understandings of science have been identified:

- First, it is a body of certified knowledge,
- Second, science is also a set of procedures for finding things out,
- Third, "… science is a social enterprise, a culture or tradition, and a set of social arrangements for developing, certifying, and communicating knowledge." ([303], p. 513)

E-science particularly refers to the second and third understanding. The penetration of science with computer networks has modernised science and it has the potential to transform it. Since the initial spread of electronic mail and the ARPANET thirty years ago [201] a multitude of further services for scientists has been developed. Computer networks and particularly the Internet have changed the way how scientists collect data, retrieve information, communicate and collaborate. Of course, this is an ongoing process. E-science denotes this modernised practice of science that is unthinkable without the availability of computer networks. Researchers also investigate the hypothesis that the computerisation of science transforms its economic and social structures [170]. For instance the establishment of electronic journals and preprint archives is supposed to retroact on the relations to scientific publishers and the traditional peer review of scientific publications. However, these are very recent developments and they contain lots of unsolved problems. It would be premature to include them in a statistical measurement, as many of the less complex phenomena of modernised e-Science are not yet assessed and understood properly.

This section proposes indicators for the most important facets of e-Science. We differentiate between three groups of indicators:

- *Readiness for e-Science* covers indicators on the computer and network infrastructure in science and the computer skills and IT awareness of scientists. Capable computers and networks with sufficient transmission capacities are the technical preconditions for e-Science. Computer skills and an awareness of the capacities of IT for knowledge production are other, rather soft prerequisites.
- *Use of e-Science* includes indicators on a variety of purposes in science for which computer networks are employed. Internet-based applications have become integrated into such diverse

activities as getting ideas for new research, data collection and data analysis, information retrieval, communication, collaboration and publishing. Some of the applications are especially useful in a certain phase of a research project, i.e. during planning and definition, implementation or dissemination, whereas others are used during the entire duration of a project.

- *Impact* indicators assess on the one hand the production of new knowledge which may be considered as the main aim of science. We include indicators that cover different outcomes of scientific work i.e. publication and patents. On the other hand scientific collaborations can be affected by the use of Internet technologies. Therefore we also include an indicator on the size of collaboration networks. Readiness and use related variables can be regressed on these outcome variables in causal analyses.

Indicators were developed with the four quality criteria listed in section 1.2 (benchmarking value, validity, reliability and availability) in mind. In addition, the applicability to different scientific disciplines was another important criterion for selecting an indicator in this section. Multi-disciplinary indicators generate the opportunity of making comparisons across disciplines and countries.

Most indicators in this section were developed within the SIBIS project. For some indicators experiences from previous scientometric and other scientific work could be used which was extensively analysed in the previous deliverables in the topic area “Internet for R&D” (see particularly the reports from work packages 2 and 5 at the SIBIS website http://www.sibis-eu.org/sibis). In order to test the indicators and collect more information on their strengths and weaknesses a survey was carried out among European scientists in five scientific disciplines (astronomy, chemistry, economics, computer science and psychology). Another major source of indicators on research networks (RN) was TERENA, the Trans-European Education and Research Networking Association [284]. TERENA has very good access to the national RN and offers unique data on their capacities and performances. Indicators from other sources do not exist. The OECD, together with the national statistical institutes and R&D institutions, has developed various manuals ([235] [232] [233]) and databases: The Main Science and Technology Indicators Database (MSTI) covers the outputs (patents) as well as inputs (personnel, expenditure) of R&D activities in the public and the private sector. Patent data from different sources are also published on the OECD website. Other partly proprietary databases cover specific elements of science such as the publications and citations databases of the Institute for Scientific Information (ISI). However, as yet there is no database covering the technological inputs for science or private R&D activities.

The SIBIS activities on measuring e-Science should be considered as exploratory. Though the indicator system tackles some important developments it also leaves some major issues for future work.

- The indicators are based on an evolutionary world view taking e-Science as a modernized form of traditional science. The impacts of computer networks are limited to the cost-efficiency dimension. However, some authors have developed much more far-reaching and revolutionary arguments about the consequences of preprints, on-line databases or collaboratories for scientific communication and science in general [166], [165], [170], [229]. We do not contest these visionary views. However, we do not think that they provide a reliable basis for statistical measurement yet.
- In the context of the previous argument lies another restriction which refers to the status-quo of the e-Science technologies considered. A few applications, such as e-Mail, have become omnipresent tools for researchers. Other applications are still in the market introduction phase, such as on-line conferencing tools or Grids. However, the latter tools do not render themselves easily for a reliable and detailed measurement as their level of stability is still low. Looking at the relationship between new technology and its users (and other relevant social groups) we must expect frequent modifications of the technology before ‘closure’ takes place [16]. Hence, in an early innovation phase, it is very difficult to collect valid and reliable quantitative data, establish benchmarks or undertake comparisons at national level. Indicators on the more established and stable applications are therefore much more frequent and detailed in our indicator system.
- Another issue that has to be left for future indicator development is the coverage of other stakeholders in science than the scientists themselves. Technicians, research managers, ancillary organisations such as research-related services (libraries, publishers etc.), scholarly societies, administrations and foundations and last but not least the principals, customers and beneficiaries

of science – all somehow shape or use e-Science and have a very influential position in regard to its outcomes. For instance, e-publishing demands that scientific publishers develop new publishing models which suit both, their economic constraints and the changing publication habits of scientists. Many of these stakeholders and their activities related to e-Science could not be included due to the limits of time and funds of the present project. Also, the outreach of e-Science into society and the economy had to be neglected in the present project.

- Last but not least it would be a valuable undertaking to extend the indicator system to R&D activities beyond science, particularly in private firms. Some of the indicators developed in this section could be used with slight modifications, whereas others have to be developed from scratch. This, however, also would have overburdened the present project.

All these issues are worthy topics for future investigations. It is the strength of this section that it focuses on one important stakeholder, the scientist, and proposes indicators on all dimensions of computer networks (readiness, use and impact) and for some of the most important purposes and activities in R&D.

Readiness for e-Science

Table 3.3-27: Core usable backbone capacity on a national RN

Definition and explanation	Maximum data rate per second that is available within a national research network (RN). Maximum data rates are currently (2003) in the Megabit per second and Gigabit per second range in the EU member states.
Importance and value added	National RNs provide the infrastructure for data transmission which is particularly important in research fields which use large amounts of data from several sites or which engage in data-intensive and collaborative research (for instance analysis of climate or space data, of genome data etc.). This kind of research depends on a high service level of data transmission networks. In many other fields data are exchanged more or less regularly. An upgrading of the Internet infrastructure for research has also been formulated as one of the action-lines in the *e*Europe initiative [85][84]. The core usable backbone capacity can be considered as an indicator for the service level within a national RN. It shows whether R&D systems find the conditions for transmitting large amounts of data across different sites within a country. An increase of the core capacity should be interpreted as an improvement of the service level.
Sources of data	The TERENA surveys of national research networks [284] have provided the data for 2001 to 2003.
Countries and time intervals covered	EU member states, NAS and CH (and a selection of further European, North African and Asian countries) for 2001-2003
Question wording	In 2001 and 2002: What is the current core usable backbone capacity on your network (in Mbit/s)? In 2003: What is the current typical core usable backbone capacity on your network (in Mbit/s)?
Discussion	The maximum backbone capacity reflects the maximum service level for data transmission between different R&D sites within a country. It does not contain any information on local or international data transmission capacities and on the average service level. Therefore it should not be assumed that the core capacity is really representative for the conditions that any researcher encounters at his workplace. For a representative country comparison more detailed data on different RNs and on the users would be necessary which is currently not available.

	A cross country comparison faces some additional problems: most notably, the topologies of NRNs vary and in "star topologies" lower capacities might lead to the same service level as higher capacities in "network topologies" (if the large site in the RN is the centre of the star). A comparison of the values for 2001, 2002 and 2003 showed some inconsistencies: In some countries the core capacity has presumably decreased in 2003. This is not plausible and a possible explanation could be the slight change of wording in the question or problems which some respondents experienced when filling in the questionnaire.			
Supplementary indicators	None available.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3 (2.66)	1	2	3

Table 3.3-28: Total congestion ratio on the RN

Definition and explanation	Percentage of users that might be affected by excess traffic on the RNs within a country. The congestion ratio can be assessed for different elements of a computer network: the campus network, the access to the NRN, the NRN itself, and for international connections. As the differing congestion ratios for each element provide a very heterogeneous picture, it makes sense to integrate them into a composite indicator that tries to assess the probability of encountering congestion on the networks of a country. Such an index can be constructed using the following simple formula: $TCR = 100 * \left(1 - \left(\prod_1^n (1 - p_i)\right)\right)$ with TCR Total congestion ratio p_i Probability to experience congestion on a certain network i, with i being one of 1,...,n networks The term in brackets represents the product of the probabilities that a client institution will not encounter congestion on a certain network, thus producing the overall probability of not encountering congestion. Subtracting this from 100 we get the total congestion ratio. An example may help to illustrate this: If a user wants to transmit data from a randomly selected computer to a colleague in another country and on average 30% of the client institutions of the NRN experience congestion on their campus network, 20% on the access network and 5% on the NRN, the congestion probabilities p_i are 0.3, 0.2 and 0.05. All in all, within this country a user runs the risk of choosing a moment with excess demand on the networks he wants to use of TCR = 100 * (1 - [(1-0.3)*(1-0.2)*(1-0.05)]) = 46.8 This means, 46.8% of the users using this connection will experience congestion. The optimum is 0, i.e. no congestion at all, the worst case is 100 or total congestion. Value range: $0 \leq TCR \leq 100$
Importance and value added	The TCR tries for the first time to combine the service levels on different RNs across a country. It also goes beyond a pure listing of maximum transfer rates and, by using congestion information it matches information on the infrastructure and the demand for data transfer. As it is not affected by the size of a country and its research system it is useful for a cross country comparison and benchmarking. As indicated above, a large (increasing) TCR means a low (decreasing) service level.

Sources of data	The TERENA surveys of national research networks [284] have provided the data for 2001 to 2003.
Countries and time intervals covered	EU member states, CH (and a selection of further European, North African and Asian countries) for 2001-2003
Question wording	Please give us an indication of where there is congestion (if at all) within the national network. Please rank from most to least congested and, if possible, estimate the percentage of client institutions which experience congestion in those locations RankEst. 1 = most congested 5 = least congested percentage [ ] [%] Campus LAN [ ] [%] Metropolitan or regional network [ ] [%] Access network [ ] [%] NRN backbone [ ] [%] External connections
Discussion	The data currently available permits only an approximate calculation of the TCR. The congestion data are pure estimates from the NRNs and they do not differentiate between the campus networks within a country. It was assumed that the computer to transmit the data was randomly selected from all computers connected to the RNs. However, in reality larger organisations with larger needs for data transmission have usually better network connections and run a lower risk of suffering congestion. The more elements of an RN are included in the calculation, the smaller the number of users that is really affected by the service levels (every user has to use the LAN, only those transmitting data to other campuses use the access network and the NRN, only those transmitting data to other countries use the NRN's international connections). No related data exist and a validation of the entire indicator is not possible yet. Terena calculated inbound and outbound traffic loads on the external connection(s) of an NRN (unpublished information from Terena). These calculations confirmed the subjective judgements of the NRNs in regard to congestion on this part of the network [12]. However, as the external connections were the least congested in 2002, this validation excludes the largest and most problematic part of the TCRs and is only of limited value.
Supplementary indicators	The TCR can also be calculated at international level, including the estimated congestion for external connections.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2 (1.5)	1	2 (2.33)

Table 3.3-29: Average budget of a national RN

Definition and explanation	Average budget of a national research network per researcher outside of business enterprises $\bar{B} = \frac{\frac{1}{n}\sum_1^n B_i}{R}$ $\bar{B}$ Average budget of an NRN B_i Budget of an NRN for budget year i, i = 1, ..., n R Researchers outside of business enterprises

	Value range: $\bar{B} > 0$ For example, the Dutch research network SURFnet lists budget figures of 32 million € for 2000, 35 for 2001, 46 for 2002 and 33 for 2003. The average budget is 36.5 million € and the average budget per researcher is 1715 € (using the 1999 researcher figures to normalise the budget data).
Importance and value added	Another indicator useful for assessing the current and future service levels of NRNs is their budget size in relation to a variable that estimates the size of the research system. It looks at RNs from the financial and not the technical perspective. Raising the budgets of RNs could be an EU policy target, leaving the decision about the appropriate use of the funds to the national level.
Sources of data	The TERENA surveys of national research networks [284] have provided the budget data for 2001 to 2003; OECD and Eurostat provide the researcher data, PPP data can also be obtained form Eurostat.
Countries and time intervals covered	EU member states, CH (and a selection of further European, North African and Asian countries) for 2000-2003
Question wording	What was the total budget for 2000 (or 2001/2002/2003)? (In millions of Euro at the current exchange rate) (please do not include your budget for activities not directly related to R&E networking, e. g. the budget for activities such as Domain Name registration services for parties outside the NREN)
Discussion	Unfortunately the available budget figures contain some weaknesses. Though the NRNs were asked to include only the budget for activities related to networking activities (and exclude for instance domain name registration), it is still not certain that the data are entirely comparable, as even the scope of networking activities differs. For instance, some networks provide a lot of user support, and some carry out research, whereas others don't. However, this could only be taken into account, if the NRNs provided a detailed breakdown of their budget figures which is currently not the case. As the budget is influenced by shifting capital expenditures it seems advisable to calculate mean values over a longer period of time. Purchasing power parities (PPP) are preferable to € as currency unit for a country comparison because they take price level differences into account. Budget data should be normalised with variables that take into account the size of the national research systems. Possible alternatives for normalisation are for example data on researchers and R&D personnel published by the OECD, the number of students from the national statistical institutes, or the number of publications in scientific journals included in citation indices. However, these indicators cover only parts of the research system and have additional drawbacks (up-to-date data is not available, no information on the data transmission needs etc.). For the present calculation the number of researchers outside of business enterprises was chosen as it seemed to provide the most stable results and correlated fairly well with the other variables available for normalisation. The size of an NRN also affects the numerator of the indicator, i.e. the budget figures: Economies of scale are the result of lower average data transmission costs (e.g. twice the money buys four times the transmission rate) and the better bargaining position of an NRN with a large customer base. As a consequence, larger countries should systematically have a lower NRN budget to R&D system ratio. All in all, it is therefore advisable to compare only countries of similar size. A comparison of the values for 2001, 2002 and 2003 showed some inconsistencies and shifting budget figures for the same calendar year depending on the date of data assessment. This very much limits the value of this indicator, as the NRNs seem to have difficulties with providing consistent budget data.
Supplementary indicators	None available.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1(0.5)	0	2 (2.33)

Table 3.3-30: Quality of scientists' computer equipment

<table>
<tr><td>Definition and explanation</td><td>
Average quality index of scientists' computer equipment (arithmetic mean of all researchers in a country)
The quality index of the computer equipment is calculated on the basis of two indicators:
• The type of computer available; ascending "quality ladder" from PC to supercomputer
• The age of the computer used most of the time
(1) Scores of the quality index of the computer equipment
<table>
<tr><td rowspan="2">Age</td><td colspan="4">Type of computer</td></tr>
<tr><td>PC</td><td>Work-station</td><td>Main-frame</td><td>Super-computer</td></tr>
<tr><td>Older than 4 years</td><td>1</td><td>2</td><td>4</td><td>8</td></tr>
<tr><td>2-4 years</td><td>2</td><td>4</td><td>8</td><td>16</td></tr>
<tr><td>Less than 2 years old</td><td>4</td><td>8</td><td>16</td><td>32</td></tr>
</table>
These values were recoded into quality levels 0 to 10.
(2) $\overline{QCE} = \frac{\sum_1^S QCE_s}{S}$
$\overline{QCE}$ Average Quality index of the Computer Equipment available to the scientists of a country
QCE_s Quality index of the computer equipment of an individual scientist s
SR Total number of scientists in a country (here: sample of SIBIS survey)
Value range: $0 \leq \overline{QCE} \leq 10$
Example: If a researcher stated to use a workstation and a mainframe computer, and furthermore stated that the computer he used most of the time was two to four years old, he receives a value of 8. This is recoded into the quality score 6. Another researcher who stated to use a PC and a supercomputer, and gave "older than 4 years" as the age of the computer she uses most of the time, receives the same quality score of 8 recoded into quality level 6. The arithmetic mean of these values across all researchers of a country constitutes the country value (2).
</td></tr>
<tr><td>Importance and value added</td><td>
Sophisticated software needs the appropriate hardware. A high quality of the computer equipment is therefore a precondition for carrying out high-level computer-based research.
The higher the index the better the computer equipment available to the researchers in a country. An increasing index shows an improvement of the computer hardware.
</td></tr>
<tr><td>Sources of data</td><td>SIBIS survey on the Internet in R&D</td></tr>
<tr><td>Countries and time intervals covered</td><td>CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)</td></tr>
<tr><td>Question wording</td><td>
What type of computers do you typically use for your R&D activities?
• Personal Computer (stand-alone desktop PC, notebook)
• Workstation (PC connected to a network)
• Mainframe
• Supercomputer
• others, please specify:
• I don't know.
</td></tr>
</table>

	How old is the computer you use most of the time for your R&D? • Less than two years old • Two to four years old • Older than four years • I don't know.
Discussion	The values for the age of the computer approximate the increase of processor capacity as reflected by Moore's Law. The differences of computing power between PCs, workstations, mainframes and supercomputers are only partially reflected in the indicator values (of course, a supercomputer has a lot more power than 8 PCs). However, it was assumed that computing tasks also differ, that is that supercomputer users have more complicated demands than users of regular PCs or workstations. In countries and scientific disciplines where the indicator values are large, the use of supercomputers is rather widespread and the use of PCs only is not so common. Therefore, instead of the compound indicator, its components could also be used to get an idea of the quality of the computer equipment. However, the magnitudes of the correlations increase, if we combine separate responses (e.g. add up the use of supercomputers and mainframes). Therefore, we can assume that the combined and weighted indicator provides a better overall picture than its separate components. The indicator varies among different research disciplines. In order to compare countries, a weight should be included that either corresponds to the total number of researchers in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.
Supplementary indicators	The components of the indicator without an additional weight for the age of the computer which is used most of the time can also be used (these are the use of supercomputers, mainframes, workstations, or PCs only). A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	2	–	1 (1.33)

Table 3.3-31: Size of digital journal collections

Definition and explanation	Number of scientific journals in digital collections of scientific libraries per target population (scientists, students other users) of these libraries. $$\overline{EJ} = \frac{\sum_1^n EJ_i}{\sum_1^n TP_i}$$ EJ_i Electronic journals in library i, i = 1, ..., n TP_i Target population of library i, i = 1, ..., n $\overline{EJ}$ Number of electronic journals per target population of all scientific libraries in a country Value range: $\overline{EJ} > 0$
Importance and value added	Electronic library resources and especially those accessible via a computer network are one of the major benefits for information retrieval in an era of e-Science. The speed of access and the search facilities of electronic texts can speed up information retrieval notably. However, access to the electronic versions of scientific journals is usually expensive and depending on a valid subscription.

	Increasing the access to advanced Internet services, among which electronic information sources could be included, is one specific goal of European research policy as it has been laid down in the communications on the ERA [87].
Sources of data	Data assessment from scientific libraries at universities, polytechnics, non-university research institutes and other organisations which are active in the production of scientific knowledge.
Countries and time intervals covered	–
Question wording	Q0 (filter): Do you provide access to your collections by means of the Internet or other computer networks? Q1: How many separate scientific journals did you provide for electronic access on 31 December 2003? How is the access possible? (the question should be put in a table, answering categories for the second part must be explored) Q2: What was the size of your target population on 31 December 2003? (If there are different target populations for different sources, please give a separate figure for each source).
Discussion	Major problems are the definition of scientific libraries and what should be considered as their target population. In regard to scientific libraries a first pragmatic approximation could be to consider only university and research institute libraries. However, as the organisational structures differ across countries other institutions might have to be added on a case by case basis. In the Equinox project the target population was defined as "Groups of actual and potential users appropriate to an individual library as the object of a specific service or as the primary users of specific materials" [23]. This is hardly operational. More practicable seems to take all registered users. However, some libraries have lots of occasional users which also might need to be included. It may be useful to include some weighting to take into account the time and effort required to access a title; on-line titles with free access would then receive the highest weight, off-line titles which can only be accessed by having them sent by mail would receive the lowest weight. The indicator still has some weaknesses: for instance, the number of objects does not give an indication of their informational value which may be better expressed by their size and quality. However, commonly accepted definitions do not exist for either the size or the quality, nor can they be measured with an acceptable effort. Surveys in the US indicate that the number of electronic database titles is actually the only information that is collected by libraries on a regular basis [273].
Supplementary indicators	The indicator was only described for electronic journals. However, different scientific disciplines use different publication media. Books, video resources, audio resources, patents and other resources could also be assessed with separate indicators.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	–	–	0

Table 3.3-32: Staff providing electronic library services

Definition	Staff providing electronic library services in relation to the target population $\overline{SELS} = \frac{\sum_1^n SELS_i}{\sum_1^n TP_i}$ $SELS_i$ Staff for electronic library services in library i, i = 1, ..., n TP_i Target population of library i, i = 1, ..., n

<table>
<tr><td></td><td colspan="4">$\overline{SELS}$ Staff providing electronic library services per target population of all scientific libraries in a country
Value range: $\overline{SELS} > 0$</td></tr>
<tr><td>Importance and value added</td><td colspan="4">Staff figures were proposed by the Equinox project as an indicator for the provision of digital library services. The objective of this indicator is stated on the Equinox website: “To assess the human resources the library puts into its electronic library services, in order to indicate the library’s efforts to develop and provide its services, user training and prepare for future requirements.” [23]
The indicator is of specific importance during the upgrading of traditional library services to ELS. Understaffing may limit the benefits of electronic library services if it results in delays of the provision of services, insufficient consulting with, or training of, the users. However, when electronic collections will have been established and users are familiar with using them, the staffing requirements should change.
Increasing the access to advanced Internet services, among which electronic information sources could be included, is one specific goal of European research policy as it has been laid down in the communications on the ERA [87].</td></tr>
<tr><td>Sources of data</td><td colspan="4">Survey of scientific libraries at universities, polytechnics, non-university research institutes and other organisations which are active in the production of scientific knowledge.</td></tr>
<tr><td>Countries and time intervals covered</td><td colspan="4">–</td></tr>
<tr><td>Question wording</td><td colspan="4">Q1: How many members of staff in your organisation were responsible for providing digital library services on 31 December 2003? (in full-time equivalents).
Q2: How many additional members of staff in your organisation would be necessary to substitute for the services related to the digital collections which were obtained from external service providers on 31 December 2003? (in full-time equivalents).</td></tr>
<tr><td>Discussion</td><td colspan="4">To normalise the indicator, Equinox proposes to calculate a fraction of staff providing electronic services in relation to all staff. Also the staff at external institutions responsible for providing the service should be included. However, this does not seem to be a useful normalisation for our purposes. As we do not evaluate the performance of digital library services but rather look for the availability of these services to science on the national level, the relation to the total target population or the number of scientists seems to be more appropriate.
One problem might result from different types of services provided by digital libraries: while some might restrict themselves to the pure provision of information objects, others also provide their users with training. A categorisation of the services and the assessment of staff data for the different categories should solve this problem and lead to comparable data.
Other problems are the definition of scientific libraries and what should be considered as their target population (see Table 3.3-31: Size of digital journal collections on this issue).
Definitions of "electronic library services (ELS)" and the "staff providing ELS" should be included in a questionnaire to ensure that the assembled data are comparable.</td></tr>
<tr><td>Supplementary indicators</td><td colspan="4">–</td></tr>
<tr><td rowspan="2">Evaluation results</td><td>Benchmarking Value</td><td>Validity</td><td>Reliability</td><td>Availability</td></tr>
<tr><td>3</td><td>–</td><td>–</td><td>0</td></tr>
</table>

Table 3.3-33: Scientists' access to on-line information sources

Definition and explanation	Percentage of scientists stating that they have access to many/the most of the important information sources via the Internet of all scientists in a country. $\frac{\text{Scientists having access to many / the most important information sources}}{\text{All scientists of a country}}$ Value range: 0 – 100 (percentages)
Importance and value added	The increasing specialisation in science has led to a large variety of scientific communities using an ever increasing number of journals for communication. Funds for subscription, however, have usually not increased at the same rate and therefore access to journals is always somehow limited. On-line access has not changed the problem of lacking funds for subscriptions, but still it should have improved the access to scientific information for two reasons: • Whereas formerly one much sought hardcopy may have been available in the library, electronic versions are available more readily (especially if libraries cooperate and pool their subscriptions). • Alternative strategies can be sought to get access to a journal article, such as looking at the author's web page or in a discussion paper archive for a previous version. The present indicator covers the quality of the access to on-line contents for R&D from the users' perspective (on the providers' perspective see Table 3.3-31: Size of digital journal collections). Increasing the access to advanced Internet services, among which electronic information sources could be included, is one specific goal of European research policy as it has been laid down in the communications on the ERA [87]. An increase in accessibility constitutes an improvement of service (information supply) quality. As information constitutes one input to R&D activities, an improvement of service quality can be considered as a contribution to an increase of R&D efficiency.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	Do you have Internet access to the important (for you personally) information sources in your field? • Not at all • Few of them • Some • Many/the most • I don't know.
Discussion	The term information was defined in the questionnaire in order to avoid confusion with data. The indicator is straightforward and directly asks for the access to on-line information sources that the respondent considered important for him or her personally. Still, it is a subjective perception of the access that might be wrong and somebody might have access to an information source through a channel (s)he has not yet discovered. The loss of information incurred by considering only the answering extreme "many/the most" is negligible, as the ranking of countries or scientific disciplines does not change, if a more complicated (weighted) indicator is calculated. In the SIBIS data set the indicator correlates positively with the indicator that measures the usage of on-line information sources. This might be considered as

	evidence for its validity. However, if a respondent misperceived the access to on-line information sources to be low, it is only consequent that (s)he also makes little use of these sources. The indicator varies among different research disciplines. In order to compare countries, a weight should be included that either corresponds to the total number of scientists in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.			
Supplementary indicators	Some information sources may not be available on the Internet because they do not exist in digital format. Hence possible remedies to an unsatisfactory Internet access to information may be related to improving the Internet access or to broadening the digitalisation efforts. Additional information what strategy is more appropriate can be gained by looking at the reasons for not having Internet-based access which were also collected in the SIBIS survey. A breakdown of the indicator for the five scientific disciplines of the survey provides insight into variations across scientific disciplines.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1 (1.33)	–	1 (1.33)

Table 3.3-34: Influence of the Internet on choosing R&D problems

Definition and explanation	Percentage of scientists stating that any of the proposed influences of the Internet on different aspects of R&D problem choice applies totally per scientists of a country. $\frac{\text{Scientists for which any of the proposed influences applies totally}}{\text{All scientists}}$ Value range: 0 – 100 (percentages)
Importance and value added	The indicator measures the attitude towards the Internet. It assesses whether the Internet is perceived as a common tool that supports the choosing of research problems. The EC research policy also aims to build scientists' awareness on the potentials of computer networks and encourage their use [90], [87]. The present indicator can be considered as an operationalisation of the awareness construct. Of course, it is neither better nor worse, whether, for instance, the idea for a new R&D project is gotten while browsing the WWW or while debating something with a colleague. The benchmarking value of the indicator does not rest in the outward Internet usage, but in the attitude towards the Internet which it reveals. The higher the indicator value the more the Internet affects the choice of R&D problems.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	Do the following statements about the influence of the Internet on the choice of R&D problems apply to you? [answering options from 5 = applies to 1 = does not apply] • I get ideas for new research projects while browsing the WWW. • When I decide to start an R&D project, I consider whether the Internet supports its realisation (e.g. through the access to certain data, information, instruments etc.). • I use the Internet to stay up-to-date and focus my R&D on the hot issues in my field(s).

	• I get new ideas for R&D projects through e-Mail communication with colleagues. • Other influences, please specify			
Discussion	The indicator was compared to a more sophisticated indicator which takes all answering options into account. Country performances are basically the same and therefore the easier indicator was chosen.			
Supplementary indicators	A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	1	–	1 (1.33)

Table 3.3-35: Computer skills of scientists

Definition and explanation	Average rank of sophistication of the computer applications used by scientists. $\overline{CAP} = \frac{\sum_1^S CAP_s}{S}$ $\overline{CAP}$ Average rank of sophistication of the **C**omputer **Ap**plications used by scientists CAP_r Rank of sophistication (see below) of the computer applications used by an individual scientist s, with … CAP_s = 0: no computer is used for R&D CAP_s = 2.5: up to four unsophisticated computer applications are used CAP_s = 5: five and more unsophisticated computer applications are used CAP_s = 7.5: at least one of the sophisticated computer applications is used CAP_s = 10: at least one of the very sophisticated computer applications is used S Total number of scientists in a country (here: sample of SIBIS survey) Value range: $0 \leq \overline{CAP} \leq 10$
Importance and value added	The indicator aims to assess the level of computer skills of scientists. As there is no absolute benchmark for determining a high level of skills, only a relative benchmarking provides insight into the position of individual countries. The higher the level of skills the better the public research system is equipped for computerised knowledge production.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	Please tick the computer applications you personally use for your R&D activities. *Classification (not included in the questionnaire)* • Word processing • Spreadsheets (e.g. Excel) • Databases • Speech recognition • Visualisation or graphics packages • Presentation software • Internet browsers *unsophisticated applications*

	• Communication (e-Mail), collaboration and time management software • Speciality-specific software • Statistics and mathematics software, computing and data processing — *sophisticated applications* • Programming • Virtual environments — *very sophisticated applications* • Others, please specify — *case-based classification*
Discussion	In order to assess the computer skills level in the survey the actual use of applications was explored. This might lead to an underestimation of skills, as an application might be mastered though it is not used currently. However, as applications continue to develop, we assumed that skills may also be unlearned, if they are not used. The ranking scheme employed for this index basically serves the purpose of weighting the different types of computer skills assessed in the survey. However, the weights were established on an ad-hoc basis. The indicator could certainly be improved by developing a more advanced weighting system. In order to check the validity of the calculations, a simple unweighted indicator was calculated: the plain number of computer applications used by a scientist. In the present survey this number varied between 0 and 13. This unweighted indicator and the weighted CAP index correlate fairly well. The indicator varies among different research disciplines. In order to compare countries, a weight should be included that either corresponds to the total number of scientists in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.
Supplementary indicators	A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (1.67)	2	–	1 (1.33)

Table 3.3-36: Internet skills of scientists

Definition and explanation	Average number of Internet tools used by scientists. $$\overline{IT} = \frac{\sum_{1}^{S} (IT_s * \omega)}{S}$$ $\overline{IT}$ Average number of **I**nternet **T**ools used by scientists IT_s Number of Internet tools used by an individual scientist s ω Weight; each application was given an equal weight to scale the indicator from 0 to 10. S Total number of scientists in a country (here: sample of SIBIS survey) Value range: $0 \leq \overline{IT} \leq 10$
Importance and value added	The indicator aims to assess the level of Internet skills among scientists. As there is no absolute benchmark for determining a high level of skills, only a relative benchmarking provides insight into the position of individual countries. The higher the level of skills the more the Internet is integrated into scientific knowledge production.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations

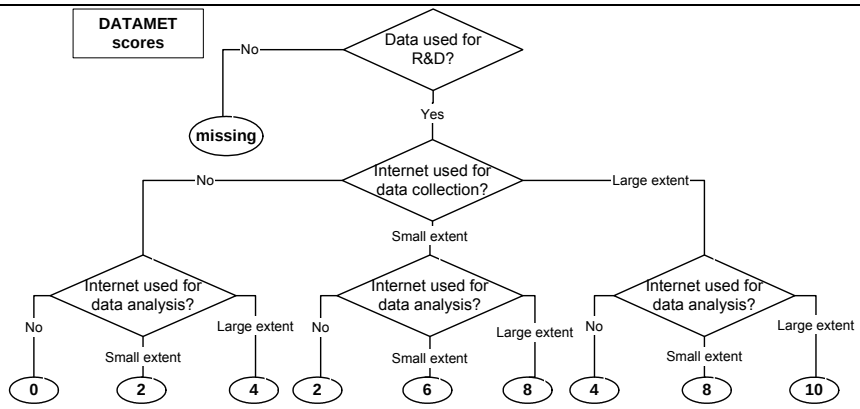
covered	in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	Please tick the Internet tools you personally use for your R&D activities. • E-Mail • Mailing lists • Newsgroups • Chat rooms • Internet telephony • Video conferences • World Wide Web (web pages) • Intranet (an employer-based, internal website) • Collaboration tools (e.g. NetMeeting, Lotus Domino), WWW-based project management • FTP software • Remote access to computers with different client software (e.g. Telnet) • Others, please specify
Discussion	In order to assess the Internet skills level in the survey the actual use of Internet tools was explored. This might lead to an underestimation of skills, as a tool might be mastered though it is not used currently. However, as tools continue to develop, we assumed that skills may also be unlearned, if they are not used. For this indicator the weighting scheme only served scaling purposes and no differences were made between applications (other than for Table 3.3-35: Computer skills of scientists), because the applications are prefabricated and the users were not supposed to need further Internet skills for using them. The indicator varies among different research disciplines. In order to compare countries, a weight should be included that either corresponds to the total number of scientists in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five scientific disciplines in the sample.
Supplementary indicators	A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (1.67)	2	–	1 (1.33)

Use of e-Science

Table 3.3-37: Usage of Internet-based data collection and data analysis methods

Definition and explanation	Weighted usage of Internet-based data collection and data analysis methods per scientist that uses raw data for his or her R&D activities (1)



$$(2)\ \text{DATAMET Index} = \frac{\sum_{1}^{S} \text{DATAMET}_s}{S}$$

DATAMET_s	Usage of Internet-based **DATA** collection and data analysis **MET**hods per scientist s
No	No Internet-based method is used
Small extent	Only one Internet-based method is used
Large extent	Two or more Internet-based methods are used
S	Total number of scientists in a country (here: sample of SIBIS survey)

Value range: $0 \leq \text{DATAMET Index} \leq 10$

Provided that a scientist uses data for his or her research, the values for the DATAMET Indicator were attributed according to the extent to which (s)he used Internet-based methods for data collection and data analysis (1). The listed data collection and analysis methods include methods used in the sciences and in the social sciences (see question wording below). Then the average (= DATAMET Index) is calculated for all scientists of a country (2).

For instance, if a scientist stated that she collected data via the Internet from databases and by means of surveys, she was assumed to make large use of Internet based data collection methods. If she furthermore stated to download data analysis tools from the Internet, she was assumed to use Internet-based data analysis to a small extent, and received an overall DATAMET value of 8.

Importance and value added	The collection and processing of data is a genuine task of empirical research. In many disciplines it is also the most expensive task. The Internet has the potential to reduce costs, e.g. as the data sources can be accessed more easily or expensive equipment gets more used to its capacity. The latter is one target of European research policy, expressed for instance in the FP5 program “Access to Research Infrastructures” and in the ERA communications [90], [87]. The higher the indicator value the more intensively Internet-based methods are used.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	Which of the following methods of Internet-based data collection and data analysis do you use within your R&D activities? **Methods of data collection** • Gathering data from existing databases by means of the Internet • Conducting own surveys, interviews or other human-related data collection methods over the Internet • Collecting data from scientific instruments (e.g. laboratory instruments,

	telescopes etc.) through the Internet • Other Internet-based methods of data collection, please specify • None of these **Methods of data analysis** • Using on-line and/or downloading tools for data analysis • On-line use of computing power over the Internet (e.g. on supercomputers, distributed computing, Grid) • Other Internet-based methods of data analysis, please specify • None of these
Discussion	Certainly not every type of evidence is suited to be collected over the Internet, e.g. in the social sciences because of problems in regard to representativeness. Therefore the index does not reveal anything about the quality of the data or the research in general. It rather highlights to what extent scientists realise the potentials of collecting and analysing data via the Internet. A rather critical issue is the binary construction of the indicator. An increase of Internet-based data collection and analysis activities might not be recorded (e.g. if more on-line surveys are carried out than previously, or if more than two methods are employed). Therefore, in the long run, the binary scale of the components (i.e. the different methods) might have to be changed and further methods might have to be added. In order to avoid confusion between "information" and "data", the term data was also defined in the questionnaire. The indicator varies among different research disciplines. In order to compare countries, a weight should be included that either corresponds to the total number of researchers in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.
Supplementary indicators	A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2	–	1 (1.33)

Table 3.3-38: Usage of on-line information sources

Definition and explanation	Weighted usage of on-line information sources in relation to the weighted usage of all (on-line and off-line) information sources for R&D purposes, average across all scientists of a country. (1) $OIS_s = \frac{\sum_{on}(\text{Information source}_{on} * \omega)}{\sum_{on+off}(\text{Information source}_{on+off} * \omega)}$ (2) $OISI = \frac{\sum_{1}^{S} OIS_s}{S} * 100$ OIS_s Usage of **O**n-line **I**nformation **S**ources per individual scientist s (see below on the different sources) OISI On-line information source index S Total number of scientists in a country (here: sample of SIBIS survey) ω Weights; information sources are used … 1 Never 3 Once or twice a week 2 Less than once a week 4 More than twice a week Value range: 0 ≤ OISI ≤ 100 Each information source (on-line and off-line, see below) receives a weight

	between 1 and 4 that corresponds to the frequency with which it is used. The weighted usage of on-line information sources is added up for each scientist and divided over the weighted usage of on-line and off-line information sources (1). Then the average (= OISI) is calculated for all researchers of a country (2).
Importance and value added	Assesses the use of electronic information sources which should be encouraged according to the new European Research Policy laid down in the EC communications on the ERA. The higher the indicator value the more intensively on-line sources are used in comparison to off-line sources.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	How frequently do you personally use one of the following on-line and off-line sources for information for your R&D? **On-line information sources** • Internet sites of libraries and archives • Electronic journals, working paper and article databases • Peers' web pages • Websites of other institutions • Other on-line source, please specify **Off-line information sources** • Your own collection of information items (books, journals, papers etc.) • Off-line electronic sources (e.g. CD-Roms, databases on your local computer or network) • Libraries • Colleagues, assistants, superiors • Conferences, workshops, seminars • Other off-line source, please specify
Discussion	The use of information in general differs between scientists from different countries (e.g. in the SIBIS sample Irish scientists used all information sources less) and disciplines (e.g. astronomers used almost all information sources more than scientists on average). In order to obtain a reliable picture of the importance of Internet-based information sources, it is necessary to include both, on-line and off-line information sources. A general problem of this indicator lies in the weighting of the different information sources. While the answers were weighted, the information sources themselves were not. However, it is certainly not right to assume that visiting a conference leads to the same amount of information as browsing a peer's web site. As for a usable weighting scheme the informational value of each source would have to be assessed, the sources were not weighted in this pilot approach. To compensate for this weakness, the indicator should only be used together with its constituents. In order to avoid confusion between "information" and "data", the term information was defined in the questionnaire. In order to compare countries, a weight should be included that either corresponds to the total number of scientists in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.
Supplementary indicators	The use of the different on-line sources that form part of the index should also be evaluated in order to make up for the lack of a proper weighting scheme for the index.

	A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (1.67)	2 (1.5)	–	1 (1.33)

Table 3.3-39: World Wide Web penetration ratio

Definition and explanation	Percentage of scientists with web-pages with professional contents of all scientists (in this case: respondents in the SIBIS R&D survey). $\text{WWW penetration ratio} = \frac{\text{Scientists with a web-page}}{\text{All scientists}} * 100$ Value range: $0 \leq$ WWW penetration ratio ≤ 100			
Importance and value added	The ESIS II project for Central and Eastern European Countries (CEEC) collected data on the percentage of high schools and universities with Internet websites [140]. This indicator may be useful in an environment with low Internet penetration rates and few organisations connected to the Net. For Western Europe we do not expect much benefit from this indicator as effectively 100% of all higher education and research institutions should be connected. This should be different at the individual level. This indicator covers the supply side of information retrieval from the Internet (Table 3.3-38: Usage of on-line information sources covers the demand side) that is also important from the perspective of a science system: individual web-pages facilitate the search of collaboration partners, possible contractors and scientific information in general for different user groups. As setting up and maintaining a web page requires also a certain amount of time and money, the indicator also provides insight into the attitude of scientists towards the WWW and whether they think it is a useful medium for spreading information.			
Sources of data	SIBIS survey on the Internet in R&D			
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (researchers from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)			
Question wording	Do you have an individual presentation of your professional activities and competences on the World Wide Web (WWW)?			
Discussion	Of course, a WWW penetration ratio of 100% is the upper limit. When this is reached, the indicator doesn't show any further improvements. However, up to this total penetration, each increase can be considered clearly as an improvement, as more scientists spread professional information through the WWW. The ratio is affected by the position of a scientist, e.g. doctoral students sometimes do not have web-pages of their own, and by the time a scientist has been working for an organisation, as it requires some time to set up a web-page. These factors should been taken into account when comparing WWW penetration ratios across disciplines or countries.			
Supplementary indicators	A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (1.67)	3 (2.5)	–	1 (1.33)

Table 3.3-40: Working papers available via the Internet

Definition and explanation	Percentage of working papers which are available on-line off all working papers published $EWPI = \frac{\text{Working papers available on-line}}{\text{All working papers published}} * 100$ EWPI **E**lectronic **W**orking **P**aper **I**ndicator Value range: 0 ≤ EWPI ≤ 100
Importance and value added	The traditional scientific communication system has developed over centuries. However, scholars have qualified it as inefficient because of its slowness, the restricted access for outsiders and the difficulties with handling interdisciplinary research. Also scientists had to confront large search costs when looking for information outside of their core research area(s). Electronic publishing has been assumed to reduce some of these weaknesses, providing faster and broader access to the results of scientific work [48] [236]. In addition it has been shown, that on-line availability increases the visibility of publications [199]. In general, e-publishing can be considered as a valuable enhancement to the scientific communication system. The present indicator covers one specific part of e-publishing activities that is the electronic publishing of working papers. A comparison reveals to what extent scientists in the different disciplines and countries use the Internet to disseminate the outcome of their research. The higher the indicator value the higher the percentage of working papers available on-line.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	How many publications have you made in the following media during the past two years (2001 and 2002)? How many of these publications were refereed, how many have co-authors, and how many are available on-line? • Working and discussion papers, preprints
Discussion	To obtain reliable estimations of the number of publications the time period in the question was set to two years (2001 and 2002). This was suitable for the majority of scientists. However, some highly productive researchers seemed to have difficulties with estimating their number of publications over such a long time period. The indicator was limited to working papers, though information on other publications was also collected in the SIBIS survey. However, for other types of publications, the question did not produce the desired results. This can be exemplified by means of journal articles: Virtually all publishers have developed electronic versions of their journals in the meantime and consequently all newly published journal articles are available on-line. However, not every author knows whether and under what conditions his or her article is available on-line. Also accessibility differs: most publishers charge for access, genuine e-journals usually don't, some scientists manage to put copies of their articles on other websites, or some are posted by third parties (e.g. as course content for teaching). Therefore, de facto accessibility to journal articles differs, though in principle all might be accessible via the Internet. Comparable problems apply to other types of publications, such as books, reports, conference presentations etc. Hence, the indicator was limited to working papers, because only for these it depends mostly on the author whether they are made available on-line. The indicator varies among different research disciplines. In order to compare

	countries, a weight should be included that either corresponds to the total number of scientists in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.			
Supplementary indicators	A breakdown of the indicator for the five research disciplines of the survey provides insight into variations across research disciplines.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2	2 (1.5)	–	1 (1.33)

Table 3.3-41: Computer-mediated social communication for R&D purposes

Definition and explanation

Weighted usage of computer-mediated communication tools in relation to the weighted usage of all communication media for R&D purposes, average across all scientists of a country.

$$(1)\ CMC_s = \frac{\sum_{CMC}(\text{Communication tool}_{CMC} * \omega)}{\sum_{N}(\text{Communication tool}_{N} * \omega)} * 100$$

$$(2)\ CMCI = \frac{\sum_{1}^{S} CMC_s}{S}$$

CMC Computer-mediated communication tools

N All communication tools (CMC and non-CMC)

ω Weights; information sources are used during an average working week

0 Never
1 up to 2 times
2 3 to 5 times
3 6 to 10 times
4 11 to 20 times
5 21 to 50 times
6 more than 50 times

To account for differences in information richness (verbal and non-verbal cues, quick feedback, and multiple modalities) the weights for face-to-face meetings, phone calls, chat room sessions and video conferences were increased. Written communication per e-Mail and letters constitutes the baseline.

The weights for formal face-to-face meetings and video conferences were raised from 1 to 4 (2 to 5 etc.), for informal meetings, chat sessions, and phone conferences from 1 to 3 (2 to 4 etc.) and for phone calls from 1 to 2 (2 to 3 etc.).

CMC_s Computer-mediated communication per individual scientist s

CMCI Computer-mediated communication index

S Total number of scientists in a country (here: sample of SIBIS survey)

Value range: 0 ≤ CMCI ≤ 100

Among the computer-mediated communication tools are included

- e-Mail
- chat room sessions
- video conferences.

Each medium (computer-based and non computer-based) receives a weight between 0 and 6 that corresponds to the extent to which it is used (and to its information richness). The weighted usage of CMC is added up for each scientist and divided over the weighted usage of all communication tools (CMC and non-CMC) resulting in a value of computer-mediated communication per individual scientist s (1). This value is actually a percentage of CMC of all communication tools and methods. Then the average percentage (= CMCI) is calculated for all scientists of a country (2).

Importance and value	E-Mail was one of the breakthrough applications of the Internet, as it offers

<table>
<tr><td>added</td><td colspan="4">significant advantages over some older forms of communication. The extent to which scientists use e-Mail and other forms of computer-supported communication may be considered as an indicator for the acceptance of new ICT in R&D which is one of the goals of European research policy [90] [87].
Whereas in the early stages of the diffusion of CMC tools a more intensive usage could be seen as a positive evidence for their acceptance, this is not generally true for later stages. A CMCI value of 100, that means all R&D communication takes place via computers, is certainly not a desirable goal. Other communication media differ to CMC tools in regard to their perceived information richness; also experiences and skills with media vary, the tasks for which media are used differ, and situational factors influence the media use [152]. Therefore, an optimal R&D communication consists of a mix of different media.</td></tr>
<tr><td>Sources of data</td><td colspan="4">SIBIS survey on the Internet in R&D</td></tr>
<tr><td>Countries and time intervals covered</td><td colspan="4">CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)</td></tr>
<tr><td>Question wording</td><td colspan="4">Please indicate how often you use the following communication media for R&D in an average working week during which you work on an R&D project.
• How many e-Mails do you send in connection with R&D?
• How many e-Mails do you receive in connection with R&D?
• How many phone calls do you make in connection with R&D?
• How many phone calls do you receive in connection with R&D?
• How many letters or other written communication (fax etc.) do you send for R&D (excluding e-Mails)?
• How many letters or other written communication do you receive for R&D (excluding e-Mails)?
• How many times do you discuss R&D issues face-to-face in formal meetings?
• How many times do you discuss R&D issues face-to-face in coincidental encounters, informal meetings, talks at lunch breaks etc.?
• In how many chat room sessions for R&D do you participate?
• How many video conferences for R&D do you attend?
Other communication media that you use, please specify</td></tr>
<tr><td>Discussion</td><td colspan="4">The usage of computer-mediated communication tools is calculated as a fraction of all communication in order to account for differing communication habits and needs (e.g. the head of a research institute supposedly communicates more than a PhD student due to the differing range of tasks).
The indicator demands rather detailed information on the communication behaviour, as it differentiates between communication media, asks only for R&D related communication and collects the information for an average working week. Another problem is the weighting scheme that was established on an ad hoc basis to account for media differences of information richness [285].
The indicator varies among different scientific disciplines. In order to compare countries, a weight should be included that either corresponds to the total number of scientists in a discipline or levels out the differences of sample composition. In the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.</td></tr>
<tr><td>Supplementary indicators</td><td colspan="4">A breakdown of the indicator for the five scientific disciplines of the survey provides insight into variations across research disciplines.
As video conferences may be considered as the most innovative form of CMC, a separate indicator can be calculated.</td></tr>
<tr><td rowspan="2">Evaluation results</td><td>Benchmarking Value</td><td>Validity</td><td>Reliability</td><td>Availability</td></tr>
<tr><td>1 (1.33)</td><td>1</td><td>–</td><td>1 (1.33)</td></tr>
</table>

Table 3.3-42: Usage of collaboration applications

Definition and explanation	Percentage of scientists stating that they use at least one collaboration application on a regular basis (more than once a week) of all scientists involved in R&D collaborations. $\frac{\text{Scientists which use at least one collaboration application regularly}}{\text{All collaborating scientists}}$ Value range: 0 – 100 (percentages)
Importance and value added	The support of new forms of electronic collaboration among researchers is one of the explicit ICT-related goals of European research policy as laid down in the ERA communications. Whereas e-Mail and the WWW are widely used outside of science, applications supporting collaboration among geographically separated workers are rather new and not very well-known yet. This makes them a good indicator for innovative and pioneering Internet uses which may spread to other sectors outside of science. The higher the indicator value the more intensively collaboration technologies are used.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	How frequently do you personally use the following applications of collaboration technologies for your R&D activities? (never, less than once a week, once or twice a week, more than twice a week) • Passing a file back and forth via e-Mail (not included among the collaboration technologies) • Document sharing (synchronously working on a file via the Internet) • Application sharing (using an application that is only installed on one collaborator's server through remote access) • Chat room features • Audio and/or video conference applications • Others, please specify
Discussion	The assessment of collaboration applications is difficult, as some collaboration software is multi-functional whereas other is limited to one function. Whiteboard, another collaboration application, was excluded as it could not be differentiated satisfactorily from application and document sharing. In order to avoid confusion between document sharing and the simple and a lot more common activity of passing a file back and forth via e-Mail, the latter was included as a response option and a brief definition for document sharing was given. However, the rather too frequent positive answers in the SIBIS survey indicate that some respondents might have misunderstood the meaning of document sharing. The indicator was calculated for all scientists using at least one collaboration application at least once a week. Taking only the "extreme" answer "more than twice a week" did not lead to plausible results (as few scientists indicated to use most of the applications that frequently). A more complicated calculation building an overall collaboration application indicator and including all answers with weights provided very similar results. Therefore, the easier version was chosen. The indicator varies among different scientific disciplines. In order to compare countries, a weight should be included that either corresponds to the total number of scientists in a discipline or levels out the differences of sample composition. In

	the SIBIS project the calculated weights brought about an equipartition of the responses across the five research disciplines in the sample.			
Supplementary indicators	A breakdown of the indicator for the five scientific disciplines of the survey provides insight into variations across scientific disciplines.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (2.33)	1	–	1 (1.33)

Impact of e-Science

Table 3.3-43: Publications in scientific journals per capita

Definition and explanation	Publications in scientific journals per million population $\frac{\text{Publications in scientific journals}}{\text{Million inhabitants}}$ Value range: ≥ 0			
Importance and value added	Among the different outputs of scientific R&D (skilled graduates, new instruments, new methods, prototypes, publications) scientific publications are one of the most important. They partially capture the essence of other output forms and contain the theoretical knowledge that constitutes the base for many discoveries [241]. Previous scientific analyses have tested the hypothesis that Internet applications increase the productivity and raise the output of scientific research [169][191][295] and more often than not found positive effects. The indicator on articles in scientific journals per capita covers the quantitative aspect of scientific publications. An increase of the number of publications per capita can be considered as an increase of scientific output.			
Sources of data	Institute for Scientific Information (ISI) data on publications in scientific journals, further processed and published for instance in [120] [241].			
Countries and time intervals covered	Globally available, time lag of approx. 2 years (in 2003: 2001 data available)			
Question wording	–			
Discussion	Publication data used for the indexes is based on journal publications only. This may lead to a misrepresentation of actual scientific output. First of all, the propensity to publish differs across countries and scientific fields [241], p. 62. Also scientific fields which rely on other types of publications to a larger extent (such as books, conference presentations) may not be represented appropriately. And last but not least the mere number of publications doesn't say much about their quality, though the journals may be peer reviewed. Another weakness is that the only available data from ISI tends to reflect the structure of US science. Therefore, publications are underestimated for countries specialised in fields which are not well represented in the indexes ([120], p. 43; [217], p. 5-37). As most journals included in the indices are published in English, the indexes also contain a language bias towards researchers from English-speaking countries [290].			
Supplementary indicators	Another possible denominator is the number of researchers of a country. The indicator then relates more to the productivity of research, than the size of the research system. The SIBIS e-Science analysis used this figure, as publication data was only collected for a fraction of the national scientific communities. A breakdown of the indicator by field provides insight into variations across scientific fields.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2 (1.5)	3	2

Table 3.3-44: Citation index

Definition and explanation	Citations in scientific journals from all over the world to scientific articles from a country adjusted for the number of scientific articles from this country. $CI = \frac{1}{I} \sum_{1}^{I} \frac{C_i^P}{P_i}$ C^P_i Citations to a country's scientific publications in field i P_i Scientific publications of a country in field i I Scientific disciplines i CI **C**itation **I**ndex of a country Value range: CI ≥ 0 For each scientific discipline the following calculation is carried out: The citations in scientific publications from all over the world to scientific articles from a country are divided by the scientific publications of researchers from this country. The citation ratios for all disciplines are added up and divided by the number of disciplines. This leads to an (unweighted) citation index.
Importance and value added	Whereas "Table 3.3-43: Publications in scientific journals per capita" covers the quantitative aspect of scientific publications, the citation index gives clues on the quality of the scientific output of a country. The number of citations a paper receives mirrors its influence on the development of the field [120] [217]. The indicator is a further indicator for the output of science that can be used to assess the effects of the Internet. Recent scientific analyses have shown that the impact of a research article on subsequent research is higher, if it is available on the Internet [199].
Sources of data	Institute for Scientific Information (ISI) citation indexes such as the Science Citation Index (SCI) and the Social Science Citation Index (SSCI).
Countries and time intervals covered	ISI data is globally available, however, this particular indicator has not been calculated yet; time lag of 2 years (in 2003: 2001 data is available)
Question wording	–
Discussion	The indicator has the same weaknesses as the indicator in Table 3.3-43: Publications in scientific journals per capita. In particular it has been shown that a language bias also affects citation indexes, as papers from non-English journals are cited less than the English literature [290]. An additional problem stems from self-citations and so called "citation cartels", i.e. researchers which cite each other out of friendship, to advance their point of view or support their citation counts (which in some countries and universities affect the personal careers and access to funds). Also the size of a field affects citation numbers; therefore, a normalisation by field is necessary when fields are compared [120]. The indicator values are also correlated to the size of a country's research output, as citations are "home-biased" ([217], p. 5-49). Similar indicators have been used in other sources: • The US National Science Board publishes citation indexes for 10 different fields and all fields together ([217], vol.1, p. 5-50 and vol. 2, table 5-52). • The Swiss Science Council carries out a benchmarking of scientific fields and institutions but it does not add up the indexes to the country level. Also, it uses a slightly more complicated version of the index [279]. • The European Commission/Research DG takes the highly cited papers (top 1%) and looks at the country's shares compared to all scientific publications [121][120]. However, this is not a true citation index and it takes only a small part of the literature into account.

Supplementary indicators	A breakdown of the indicator by field provides insight into variations across scientific fields.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3 (2.66)	2 (1.5)	–	1 (0.66)

Table 3.3-45: Triad patent families per capita

Definition and explanation	Triad patent families per million inhabitants. $\frac{\text{Triad patent families}}{\text{Million inhabitants}}$ Patent families having one member in Europe (patent application to the European Patent Office EPO), the US (patent granted by the US Patent and Trademark Office USPTO) and Japan (patent application to the Japanese Patent Office JPO). Patents families are attributed geographically by the inventor's country of residence. Value range: ≥ 0
Importance and value added	Since its beginning the main aim of European Union science and technology policy has been to strengthen the science and technology bases of European Community industry ([80], p. 208) and it still constitutes one of its major objectives [90][87]. Patent filings indicate that the results of R&D are considered potentially valuable from an economic point of view. Patent data have a long tradition as indicators for the applied scientific and technological performance of a country and they are used widely (e.g. in [121][120][217][241]). An increase of the patent per capita indicator points to an increase of putting R&D results to an economic use.
Sources of data	Patent data are available from patent offices. The OECD publishes data on triad patent families on its website.
Countries and time intervals covered	Patent data is globally available with a time lag; for data from individual patent offices this time lag is only 1-2 years, for triadic patent data it is up to 5 years.
Question wording	–
Discussion	As patents have been used for a long time, their weaknesses are rather well known and sometimes tend to overshadow their strengths: Patents provide unique insight into the extent to which the rights to exploit an invention commercially are secured. They indicate to what extent the results of applied research and experimental development are translated into potential economic returns. Some of their most important weaknesses are listed subsequently, for a more detailed discussion see for instance [233] [61]: • Using patent data from one patent office only introduces a bias into the data, as patent applications tend to be made predominantly at the domestic (in Europe: the EPO) patent office. To eliminate this home advantage, patents of two countries should be compared in a third, foreign market. Triad patent families are another possible alternative to single office patents ([61], p. 143). • Differences in patent regulations tend to hamper international comparability and changes of patent laws affect time series. • Patenting is only one way to secure the economic gains of an invention: Secrecy, rapid launching, low prices are other possible ways. Many inventions are not patented at all and the propensity to patent differs across countries, industries, firms of different sizes, technological fields etc. • The economic value of patents varies a lot. Few patents trigger large economic gains whereas most patents do not lead to any revenue at all. Patents in a patent family can be considered to be rather high-value patents ([61], p. 143).

	The geographical distribution should be made according to the inventor's country of residence, and patents with multiple inventors should be included with a fractional counting procedure [241]. In order to produce patent indicators which are independent of the size of countries and offer some information on the comparative patent 'productivity' a normalisation is needed. This can be for instance the population of a country, the labour force or the number of researchers. Population figures are usually most readily available.			
Supplementary indicators	A great variety of further indicators based on patent counts has been developed and used, such as specialization indexes of patents, patents' citations of older patents or the scientific literature, patent applications of scientific researchers etc. [233]. It is not possible to discuss these in the present context. However, the SIBIS survey among scientific researchers created the possibility to collect data on the patenting activities of scientists. This indicator is often considered to provide insight into science-industry relations [268]. As the data was based on the scientists' responses to the survey only, it was normalized by calculating patent applications per scientist. This indicator relates to scientists' productivity in applied research and development. A breakdown of the indicator by field provides insight into variations across scientific fields.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2	3	2

Table 3.3-46: Involvement in international R&D collaborations

Definition and explanation	Percentage of scientists involved in collaborative R&D with collaborators located in a foreign country of all scientists. $$\frac{\text{Scientists collaborating with partners located in a foreign country}}{\text{All scientists}}$$ Value range: 0 – 100 (percentages)
Importance and value added	In previous analyses computer-mediated communication applications have been found to facilitate long-distance collaboration among researchers (for instance [40], [193], [200], [294] and [295]). Increasing European/international research collaboration has been one of the major goals of European research policy since its beginning ([80], p. 208) and still continues to be an important objective [90][87]. The indicator assesses international collaborations.
Sources of data	SIBIS survey on the Internet in R&D
Countries and time intervals covered	CH, D, DK, I, IRE, NL, and UK for 2003 (scientists from public R&D organisations in the disciplines astronomy, chemistry, economics, computer science and psychology)
Question wording	Have you been involved in collaborative R&D during the last two years (2001 and 2002)? Please, enter in the following table with how many individuals you collaborate, what their affiliations are and whether they are located in your country or abroad? • Your own organisation • Public research institutions (university, research institute) • Private firms • Governments and public administrations • Other institutions, please specify
Discussion	Definitions of the terms "collaborative R&D" and "R&D collaborators" were given in

	the questionnaire to avoid misunderstandings. In order to find out the best way of assessing R&D collaborations a number of slightly different indicators were calculated on the basis of the SIBIS survey data: • indicators assessing the size of a scientist's collaboration network (total number of all/only external/only foreign collaboration partners as estimated by the respondent) and • nominal indicators assessing whether a scientist was involved in R&D collaboration at all/with external partners/with foreign partners. The nominal indicators produced a stable ranking of countries and disciplines and significant differences, whereas country performances for the more detailed indicators varied and were more affected by extreme values. The use of nominal indicators is therefore preferable. It also puts lower demands on the respondents. For the present purpose the percentage of scientists involved in collaborative R&D with partners located in a foreign country was chosen, because it focuses particularly on international cooperation. However, the country performances are nearly identical for the other indicators (percentage of all collaborating scientists and of those with external partners only). It should be noted that this includes partners from the scientist's own organisation which are currently located abroad (e.g. as visiting scholars). Indicators which measure collaboration by looking at collaborators might fail to recognize changes, if only the project level is affected, e.g. the same people doing two instead of one collaborative project. This can only be avoided by assessing additionally some indicator for the intensity of collaboration.
Supplementary indicators	The components of this indicator (e.g. collaboration with universities, firms, government officials) and of collaboration at national level can be used to calculate separate indicators for the frequency of inter-university links, university-firm links etc. In addition to the country level, foreign collaboration ratios can also be calculated for scientific disciplines.

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	–	1 (1.33)

Table 3.3-47: Percentage of coauthored scientific articles

Definition and explanation	Percentage of publications in scientific journals with foreign coauthors of all publications in scientific journals. $\frac{\text{Publications with foreign coauthors}}{\text{All publications}}$ Value range: 0 – 100 (percentages)
Importance and value added	The indicator also assesses international collaborations. The same rationale applies as with the previous indicator in Table 3.3-46: Involvement in international R&D collaborations.
Sources of data	Institute for Scientific Information (ISI) data on publications in scientific journals, further processed by CHI research and used for instance in [217].
Countries and time intervals covered	In principle data is globally available. So far it has been processed for the US for 1999, differentiated by scientific field (see [217], vol. 2, table 5-45)
Question wording	–
Discussion	Coauthorship has been used to assess scientific collaboration for quite some time. However, also some weaknesses have been noted. For instance, an author might choose to include coauthors for various reasons and not necessarily only because (s)he has collaborated. Heads of research teams and labs are often included among the coauthors no matter whether they actually contributed to a publication.

	The definition of coauthorship proposed in [217] tries to take this into account by limiting coauthors to those with different institutional affiliations.			
Supplementary indicators	In the SIBIS survey the number of coauthored journal articles was assessed. However, the institutional affiliation of the coauthors could not be collected. Additionally, the number of coauthors typically writing a research publication was also gathered.			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2 (1.5)	3	1

3.3.4 E-Government

Introduction

E-Government plays an important function in mediating government actions and its role will continue to grow as communications technologies become more widespread. Already, communications technologies change the way that government operates by facilitating information dissemination, communications, and transactions.

By necessity, e-Government comprises a number of functions currently fulfilled by traditional modes of communications, while also offering the possibility for a new way of linking parties in government transactions. In some instances, transactions that today require face-to-face contact, letter writing, or telephone communication may be replaced by electronic interaction. This has the potential to facilitate and speed up many processes. Citizens, operators of businesses and even government employees transacting government business will avoid standing in long lines and will perhaps be able to communicate with the government at any time of day or night. At the same time, governments and citizens will need to weigh the benefits of e-Government against perceived or real dangers, such as loss of privacy and potential for fraud. In the same vein, the implementation of e-Government should do more than merely map existing processes onto new technologies and instead force a re-evaluation of government interactions occur today and how they may be improved in the future.

The range of services that may be provided by e-Government spans from simple information sites to fully interactive applications where users and government engage in a dialog mediated by information technology.

All EU states have agreed to make e-Government a reality. Financial resources are available that will help gauge the level of commitment. E-Government is still being created, and the total cost of its implementation cannot be estimated and measured yet. In addition, it is too early to try to quantify the return on investments in e-Government.

Looking at the face of e-Government is already making a difference in its implementation. E-Government works better in some applications than in others. This is borne out by the comparison of how different countries throughout the world are approaching the challenge of creating a presence on-line.

A commitment to invest in e-Government can be considered the first step in building a presence on-line. Making sites that work is the second step that is necessary. The first ensures that access will exist and the second that accessibility is built into the process. The true test of e-Government is whether or not it is used. Statistical indicators provide one way to measure this.

Government operates on several different levels. As a result, it is necessary to split e-Government into three categories:

- Government to citizen (G2C),
- Government to business (G2B) , and
- Government to government (G2G) .

In all cases, the relationship is between the two parties so that G2C designates just as well interactions that originate with government as with the citizen. Likewise, G2B designates interactions between businesses and government. G2G comprises all intra-government interactions within and across agencies.

The successful execution of an e-Government strategy consists of two complementary phases. In the first phase, the necessary infrastructure must be put in place for e-Government to function. This requires an understanding of what e-Government will do and how it will operate. In the second phase,

the infrastructure is tested and eventually adopted as the preferred mode of interaction with and within government. During the latter phase, the infrastructure evolves in response to needs of users. During both phases, benchmarking through indicators is a critical part of the process of implementation.

Reactions to e-Government may vary. Some welcome the application of improved ICTs to government, while others may view these developments with a certain degree of suspicion, fearing a loss of privacy.

Existing reports often cite statistical indicators to test hypotheses or to support conclusions. The types of indicators used depend on the particular area that the research considers. Some indicators cited are extremely broad and apply across a wide variety of fields. These may not always be helpful for a detailed analysis of a given topic. More specific indicators are sometimes lacking and the broad indicators can point to new indicators that need to be developed. Other times, specific focused indicators exist that can provide pertinent information.

Among the most general indicators applicable to e-Government are the percentage of the population who regularly use the Internet and the percentage of households with Internet access at home. While these provide useful starting information for any study of e-Government, they are too general to give any insights beyond the most basic information.

More sophisticated measures of e-Government performance include the percent of Internet users visiting government sites. These may be further classified according to the types of interactions, such as: finding or downloading information, e-Mail enquiries, and submission of forms. Similarly, one can consider the percentage of municipalities with an on-line presence. Proposed e-Government benchmarking includes:

- percentage of public services on-line,
- use of these on-line services by the public, and
- percentage of e-procurement.

Further information might be gathered by considering examples of services or applications. The services or applications would then be rated according to whether they represent information, one-way interactions, two way interactions, or transactions.

In the last two years, several e-Government indices were developed to rank services and countries according to the availability, quality and level of sophistication of on-line government services [2], [3], [15], [24], [197], [286], [300].

The focus of the SIBIS work has been on building a set of indicators that complement what is already available. To that end, the usage of and attitudes toward e-Government has been studied by way of surveys. At the time the project started in 2001, these types of indicators where rarely available. Now, in 2003, you see that some other companies also identified these gaps and came up with several surveys dealing with the demand-side of e-Government [183], [221].

As it will not be possible to deal with all developed and piloted indicators in detail, the focus of this part of the indicator handbook on e-Government is on indicators covering all EU Member States like the SIBIS indicators and the well-known indicators used by the EC, like the Eurobarometer results. However, the other indicators are not ignored but are referred to, and discussed in several discussion parts of this report. Judging the quality and robustness of those indicators is rather difficult because in most reports detailed information on the survey and methodology are not available.

In SIBIS, a sample of respondents from the general population answered pilot questions focused on G2C. The respondents were randomly selected to provide a representative sample to pilot the SIBIS indicators. Similarly, a sample of respondents from the business community answered questions focused on G2B. In this case, IT managers were selected for the survey. As the area of e-Government was just one out of nine topics in the surveys, only a limited set of questions could be asked.

The third aspect of e-Government, G2G could not be examined in the current study, because this would require a third set of questions and it was outside the scope, time and budget of this study to ask separate questions to the government agencies. Although several e-Government surveys and statistics have been developed in the last two years, this element of e-Government have still not got much attention and besides some qualitative reports, there are rarely statistics available measuring this important element of e-Government. It is hoped that an opportunity will arise to study this important area of e-Government as well, although this will not occur in the scope of SIBIS.

e-Government - G2C

Table 3.3-48: On-line availability of government services for citizens

Definition and explanation	Availability (supply) of on-line public services for citizens measured by the average level of sophistication of 12 on-line government services for citizens. To measure the level of on-line sophistication, four stages are distinguished: Stage 1 - Information: on-line information about public services; Stage 2 - Interaction: downloading of forms; Stage 3 - Two-way interaction: processing of forms, including authentication; Stage 4 - Transaction: case handling; decision and delivery (payment). Besides these 4 stages a stage 0 was introduced to capture two possible research outcomes: ▪ Total absence of any publicly accessible website managed by the service provider ▪ The public service provider has a publicly accessible website, but this one does not offer any relevant information, interaction, two-way interaction or transaction possibilities at all concerning the analysed service. The on-line availability of public services has been determined by the extent to which it is possible to provide a service electronically. As, for some public services, the maximum stage is stage 3, stage 4 being not relevant, the score per public service is recalculated as a percentage of the maximum. The percentage indicates the extent to which each service has progressed towards full electronic case handling. The average score of a service in a country is recalculated to an overall percentage of on-line sophistication: Stage 0 = score 0 - 0,99 = 0% - 24% Stage 1 = score 1 -1,99 = 25% - 49% Stage 2 = score 2 - 2,99 = 50% - 74% or stage 2 Stage 3 = score 3 – 3,99 = 75% - 99% or stage 3 Stage 4 = score 4 = 100% or stage 4 For certain services the maximum stage was limited to Stage 3, the calculation of the percentages is then as follows: Stage 0 = score 0 - 0,99 = 0% - 32% Stage 1 = score 1 -1,99 = 33% - 66% Stage 2 = score 2 - 2,99 = 67% - 99% Stage 3 = score 3 = 100% If the score of a service in a country is based on the analysis of the websites of multiple service providers, or a combination of unique and multiple service providers, the calculated percentage is an aggregate of the average scores of the websites and will be positioned on the scale between the starting points of the ranges. The final percentage, i.e. split up by country, is calculated as the average of the percentages of the 12 services for that country.

	Value range: 0≤ On-line availability of government services for citizens ≤100
Importance and value added	On-line availability measured by level of sophistication is an important supply side indicator of e-Government because it shows how the infrastructure evolves with time and place. This indicator is one of the eEurope 2002 e-Government indicators and also identical to the eEurope 2005 policy indicator as stated in the Action plan; "No of basic public services fully available on-line"
Sources of data	EC, CGEY [117]
Countries and time intervals covered	EU member countries, Iceland and Norway: October 2001 and April 2002, October 2002 Switzerland: 2002 Further updates to the survey should occur every year.
Question wording	No real questions, but Internet research: Based on the definition of the public services, the research definition of the stages has been determined and current stage has been determined for a list of governmental websites.
Discussion	Indicator is based on Internet research; what type (at which stage) of information is available on a selected list of governmental sites. This was evaluated on the national level for 20 basic services, 12 for citizens and 8 for businesses. Analyses are made by country, by type of services (business or citizen) and by nature of service (four clusters of related services are identified: Income generating cluster, Registration Cluster, Permits & licences cluster and Returns Cluster. This web-based survey only takes into account the public services that are *supplied via the Internet*. This means that e-Government initiatives which use any other electronic application will not be taken into account; This survey evaluates the on-line accessibility of public services for citizens and businesses. It does not evaluate the redesign of administrative procedures, which is also covered by the term *e*Government and is often necessary to improve the on-line delivery of public services. The term "availability" of on-line services for this indicator is misleading, as this indicator does not measure the availability in terms of average percentage of government services that are available on-line, but calculates a kind of average scoring based on the level of sophistication of on-line government services. If not explained carefully this can lead to misinterpretation of the reported results as the mean on-line availability of services is not measured directly but transferred to the level of sophistication. The calculation tool is not well defined either: based on the information and explanation given it is not possible to recalculate this indicator. Several indicators measuring sophistication, quality and availability of on-line government services have been developed by other sources like e.g. Accenture and the World Markets Research Centre [2], [3], [15], [197], [286], [300], resulting in a so called "e-Government index": a ranking of countries using combinations of complex calculations and weighing of the relevant factors. For none of these indicators is it completely clear how the index has been calculated and how it can be reproduced. The indicator described here has been chosen as an example for all of those indicators measuring availability and sophistication in different ways; though this calculation is also not completely clear, it is a rather well-known indicator used by the EC.

Supplementary indicators	• On-line availability of income tax services for citizens • On-line availability of job search services for citizens • On-line availability of social security benefits services • On-line availability of personal documents services for citizens • On-line availability of car registration services for citizens • On-line availability of building permission services for citizens • On-line availability of police services for citizens • On-line availability of public library services for citizens • On-line availability of birth and marriage certificate services for citizens • On-line availability of enrolment for higher education services for citizens • On-line availability of change of address announcement services for citizens • On-line availability of health related services for citizens			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (2.3)	1 (0.5)	2	3 (2.7)

Table 3.3-49: Citizens' awareness of availability of on-line government services

Definition and explanation	Average percentage of regular Internet users reporting that government services are available on-line (1) $AeGOV_r = \frac{\text{Regular Internet users reporting availability of online government services}}{\text{All regular Internet users}} * 100$ (2) $\overline{AeGOV} = \frac{\sum_1^R AeGOV_r}{R}$ $AeGov_r$ Average number of regular Internet users reporting availability of the on-line service, for each individual service r $\overline{AeGOV}$ Average percentage of regular Internet users reporting the availability of on-line government services R Total number of government services (here: 7) Value range: $0 \leq \overline{AeGOV} \leq 100$
Importance and value added	This indicator is an important indicator because the value of e-Government depends on its accessibility. Available indicators tend to focus on the availability and level of sophistication of on-line services of e-Government. This indicator is an important complement because it provides interesting information related to the demand side of e-Government; are citizens aware of the availability of on-line services? It would be extremely interesting to compare this with the actual availability of on-line government services. Splitting this indicator by country, e.g. benchmarking the differences between countries is of high interest for (national) policymakers. Government can derive benefits by improving and promoting those services of which the on-line-availability is not well known by citizens.
Sources of data	Derivate of SIBIS 2002/3 GPS
Countries and time intervals covered	EU member states, Switzerland and the United States for 2002, NAS 10 for 2003
Question wording	For each activity, is it possible to use the Internet for this in the area you live: (a) Tax declaration / filing your income tax return (b) Use of job search services of public employment service (c) Request for passport, driver's licence, birth certificates or other personal documents (d) Car registration

	(e) Declaration to the police, e.g. in case of reporting theft (f) Searches for books in public libraries (g) Announcement of change of address Answers: (a) yes (b) no (c) don't know
Discussion	In the SIBIS survey, this question has only been asked to those regular internet users who reported to prefer to use the on-line government services. It was learned that it would have been more interesting to ask this question to all regular Internet users (as stated in this indicator), because it is also of interest to know whether people are aware of the availability of on-line services even if they do not prefer to use it. This will give a more complete picture of the general awareness of e-Government services, which can be of use for governments for improving their e-Government policies, for example starting a campaign to raise the awareness. The services included in the SIBIS survey are a subset of the 12 on-line government services for citizensas defined by the Commission in February 2001[266]. For future surveys it would be best to include all 12 on-line government services for citizens as defined by the Commission, preferably split up in several clusters of related services. Another issue that need to be taken into account before interpreting the results is that the methodology chosen here does assume that G2C services are delivered direct from government to citizens, while in reality a number of the services are delivered indirectly via intermediaries, (G2B2C) and future survey methodology needs to recognize this.
Supplementary indicators	• Citizen Awareness of Availability of on-line government services for filing of taxes • Citizen Awareness of Availability of on-line job search services of public employment services • Citizen Awareness of Availability of on-line government services for requesting passports, driver's licences, birth certificates or other personal documents • Citizen Awareness of Availability of on-line government services for on-line car registration • Citizen Awareness of Availability of on-line government services to handle declarations to the police, e.g. in case of reporting theft • Citizen Awareness of Availability of on-line searching for books in public libraries • Citizen Awareness of Availability of on-line announcements of change of address

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (2.3)	1 (0.5)	0	2

Table 3.3-50: BEGIX Index (Balanced e-Government Index)

Definition and explanation	The BEGIX index is a balanced e-Government scorecard recording and evaluating the various dimensions of e-Democracy and e-Government services. The matrix which forms the basis for the e-Government scorecard comprises a dynamic and a static component - with a total of five fields - as follows: 1. Benefit: quality and quantity of services, e.g. benefits citizens can derive 2. Efficiency: improvements in efficiency 3. Participation: services designed to promote political communication and

	enable a higher degree of citizen participation. 4. Transparency: realisation of the transparent state 5. Change management: planning and implementation process Each fields is build up out of several criteria and in accordance with predefined and qualitatively described "levels" (a total of five different levels of markedness are distinguished), a total of 49 criteria form the basis for detailed grading. These grades are subsequently translated into a score (0-100) for each of the five tested areas, the maximum number of points relating to an ideal reference model, i.e. "next-generation best-practice". This diagnosis and measurement approach employed in this scorecard is finally compressed into BEGIX, the balanced e-Government index, which indicates the point at which a certain on-line offering is to be found along the route towards the realization of e-Government. Value range: 0 ≤ BEGIX-index ≤ 100
Importance and value added	The BEGIX index combines electronic information-based services for citizens (e-administration) with the reinforcement of participatory elements (e-Democracy) to achieve the objective of a "balanced e-Government". Taking citizens' needs as a starting pint, this index is not only oriented towards the quality of the services that are being offered, but the crucial factor is the degree to which comprehensive government is realised.
Sources of data	Bertelsmann Stiftung
Countries and time intervals covered	2001; worldwide
Question wording	No questions, but worldwide case studies via Internet research.
Discussion	This index is an example of one of the several e-Government indices that are developed in the last two years, measuring availability, level of sophistication and quality of e-Government services [2], [3], [15], [24], [197], [286], [300]. It has been chosen because it is one of the most sophisticated indices in its field, taking into account a considerable amount of criteria elements. However, even as for the other indices, the methodology, formulas, calculations and results cannot be reproduced from the information available and this makes it difficult to judge the quality of this indicator.
Supplementary indicators	None available

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	1	1 (0.5)	1	0 (0.3)

Table 3.3-51: Citizen experience of using on-line government services

Definition and explanation	Average percentage of regular Internet users reporting that they have used on-line government (1) $UeGOV_r = \frac{\text{Regular Internet users using online government services}}{\text{All regular Internet users}} * 100$ (2) $\overline{UeGOV} = \frac{\sum_1^R UeGOV_r}{R}$ $UeGov_r$ Average number of regular Internet users using on-line services, for each individual service r $\overline{UeGOV}$ Average percentage of regular Internet users reporting the use of on-line government services R Total number of government services (here: 7) Value range: 0 ≤ $\overline{UeGOV}$ ≤ 100
Importance and value	The progression of e-Government from concept to reality depends on critical

added	elements. From the supply side, e-Government services need to be present. From the demand side, citizens should be interested in using these services. These two factors come together when citizens finally make use of these services, which is what this indicator measures. Splitting this indicator by country, e.g. benchmarking the differences between countries is of high interest for (national) policymakers. Government can derive benefits by improving and promoting those services that are not well used.
Sources of data	Derivate of SIBIS 2002/3 GPS
Countries and time intervals covered	EU member states, Switzerland and the United States for 2002, NAS 10 for 2003
Question wording	For each activity, have you ever tried using the Internet for this? (a) Tax declaration / filing your income tax return (b) Use of job search services of public employment service (c) Request for passport, driver's licence, birth certificates or other personal documents (d) Car registration (e) Declaration to the police, e.g. in case of reporting theft (f) Searches for books in public libraries (g) Announcement of change of address Answers: (1) yes (2) no (3) don't know
Discussion	In the SIBIS survey, this question has only been asked to those regular internet users who reported to prefer to use the on-line government services and mentions the availability of the on-line services in the region where they live. It was learned that it would have been more interesting to ask this question to all regular Internet users (as stated in this indicator), because it is also of interest to know whether people who do not prefer to use on-line services have ever tried to use this service (if they have the on-line availability of this service). In addition to this it would then have been interesting to combine this with the indicator(s) described in Table 3.3-55 (barriers and advantages of on-line services), to know why these people do not prefer to use on-line services. This will give a more complete picture of the general feeling of citizens towards e-Government services, which can be very important for governments, because it will give them an impression how e-Government services are perceived and where it still needs improvement. The services included in the SIBIS survey are a subset of the 12 on-line government services for citizens as defined by the Commission in February 2001 [266]. For future surveys it would be best to include all 12 services as defined by the Commission, preferably split up in several clusters of related services. Another issue that need to be taken into account before interpreting the results is that the methodology chosen here does assume that G2C services are delivered direct from government to citizens, while in reality a number of the services are delivered indirectly via intermediaries, (G2B2C) and future survey methodology needs to recognize this. This indicator gives valuable information about the use of different services, but caution need to be taken by interpreting the results, as it is not clear how these services has been used, e.g. only to find information or sending an e-Mail or if complete transactions have taken place. This indicator is closely related to the indicator described in Table 3.3-52: Usage of on-line Government Services by citizens. At the aggregated level both indicators tend to measure the same. However, at the disaggregated level they are completely different. Combining those two indicators gives detailed information about the level of use per

	government service. Which one of the two indicators is better, depends on the need of information. Taylor [221] also measures usage of e-Government services by citizens. The methodology (questioning) is rather similar to the indicator described in Table 3.3-52, but does not cover all the EU member states. Results are available for both 2001 and 2002.			
Supplementary indicators	▪ Citizen experience of using on-line government services for filing of taxes ▪ Citizen experience of using on-line government services for requesting passports, driver's licences, birth certificates or other personal documents ▪ Citizen experience of using on-line government services to handle declarations to the police, e.g. in case of reporting theft ▪ Citizen experience of using on-line searching for books in public libraries ▪ Citizen experience of using on-line government services for car registration ▪ Citizen experience of using on-line job search services of public employment services ▪ Citizen experience of using on-line announcements of change of address			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	2	2	2

Table 3.3-52: Usage of on-line Government Services by citizens

Definition and explanation	Percentage of internet users who visit on-line government sites. $\text{e-usage} = \frac{\text{Internet users who accessed a public administration site online}}{\text{All Internet users}} * 100$ e-usage Intensity of reported use of on-line public services Value range: 0 ≤ e-Usage ≤ 100 The indicator considers 4 different reasons why respondents might consider accessing a public administration site on-line. Any of the 4 reasons for accessing a public administration site on-line counts as a contact, without double counting.
Importance and value added	The progression of e-Government from concept to reality depends on critical elements. From the supply side, e-Government services need to be present. From the demand side, citizens should be interested in using these services. These two factors come together when citizens finally make use of these services, which is what this indicator measures. Splitting this indicator by country, e.g. benchmarking the differences between countries is of high interest for (national) policymakers. This indicator provides insight into any use of on-line government services. It is the eEurope 2002 (and 2005) indicator measuring the use of on-line government services [106]. It works at the lowest level of interaction between citizens and government by asking only whether they have ever visited on-line government sites, without distinguishing between different types of interactions that may occur. The question on which this indicator is based, provides information of the different types of interactions that occur and splitting this indicator according to these interactions delivers important information on the use of the different levels of interaction.
Sources of data	Eurobarometer 125 [77]
Countries and time intervals covered	EU member countries June and November 2001 and 2002
Question wording	Have you ever contacted a public administration to (a) Find administrative information (b) forms fillings/procedures

	(c) send them an e-Mail (d) other reasons (e) never through the internet
Discussion	Although this indicator provides some measure of e-Government usage, it should be viewed with caution, because it may not provide the correct reference against which to estimate whether e-Government usage is high or low. For this indicator to deliver a useful value, it must take into account whether respondents have used other methods to interact with government instead of Internet. This approach may then give some insight into e-Government and traditional government usage among internet users. This indicator is closely related with the indicator described in Table 3.3-51. At the aggregated level both indicators tend to measure the same. However, at the disaggregated level they are completely different. Combining those two indicators gives detailed information about the level of use per government service. Which one of the two indicators is better, depends on the needs of information. Taylor [221] also measures usage of e-Government services by citizens. The methodology (questioning) is rather similar to the indicator described in this table, but does not cover all EU member states. Results are available for both 2001 and 2002.
Supplementary indicators	None available

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (2.3)	1 (0.5)	0	2

Table 3.3-53: Citizen preference for on-line government services

Definition and explanation	Average percentage of regular Internet users reporting a preference for the use of on-line government services over their traditional counterparts. (1) $PeGOV_r = \frac{\text{Regular Internet users preferring to use the online service r}}{\text{All regular Internet users}} * 100$ (2) $\overline{PeGOV} = \frac{\sum_1^R PeGOV_r}{R}$ $PeGov_r$ Average number of regular Internet users preferring to use the on-line service above their traditional counterpart per individual service r $\overline{P\,eGOV}$ Average percentage of regular Internet users preferring to use on-line government services over their traditional counterparts R Total number of government services (here: 7) Value range: $0 \leq \overline{P\,eGOV} \leq 100$
Importance and value added	Available indicators tend to focus on the supply side (availability and level of sophistication of on-line services) of e-Government. This indicator is an important complement because it provides necessary information related to the demand side of e-Government; what do citizens prefer? Splitting this indicator by country, e.g. benchmarking the differences between countries is of high interest for (national) policymakers. Government can derive the greatest benefit by improving those services that are well received by citizens and that enjoy high usage.
Sources of data	SIBIS 2002/3 GPS
Countries and time intervals covered	EU member states, Switzerland and the United States for 2002, NAS 10 for 2003

Question wording	For each activity, please answer whether you would prefer to use the Internet or prefer to use the traditional way, that is face-to-face, by postal mail, fax or phone (a) Tax declaration / filing your income tax return (b) Use of job search services of public employment service (c) Request for passport, driver's licence, birth certificates or other personal documents (d) Car registration (e) Declaration to the police, e.g. in case of reporting theft (f) Searches for books in public libraries (g) Announcement of change of address Answers: (1) Internet (2) Traditional way (3) Do not use this service (4) Don't know
Discussion	The services included in the SIBIS survey are a subset of the 12 public services for citizens as defined by the Commission in February 2001[266]. Citizens seem eager to transact with government on-line. However, not all e-Government services are equally attractive. Services that require users to reveal a great deal of personal information are less popular than those that allow users to operate anonymously. For future surveys it would be best to include all 12 services as defined by the Commission, preferably split up in several clusters of related services. Another issue that need to be taken into account before interpreting the results is that the methodology chosen here does assume that G2C services are delivered direct from government to citizens, while in reality a number of the services are delivered indirectly via intermediaries,(G2B2C) and future survey methodology needs to recognize this. Citizens have a variety of options when it comes to interacting with government. To understand which method they prefer, they are given a variety of means from which to choose which one is the most desirable to them. A similar indicator developed by the Henley Centre [25] provides insight into which means of communicating with government citizens enjoy (written correspondence, face to face, telephone, Internet via PC, Internet via digital TV, Internet via games console, Internet via mobile phone, Internet via public kiosk). This suggests whether e-Government will be used and which means of communicating will be successful. This indicator broadens what may be e-Government to include interactions that do not rely directly on using a PC. The advantage of this approach is that it may point to ways in which e-Government may be implemented without forcing the migration of citizens to computers. Thus, in some cases, e-Government may be used to enable government employees to access information or to carry out transactions electronically while face-to-face interaction with citizens remains prominent.
Supplementary indicators	• Citizen preference for on-line filing of taxes • Citizen preference for on-line requests for passport, driver's licence, birth certificates or other personal documents • Citizen preference for on-line declarations to the police, e.g. in case of reporting theft • Citizen preference for on-line searching for books in public libraries • Citizen preference for on-line car registration • Citizen preference for use of on-line job search services of public employment services • Citizen preference for on-line announcements of change of address

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3 (2.7)	1	0	2

Table 3.3-54: Attitude towards on-line public services

Definition and explanation	Reported attitude of respondents towards on-line public services , based on people's combined responses to a series of questions on perceived usefulness, advantages and disadvantages of e-Government services. The indicator combines 8 items, 4 positive (on-line public services are faster than traditional methods, reduce the number of mistakes by public authorities, make it possible to deal with public authorities at more convenient times and at more convenient locations) and 4 negative (on-line public services are not useful enough, require you to install special equipment or software, do not seem as safe as traditional ways, are difficult to use). Attitude towards a positive item, “Advantage”: $$\text{Attitude}_a = \frac{\sum_{i=1}^{n} w_a(i) * f_a(i)}{\sum_{i=1}^{n-1} f_a(i)}$$ Attitude towards a negative item, “Barrier”: $$\text{Attitude}_b = \frac{\sum_{i=1}^{n} w_b(i) * f_b(i)}{\sum_{i=1}^{n-1} f_b(i)}$$ $$\Rightarrow \text{Attitude} = \frac{\sum_{j=1}^{m} (\text{Attitude}_a(j) + \text{Attitude}_b(j))}{m}$$ Where: W_a (i) = weight per answer category advantages: 10 if answer is “agree completely” (i =1) 6.67 if answer is “agree somewhat” (i =2) 3.33 if answer is “do not agree” (i =3) 0 if answer is “don’t know” (i =4) f_a (i) = number of respondents per answer category advantages n = total the number of answer categories (4) W_b (i) = weight per answer category barriers: 0 if answer is “don’t know” (i =4) 3.33 if answer is “agree completely” (i =1) 6.67 answer is “agree somewhat” (i =2) 10 if answer is “do not agree” (i =3) f_b (i) = number of respondents per answer category barriers n = total number of answer categories (4) m = total number of items (8: 4 advantages and 4 barriers) Value range: 0≤ Attitude ≤10

	A value of 0 means that people do not see any advantages of electronic government services, a value of 5 means that people are indifferent between interacting with government via the traditional way or via the Internet. A value higher than 5 means that people are rather positive towards electronic government services and see the advantages of those e-services.			
Importance and value added	This indicator provides an insight in the attitudes of citizens towards e-Government. Although this indicator does not show what type of advantages and barriers citizens face using e-Government services, it gives an idea about the general attitude towards e-Government. Splitting this indicator by country, e.g. benchmarking the differences between countries is of high interest for (national) policymakers, e.g. in analysing whether e-Government services are appreciated in general or if promotion and awareness creation of the value added of those e-Government services should make sense. Differentiating this indicator among types of users (e.g. users of on-line public services versus non-users of on-line public services) gives an important insight into the profiles of the different users and non-users.			
Sources of data	SIBIS 2002/3 GPS			
Countries and time intervals covered	EU member states, Switzerland and the United States for 2002, NAS 10 for 2003			
Question wording	For each of the following statements about on-line services of public administration, please indicate whether you agree. Public services on the Internet (a) are not useful enough (b) are faster than the traditional way (c) require that you install special equipment or software (d) reduce the number of mistakes public authorities make (e) do not seem as safe as using the traditional way (f) make it possible to deal with the authorities at more convenient times (g) make it possible to deal with the authorities at more convenient locations, e.g. from home or from the workplace (h) are difficult to use Answers: (1) agree completely (2) agree somewhat (3) do not agree (4) DK			
Discussion	The weights that are chosen (scale 0-10) are a rather general and accepted method to weigh those types of categories. Other weighing is possible. Although this indicator does not show what type of advantages and barriers citizens face using e-Government services, it gives an idea about the general attitude towards e-Government.			
Supplementary indicators	• Citizen perception of the usefulness of on-line public services • Citizen perception about the speed of on-line public services • Citizen perception towards the needs for special equipment to use on-line public services • Citizen perception of the safety of on-line public services • Citizen perception about the time convenience of on-line public services • Citizen perception of location convenience of on-line public services • Citizen perception of the difficulty to use on-line public services			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (1.7)	1 (0.5)	0	2

Table 3.3-55: Citizen perception of the safety of on-line government services

Definition and explanation	Reported perception of regular Internet users on the safety of on-line public services as a percentage of the number of respondents to the question. $P_{unsafe} = \frac{RIU_{unsafe}}{\text{All regular Internet users}} * 100$ $P_{safe} = 100 - P_{unsafe}$ P_{unsafe} Intensity of perception that on-line public services less safe than the tradition way RIU_{unsafe} Number of regular Internet users agreeing completely that on-line public services are less safe than the traditional way P_{safe} Intensity of perception of safety of on-line public services Value range: $0 \leq P_{safe} \leq 100$
Importance and value added	This indicator gives an important insight in the perceptions of citizens regarding the safety of on-line government services, an issue that's high on the political agenda. Once split up by country, this is an important benchmarking indicator to show differences in perceptions between countries. Governments can improve the use of government services once people believe and trust the safety of the on-line services. Differentiating this indicator among types of users (e.g. users of on-line public services versus non-users of on-line public services) gives an important insight into the profiles of the different users and non-users.
Sources of data	SIBIS 2002 General Population Survey
Countries and time intervals covered	2002: EU member states, Switzerland and the United States
Question wording	For each of the following statements about on-line services of public administration, please indicate whether you agree. Public services on the Internet (a) are not useful enough (b) are faster than the traditional way (c) require that you install special equipment or software (d) reduce the number of mistakes public authorities make **(e) do not seem as safe as using the traditional way** (f) make it possible to deal with the authorities at more convenient times (g) make it possible to deal with the authorities at more convenient locations, e.g. from home or from the workplace (h) are difficult to use Answers: (1) agree completely (2) agree somewhat (3) do not agree (4) DK
Discussion	The barrier stated in this question is an important issue for governments; if people do not trust that the on-line service they use is safe, they should not be willing to use this on-line service and prefer to interact with governments via the traditional way. Similar indicators can be developed for other barriers and advantages (see supplementary indicators). Taylor Nelson [221] also questioned citizens about their perceptions of the safety of the on-line government. As this survey has been conducted twice (2001 and 2002) the results show developments in time, however, it does not cover all EU Member States and this limits its value for the purpose of this indicator handbook. As detailed information about sampling and methodology is not available in his summary report, it is difficult to judge the quality of this indicator.
Supplementary indicators	• Citizen perception of the usefulness of on-line public services

	• Citizen perception about the speed of on-line public services • Citizen perception towards the needs for special equipment to use on-line public services • Citizen perception about the time convenience of on-line public services • Citizen perception of location convenience of on-line public services • Citizen perception towards the difficulty of use of on-line public services			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3 (2.7)	1	0	2

e-Government - G2B

Table 3.3-56: Availability of on-line government services for businesses

Definition and explanation	Availability (supply) of on-line public services for businesses measured by the average level of sophistication of 8 on-line government services for businesses. To measure the level of on-line sophistication, four stages are distinguished: Stage 1 - Information: on-line information about public services; Stage 2 - Interaction: downloading of forms; Stage 3 - Two-way interaction: processing of forms, including authentication; Stage 4 - Transaction: case handling; decision and delivery (payment). Besides these 4 stages a stage 0 was introduced to capture two possible research outcomes: Total absence of any publicly accessible website managed by the service provider The public service provider has a publicly accessible website, but this one does not offer any relevant information, interaction, two-way interaction or transaction possibilities at all concerning the analysed service. The on-line availability of public services has been determined by the extent to which it is possible to provide a service electronically. As, for some public services, the maximum stage is stage 3, stage 4 being not relevant, the score per public service is recalculated as a percentage of the maximum. The percentage indicates the extent to which each service has progressed towards full electronic case handling. The average score of a service in a country is recalculated to an overall percentage of on-line sophistication: Stage 0 = score 0 - 0,99 = 0% - 24% Stage 1 = score 1 -1,99 = 25% - 49% Stage 2 = score 2 - 2,99 = 50% - 74% or stage 2 Stage 3 = score 3 – 3,99 = 75% - 99% or stage 3 Stage 4 = score 4 = 100% or stage 4 For certain services the maximum stage was limited to Stage 3, the calculation of the percentages is then as follows: Stage 0 = score 0 - 0,99 = 0% - 32% Stage 1 = score 1 -1,99 = 33% - 66% Stage 2 = score 2 - 2,99 = 67% - 99% Stage 3 = score 3 = 100% If the score of a service in a country is based on the analysis of the websites of multiple service providers, or a combination of unique and multiple service providers, the calculated percentage is an aggregate of the average scores of the websites and will be positioned on the scale between the starting points of the ranges.

	The final percentage, e.g. split up by country, is calculated as the average of the percentages of the 8 services for that country. Value range: 0≤ On-line availability of government services for businesses ≤100
Importance and value added	On-line availability measured by level of sophistication is an important supply side indicator of e-Government because it shows how the infrastructure evolves with time and place. This indicator is one of the eEurope 2002 e-Government indicators and also identical to the eEurope 2005 policy indicator as stated in the Action plan; "No of basic public services fully available on-line"
Sources of data	EC, CGEY [117]
Countries and time intervals covered	EU member countries, Iceland and Norway: October 2001 and April 2002, October 2002 Switzerland: 2002 Further updates to the survey should occur every year.
Question wording	No real questions, but Internet research: Based on the definition of the public services, the research definition of the stages has been determined and current stage has been determined for a list of governmental websites.
Discussion	Indicator is based on Internet research; what type (at which stage) of information is available on a selected list of governmental sites. This was evaluated on the national level for 20 basic services, 12 for citizens and 8 for businesses. Analyses are made by country, by type of services (business or citizen) and by nature of service (four clusters of related services are identified: Income generating cluster, Registration Cluster, Permits & licences cluster and Returns Cluster. This web-based survey only takes into account the public services that are *supplied via the Internet*. This means that e-Government initiatives which use any other electronic application will not be taken into account; This survey evaluates the on-line accessibility of public services for citizens and businesses. It does not evaluate the redesign of administrative procedures, which is also covered by the term e-Government and is often necessary to improve the on-line delivery of public services. The term "availability" of on-line services for this indicator is misleading, as this indicator does not measure the availability in terms of average percentage of government services that are available on-line, but calculates a kind of average scoring based on the level of sophistication of on-line government services. If not explained carefully this can lead to misinterpretation of the reported results as the mean on-line availability of services is not measured directly but transferred to the level of sophistication. The calculation tool is not well defined either: based on the information and explanation given it is not possible to recalculate this indicator. Several indicators measuring sophistication, quality and availability of on-line government services have been developed by other sources like Accenture and the World Market Research Centre [2], [3], [15], [197], [286], [300], resulting in a so called "e-Government index": a ranking of countries using combinations of complex calculations and weighing of the relevant factors. For none of these indicators is it completely clear how the index has been calculated and how it can be reproduced. The indicator described here has been chosen as an example for all of those indicators measuring availability and sophistication in different ways: though this calculation is also not completely clear, it is a rather well-known indicator used by the EC. Instead of an Internet research, the IDA e-Government Observatory initiative [183] surveyed public administrations to ask them about the level of sophistication of their on-line services. Although this approach is refreshing, the returned amount of questionnaires was rather low, so comparing those results with the CGEY results and evaluation of the quality of the results is difficult.

Supplementary indicators	• On-line availability of social contribution for employees services • On-line availability of corporate tax services • On-line availability of VAT declaration • On-line availability of registration of a new company • On-line availability of submission of statistical data • On-line availability of custom declaration • On-line availability of environmental permits • On-line availability of on-line participation in public invitation to tender			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (2.3)	1 (0.5)	2	3 (2.7)

Table 3.3-57: Business awareness of availability of on-line government services

Definition and explanation	Average percentage of businesses reporting that government services are available on-line (1) $BA_r = \frac{\text{Establishments reporting availability of online government services}}{\text{All establishments}} * 100$ (2) $\overline{BA} = \frac{\sum_1^R BA_r}{R}$ BA_r Business Awareness: Average number of establishments reporting availability of the on-line service, for each individual service r $\overline{BA}$ Average percentage of establishments reporting the availability of on-line government services R Total number of government services (here: 6) Remark: establishments are defined as private establishments with access to the Worldwide Web, excluding governmental organisations and public administrations Value range: $0 \leq \overline{BA} \leq 100$
Importance and value added	This indicator is an important indicator because the value of e-Government depends on its accessibility. Available indicators tend to focus on the availability and level of sophistication of on-line services of e-Government. This indicator is an important complement because it provides interesting information related to the demand side of e-Government; are citizens aware of the availability of on-line services? It would be extremely interesting to compare this with the actual availability of on-line government services. Splitting this indicator by country, e.g. benchmarking the differences between countries is of high interest for (national) policymakers. Government can derive benefits by improving and promoting those services of which the on-line-availability is not well known by citizens.
Sources of data	Developed for SIBIS Decision Maker Survey, not piloted
Countries and time intervals covered	-
Question wording	For each activity, is it possible to use the Internet for this in the area you live: (a) Payment of social contribution for employees (b) Corporation tax declaration (c) VAT declaration (d) Submission of data to statistical offices (e) Obtaining environment-related permits (f) Participation in public invitation to tender Answers:

	(1) yes (2) no (3) don't know			
Discussion	This indicator has been developed in the SIBIS work, but has not been piloted. This indicator will give a more complete picture of the general awareness of e-Government services, which can be of use for governments for improving their e-Government policies, for example starting a campaign to raise the awareness. For future surveys it would be best to include all 8 on-line government services for businesses as defined by the Commission [266], preferably split up in several clusters of related services.			
Supplementary indicators	• Business awareness of availability of on-line payment of social contribution for employees • Business awareness of availability of on-line tax declaration • Business awareness of availability of on-line VAT declaration • Business awareness of availability of on-line submission of statistical data • Business awareness of availability of on-line request for environmental permits • Business awareness of availability of on-line participation in public invitation to tender			
Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (1.7)	0	0	0 (0.3)

Table 3.3-58: Business use of on-line government services

Definition and explanation	Average percentage of business with access to the Worldwide Web reporting that they have used on-line government services (1) $BU_r = \frac{\text{Establishments using online government services}}{\text{All establishments}} * 100$ (2) $\overline{BU} = \frac{\sum_1^R BU_r}{R}$ BU_r Business Use per service: Average number of establishments using on-line services, for each individual service r $\overline{BU}$ Average percentage of establishments reporting the use of on-line government services R Total number of government services (here: 6) Remark: establishments are defined as private establishments with access to the Worldwide Web, excluding governmental organisations and public administrations Value range: $0 \leq \overline{BU} \leq 100$
Importance and value added	This indicator gives important information on the preferences of businesses regarding e-Government services. This is vital information for governments, because it only make sense to invest in (improving) on-line services if on-line availability of those services is appreciated and used, or will be used once it becomes available. In this case it does make sense to split this indicator by service.
Sources of data	Derivate of SIBIS DMS
Countries and time intervals covered	Germany, Finland, France, Great Britain, Italy, Greece and Spain for 2002
Question wording	I am going to read you a list of activities for which establishments have to get in touch with public administration. For which of these activities do you already use on-line media such as EDI or the Internet?

	What about ...[item]? Do you use on-line media such as EDI or the Internet for this? (a) Payment of social contribution for employees (b) Corporation tax declaration (c) VAT declaration (d) Submission of data to statistical offices (e) Obtaining environment-related permits (f) Participation in public invitation to tender
Discussion	The services included in the SIBIS survey are a subset of the 8 public services for businesses as defined by the Commission in February 2001 [266]. For future surveys it would be best to include all 8 services as defined by the Commission, preferably split up in several clusters of related services. Respondents in the SIBIS survey are the IT managers of the establishments: it is questionable if these are the right people to ask the questions about e-Government, as this are in most cases not the persons dealing with those governmental issues. Future surveys should take this into account and it is recommended to ask questions on e-Government to for example the Administrations and Finance Manager. The IDA e-Government Observatory initiative [183] also surveyed businesses to ask them about their use of on-line services, however as the returned amount of questionnaires was rather low (les than 20% out of a small sample) comparing those results with the SIBIS results and evaluation of the quality of the results is difficult.
Supplementary indicators	• Business use of on-line tax declaration • Business use of on-line VAT declaration • Business use of on-line submission of statistical data • Business use of on-line request for environmental permits • Business use of on-line participation in public invitation to tender

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	3	1	0	1 (1.3)

Table 3.3-59: Business preference for using on-line government services

Definition and explanation	Average percentage of business with access to the Worldwide Web reporting that they prefer using on-line government services instead of the traditional way. (1) $BP_r = \frac{\text{Establishments preferring to use on-line government services}}{\text{All establishments}} * 100$ (2) $\overline{BP} = \frac{\sum_1^R BP_r}{R}$ BP_r Business Preference per service: average number of establishments preferring using on-line services, for each individual service r $\overline{BP}$ Average percentage of establishments reporting the use of on-line government services R Total number of government services (here: 6) Remark: establishments are defined as non-governmental organisations with access to the World Wide Web, excluding governmental organisations and public administrations Value range: $0 \leq \overline{BP} \leq 100$
Importance and value	From the supply side, e-Government services need to be present. From the

<table>
<tr><td>added</td><td>demand side, businesses should be interested in using these services. This indicator describes the preferences of businesses towards on-line government services. This gives valuable information for governments, as it does not make sense to invest in sophistication of those on-line services if they will probably not been used.</td></tr>
<tr><td>Sources of data</td><td>SIBIS DMS</td></tr>
<tr><td>Countries and time intervals covered</td><td>(Germany, Finland, France, Great Britain, Italy, Greece and Spain for 2002</td></tr>
<tr><td>Question wording</td><td>I am going to read you a list of activities for which establishments have to get in touch with public administration.
Would your establishment prefer to use on-line media such as EDI or the Internet for this purpose?
(a) Payment of social contribution for employees
(b) Corporation tax declaration
(c) VAT declaration
(d) Submission of data to statistical offices
(e) Obtaining environment-related permits
(f) Participation in public invitation to tender
For each question:
(1) yes
(2) no
(3) don’t know</td></tr>
<tr><td>Discussion</td><td>In the SIBIS survey this question has only been asked to those people who said not to use government services on-line. Although this gives a good overview of the potential of new users, the indicator presented here is an improvement of this indicator as it would also be of interest to know if those businesses reporting use of the on-line services also prefer this on-line service or only tried it once and decided never to use it again. From those respondents who used it, but will not prefer to use it another time, it would be interesting to know why they will not use it anymore, e.g. combine this indicator with the supplementary indicator described in Table 3.3-60: Attitudes of businesses towards on-line government services: barriers and advantages of on-line government services.
The services included in the SIBIS survey are a subset of the 8 public services for businesses as defined by the Commission in February 2001 [266]. For future surveys it would be best to include all 8 services as defined by the Commission, preferably split up in several clusters of related services.
Respondents in the SIBIS survey are the IT managers of the establishments: it is questionable if these are the right people to ask the questions about e-Government, as this are in most cases not the persons dealing with those governmental issues. Future surveys should take this into account and it is recommended to ask questions on e-Government to for example the Administrations and Finance Manager.</td></tr>
<tr><td>Supplementary indicators</td><td>• Business use of on-line tax declaration
• Business use of on-line VAT declaration
• Business use of on-line submission of statistical data
• Business use of on-line request for environmental permits
• Business use of on-line participation in public invitation to tender</td></tr>
<tr><td>Evaluation results</td><td><table><tr><td>Benchmarking Value</td><td>Validity</td><td>Reliability</td><td>Availability</td></tr><tr><td>3 (2.7)</td><td>1 (0.5)</td><td>0</td><td>1 (1.3)</td></tr></table></td></tr>
</table>

Table 3.3-60: Attitudes of businesses towards on-line government services

Definition and explanation	Reported attitude of businesses towards on-line government services, based on people's combined responses to a series of questions on perceived usefulness, advantages and disadvantages of e-Government services. The indicator combines 8 items, 4 positive (on-line public services are faster than traditional methods, reduce the number of mistakes by public authorities, make it possible to deal with public authorities at more convenient times and at more convenient locations) and 4 negative (on-line public services are not useful enough, require you to install special equipment or software, do not seem as safe as traditional ways, are difficult to use). Attitude towards a positive item, "Advantage": $$\text{Attitude}_a = \frac{\sum_{i=1}^{n} w_a(i) * f_a(i)}{\sum_{i=1}^{n-1} f_a(i)}$$ Attitude towards a negative item, "Barrier": $$\text{Attitude}_b = \frac{\sum_{i=1}^{n} w_b(i) * f_b(i)}{\sum_{i=1}^{n-1} f_b(i)}$$ $$\Rightarrow \text{Attitude} = \frac{\sum_{j=1}^{m} (\text{Attitude}_a(j) + \text{Attitude}_b(j))}{m}$$ Where: $W_a(i)$ = weight per answer category advantages: 10 if answer is "agree completely" (i =1) 6.67 if answer is "agree somewhat" (i =2) 3.33 if answer is "do not agree" (i =3) 0 if answer is "don't know" (i =4) $f_a(i)$ = number of respondents per answer category advantages n = total the number of answer categories (4) $W_b(i)$ = weight per answer category barriers: 0 if answer is "don't know" (i =4) 3.33 if answer is "agree completely" (i =1) 6.67 answer is "agree somewhat" (i =2) 10 if answer is "do not agree" (i =3) $f_b(i)$ = number of respondents per answer category barriers n = total number of answer categories (4) m = total number of items (8: 4 advantages and 4 barriers) Value range: $0 \leq \text{Attitude} \leq 10$ A value of 0 means that businesses do not see any advantages of electronic government services, a value of 5 means that businesses are indifferent between interacting with government via the traditional way or via the Internet. A value

	higher than 5 means that businesses are rather positive towards electronic government services and see the advantages of those e-services.
Importance and value added	This indicator provides an insight in the attitudes of businesses towards e-Government. Although this indicator does not show what type of advantages and barriers businesses face using e-Government services, it gives an idea about the general attitude towards e-Government. Splitting this indicator by country, e.g. benchmarking the differences between countries is of high interest for (national) policymakers, e.g. in analysing whether e-Government services are appreciated in general or if promotion and awareness creation of the value added of those e-Government services should make sense. Differentiating this indicator among types of users (e.g. users of on-line public services versus non-users of on-line public services) gives an important insight into the profiles of the different users and non-users.
Sources of data	SIBIS 2002 DMS
Countries and time intervals covered	Germany, Finland, France, Great Britain, Italy, Greece and Spain for 2002
Question wording	For each of the following statements about on-line services of public administration, please indicate whether you agree. Public services on the Internet (a) are not useful enough (b) are faster than the traditional way (c) require that you install special equipment or software (d) reduce the number of mistakes public authorities make (e) do not seem as safe as using the traditional way (f) make it possible to deal with the authorities at more convenient times (g) make it possible to deal with the authorities at more convenient locations, e.g. from home or from the workplace (h) are difficult to use Answers: (1) agree completely (2) agree somewhat (3) do not agree (4) DK
Discussion	The weights that are chosen (scale 0-10) are a rather general and accepted method to weigh those types of categories. Other weighing is possible. Although this indicator does not show what type of advantages and barriers businesses face using e-Government services, it gives an idea about the general attitude towards e-Government. The IDA e-Government Observatory initiative [183] conducted a small pilot survey in which they asked both public administrations and businesses about their opinions on several barriers and advantages towards on-line services, however as the returned amount of questionnaires was rather low (les than 20% out of a small sample) comparing those results with the SIBIS results and evaluation of the quality of the results is difficult.
Supplementary indicators	• Business perception of the usefulness of on-line public services • Business perception about the speed of on-line public services • Business perception towards the needs for special equipment to use on-line public services • Business perception of the safety of on-line public services • Business perception about the time convenience of on-line public services • Business perception of location convenience of on-line public services • Business perception towards the difficulty of use of on-line public services

Evaluation results	Benchmarking Value	Validity	Reliability	Availability
	2 (1.7)	1 (0.5)	0	1(1.3)

3.3.5 E-Health

Introduction

The e-Health domain is potentially a very broad and complex one to benchmark. Part of this complexity derives from the wide variety of players involved. These include government departments, health administrations, insurance agencies, pharmaceutical companies, large hospitals, health clinics, imaging and laboratory facilities, individual doctors in hospitals, clinics or their own offices, other paramedical professionals and staff, administrative personnel, and, of course, individuals moving between the roles of citizen, patient and carer. Another element of complexity derives from the variations in the ways that healthcare systems are organised in different countries, with varying mixes in terms of public and/or private provision and utilisation and whether or not general practitioners play a gatekeeper role in determining access to other services. There are also significant variations in the ways that services are delivered and in what is deemed to be acceptable or good practice (for example, variations in relation to whether or not telephone consultations with one's doctor are encouraged or are even possible, and in whether or not doctors are reimbursed for these).

This complexity poses certain challenges for benchmarking e-Health developments in Europe. To begin with, there are issues posed by the wide variety of players, each with their own information and communication needs [70]. It would require a very large scale, dedicated and multi-method exercise, and certainly one that is far beyond the scope of a single project such as SIBIS, to fully benchmark e-Health activity across all of these players. A second challenge relates to the importance of linking benchmarking data on e-Health activity (e.g. e-Mail interaction between doctors and patients, or activity-based reimbursement claims and payments for doctors) with contextual information on the healthcare systems within which the relevant parties are operating. In some countries such activities may not be allowed or may not make sense (e.g. where doctors are salaried and have little or no activity-based reimbursement).

There is also another layer of complexity in the e-Health domain that relates to the actual variety of e-Health applications and services themselves, and to their varying degrees of maturity. Just some of the wide range of e-Health applications and services are outlined for illustrative purposes below. To begin with, there are ICT-based administrative systems of varying degrees of scale and functionality to meet the needs of the different players, large and small. Examples include hospital information systems (HIS), practice and record management systems for office-based doctors, picture archiving and communication systems (PACS) for imaging facilities and transaction processing systems for bookings, claims and reimbursements. These are progressing from purely administrative systems to systems supporting clinical activities, particularly supporting access to, sharing of and management of clinical information on patients. Examples include electronic health care records (EHCRs), networks interconnecting doctors and other clinical services, case management systems and smart cards. There are also systems supporting direct healthcare delivery, including many different applications of telemedicine and telecare supported by telemetry, audio-visual systems and so on. Then there are customer service systems, including call centres and web sites. Finally, there is the large and rapidly growing resource of information and other services on the web aimed at self-directed activity by consumers. Examples include public and private health information web sites and portals, on-line pharmacies, and on-line self-help groups.

As noted earlier, a full benchmarking of this domain would require a large scale, multi-method exercise. Quite a lot of benchmarking data could be collected through surveys, but there would have to be many of these in order to address all of the different entities (hospitals, office-based doctors, insurers, imaging facilities, laboratories, patients/ consumers and so on). Individual players within entities would also need to be surveyed, for example, individual doctors within hospitals and practices. Also, although some generic indicators would apply across a number of players, indicators on specific e-Health activities would have to developed that were tailored to the types of information and communication of most relevance under each circumstances.

Apart from surveys, other methods would also be needed for a full benchmarking. To begin with, consistent and reliable contextual information on healthcare systems and practices in the different countries would be needed both to inform the survey work and to enable results to be interpreted. For example, a low level of reported usage of a particular form of e-Health activity might reflect a lack of opportunity or a lack of meaningfulness of the particular activity for particular users. Preparatory studies involving identified users of eHealth services (e.g. through focus groups or on-line surveys) would also be very valuable for identifying and exploring specific issues to be addressed in larger scale quantitative surveys of the population.

Apart from this, other methods that are relevant for e-Health benchmarking include web scanning and automatic collecting of usage data from health web sites. Web scanning has particular relevance for mapping the e-Health domain on the Internet and for collecting objective data on the extent to which on-line health sites are reaching the quality criteria developed under the eEurope initiative. Automatic data collection on usage of web sites has particular relevance for understanding who is using particular sites and how they are using them, although issues of data privacy, commercial sensitivity and so on need to be dealt with.

The e-Health indicator system developed in SIBIS

Like much of the eEurope benchmarking to date, the SIBIS project's work on indicator testing and benchmarking was primarily based on survey approaches. In fact, two surveys were carried out in the project, one of the general population and one of establishments. Only the population survey was suitable for collecting data on e-Health indicators; the establishment survey covered all sectors and the indicators were generic ones not tailored to specific types of "e-Activity" such as e-Health.

General public: As a consequence, the main focus of the e-Health indicators in this handbook is on e-Health activity of the general public, specifically e-Health activity over the Internet. Other forms of e-Health activity, such as telemedicine or telecare to the home, are not included. The diffusion of such applications is very limited at present and what diffusion there is tends to be localised around particular trials or centres of excellence so that population surveys are not an appropriate way to benchmark such developments.

The proliferation of on-line e-Health services (information, advice, clinical services and pharmaceutical sales) is facilitating increased self-directed, self-servicing activity amongst consumers. It is important to have indicators of both the availability and quality of such services, and of the use (and possible mis-use) of such services if policy positions and initiatives are to be well-informed and up-to-date. It is also important to monitor the extent to which such services and their usage are affecting health and healthcare divides across social groups - are they resulting in better health practices and are they reducing or increasing the health differentials that currently exist across socio-economic groups?

Apart from some few exceptions (e.g. the research by the Pew group in the US [151], [149]) there has so far been relatively little benchmarking of e-Health activity of the public to support the formulation of public health policy in the area. In the EU, the Eurobarometer surveys of Internet usage provide a very basic benchmarking of e-Health activity [77], [75], [73], [76], but are only based on a single generic item. There has also been a recent Eurobarometer survey carried out for DG SANCO that focused on sources of information, including the Internet, used by the general public to get health information [139]. Most other studies are based on on-line surveys with attendant problems of representativeness.

The SIBIS GPS has provided a more in-depth benchmarking than has been available from Eurobarometer so far. The results of this are summarised in other SIBIS reports, along with suggestions on how this aspect could be taken further in the context of the eEurope 2005 benchmarking work, including proposals on how population surveys could be augmented with the other methods of data collection outlined above.

Table 3.3-61: e-Health indicator framework for the general public

Indicator level and domain	Core Indicators (and ancillary variables)	Existing Sources	Benchmarking methods			
			Survey	Document System	Web scan	Monitor activity
Readiness:						

Indicator level and domain	Core Indicators (and ancillary variables)	Existing Sources	Benchmarking methods			
			Survey	Document System	Web scan	Monitor activity
User characteristics:	(Demographic)	[299], [105]	√			√
Opportunities and incentives	• (Sub) set of eHealth activities that are relevant, possible, reimbursed	[70]	√	√	√	
Knowledge and awareness	• Extent of awareness of relevant eHealth possibilities	[271]	√			
Attitudes/interests	• Degree of interest in eHealth activities • Willingness to pay	[271], [187]	√	√		
Drivers/barriers	• Specific health-related needs • Geographical/service availability factors	[271], [27]	√	√		
Skills (needed and possessed)	• Level of on-line skills • Level of health literacy • Language skills • Skills in quality assessment	[52],[269], [174], [167], [104], [271], [163]	√		√	√
Perceived trustworthiness	• Level of trust in different sources of information	[52], [151]	√			
Usage:						
Type of application/service	Which eHealth activities undertaken: • Informal, self-directed search for information (lifestyle, specific conditions • On-line interaction with own doctor or clinic (administrative, clinical) • On-line interaction with other doctors or clinics (administrative, clinical) • On-line purchase of pharmaceuticals (prescription, non-prescription)	[299], [271], [71], [105], [149], [18], [75], [73], [76]	√			√
Actual services used	• Specific services/ sites used • Type of provider (public/private) of services used • Quality of services used	[71]	√		√	√
Sphere of eHealth activity	• Nature and scope of communication networks	[70], [299]	√		√	√
Frequency	• Frequency, regularity, amount and duration of usage	[299], [105], [149], [77]	√		√	√
Mode of interaction	• Passive browsing, active consultation	[71]	√			
Quality/outcome:						
Success	• Finding information needed	[174], [299]	√			√
Benefits, Quality, Satisfaction	• Cost-effectiveness, quality of service • Quality of on-line services • Satisfaction with on-line services	[269], [174], [167], [104]	√		√	
Importance	• Whether substitutes for or is in addition to more traditional approaches	[139]	√			
Behavioural impact	• Actions taken as a result	[174]	√			
Health impact	• Measurable health gain/impact		?	?		

Table 3.3-61 presents a summary tabulation of some of the main indicators that were identified in the SIBIS analysis as important for monitoring the development of e-Health activity amongst the general public and/or patients. The framework draws upon the main research developments and approaches from across Europe and the US and represents the first effort to develop an overall conceptual framework for a thorough benchmarking of this domain.

Healthcare providers: Table 3.3-62 presents a tabulation of the indicator areas that have been identified in SIBIS as needing to be addressed if the domain is to be more fully covered in the future.

Table 3.3-62: e-Health indicator framework for healthcare providers

Indicator level and domain	Core Indicators (and ancillary variables)	Existing Sources	Benchmarking methods			
			Survey	Document System	Web scan	Monitor activity
Readiness:						
User characteristics	(Demographic)	[72], [74], [78]	√			√
Establishment characteristics	(Practice/clinic characteristics - type, size, location)	[70], [72], [74], [78]	√			
Opportunities and incentives	• (Sub) set of eHealth activities that are relevant, possible, reimbursed	[70]	√	√	√	
Knowledge and awareness	• Extent of awareness of relevant eHealth possibilities	[271]	√			
Attitudes/interests	• Degree of interest in eHealth activities • Willingness to pay	[271]	√	√		
Drivers/barriers	• Importance of situational factors, such as geography and dispersal of clients • Importance of requirements of other parties	[271]	√	√		
Skills (needed and possessed)	• Level of on-line skills • Language skills • Skills in quality assessment	[52], [269], [174], [167], [104]	√		√	√
Perceived trustworthiness	• Level of trust in different sources of information	[299]	√			
Usage:						
Type of connectivity	• Public Internet • Dedicated health telematics network	[70]	√	√		
Type of application/service	Which eHealth activities undertaken: • Informal, self-directed usage • Individual or establishment web site • Clinical • Administrative/financial • Continuing education • Other (EHCRs, smart cards etc.)	[70], [72], [74], [78], [174], [17], [271]	√		√	√
Actual services used	• Specific services/ sites used • Type of provider (public/private) of services used • Quality of services used	[71]	√		√	√
Sphere of eHealth activity	• Nature and scope of communication networks	[70], [299]	√		√	√
Frequency	• Frequency, regularity, amount and duration of usage	[299], [77], [105]	√			√
Expenditure	• Amount of expenditure on equipment, connection, subscription, communications, service/content etc.	[70]	√			
Charging	• Type and level of charging for services provided to patients	[70]	√	√	√	
Quality/outcome:						
Success	• Finding information needed	[174], [299]	√			√
Benefits, Quality,	• Cost-effectiveness, quality of	[269], [174],	√		√	

Indicator level and domain	Core Indicators (and ancillary variables)	Existing Sources	Benchmarking methods			
			Survey	Document System	Web scan	Monitor activity
Satisfaction	service • Quality of on-line services • Satisfaction with on-line services	[167], [104]				

Although not the main focus of the SIBIS work on e-Health, attention was also given within the project to identifying e-Health indicators for healthcare providers. A variety of medical and paramedical organisations and professionals are involved in the direct delivery of health services, each with particular communication needs and types of e-Health applications and services of most relevance [70]. Also of importance for benchmarking purposes are the networks of communication in which healthcare practitioners and enterprises are involved. These provide the rationale for implementation of and connection to dedicated e-Health telematics networks. As noted earlier, for a complete benchmarking of e-Health developments it would be necessary to develop indicators tuned to the specific communication needs and circumstances of each type of player. Within SIBIS, however, the main focus was on general practitioners as these are pivotal players in most health care systems. Analyses of the communication needs of the other players can be found in the report of the SATS study [70].

Recently a series of specific surveys by Eurobarometer have focused on e-Health activity by general practitioners and have been used in the compilation of the eEurope 2002 benchmarking report [72], [74], [78]. There is considerable scope for an improvement and expansion of benchmarking in this area, however. For example, as in the case of e-Health activity of the general public, there is a need for contextual information on the extent to which it is possible or meaningful for doctors in particular countries, regions or administrative contexts to engage in some e-Health activities. More generally, there is a need for more specificity in the benchmarking of doctors' e-Health activity.Selected key indicators for e-Health activity of the general public

Usage of e-Health

Table 3.3-63: Usage of the Internet by the general public to search for health-related information

Definition and explanation	Percentage of the population aged 15 years and older who have used the Internet in defined reference periods (last 4 weeks, last 12 months) for private purposes to search for any health-related information: $\frac{\text{Persons using Internet to search for health - related information}}{\text{All persons}} * 100$ Value range: 0 – 100
Importance and added value	The Internet is becoming an increasingly important source of health-related information and it is necessary for public health policy to monitor and quantify the public's use of such on-line information sources and for Information Society/health policy to track possible digital divides in relation to this
Sources of data	SIBIS GPS Variants on this indicator were used in recent Flash Eurobarometer surveys [73], [75], [76], [77].
Countries and time intervals covered	EU Member States, US and CH for 2002, NAS for 2003
Question wording	For your private purposes have you used it [the Internet] in the last 12 months…to search for any health-related information? (If yes) Have you done so in the last four weeks?

	Response categories: Yes/No/Don't Know			
Discussion	Good consistency was found between the SIBIS indicator and that used in the Flash Eurobarometer survey conducted closest to the SIBIS survey [77]. The choice of reference periods (last 4 weeks, last 12 months) was influenced by the desire for consistency with indicators on other SIBIS topics. Recent Eurobarometer surveys have not used any reference periods. This issue of reference periods relates to the broader question of developing indicators of frequency/intensity of eHealth activity. Further consideration needs to be given to this in future indicator development, including the issue of contextualising usage in relation to precipitating factors such as the occurrence of a particular illness/condition.			
Supplementary indicators	Breakdowns by: - Socioeconomic and demographic groupings - Health status, presence/absence of long-standing illness/disability - Duration and intensity of Internet usage - Location of Internet usage. Expansion of the indicator with sub-indicators: - Extent and nature of actively looking for health-related information (any medium) and relative importance of on-line searching in this context - Type of health-related information sought on the Internet (e.g. lifestyle, specific illness/condition/treatment/medication, health services availability/ location/opening hours) - Reasons why searched for such health-related information on the Internet (e.g. Internet is best source, quickest way) - Actual (type of) sites used to seek such information (e.g. official site of health services, medical association, self-help group, health insurance organisation, pharmaceutical company, etc.) - Satisfaction with and quality of sites used (e.g. found what was looking for, need to search non mother-tongue sites, easy to use, had quality mark/accreditation, adhered to quality criteria) - Actions taken as a result of information found (e.g. discussed with own doctor, took action on own initiative)			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	3	3	3	3

Table 3.3-64: On-line communication by the general public with one's own doctor/ clinic

Definition and explanation	Percentage of the population aged 15 years and older who have used the Internet in defined reference periods (last 4 weeks, last 12 months) for private purposes to communicate with their own doctor/clinic: $\frac{\text{Persons using Internet to communicate with own doctor/clinic}}{\text{All persons}} * 100$ Value range: 0 – 100
Importance and added value	On-line communication with one's own doctor/clinic can increase the efficiency and accessibility of day-to-day health services and it is important for Information Society/health policy to monitor the speed at which this is evolving and to track possible digital divides in relation to this
Sources of data	BISER RPS [19] Proposed for eEurope 2005 benchmarking
Countries and time intervals covered	28 NUTs 2 regions of the EU for early 2003

Question wording	When communicating with your own doctor/health clinic. Have you ever (a) visited their web site (b) had a consultation about a medical condition via e-Mail (c) received test results via e-Mail (d) received a prescription renewal via e-Mail Response categories: Yes/No/Don't Know			
Discussion	Performance information on this indicator will be available from the BISER project later in 2003. Preliminary information suggests that the indicator worked quite well.			
Supplementary indicators	Breakdowns by: - Socioeconomic and demographic groupings - Health status, presence/absence of long-standing illness/disability - Duration and intensity of Internet usage - Location of Internet usage. Expansion of the indicator with sub-indicators: - Whether the eHealth activities are relevant/possible (doctor/clinic is on-line, activity is allowed) - Reasons for communicating in this way (e.g. more efficient, cheaper) - Satisfaction (any problems encountered, preferences for on-line versus face-to-face)			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	1	1

Table 3.3-65: Usage of the Internet by the general public to consult with a medical professional/service other than one's usual doctor

Definition and explanation	Percentage of the population aged 15 years and older who have used the Internet in defined reference periods (last 4 weeks, last 12 months) for private purposes to communicate with a doctor/clinic other than their own usual one: $\frac{\text{Persons using Internet to communicate with other doctor/clinic}}{\text{All persons}} * 100$ Value range: 0 – 100
Importance and added value	On-line communication with doctors/clinics other than one's usual one can open up new opportunities for consumers to shop around and/or get second opinions on medical matters, posing new challenges for public health and for doctors to deal with; it is important for Information Society/health policy to monitor the speed at which this is evolving and what types of activity are taking place and with whom
Sources of data	None so far
Countries and time intervals covered	None so far
Question wording	Proposed: Have you ever had an on-line consultation about a medical matter with a doctor/health service other than the doctor/clinic that you usually attend? Response categories: Yes/No/Don't Know
Discussion	This is a proposed indicator and there are no performance data available
Supplementary indicators	Breakdowns by: - Socioeconomic and demographic groupings - Health status, presence/absence of long-standing illness/disability - Duration and intensity of Internet usage

	- Location of Internet usage. Expansion of the indicator with sub-indicators: - Type of service used (commercial/non-commercial service(s) in own/other country) - Reasons for such consultations (e.g. get second opinion, easier access) - Satisfaction with and quality of service(s) (easy to use, satisfied with the service, had quality mark/accreditation, adhered to quality criteria) - Actions taken as a result of information found (discussed with own doctor, took action on own initiative)			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	-	-	-	-

Table 3.3-66: Usage of the Internet by the general public to purchase medications

Definition and explanation	Percentage of the population aged 15 years and older who have used the Internet in defined reference periods (last 4 weeks, last 12 months) for private purposes to order/purchase medications from an on-line pharmacy: $\frac{\text{Persons using Internet to order/purchase medication(s)}}{\text{All persons}} * 100$ Value range: 0 – 100
Importance and added value	On-line purchase of medications is growing and it is an area of concern for health policy both because of the potential for mis-use and because there are variations across the EU countries in whether or not particular medications are prescription only or not, and/or in the types of outlets that can sell them; information on trends and developments in this area is important for Information Society/health policy
Sources of data	BISER RPS [19]
Countries and time intervals covered	28 NUTs 2 regions of the EU for early 2003
Question wording	Have you - in the last 12 months - used the Internet to order medication from an on-line pharmacy? Response categories: Yes/No/Don't Know
Discussion	Performance information on this indicator will be available from the BISER project later in 2003. Preliminary information suggests that the indicator worked quite well although levels of (reported) usage are still only of the order of a few percent of Internet users. Issues of potential respondent sensitivity and under-reporting also need to be considered (products purchased may be for sensitive conditions and/or the activity may not be allowed in particular countries)
Supplementary indicators	Breakdowns by: - socio-economic and demographic groupings - health status, presence/absence of long-standing illness/disability - duration and intensity of Internet usage - location of Internet usage. Expansion of the indicator with sub-indicators: - Nature of the activity (purchase of items that are prescription/non-prescription in own country, from an on-line service operating from or registered in own/other country) - Reasons for such on-line purchases (e.g. cheaper, easier access, avoid the need for a prescription) - Satisfaction with and quality of service(s) (easy to use, satisfied with the service, had quality mark/accreditation, adhered to quality criteria) - Actions taken as a result of information found (discussed with own doctor,

	took the medication on own initiative)			
Evaluation results	Benchmarking value	Validity	Reliability	Availability
	2	2	1	1

Part B: Glossary and Bibliography

4 Glossary

Term	Definition	Source
Accessibility (of the Information Society)	Denotes, in the project's context, 'eAccessibility' and stands for "the access which new Information and Communication Technologies (ICTs) can provide to people – both access to the real world and to the growing Information Society world". It thus relates to the concept of taking into account the different needs of the "end-users" with the overriding principle that all citizens should be participants in the Information Society. The concept is particularly relevant to the participation of people with disabilities and is related to the 'Design for All' concept. While accessibility is relevant for all ICTs, the main emphasis in the Project has been placed upon website accessibility. The term 'website accessibility' is then derived upon the above premise. It essentially relates to making web content accessible (and this could include supporting software [development] issues).	SIBIS definition, based on work in the area by e.g. EdeAN [135]; and [296]
Application	Program or group of programs designed for end users	http://www.webopedia.com/TERM/a/application.html
Application sharing	A collaboration tool that enables users to share computer applications via the Internet. The application itself runs on the computer of one user only but the other users can see the results and interact with the application.	SIBIS definition
Applied research	Applied research is original investigation undertaken in order to acquire new knowledge. It is directed primarily towards a specific practical aim or objective.	[232], p. 69
Assistive Technologies (AT)	The term describing technological products / systems especially designed to assist people with disabilities and elderly people allowing them to use and benefit from ICTs. In principle, ATs can be any item / product / system / piece of equipment that increases, maintains, or improves functional capabilities of individuals with cognitive, physical, sensory or communication disabilities. ATs can be acquired commercially off the shelf, modified, or customised. For example, the most relevant ATs for on-line participation of people with disabilities are screen readers and magnifiers, speech synthesisers, voice input software operating in conjunction with graphical desktop browsers, and alternative keyboard devices	Adapted from [136] and [206]
Asymmetric Digital Subscriber Line (ADSL)	ADSL uses a technology that transforms a normal telephone line into a high-speed digital line that enables access to telephony services and the Internet at the same time. ADSL provides always-on access to Internet or TV and Video on-demand services at speeds that are 10 to 40 times faster than a standard 56k modem. An ADSL line has a higher downstream speed (into the end user) than upstream speed (away from the end user)	Oftel http://www.oftel.gov.uk/publications/glossary/index.htm#B
Authentication	Authentication is any process by which a system verifies the identity of a user who wishes to access it.	SIBIS definition

Term	Definition	Source
Automatic data collection (on web site usage)	Monitoring of usage of web sites in real-time, with or without capture of data on user characteristics	SIBIS definition
Availability	System availability is whether (or how often) a system is available for use by its intended users. Availability is the opposite of downtime.	SIBIS definition
Bandwidth	Bandwidth is the range of frequencies available to be occupied by signals. In analogue systems it is measured in terms of Hertz (Hz) and in digital systems in bit/s per second (bit/s). The higher the bandwidth, the greater the amount of information that can be transmitted in a given time. High bandwidth channels are referred to as broadband which typically means 1.5/2.0 Mbit/s or higher. The term is often used erroneously to mean data rate or capacity - the amount of data that is, or can be, sent through a given communications circuit per second.	ITU http://www.itu.int/osg/spu/ni/broadband/glossary.html
Basic research	"Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view."	[232], p. 68
Bibliometrics	Statistics on scientific publications	SIBIS definition
BISER	IST programme research project, 2001-2003. Pilot surveys carried out in the context of BISER early 2003: a population and an establishment survey. Conducted in 28 regions across Europe.	www.biser-eu.com
Bobby	Bobby was created to help web page authors identify and repair barriers to accessibility with regard to individuals with disabilities. Bobby tests web pages using the guidelines established by the World Wide Web Consortium's (W3C) Web Accessibility Initiative (WAI), as well as Section 508 guidelines from the Architectural and Transportation Barriers Compliance Board (Access Board) of the U.S. Federal Government [8]. The way a 'Bobby approval might be obtained for a website is to have it interactive in a sense that the designers interacts with users who help them to identify the changes needed to enhance user friendliness, especially relevant for users with disabilities. The "Bobby" is a term used for this Web page authors' tool. For example, a blind user will be aided by adding a sound track to a movie, and a hard-of-hearing user will be aided by a written transcript of a sound file on a Web page. "Bobby" will recommend that these be added if they do not already exist. The "Bobby Test" is an accessibility test provided on the Web originally devised by CAST (Centre for Applied Science and Technology) , a non profit organisation which aims to expand the opportunities for people with disabilities through innovative development and application of technology. It has since been acquired by the Watchfire Corporation.	http://cast.org and http://bobby.watchfire.com/bobby/html/en/index.jsp Adapted from [296]

Term	Definition	Source
Broadband	The capacity to transmit large quantities of electronic signals (including data, video, text and voice) rapidly. This raises two important issues. The first is that, in transmitting various types of signals, broadband is at the heart of the convergence of telecommunication, information technology and broadcasting. Several technologies and media may be used to provide broadband services. There may be competition between: networks (e.g. telephony and cable TV); media (copper, fibre optic, satellite, terrestrial microwave, or a hybrid of these). With regards to speed issues, the term is commonly used to refer to communications lines or services at T1 rates (1.544 Mbps) and above. However the speed threshold of broadband is subjective and can be above or below T1. In every case however, it implies transmitting at higher speeds than what was common before, and above dial-up and ISDN technologies.	ITU http://www.itu.int/osg/spu/ni/broadband/glossary.html
Business to Business (B2B)	B2B refers to the implementation of electronic transactions between firms including ordering, payment and delivery. The term refers also to on-line interactions between firms including the management of various business processes and electronic transactions within establishments of the same firm.	OECD [244]
Business to Consumers (B2C)	B2C includes any electronic trading transaction where the purchaser is the end user of the products or services bought.	OECD [243]
Business to Government (B2G)	Interactions between business and government; e.g. filing of business registration information, taxes, regulatory information, public government administrations purchasing on-line goods or services from business	SIBIS definition
Cable Modem	A cable modem is a device that enables you to connect your PC to a local cable TV line and receive data at about 1.5 Mbps. This data rate far exceeds that of the prevalent 28.8 and 56 Kbps telephone modems and the up to 128 Kbps of Integrated Services Digital Network (ISDN) and is about the data rate available to subscribers of Digital Subscriber Line (DSL) telephone service. A cable modem can be added to or integrated with a set-top box that provides your TV set with channels for Internet access.	[60], p. 151-155
Chat	"Chat is a system for the interactive exchange of text messages in real time (synchronously)."	http://www.terena.nl/library/gnrt/group/chat.html
Chat room	Area for chat discussions organised by subject topic.	http://www.terena.nl/library/gnrt/group/chat.html
Citizens to government (C2G)	Interactions between citizens and government; e.g. citizen information provision, tax filing, electronic voting, vehicle licensing	SIBIS definition. This definition exists by analogy with G2C

Term	Definition	Source
Clickstream	"A virtual trail that a user leaves behind while surfing the Internet. A clickstream is a record of a user's activity on the Internet, including every Web site and every page of every Web site that the user visits, how long the user was on a page or site, in what order the pages were visited, any newsgroups that the user participates in and even the e-Mail addresses of mail that the user sends and receives. Both ISPs and individual Web sites are capable of tracking a user's clickstream."	http://www.webopedia.com/TERM/c/clickstream.html
Clinical activities	Activities in the healthcare sector that are directly related to the treatment of patients, including consultation and processing of treatment-related information	SIBIS definition
Coauthorship	A publication is considered coauthored only if its authors have different institutional affiliations. Coauthorship is therefore limited to institutional coauthorship.	[217], volume 1, p. 5-37
Collaboration applications	Applications provided on a server and accessed with a web browser to jointly create or edit documents, share a workspace for drawing or brainstorming, or easy exchange and management of document versions and group members. Partially the tools were adapted for the Internet from standard groupware applications. New tools combine audio and video communication with facilities such as document and application sharing or whiteboards.	http://www.terena.nl/library/gnrt/group/collabfn.html
Collaboratory	"…a center without walls, in which researchers can perform their research without regard to physical location – interacting with colleagues, accessing instrumentation, sharing data and computational resources, and accessing information in digital libraries" The term is a hybrid of 'collaborate' and 'laboratory'.	Wulf 1989, p. 19 according to [143]; see also [236], p. 19
Communication infrastructure	The collection of hardware equipment and procedures (software, management) for transporting data needed by an application to deliver specified services to the users. Synonymous with information infrastructure.	SIBIS definition
Community	A multidimensional term, denoting a group of people brought and maintained together by a collective, shared purpose, and shared interests and activities. Participating in communities is non-segmented, democratic, based on mutuality and free of coercion, while internal relations are not formally regulated and are based on the notion of fairness and justice. The members have a right to access appropriate information, services and facilities that such a group possesses. The advent of the Information Society presents some new opportunities as well as potential threats to communities.	SIBIS definition
Community on-line	Participation in traditional , existing communities being enhanced via ICTs	Derived from work by Pew Internet [175], also [272]
Computer staff	All staff that • manages the computers, networks and digital resources, or • manages the Internet access and presentation, or • carries out information searches and computations as their major work tasks, or • provides user training.	SIBIS definition

Term	Definition	Source
Computer virus	A program that can "infect" other programs by modifying them to include a, possibly evolved, copy of itself.	IAAC [182]
Computer-mediated communication	Intended human communication between two or more individuals in which the receiver has been personally addressed by the sender through the use of central computers that store and process message content, and are connected to users in a communication network.	SIBIS definition, based on [278]
Data (= raw data)	Unstructured results of measurement, observation and other forms of evidence collection; collected directly at the source or from secondary sources (e.g. statistics).	SIBIS definition
Data confidentiality	Data Confidentiality is whether the information stored on a system is protected against unintended or unauthorised access.	SIBIS definition
Data rate (=Transmission capacity)	Number of bits that can be transmitted by a communications channel or a computing or storing device; units: • Kilobits/s 1.000 Bit/s • Megabits/s 1.000.000 Bit/s • Gigabits/s 1.000.000.000 Bit/s • Terabit/s 1.000.000.000.000 Bit/s	SIBIS definition
Design for All	Also referred to as “Universal design” is a concept / principle which seeks to take account of the needs of the maximum number of potential users of a product or service, at the design stage. The aim is to achieve highest possible direct usage of and access to the ICTs for people with extremely varied abilities and circumstances, thus minimising the need for assistive devices and procedures, but nevertheless assuring that the design is at the same time compatible with assistive technologies. Although it has a particular relevance for people with disabilities, it has been recognised that products and services designed according to this principle are easier to use by everybody. Therefore, it is as much relevant for supporting diversity as it is for supporting any particular group of people	SIBIS definition grounded on the work in the area by The European Institute for Design and Disability, (EIDD) Www.design-for-all.org; And Web Content Accessibility Guidelines, http://www.w3.org/TR/WAI-WEBCONTENT/ [162], [116]
Digital divide	This term is multidimensional in a sense that denotes the gap between individuals (citizens), groups of individuals, households, business establishments, geographic areas and countries with regard to access to and usage of information and communication technologies (ICTs), or the “Information Society”. At micro level, the main focus is on the differential among citizens and / or particular groups of citizens and / or communities in relation to their closeness to, and subsequently, their potential to benefit from the Information Society.	SIBIS definition, derived from literature review on the issue

Term	Definition	Source
Digital literacy	The SIBIS definition is the ability to operate within four types of skills: • Communicate with others on the Internet • Obtaining (or download) and install software on a computer • Questioning the source of information found on the Internet • Search for required information on the Internet. This definition is based on the definition of the minimum list of digital literacy skills from the European Commission Digital Literacy Workshop, which do also includes a life-long learning perspective: "Learn and take responsibility for continuous, personal learning development and employability" [93]	SIBIS definition
Digital Subscriber Line (DSL)	A family of technologies, generically referred to as DSL or xDSL, that are capable of transforming a normal telephone line into a high-speed digital line. These include ADSL (Asymmetric DSL), SDSL (Symmetric DSL), HDSL (High data rate DSL) and VDSL (Very high data rate DSL). DSL enabled lines are capable of supporting services such as fast Internet access and video or TV on-demand.	ECTA http://www.ectaportal.com/html/index.php?pgd=resources_itglossary
Distributed computing	"A type of computing in which different components and objects comprising an application can be located on different computers connected to a network. So, for example, a word processing application might consist of an editor component on one computer, a spell-checker object on a second computer, and a thesaurus on a third computer. In some distributed computing systems, each of the three computers could even be running a different operating system."	http://www.webopedia.com/TERM/d/distributed_computing.html
Document sharing	"Co-workers can view and edit documents stored in a common area (a shared workspace). Documents are updated as edits occur. Document sharing may simply be a user friendly interface to uploading and storing of documents on a Web server, however, most document sharing systems offer a more sophisticated package including management of group members, controls on user access to documents, versioning and annotating."	http://www.terena.nl/library/gnrt/group/collabfn.html
Downtime	Downtime is the opposite of availability. It is whether (or how often) a system is unavailable for use by its intended users.	SIBIS definition
e-Administration	Transaction of user-oriented services offered by public institutions that are based on information and communication technologies	www.begix.de
e-Commerce	An electronic transaction (or an Internet transaction) in the sale or purchase of goods, services whether between businesses, households, individuals, governments and other public or private organizations conducted over computer mediated networks. The goods and services are ordered over those networks (or over the Internet), but payment and ultimate delivery of goods or services may be conducted on-line or offline.	OECD [244]
e-Democracy	Digitally conveyed information (transparency) and the political influence (participation) exerted by citizens and businesses on the opinion-forming processes of public – state and non-state- institutions	www.begix.de

Term	Definition	Source
eEurope	eEurope - "An Information Society for all" – an initiative launched by the European Commission on 8 December 1999, to bring the benefits of the Information Society to all Europeans.	IDA http://europa.eu.int/ISPO/ida/jsps/index.jsp?fuseAction=showChapter&chapterID=140&preChapterID=0
e-Government	The term "e-Government" focuses on the use of information and communications technologies by governments as applied to the full range of government functions. In particular, the networking potential offered by the Internet and related technologies have the potential to transform the structures and operation of government. E-government refers to the use by government agencies of information technologies (such as Wide Area Networks, the Internet, and mobile computing) that have the ability to transform relations with citizens, businesses, and other arms of government. These technologies can serve a variety of different ends: better delivery of government services to citizens, improved interactions with business and industry, citizen empowerment through access to information, or more efficient government management. The resulting benefits can be less corruption, increased transparency, greater convenience, revenue growth, and/or cost reductions.	http://www.oecd.org/EN/about/0,,EN-about-301-nodirectorate-no-no-no-11,00.html http://www1.worldbank.org/publicsector/egov/definition.htm
e-Health	An umbrella term covering all healthcare activities that are carried out on-line and/or with the support of Information and Communication technologies.	SIBIS definition
e-Lancers	E-Lancing is defined as • attracting new business through the Internet or via e-Mail • delivering work results to clients/customers through the Internet or via e-Mail • communicating with clients/customers exclusively by electronic means, i.e. via Internet, e-Mail, phone or fax, but without meeting face-to-face.	see [205]
e-Learning	E-learning is defined as comprising offline as well as on-line use of learning content. Offline learning content includes learning materials on CD-ROMs, diskettes, audio and video tapes and similar media. On-line learning content includes learning materials provided on the internal computer system of an organisation or provided through the Internet.	SIBIS definition based on [100]
Electronic (e-) publishing	Publishing of full text research results in electronic media as CD-ROM or DVD or the Internet. Resulting publication forms are e-books (electronic books), e-journals (electronic journals), preprint and reprint publications.	SIBIS definition
Electronic Data Interchange (EDI)	Data exchange in structure form (EDIFACT) between businesses.	
Electronic health care records (EHCRs)	Patient records that are maintained and updated in electronic format; may be transmissable and/or accessible to remote users	SIBIS definition

Term	Definition	Source
Electronic library resources	"Every document in electronic form which needs special equipment to be used. [NOTE: electronic resources include digital documents, electronic serials, databases, patents in electronic form and networked audio-visual documents.] ISO/DIS 2789"	[23]
Electronic library services (ELS)	"A service which is either supplied from local servers or accessible via networks. [NOTE: electronic library services comprise the OPAC, the library website, electronic resources, electronic document delivery and internet access offered via the library.] ISO/DIS 2789"	[23]
ELS staff	Staff providing ELS: number of library staff providing, maintaining and developing ELS and training users.	[23], appendix 2
e-Marketplace	A B2B Internet trading forum in which multiple buyers and sellers exchange goods and services within an industry group or geographic region	SIBIS definiton
Employment	Total employment of the statistical units included in all sectors of the economy. It includes: employees and self-employed; full- and part-time personnel. It is measured in terms of the number of persons employed and not in full-time equivalent (FTE).	SIBIS definition based on ILO.
Ethernet	The most widely used local area network (LAN) access method. Ethernet has become so popular that a specification for "LAN connection" or "network card" generally implies Ethernet without saying so. All Macs and many PCs come with 10/100 Ethernet ports for home use, not just to create a small home network, but to connect to the Internet via a DSL or cable modem, which requires it.	ECTA http://www.ectaportal.com/html/index.php?pgd=resources_itglossary
European Computer Driving Licence (ECDL)	The ECDL Foundation works to promote an International certification of industry-standard computing skills. The European Computer Driving Licence Foundation was established by the Council of European Professional Informatics Societies CEPIS, to support and co-ordinate the work of the ECDL organization in each country. Headquartered in Dublin, the ECDLF was established in January 1997 as a not-for-profit company limited by guarantee. It developed naturally from the User Skills Task Force set up earlier by CEPIS and its member societies.	http://www.ecdl.com
European Research Area (ERA)	European research policy developed by the Commission in 2000 and 2001 with the aim "to create conditions making it possible to increase the impact of European research efforts by strengthening the coherence of research activities and policies conducted in Europe." [87], p. 3 It includes policy measures in five fields: • Research activities • Research and innovation, "start-ups" and SMEs • Research infrastructure • Human resources • Science, society and citizens	[90], [87]

Term	Definition	Source
Experimental development	"Experimental development is systematic work, drawing on existing knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed."	[232], p. 70
Extranet	A private, secure extension of the intranet running on Internet protocol that allows selected external users to access some parts of an organisation's intranet	SIBIS definition
File Transfer Protocol (FTP)	A facility for transferring files between host computers on the Internet.	http://www.terena.nl/library/gnrt/group/ftp.html
Firewall	IT solution that regulates external access to a closed network based on pre-defined rules.	SIBIS definition
Government to Business (G2B)	Interactions between government and business enterprises. E.g. delivery of business services and information, e-Procurement (tendering), sales of government-owned business-relevant information	http://www1.worldbank.org/publicsector/egov/definition.htm SIBIS definition, this definition is adapted from a definition available at: http://glossar.iwv.ch/
Government to Business to Citizen (G2B2C)	Interaction between government and citizens via an intermediary, e.g. outsourcing of tax declaration.	SIBIS definition
Government to Citizens (G2C)	Interaction between government and citizens E.g. provision of public information and transparency of information (both passive and active (in response to specific requests) about government workings and performance, electronic service delivery (including 'one-stop-shops')	http://www1.worldbank.org/publicsector/egov/definition.htm SIBIS definition, this definition is adapted from a definition available at: http://glossar.iwv.ch/
Government to Government (G2G)	Interaction related to inter-agency relationships Refers to communication between government agencies, e.g. back office introduction of ICT, intra- and intergovernmental exchange, government networks, standards, expertise	http://www1.worldbank.org/publicsector/egov/definition.htm This definition is adapted from a definition available at: http://glossar.iwv.ch/
Grid	Distributed computing infrastructure for advanced science and engineering. A Grid needs Grid technologies, i.e. the protocols, services and software development kits needed to enable flexible, controlled resource (data, computers, sensors and other resources) sharing on a large scale.	[146]
Health literacy	Ability to find, read, understand and act appropriately on health-related information	SIBIS definition
Health telematics network	Dedicated network for healthcare providers and/or healthcare activities	SIBIS definition
Healthcare providers	Direct providers of health-related services, including clinical services and information	SIBIS definition
Healthcare system	The nature and organisation of healthcare services delivered to administratively- or geographically-defined groups, including the public-private mix of service provision, funding and reimbursement arrangements	SIBIS definition

Term	Definition	Source
Health-related information	The broad range of information of relevance for an individual's health management, including information on healthy lifestyles, specific conditions and/or medications, available health services	SIBIS definition
Hospital Information Systems (HIS)	Integrated ICT-based information management systems for hospitals	SIBIS definition
ICT-related training/ learning	Includes all training/learning activities which have ICTs as a subject ("computer training"), or which have subjects in which ICTs are a main component (e.g. training in software applications, computer-controlled machines).	SIBIS definition
Identity theft	Identity theft is a crime in which an impostor obtains key pieces of personal information, such as Social Security or driver's license numbers, in order to impersonate someone else. Identity theft has been exacerbated by the arrival of IT and network technologies. However, the history of this crime in long.	SIBIS definition
Income generating cluster	Services where finance flows from citizens and businesses to the government (mainly taxes and social contributions	http://europa.eu.int/information_society/eeurope/benchmarking/list/source_data_pdf/2nd_measurement_final_report.pdf
Information security policy	Rules, directives and practices that govern how IT assets, including sensitive information, are managed, protected and distributed within an organisation and its systems.	CISSP Prep Guide [198]
Information	"Information is data that have been organized and communicated."	[259]
Informetrics	"Informetrics investigates quantitative aspects of information (communication) processes, particularly those using text; it is the quantitative arm of Information Science and of Library Science."	http://www.cindoc.csic.es/cybermetrics/links0.html
Integrated Services Digital Network (ISDN)	A network based on the existing digital PSTN which provides digital links to customers and end to end digital connectivity between them. ISDN provides a maximum bandwidth of 128kbit/s.	Oftel http://www.oftel.gov.uk/publications/glossary/index.htm#B
Integrity	Data Integrity means that the information stored on a system is reliable and can be trusted.	SIBIS definition
Internet Service Provider (ISP)	ISPs provide end-users, and other ISPs, access to the Internet. ISPs may also offer their own proprietary content and access to on-line services such as e-Mail.	ITU http://www.itu.int/osg/spu/ni/broadband/glossary.html
Internet telephony	"A category of hardware and software that enables people to use the Internet as the transmission medium for telephone calls."	http://www.webopedia.com/TERM/I/Internet_telephony.html
Intranet	"A network based on TCP/IP protocols (an internet) belonging to an organization, usually a corporation, accessible only by the organization's members, employees, or others with authorization. An intranet's Web sites look and act just like any other Web sites, but the firewall surrounding an intranet fends off unauthorized access."	http://www.webopedia.com/TERM/i/intranet.html

Term	Definition	Source
Kiosk	A free-standing electronic information point which aims to provide information or services and acces to the Internet to users, without the need for the assistance of staff. Kiosks can incorporate touch-screen technology and video conferencing facilities	[60]
Labour Force Survey (LFS)	also Community Labour Force Survey, harmonised survey of representative samples across all Member States of the EU.	[124]
Labour force	Sum of total employment and unemployment.	SIBIS definition based on ILO
Labour reserve	For data collection via surveys, this is being operationalised as all persons who are not working and either unemployed or not unemployed but stating a willingness to be in paid work.	SIBIS definition
Leased line	A leased line is a telephone line typically supplied by the telephone company or transmission authority, that has been leased for private use as a dedicated circuit that permanently connects two or more user locations and is for the sole use of the subscriber. In some contexts, it is called a dedicated line. A leased line is usually contrasted with a switched line or dial-up line. Typically, large businesses rent leased lines to interconnect different geographic locations in their business. The alternative is to buy and maintain their own private lines or, increasingly perhaps, to use public switched lines with secure message protocols.	[60], p. 151-155
Lifelong Learning (LLL)	"Includes all learning activities: (a) that are purposeful, that is activities which are undertaken with the purpose of 'improvement in behaviour, information, knowledge, understanding, attitude, values or skills' (ISCED 97, par.9 – definition of education); (b) that are undertaken on an ongoing basis, which means that they are not incidental or random but have 'the elements of duration and continuity' (ISCED 97, par. 11), in principle without any lower duration limits; (c) independent of whether they are formal or not; includes different types of learning like apprenticeships, second-chance schools, on-the job or off-the job education and training, self-learning etc; (d) independent of source of funding, that is funded either by the private sector, the public sector or the individual;·(e) independent of mode of provision (using traditional or modern means, such as Information and communication technologies). This notion of learning also encompasses the entire population independent of age and independent of their labour market status. It includes in principle all kinds of activities ranging from early childhood education to leisure education for the retired persons. The terms 'knowledge, skills and competence' are not limited to work related outcomes of education and learning but also to societal and personal outcomes." In SIBIS, lifelong learning is sometimes limited to work-related activities, which is mentioned where applicable.	[126]:9

Term	Definition	Source
LIFT	A website design tool that includes usability guidelines. The software identifies common usability issues related to accessibility, and then presents and automates recommended fixes (based upon [223]). The tool also includes World Wide Web Consortium (W3C) Web Content Accessibility Guidelines and guidelines recommended in Section 508 of the U.S. Rehabilitation Act of 1974, amended 1 in 1998 [287].	http://www.usablenet.com Usable Net Products and Services
Local Area Network (LAN)	A LAN is a group of computers and associated devices that share a common communications line and typically share the resources of a single processor or server within a small geographic area (for example, within an office building). Usually, the server has applications and data storage that are shared in common by multiple computer users.	[60], p. 151-155
Mailing list	Mailing lists are lists of e-Mail addresses of people which are usually interested in a single subject. Sending e-Mails to the list serves to disseminate and exchange information and pool the knowledge in the subject area.	SIBIS definition
Mainframe	A very large and expensive computer capable of supporting hundreds, or even thousands, of users simultaneously. In the hierarchy that starts with a simple microprocessor at the bottom and moves to supercomputers at the top, mainframes are just below supercomputers.	http://www.webopedia.com/TERM/m/mainframe.html
Mid-band	For the purposes of SIBIS a 'Midband' category has been created for referring to ISDN connections.	SIBIS definition
Mobile workers	Mobile workers are those who spend at least 10 hours per week away from their main place of work.	SIBIS definition
Moore's Law	Observation made in 1965 by Gordon Moore that the number of transistors per square inch on integrated circuits had doubled every year since the integrated circuit was invented. In subsequent years, the pace slowed down a bit, but data density has doubled approximately every 18 months.	http://www.webopedia.com/TERM/M/Moores_Law.html
Multimedia Message Service (MMS)	An enhanced short message service for cell phones that enables graphics, video clips and sound files to be transmitted	http://www.ectaportal.com/html/index.php?pgd=resources_itglossary
Narrowband	A service or connection allowing only a limited amount of information to be conveyed, such as for telephony. This compares with broadband which allows a considerable amount of information to be conveyed. For the purpose of SIBIS work dial-up connections with modem have been included in this category.	Oftel http://www.oftel.gov.uk/publications/glossary/index.htm#B
Network Intrusion	See unauthorised entry	
Newsgroup	On-line discussion group	http://www.webopedia.com/TERM/n/newsgroup.html
Non-Repudiation	Effective conditions of non-repudiation arise when the sender of a message cannot deny being the sender and the receiver cannot deny having received the message	SIBIS definition
On-line	On-line is the condition of being connected to a network of computers or other devices. The term is frequently used to describe someone who is currently connected to the Internet.	SIBIS definition

Term	Definition	Source
On-line communities = virtual communities	Cyberspace communities with no physical interaction, on-line interaction is the only type. Examples include a single issue on-line communities and Internet Relay Chat (IRC)	Pew internet [175] Derived from work by Rheingold [267]
On-line government services for businesses	On-line public services for businesses as defined by the European Commission are: • Social contribution for employees • Corporation tax: declaration, notification • VAT: declaration, notification • Registration of a new company • Submission of data to statistical offices • Customs declarations • Environment-related permits (incl. reporting) • public procurement	http://europa.eu.int/information_society/eeurope/action_plan/pdf/basicpublicservices.pdf
On-line government services for citizens	On-line public services for citizens as defined by the European Commission are: • Income taxes: declaration, notification of assessment • Job search services by labour offices • Social security contributions (3 out of the following 4): • Unemployment benefits • Child allowances • Medical costs (reimbursement or direct settlement) • Student grants • Personal documents (passport and driver's licence) • Car registration (new, used and imported cars) • Application for building permission • Declaration to the police (e.g. in case of theft) • Public libraries (availability of catalogues, search tools) • Certificates (birth, marriage): request and delivery • Enrolment in higher education / university • Announcement of moving (change of address) • Health related services (e.g.interactive advice on the availability of services in different hospitals; appointments for hospitals.)	http://europa.eu.int/information_society/eeurope/action_plan/pdf/basicpublicservices.pdf
On-line interaction facilitators	Seals which have undergone an auditing process concerning their security and privacy, and are certified by an Internet-based provider of goods and services.	SIBIS definition
Other supporting staff in R&D projects	Besides researchers and technicians other supporting staff can be included among R&D personnel if they provide support to R&D activities. The OECD lists especially: skilled and unskilled craftsmen, secretarial and clerical staff participating in R&D projects or directly associated with such projects.	[232], p. 87
People with disabilities	An umbrella term denoting people's health characteristics within the context of their individual life situation and environmental impacts. The term is based on the fact that disabilities are produced, reproduced and acquired as a result of the interaction of the individuals' health characteristics and contextual factors (this is broadly known as a social definition of disability).	SIBIS definition, derived from the literature on the issue

Term	Definition	Source
Permits & licences cluster	Documents provided by governmental bodies giving permission to build a house, to run a business etc	http://europa.eu.int/information_society/eeurope/benchmarking/list/source_data_pdf/2nd_measurement_final_report.pdf
Persons in employment	For the SIBIS general population survey, employed persons are defined as those who give a positive reply to the question "At present are you in paid work either as an employee, civil servant or as self-employed?"	SIBIS definition based on ESOMAR (see [79])
Picture archiving and communication systems (PACS)	ICT-based systems for capturing, storing, retrieval and transmission of medical images	SIBIS definition
Preprint	Working paper, often limited to the electronic version	SIBIS definition
Public Internet Access Point (PIAP)	PIAPs are defined as places which are open to the public who seek access to the Internet, either for free (such as libraries) or charged (such as commercial operations offering Internet access, often called Internet cafés). This definition differs from the one used in the eEurope 2002 benchmarking exercise which includes places where Internet access is charged but excludes "fully private Internet cafés" (see [103]), as this definition would be unsuitable for operationalisation in a population survey context. By distinguishing only between free and charged access, it is ensured that respondents are able to give a reliable answer.	SIBIS, based on [103]
Public Switched Telephone Network (PSTN)	PSTN is the world's collection of interconnected voice-oriented public telephone networks, both commercial and government-owned. It is the aggregation of circuit-switching telephone networks that has evolved from the days of Alexander Graham Bell. Today, it is almost entirely digital in technology except for the final link from the central (local) telephone office to the user. In relation to the Internet, the PSTN actually furnishes much of the Internet's long-distance infrastructure.	[60], p. 151-155
R&D collaboration	Joint R&D where the participants make substantial contributions, and/or are responsible for one or more of the main elements of the R&D.	[193]
R&D collaborator	Individuals which directly work in R&D, make substantial contributions, appear in the project proposals, or are responsible for one or more of the main elements of the research. Sponsors of R&D are not included, if they do not contribute any R&D activities of their own.	SIBIS definition

Term	Definition	Source
R&D personnel	All persons employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical staff: researchers, technicians and equivalent staff, other supporting staff Excluded should be services and indirect support activities as specific services to R&D (such as central computer departments, libraries), the services of central finance and personnel departments, security, cleaning, maintenance, canteens, etc. However, R&D personnel should include direct in-house services for R&D such as computing and library services, if they are carried out in the R&D unit(s). The measurement of number as well as of R&D activities in full-time equivalents (person-years) is recommended.	[232], pp. 79-90
Registration Cluster	Services related to recording object- or person- related data as a result of administrative obligations	http://europa.eu.int/information_society/eeurope/benchmarking/list/source_data_pdf/2nd_measurement_final_report.pdf
Regular Internet users	Internet users who used the Internet in the last four weeks	SIBIS definition
Remote access	"The ability to log onto a network from a distant location. Generally, this implies a computer, a modem, and some remote access software to connect to the network. […] remote access means that the remote computer actually becomes a full-fledged host on the network. The remote access software dials in directly to the network server."	http://www.webopedia.com/TERM/R/remote_access.html
Reprint	Re-publication of selected papers often for easier access or in order to increase the impact.	SIBIS definition
Research and (experimental) development (R&D)	"Research and experimental development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications." R&D covers three activities: basic research, applied research and experimental development Not included in R&D are activities in the areas of education and training, other related scientific and technological activities, other industrial activities, and administration and other supporting activities.	[232], p. 29

Term	Definition	Source
Research network (RN)	"... production network, and which supports various types of domain specific application research. This application research is most often used to support the sciences and education but can also be used in support of other areas of academic and economic endeavour." Different types of RN: • An Institutional Research Network (IRN) is a network that supports universities, institutes, libraries, data warehouses, and other 'campus' like networks. • National Research Networks (NRNs), such as the Netherland's Gigaport or Germany's DFN networks, support IRNs or affinity based networks. • Pan National Research Networks (PNRNs) interconnect and support NRNs (e.g. Dante's Ten-155 and the NORDUNET).	[4], p. 92
Researcher	"Researchers are professionals engaged in the conception or creation of new knowledge, products, processes, methods, and systems, and in the management of the projects concerned." The OECD lists the following occupations of the ILO International Standard Classification of Occupations (ISCO-88) as researchers: • physical, mathematical and engineering science professionals, • life science and health professionals, • college, university and higher education teaching professionals, • business professionals, legal professionals, archivists, librarians and related information professionals, • social science and related professionals, • research and development department managers. According to this classification technicians and equivalent staff as well as other supporting staff are not classified as researchers but as research personnel.	[232], pp. 86, 162
Returns Cluster	Public services given to citizens and businesses in return for taxes and contributions	http://europa.eu.int/information_society/eeurope/benchmarking/list/source_data_pdf/2nd_measurement_final_report.pdf
Safety	The property indicating that a computer system or software, when embedded in its operational environment, does not cause any actions or events that create unintended potentially or actually dangerous situations for itself or for the environment in which it is embedded.	IDA http://europa.eu.int/ISPO/ida/jsps/index.jsp?fuseAction=showChapter&chapterID=140&preChapterID=0

Term	Definition	Source
Satellite Internet connection	A satellite Internet connection is an arrangement in which the upstream (outgoing) and the downstream (incoming) data are sent from, and arrive at, a computer through a satellite. Each subscriber's hardware includes a satellite dish antenna and a transceiver (transmitter/receiver) that operates in the microwave portion of the radio spectrum. Uplink speeds are nominaly 50 to 150 Kbit/s for a subscriber using a single computer. The downlink occurs at speeds ranging from about 150 Kbit/s to more than 1200 Kbit/s, depending on factors such as Internet traffic, the capacity of the server, and the sizes of downloaded files. Satellite Internet systems are an excellent option for people in rural areas where DSL and cable modem connections are not available.	[60], p. 151-155
Science	• First, it is a body of certified knowledge, • Second, science is also a set of procedures for finding things out, • Third, "… science is a social enterprise, a culture or tradition, and a set of social arrangements for developing, certifying, and communicating knowledge."	[303], p. 513
Scientific Journal	"A serial or periodical usually devoted to a specific field or subset of scholarly knowledge. A few scholarly journals (such as Science or Nature) are multidisciplinary in their approach to a broad range of inter-related fields of investigation. An article appearing in a scholarly journal is composed of different elements including an author abstract and a bibliography of works cited or referenced in the article."	Institute for Scientific Information (ISI) http://www.isinet.com/isi/search/glossary/index.html
Sciento-metrics	Statistics on the output of scientific research, sometimes also used for labeling the research on quantitative aspects of science; it is in the latter case the quantitative arm of the science of science, of scientific communication studies and of science policy studies.	SIBIS definition.
Search engine	A co-ordinated set of programs that includes: • A spider (also called a "crawler" or a "bot") that goes to every page or representative pages on every Web site that wants to be searchable and reads it, using hypertext links on each page to discover and read a site's other pages • A program that creates a huge index (sometimes called a "catalogue") from the pages that have been read • A program that receives your search request, compares it to the entries in the index, and returns results to you In the survey exemplified as 'Google, Lycos, Yahoo or [local most used engines]'.	searchWebServices.com; http://searchwebservices.techtarget.com/sDefinition/0,,sid26_gci212955,00.html
Secure server	Secure Socket Layer server. Secure Socket Layer is an encryption protocol developed by Netscape for transmitting private documents via the Internet. SSL works by using a public key to encrypt data that is transferred over the SSL connection	European Information Technology Outlook 2003 [67]
Security breach	Security breach is a voluntary violation of a set of technical and management rules defined in an information security policy.	CISSP Prep Guide [198]

Term	Definition	Source
Security features of Websites	A technical and managerial solution aimed at making the users of a website or information network aware of the presence of detailed information security policies and instruments.	SIBIS definition
Security of information and systems	It has three basic components: confidentiality, integrity and availability. Confidentiality refers to the protection of sensitive information from unauthorised disclosure. Integrity means safeguarding the accuracy and completeness of information and computer software. Availability relates to ensuring that information and vital services are available to users when required.	SIBIS definition
Self-directed learning	Learning activities that are not provided by the employer or another organisation (e.g. PES), and that do not contain taught learning. Same as self-initiated learning.	SIBIS definition (cf. [126])
Self-employed	For the SIBIS general population survey, self-employed persons are defined as those who declare themselves to belong to the category "self-employed".	SIBIS definition based on ESOMAR, see [79]
Short Message Service (SMS)	A service available on digital networks, typically enabling messages with up to 160 characters to be sent or received via the message center of a network operator, to a subscriber's mobile phone.	ITU http://www.itu.int/osg/spu/ni/broadband/glossary.html
Small offices, home offices (SOHOs)	Comprising self-employed workers who have their main place of work at home and using and who use ICT as a major means of communication with their client(s)	SIBIS definition, see also [266]
Social capital	Refers to the institutions, relationships, and social norms impinging upon the quality and quantity of social interactions within a society. In a broad sense it includes the social and political framework that shapes both these norms but also the relevant social structures. The arrival of the Information Society raises a number of implications for social capital.	Mainly based on the work of Putnam [261] and [262]
Software application	The term application is a shorter form of application program. An application program is a program expected to provide certain functionalities. Examples are word processor or email client.	SIBIS definition
Spam	Spam is unsolicited electronic mail, usually delivered over the Internet	SIBIS definition
Supercom-puter	The fastest type of computer. Supercomputers are employed for specialized applications that require immense amounts of mathematical calculations. Uses of supercomputers include weather forecasting, animated graphics, fluid dynamic calculations, nuclear energy research, and petroleum exploration. The chief difference between a supercomputer and a mainframe is that a supercomputer channels all its power into executing a few programs as fast as possible, whereas a mainframe uses its power to execute many programs concurrently.	http://www.webopedia.com/TERM/S/supercomputer.html
T1	A 1.544 Mbit/s point-to-point dedicated, digital circuit provided by the telephone companies. The monthly cost is typically based on distance. T1 lines are widely used for private networks as well as interconnections between an organization's LAN and the telco.	http://www.ectaportal.com/html/index.php?pgd=resources_itglossary

Term	Definition	Source
Technicians and equivalent staff	"Technicians and equivalent staff are persons whose main tasks require technical knowledge and experience in one or more fields of engineering, physical and life sciences, or social sciences and humanities. They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers. Equivalent staff perform the corresponding R&D tasks under the supervision of researchers in the social sciences and humanities."	[235], p. 86
Telecare	Utilisation of telecommunications to support the remote delivery of (usually longer-term) socio-medical care, typically to the home of the client/patient	SIBIS definition
Tele-cooperation	Using ICT (e-Mail and/or file-transfer and/or video-conferencing) for communication with working partners external to the establishment where the workplace is (mainly) located.	SIBIS definition
Telemedicine	Utilisation of telecommunications to support the remote delivery of medical services	SIBIS definition
Telework, alternating	see Teleworker, home-based	SIBIS definition, see also [81] [153]
Telework, permanent	see Teleworker, home-based	
Telework, supplement-ary	see Teleworker, home-based	
Teleworker, home-based	Persons who work from home and transfer work results electronically. As types of home-based telework this indicator distinguishes between:· • permanent teleworkers: spending more than one full day per week and at least 75% of their working time at home· • alternating teleworkers: spending more than one full day per week working at home, but less than 75% of their working time· • supplementary teleworkers: spending working time at home, but less than one full day per week	SIBIS definition, see also [81] [153]
Teleworker, in SOHO	Freelancers and other self-employed whose main place of work is at home and who use ICT as a major means of communication with their client(s)	SIBIS definition, see also [153]
Teleworker, mobile	Frequent business travellers who work at least 10 hours per week away from home and the main place of work and use on-line communication links to their business when doing so.	SIBIS definition, see also [153]
Third generation (3G) UMTS	Third generation mobile systems – A European 3G mobile communications system will provide an enhanced range of multimedia services (e.g. high speed Internet access).	Oftel http://www.oftel.gov.uk/publications/glossary/index.htm#B
Total congestion ratio (TCR)	Percentage of clients within a research system which might experience congestion on their network.	SIBIS definition
Traffic load	Fraction of potential volume of traffic (capacity) and actual volume of traffic on an RN. A differentiation between inbound and outbound traffic loads is possible.	Terena definition (unpublished)
Transmission capacity	data rate	

Term	Definition	Source
Triad patent family	A patent family are patent documents filed in different countries to protect the same invention. Triad patent families have one member in Europe (patent application to the European Patent Office EPO), the US (patent granted by the US Patent and Trademark Office USPTO) and Japan (patent application to the Japanese Patent Office JPO).	[61], p. 143
Trust	The concept that a system will provide its intended functionality with a stated level of confidence.	IDA http://europa.eu.int/ISPO/ida/jsps/index.jsp?fuseAction=showChapter&chapterID=140&preChapterID=0
Unauthorised entry	Unauthorised entry is any access to networks or other IT applications such as a database without being allowed to do so.	CISSP Prep Guide [198]
Unemployed persons	Persons aged 15+ who are i) without work, ii) available to start work within the next two weeks and, iii) have actively sought employment at some time during the previous four weeks or have found a job to start later. For the SIBIS general population survey, unemployed persons are defined as those who declare themselves to belong to the category "temporarily not working, e.g. because of unemployment, paternal leave or illness".	ILO; SIBIS definition based on ESOMAR, see [79]
Video conference	"Videoconferencing allows 2 or more remote parties to communicate in real-time through the use of a live video and audio link."	http://www.terena.nl/library/gnrt/group/videoconf.html
Virtual environment	"A Virtual Environment is defined as, "real-time interactive graphics with three dimensional models, when combined with display technology gives the user immersion in the model world and direct manipulation."	http://imti-itfi.nrc-cnrc.gc.ca/vetc_e/technology.html
Voluntary organisations	Organisations operating mainly in the area of 'Social economy', characterised by certain degree of formal or institutional existence, independence from government and public administration and authority, high activity and involvement in the public arena (can be a single issue or multi-issue organisations) and by being non-profit-distributing.	Adapted from [227]
Vulnerability	Vulnerability of a system to a threat can be understood as a weakness of an IT or physical asset or group of assets that can be intentionally or accidentally exploited.	CISSP Prep Guide [198]

Term	Definition	Source
Web Accessibility Initiative (WAI)	The initiative and commitment by the World Wide Web Consortium (W3C) to achieve the Web's full potential, particularly by promoting a high degree of its usability for people with disabilities. The work of the WAI spans five major areas: technology, guidelines, tools, education and outreach, and research and development. In practical terms regarding the accessibility levels, three of these [c.f. Web Content Accessibility Guidelines] can be identified: • WCAG-A: A minimum standard that must be met to facilitate accessibility for any significant disability group • WCAG-AA: 'Professional practice' standard that should be met in order to facilitate accessibility to a broad range of disability groups, and • WCAG –AAA: A 'gold standard' of maximum accessibility , e.g. those dedicated to serving the needs of communities of people with disabilities	W3C , www.w3.org/WAI Also [287] [209]
Web scanning	Systematic and often automated searching for and analysis/assessment of particular types of web site	SIBIS definition
Webometrics (cybermetrics)	Research of all network-based communication using informetric or other quantitative measures.	[5], p. 404
Website	Technically, the *web* is just one specific service hosted on an underlying communications network, which is the *Internet*. However, given that the web is by far the most familiar Internet service, and often now provides the primary user interface to other services, website is used as a synonym for Internet / on-line presence	[209]
Webtesting (for accessibility)	Webtesting is the automatic process by which a website is tested against usability and accessibility principles (e.g. using the tools such as LIFT and Bobby. Web developers can generate interactive reports that help them fix accessibility and usability problems. Webtesting includes various assessment techniques and encompasses a broad combination of usability and accessibility guidelines. Certain aspects of determining a website's usability and accessibility will always be subjective, and will require human analysis. For these reasons, web designers are required to interpret problems reported by the tool and decide, case by case, if the reported issue has to be fixed or not. Webtesting has been expanding of late – hence the integration of Booby tool with the robust scanning and reporting capabilities of WebXM tool, developed by Watchfire corporation, taking into account Section 508 issues (accessibility related legislation in the US [6], [8]), W3C's WCAG ([293] and eEurope action plan [84]. Effectively, accessibility has now been integrated with issues of website general quality (content, interaction, working links, etc) and security and privacy issues.	http://www.usablenet.com/accessibility_usability/webtesting.html; http://www.watchfire.com/products [296]

Term	Definition	Source
Whiteboard	"A whiteboard facility allows a group of collaborators to collectively create a document such as a list of priority items, a plan of action or a diagram. The document is edited using mouse or keyboard. Locally the whiteboard program looks like a simple drawing package, but in a live session, changes made to it by any participant appear on every participant's machine. It may be used to support brainstorming, annotation of a diagram, editing and modifying a draft document etc."	http://www.terena.nl/library/gnrt/group/collabfn.html
Wide Area Network (WAN)	A computer communication network that serves users within a wide geographic area, such as a region or country. WANs consist of servers, workstations, printers and communications hardware (e.g. routers, bridges, network cards), and a network operating system.	
Wireless Application Protocol (WAP)	A license-free protocol for wireless communication that enables the creation of mobile telephone services and the reading of Internet pages from a mobile phone.	ITU http://www.itu.int/osg/spu/ni/broadband/glossary.html
Wireless Local Area Network (WLAN)	A wireless LAN is one in which a mobile user can connect to a local area network (LAN) through a wireless (radio) connection.	Oftel http://www.oftel.gov.uk/publications/glossary/index.htm
Working paper (=preprint, discussion paper)	Publication of research results before they have been published by a scientific journal or book	SIBIS definition
Workstation	(1) A type of computer used for engineering applications (CAD/CAM), desktop publishing, software development, and other types of applications that require a moderate amount of computing power and relatively high quality graphics capabilities. (2) In networking, workstation refers to any computer connected to a local-area network. It could be a workstation [in the sense of (1)] or a personal computer.	http://www.webopedia.com/TERM/w/workstation.html

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