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Statistical Indicators Benchmarking the Information Society

SIBIS – Workpackage 1: eEurope Benchmarking Framework

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1 Benchmarking the Information Society

1.1 General Background

The rapid and broad spread of information and communication technologies (ICTs) is generating continuing social change throughout Europe and the world. The proliferation of ICTs and their connection via the Internet has caused major shifts in opportunity and activities at various levels of the population. From the individual accessing information resources on his or her home computer, to the small firm reengineering its business model to take advantage of e-commerce, to the multinational firm enjoying easier access to global markets, to government organizations changing their interactions with their constituents, the spread of ICTs has made a broad range of activities possible that heretofore would have been difficult, if not wholly impossible.

The broad transforming power of ICTs is rooted in the fact that making fundamental changes in the basic communication forms and methods of society has the potential to affect almost every type of human or organizational interaction from the very personal to global, macroeconomic levels. The ease of use and the easy availability of information on the Internet have changed the way that individuals interact with each other and with social institutions. New communicating units that combine the strengths of the telephone, facsimile, and computational systems have facilitated shifts in the way that work is done and organizations are structured. Changes in the dynamics of information flow and control present new challenges to governmental units, and concomitantly, create new ways for governmental units as well as private organizations to better understand and serve the needs of their clients. At their most basic level, ICTs drastically reduce the cost of obtaining information and increase the ability of people throughout the world to interact. As a result, ICTs facilitate any process that depends upon or is affected by these ingredients.

The societal changes caused by the recent waves of technological innovation are widely viewed as having resulted in an "information society." A review of the literature provides several definitions of what is the information society.[1,2,3,4,5] These definitions suggest different qualities of the information society and while a clear consensus does not emerge regarding the meaning of this concept, these complementary points of view can be used to synthesize a broader definition than appears in any one source. In this way, the information society is a society where an ever increasing portion of societal activities – work, economic transactions, communications, and other interactions between individuals, private sector organizations, and governments – are conducted via ICT networks or are dependent on ICT technologies, all of which are increasingly interoperable; and where information and knowledge are increasingly important economic goods at all levels – that is, as determinants of wage levels for individuals, as factors of production for firms, and as sources of competitiveness among nations and regions or both. This definition encompasses both the focus on technology application that pervades most definitions of the term as well as the significance and pervasive application of information in all levels and aspects of society.

From the perspective of business and economic activity, the changes that have thus far resulted from ICTs are considered a "new industrial revolution" because of their far-reaching impact. Besides altering the business models of traditional high technology firms, ICTs have changed the manner in which virtually every industry operates. For example, many farmers now base their planting decisions on data obtained from the satellite-based Global Information System (GIS), and retail merchants are increasingly using sophisticated computer models to

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1 The Infoville Project, http://www.digitalsites.infoville.net/training/informat.htm

2 "Creating a User Friendly Information Society," http://www.cordis.lu/esprit/src/istwork.htm

3 Information Society Forum, "A European Way for the Information Society," 2000. http://www.poptel.org.uk/nuj/mike/isf/ew.html

4 IBM Community Development Foundation, "The Net Result Report of the National Working Party for Social Inclusion," 1997.

5 http://www.ed.gov/databases/ERIC_Digests/ed327216.html

specifically tailor their inventories to their customer buying patterns. Clearly, there no longer appear to be any truly "low technology" industries in the industrialised western world. In addition, the rapidity with which these new technologies have been dispersed throughout society, as well as the organizational and structural innovations introduced by the ICT industry itself, have ensured that the ICT revolution has occurred with extreme rapidity in comparison to the timeframes involved with previous revolutions. In various places, these shifts in activities have been characterized as the appearance of a "knowledge economy" or a "new economy" where information and the ability to process and manipulate it have displaced capital, labour, and natural resources as the dominant factor of production within societies.

From the perspectives of individuals within society, ICTs have made dramatic changes in the ways that people interact with one another as well as how they conduct their daily lives. For example, interactions over the Internet have resulted in an expansion of the definition of human community to include "cyberculture," which in a short time has developed norms and traditions which differ from cultural norms governing human interactions that occur outside of cyberspace. The sharing of all manner of things (e.g., official forms, books, reports, personal data, etc.) on the Internet has made all types of information readily available to more and more members of society, leading to shifts in the way retail customers deal with commercial firms, the manner in which citizens participate in their governments, the way some patients communicate with their doctors, and the manner in which students communicate with their instructors. Because the new ICTs increasingly transcend national borders and geographic boundaries, they have made it possible for people to gain knowledge of activities taking place in other nations with an immediacy and a greater variety of viewpoints than previously available from more traditional sources.

While the upsides of the ICTs revolution are readily apparent, the downsides are also now beginning to be appreciated. These include threats to the traditional notions of privacy, both directly as well as from the ease of covertly collecting and readily sharing information about the habits and behaviour of vast segments of society. In addition, because of the increase in the amount of information that is readily available on virtually any topic, individuals are now confronted with serious information overload problems, where decision-making is complicated by a lack of reliable mechanisms for evaluating the quality of and effectively processing the information at hand. As a result, the increasing availability of information and the enhanced ability to communicate with one another resulting from the ICTs revolution must be viewed in the context of a world in which the ability of individuals to control information about themselves is eroding.

At the same time, the transition to the information society can be dislocating for individual members of the labour force. Because of the knowledge and educational requirements for effectively utilizing the new technologies, individuals may suddenly discover that their skills are less valuable in an information society. This can be particularly acute for those portions of the population which have the greatest difficulty for a variety of reasons in obtaining the education or retraining needed to compete in a changing labour market.[6] The speed with which these societal changes are occurring can make it even more difficult for these segments of the population to adjust and magnifies the gap between the "ICT haves" and the "ICT have nots," be they individuals, businesses, or nations.

Concern over the potential dislocations caused by the advent of the information society are evident in the discussions of many European governments on the topic and the goals of the *e*Europe initiative. Specifically, the central goals of the European Commission with respect to the information society are to:

- Bring every citizen, home, school, business, and administration on-line;
- Create a digitally literate and entrepreneurial Europe; and
- Ensure a socially inclusive Information Society.[7]

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[3] European Commission, "Green Paper - Living and Working in the Information Society: People First," 1996 (http://www.hamburg.de/English/StadtPol/Europe/peopl1st.htm)

[7] http://europa.eu.int/comm/information_society/eeurope/objectives/index_en.htm

These objectives recognize the need for nations to understand and mitigate the disruptive effects of the arrival of the information society, while they simultaneously seek to realize the economic benefits of the new technological capabilities. Simultaneously achieving both goals requires that purposeful steps be taken to facilitate the development of the information society and to mitigate the potential dislocation of individuals, groups, or firms due to its arrival.

1.2 Purpose and objectives of the SIBIS project

The general objective of the *e*Europe strategy is to help "Europe to become the most competitive and dynamic economy in the world."[8] The European Commission has elaborated various documents which specify this strategy of increasing economic competitiveness by means of ICT and supporting the transformation of European societies from industrial to information societies. Concrete actions have been formulated to realise it.[9] The progress of the *e*Europe initiative is intended to be monitored in a pan-EU benchmarking exercise. For this purpose the *e*Europe Benchmarking Report has constructed 23 indicators according to the following guidelines[10]

- one methodology for all countries,
- coverage of all 15 EU member states, Norway, Iceland and where possible the US,
- based on recent data,
- where possible cross-checked with data from other sources.

One of the objectives of the SIBIS project is to provide additional indicators and data that can be used for this benchmarking exercise. This is an objective by itself, but the additional indicators developed by the SIBIS partners also can be used to cross-check the data used in the *e*Europe Benchmarking Report. Additionally, as the introductory section should have made clear, the progress towards an information society is far too detailed and overarching to be assessed with 23 indicators only. For each of the different topics and actions addressed by the *e*Europe Initiative and subsequent Action Plans a multitude of indicators could be developed and corresponding data could be collected. Hence, other objectives of the SIBIS project are to broaden the indicator systems on information society topics. On the other hand, as we will discuss in more detail below, SIBIS also has the objective of filtering from the multitude of possible indicators the ones that are most suitable for this task. Moreover, compound indicators will be constructed which summarize and condense the information on various related issues.

At this point, the objectives of the SIBIS project go beyond the immediate and short-term targets of the *e*Europe Initiative. **We can term it the general purpose of the project to develop indicators which better measure the modern information society.** Official statistics are still tuned to a large extent to the industrial society, where manufacturing dominated over services, tangible assets over intangibles and traditional over flexible employment models. Of course, the data provided by official statistics are informative and indispensable, as they contain uncountable important facts of societies and economies. However, the nascent information society calls for a new set of measures and indicators to benchmark progress and performance in an evolving context where the perspective of the industrial society may no longer provide a full and accurate picture. To that end, the SIBIS project intends to develop ideas, and check different options and realisations which complement official statistics on information society issues. It conceives itself as a creator of

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[8] eEurope 2002, An Information Society For All, Action Plan prepared by The European Commission for the European Council in Feira, 19-20 June 2000. p. 1. (http://europa.eu.int/information_society/eeurope/action_plan/pdf/actionplan_en.pdf)

[9] The most important documents in regard to this are probably the abovementioned *e*Europe 2002 Action Plan and the *e*Europe 2005, An Information Society For All, An Action Plan to be presented in view of the Sevilla European Council, 21-22 June 2002. (COM (2002) 263 final).

[10] Cf. eEurope Benchmarking Report, p. 4. (COM(2002) 62 final). (http://europa.eu.int/information_society/eeurope/news_library/new_documents/benchmarking/benchmarking_en.pdf).

ideas and proposals, some of which ideally will be taken over by official statistics and other national and multinational organisations whereas others will not.

However, it would neither be methodologically sound nor justify a EU-funded research project if indicator systems were the only outcome of the project. Whenever empirical measurement takes place it has to be demanded that the validity and reliability of indicators are checked. In other words, the researcher has to make sure that his or her indicators measure what they are intended to measure and that they do so in whatever particular local or temporal circumstances. These characteristics can be postulated ex ante, but they can only be verified ex post. Similarly as the *e*Europe Benchmarking Report has demanded cross-checks, the SIBIS indicators have to be tested in a pilot data collection and cross-checked with other available statistics. On this basis, first the indicator system can be improved, and second wherever the indicators have proven valid and reliable a benchmarking can be carried out. By nature this benchmarking will be limited and it can only be considered as a first step of a much broader effort in research and statistics.

1.3 The SIBIS approach: indicators and benchmarking of the Information Society

The goal of SIBIS is to develop and pilot indicators to benchmark the information society. Among statistical indicators in widespread use, economic indicators are well known because of frequent references in the news. These indicators are proxies for the measure of economic activity and are used to ascertain the economic health of regions, countries and the world. Indicators, which are based on specific measures, are used to estimate status on a broad scale. For example, so-called leading economic indicators - derived from inventories, factory orders and the like--are used to forecast how the economy will perform in the future. Based on these indicators, either alone or in combinations, it is possible to set a desirable standard of performance that regions or countries can aspire to meet or exceed. The process of matching performance to an established standard underlies benchmarking.

1.3.1 Statistical Indicators

In general, the function of indicators is to transfer latent and not-observable ideas, hypotheses and conceptions of reality into quantifiable units. When the conceptions of reality are abstract and latent rather than concrete and observable they are called "constructs".[11] In order to quantify and compare constructs, some rules of correspondence between them and observable variables have to be established. This process is usually called operationalisation and the result are called indicators. Observable indicators and latent constructs can be linked in three different ways:[12]

1) *Effect indicators* are observable results (effects) of the unobservable constructs. Effect indicators can be deduced from theories, i.e. statements on the relationships between latent variables.
2) *Components* are indicators which result from combinations of other indicators. In order to obtain an indication for a construct, the observable indicators are transformed. For example in order to measure the effect of a course in statistics the knowledge of the students before and after the course could be assessed and compared.
3) *Definitorial (or causal) indicators* define a construct. What is measured by the indicators is defined as the theoretical concept that lies underneath.[13] Changes in the observed indicators may consequently lead to changes in the constructs. Common examples are constructs such as “intelligence”, “recognition” or “merit”.

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[11] Nunnally, J. S.; Bernstein, I. H. (1994): Psychometric Theory. 3rd edition, New York et al., p. 85.

[12] See Nunnally, J. S.; Bernstein, I. H. (1994), op. cit., p. 449.

[13] See Weiss, C. H. (1998): Evaluation. 2nd edition, Upper Saddle River, pp. 144-150.

Each of the three different kinds of indicators demands the existence of a theory, rationales or at least hypotheses. Indicators have to be "rooted in theory". Evaluation research has stated further desirable features of indicators which should render them useful for the measurement of constructs.[14] The two most important are without doubt validity and reliability:

- *Validity*: The indicator should measure what it is intended to measure. Validity is based on theoretical reasoning, that is on the arguments substantiating why hidden facts come to light in an indicator and explaining its suitability for measurement.[15] But validity must be tested and proved empirically, e.g. by correlating different indicators which aim to measure the same construct or by analysing an indicator's predictive value (comparing prediction and actual development).
- *Reliability* refers to the necessity that an indicator produces the same results whenever it is implemented to measure the same construct. Reliability is not inherent to the indicator, it also depends on the context and diligence of data collection. Reliability requires, for example, that the method of data collection should not bias the results (e.g. produce answers which the interviewer obviously wants to hear).

However, important are also direction, sensitivity to differences and accessibility:

- An indicator should have *direction*: it should be unambiguous what is beneficial and what is detrimental. The direction is based on normative decisions which are also part of the theoretical foundation of an indicator.
- *Sensitivity to differences*: if all answers to a question are agglomerated in one of the different answering options, these are obviously not suited to assess the differences of the construct over the sample of measurement objects.
- An indicator should also be *accessible*: the data required to produce the indicator should be available and it should be possible to check its validity in order to assure its value for measurement.

This rather general description serves to help us understand what indicators can accomplish and what we have to keep in mind when developing them. But what is the relation to information society issues and the aim of the SIBIS project?

The *first and foremost consequence* is that the SIBIS project has to develop theoretical models for the relationships between the concepts it uses and operationalises. This has to be done *on the one hand* on the general level of the topic areas which will result in a general model to measuring (benchmarking) the information society. Such models have been constructed in the past and they constitute a good starting point for further thoughts. For instance Kirkman, Osorio and Sachs propose to measure the preparedness of nations for the networked world through a so-called Networked Readiness Index which consists of indicators for

- *Network use*, or the extent of ICT proliferation in a specific country
- *Enabling factors* among which they include indicators on each, network access, network policy, networked society and networked economy.[16]

Another model structure has been used by the Swiss Federal Statistical Office. The latter applies a matrix with ICT-related capital stock, investment and usage as columns and population/households, economy/business, education system and politics/government as

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[14] See Weiss, C. H. (1998): Evaluation. 2nd edition, Upper Saddle River, pp. 144-150.

[15] Orlikowski and Iacono give a good example of what happens when an indicator is not valid: an evaluation study of Internet usage at home detected the disturbing finding that the social and psychological well-being of the Internet users was reduced. The measure for this was "Internet use", i.e. the number of hours the subjects were connected to the Net. But, according to Orlikowski and Iacono, there was no account of what the people were actually doing on the Internet, and the reduction in well-being may well be attributable to specific uses and not the Internet in general, see Orlikowski, W. J.; Iacono, C. S. (2000): The truth is not out there: an enacted view of the "Digital Economy", in: Brynjolfsson, E. and Kahin, B. (eds): Understanding the digital economy. Data, tools, and research. Cambridge and London, p. 362.

[16] Cf. Kirkman, G.S.; Osorio, C.A.; Sachs, J.D. (2002): The Networked Readiness Index: Measuring the Preparedness of Nations for the Networked World. (http://www.cid.harvard.edu/cr/pdf/gitrr2002_ch02.pdf).

rows.[17] The development of a general model of this kind depends on the synthesis of the work in the different SIBIS work packages and the result will only become available at the end of the project.

The development of such models, *on the other hand*, is also required in the different topic areas. Again, in some topic areas useful examples exist in the literature. For example in the field of e-commerce such models have been used. A 1999 OECD workshop proposed the following constructs as realisations of an increasing level of electronic commerce activity:[18]

- *e-commerce readiness*: issues in relation to the technical, commercial and social infrastructure that are necessary to engage in electronic commerce
- *e-commerce intensity*: issues related to the state of e-commerce usage, volume, value and nature of transactions
- *e-commerce impact*: issues related to the outcomes and effects of electronic commerce, e.g. on sales to market, value added, employment etc.

A similar model for e-commerce was used by UK national statistics.[19] A model for measuring e-government was developed in an analysis by Booz, Allen and Hamilton for Bertelsmann Foundation. It uses benefits, efficiency, transparency, participation and change management as concepts in a balanced scorecard approach.[20] It is not the purpose of this section to provide a complete list of these models or to present them in detail. The examples are intended to emphasize the necessity of anchoring indicator development in theoretical considerations of the Information Society.

The *second consequence* of the properties of indicators is that it would not be sufficient to develop models and operationalise these with indicator systems for the different topic areas. In addition the indicator systems have to be filled with data and tested in regard to the criteria listed above. These criteria of validity, reliability, direction, sensitivity to differences and accessibility are binding in all situations. However, we not only employ the benchmarking exercise in order to produce new knowledge on the current state of development of the information society in Europe. We also intend to pilot indicators that will serve to draw conclusions and recommendations for European IST policy. Therefore, another criterion has to be included which does not have to apply to all indicators but at least to some in each topic area: policy relevance.

When indicators are tied to the outcomes of policy and report on the most relevant societal characteristics in particular areas, they can be used for a number of policy related functions. These include:

- **Policy Outcomes Evaluation** – Indicators can help determine the effects of a given policy decision and characterize the scope of both the intended and unintended outcomes of the change;
- **Policy Effectiveness Evaluation** – Indicators can allow determinations of how cost effective, efficient, or how well implemented policies are by providing a way of comparing the resources they use to obtain a given societal output; and
- **Benchmarking** – Indicators facilitate comparison of societal performance within and among nations and over time.

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[17] Huber, M.; Cosandey, F; Täube, V. (2002): Indikatoren zur Informationsgesellschaft, in: Huber, M. et al.: Informationsgesellschaft Schweiz – Standortbestimmung und Perspektiven. Neuchâtel 2002, pp. 14-67.

[18] Cf. Colecchia, A. (1999): Defining and measuring electronic commerce. Towards the development of an OECD methodology.

[19] The description is different to the OECD model. Its underlying five concepts are readiness, technology and access, use, purpose, impact. Nevertheless, the graphic on page 5 reveals the similarity to the OECD model, cf. Clayton, T.; Waldron, K. (2002): Towards a measurment framework for international e-commerce benchmarking.

[20] Cf. Bertelsmann Foundation; Booz, Allen and Hamilton (2002): E-Government – Connecting Efficient Administration and Responsive Democracy.

Because both national governments and the European Union are interested in promoting the change towards an Information Society, effective policy-making and appropriate resource utilization, indicators with policy relevance contain value added at the political level. Without appropriate measures that truly reflect the desired outcomes of policy, it is impossible to impartially determine the effectiveness of strategies and guide national or continent-wide improvement. Of particular relevance for the Europe-wide scope of this effort is benchmarking, which focuses on the use of indicators as a way to compare, integrate, and understand the effects of policies among different nations and social systems.

1.3.2 Benchmarking

Benchmarking continues to be used for process improvement. Although developed to improve performance in the private sector, this approach carries over to the public sector as well. A summary of approaches used for benchmarking in the private sector illustrates how this methodology can be applied to the public sector. Because of the evolving nature of the information society, the types of indicators used for benchmarking at one time may become dated and need to be revised in the future.

The goal of commercial benchmarking traditionally has been to enable a company to characterize whether certain policies or strategies it has put into practice are effective or ineffective. It has been championed as the means to improve performance.[21] Benchmarks in themselves cannot answer the question of why a company performs the way it does. Rather, by identifying differences in performance new questions about why these differences exist can be formulated. In addition, after being identified, the best performer can be studied in more detail to learn how its performance has been achieved. Benchmarking can therefore be considered as a process of "identifying, understanding, and adapting outstanding practices" to the needs of one's own organisation.[22] This process relies on four steps:

- Areas for improvement are identified,
- best practices in the areas for improvement are identified, and benchmarks or indicators of performance are developed in relation to best practices
- the process of achieving best practice is studied,
- normal practice is then benchmarked against best practice.[23]

Several methodologies of benchmarking have been developed for the commercial sector. Benchmarking can be performed against an external benchmark, such as the best performer in a given function, regardless of its other characteristics. Alternatively, benchmarking can be performed against an internal benchmark, which may be a peer company based on selected criteria. Also, benchmarking can be relative or absolute. Relative benchmarking compares the performance of companies across a given dimension at a point in time, while absolute benchmarking considers the performance of a company at one point in time in the context of its performance at an earlier time. Finally, benchmarking can consider performance for a single parameter or across a number of characteristics. A "general rule" for benchmarking does not exist. Which benchmark to use depends on the goals of the benchmarking exercise and on how the knowledge gained from benchmarking will be applied.

Although the needs and functions of governments differ from those of businesses, benchmarking can help them improve their performance as well. In this case benchmarking is expected to support policy decision, rather than give purely statistical data.[24] In the US, the Government Performance and Results Act of 1993 (GPRA) calls on government to use the

[21] Davenport, Thomas H. Process Innovation, Boston: Harvard Business School Press, 1993.

[22] "What is Benchmarking?" The Benchmarking Exchange. http://www.benchnet.com/wib.htm accessed 10 October, 2002.

[23] Sean O'Reagain and Richard Keegan. "Benchmarking Explained" in *Benchmarking in Europe – Working Together to Build Competitiveness*. PSI (2000).

[24] e*Europe Benchmarking Report,* e*Europe 2002*. Brussels, 5.2.2002. COM (2002) 62 final.

tools of benchmarking to improve performance in much the same way as corporations.[25] In Europe, the BEST Conference was established to provide a set of recommendations regarding benchmarking in the public sector.[26]

The eEurope 2002 action plan that reflects the European Council's objective for "Europe to become the most competitive and dynamic economy in the world" provides a vantage point from which to consider benchmarking the success of EU Member States in embracing the information society along a number of performance criteria. Because technology and society are constantly evolving, the challenge in successfully benchmarking the information society is quite real. Decisions about whether to use internal or external benchmarks depend on where the best performers are and many times on the data that can be made available. Relative benchmarks have the advantage that normative decisions, e.g. on what level of service should be achieved, are not necessary. However, they do not provide much orientation for the best performers. The United States rank in many benchmarking exercises on the information society among the top performers.[27] But that should not lead to the conclusion that therefore no further IST development and policy measures are needed. If that would be the case, the top position would be lost soon, of course. As a result, not only the relative position in relation to other countries should be benchmarked but also the developments within a single country over time. This, however, is only possible when time series data is available. One of the objectives of SIBIS is to involve statistical institutes and other institutions which collect data, and to raise the chances of a continuous collection of comparable data.

Importantly, measures that are useful today may become outdated or misleading in a short time. This suggests that the indicators used for benchmarking may need to change with time. Recent benchmarking activities related to *e*Europe 2002 illustrate the application of the process and the expected evolution of indicators. One of the initial measurement of interest was Internet penetration in EU households.[28] This contributed to gauging the level of progress toward an e-society and to guide policy makers about what needs to be done to increase Internet penetration. Because Internet penetration underlies the growth of *e*Europe, this is a useful indicator. However, just as telephone penetration reaches a plateau, it is reasonable to expect that at some point Internet access will cease to be a useful indicator.

Benchmarking is the method to evaluate the progression of the European Union toward its stated goal of becoming a global leader in regard to the information society. Some of the measures of this progress can be known *a priori* because they comprise measures of familiarity with online services or other basic elements of building the information society. Other measures can be found by a more careful analysis of specific topics related to the information society. In both cases, however, the usefulness and validity of these measures in assessing the progress of the information society will change and may become dated and fail to provide useful insights in the natural progression of the information society from early growth toward a more mature stage.

1.4 Structure of the remaining chapters

Due to the wide range of areas affected by the transition to an information society and the variety of the topics involved, the development of indicators to benchmark events and measure progress in this area must be segmented. The nine areas in which benchmarking indicators are to be developed are:

- Telecommunication and Access

[25] See *Business Process Reengineering Assessment Guide*, GAO/AIMD-10.1.15, for a discussion of how benchmarking is being applied to government services.

[26] Recommendations to DG TREN, European Commission, Resulting from BEST Conference 1: 'The State of the Art of Benchmarking in all Sectors', October 2000.

[27] Cf. Kirkman, G.S.; Osorio, C.A.; Sachs, J.D. (2002), op. cit. – Delpho, H.; Sutter, H.-G. (2000): Benchmarking zum Entwicklungsstand der Informationsgesellschaft und zur Wettbewerbsfähigkeit der informations- und kommunikationstechnischen Industrie am Standort Deutschland.

[28] e*Europe Benchmarking Report,* e*Europe 2002*. Brussels, 5.2.2002. COM (2002) 62 final.

- Internet for Research
- Security and Trust
- Education
- Work, Employment and Skills
- Social Inclusion
- e-Commerce
- e-Government
- e-Health

While each topic treats a different facet the information society, a degree of overlap and interdependence remains among them. In the subsequent chapters, each one of the topics is defined in terms of:

- a framework for assessing the area,
- the identification of the stakeholders and their interaction,
- statistical measures and variables of interest, and
- methodology.

Although this approach results in some duplication of information across the nine topics, it provides the reader with a complete view of each topic independent of the others. This facilitates the understanding of the reader who is interested in reading or studying one or several research areas rather than in reading this document linearly. Because this document introduces much of the work in SIBIS, it is expected that readers will readily access it in a non-linear way.

2 Telecommunications and Access

2.1 Framework for Assessing the Area

The topic of telecommunications and access is both wide ranging and 'horizontal' in nature. It is wide-ranging as it covers both the physical networks over which information is carried, as well as the means to accessing those networks. It is 'horizontal' because it cuts across many of the other priority action lines of the eEurope initiative. In many ways the topic can be considered an 'enabler' – it allows the other eEurope domains to 'happen'.

For this study we have interpreted the term 'telecommunications' very broadly to include all the networks (cable, mobile, Internet, as well as copper wire) over which all types of information (voice, data, sound, image) are carried. So, although we concentrate on telephony networks, we also look at computer networks, the Internet, cable (TV as well as telephony), and wireless forms of transmission. Overall, perhaps a more accurate descriptor in these circumstances would be 'communications'.

'Access' is another loose descriptor. We have defined it formally as 'the ability to retrieve data, graphics, sound, text etc whether on-line or offline'. Translated into the context of eEurope we cover the wide range of means by which users access electronic 'information' – e.g. computers, telephones, multimedia kiosks, televisions etc.

In terms of defining the statistical boundaries within which our study is conducted, fixed telecommunications networks have been in existence for over 100 years, so there has been plenty of time for statisticians, users and the industry to have developed indicators. These typically measure the size and growth of the market and different technologies and are used as an aid to predicting revenues, profits, universality and potentiality. However, newer forms of network – wireless, the Internet (computer use and telephony), cable (TV and telephony), radio – have not been subjected to such long term scrutiny. And, indeed, although basic indicators for public switched telephone networks (PSTNs) are widely available, commonly collected data from different sources can still be conflicting, and more sophisticated and elaborate indicators such as composite indicators are rarely available. Similarly, although basic indicators exist for newer technologies (and these are becoming more common) in many instances they are also often not comparable, nor yet ready to meet the challenge of emerging topics of interest. Examples of the latter include the ability to robustly measure VOIP (Voice over Internet Protocol), broadband penetration levels, broadband technologies or the use of alternative technologies.

The same issues apply to access mechanisms. Although telephone (fixed, mobile) and television ownership rates are well known, there is less information on the extent to which newer forms of access mechanism are available or used. New channels include digital TV, Internet-enabled phones, and interactive TV. Emerging channels will include the new generation of 3G products.

Finally, we do not cover 'content' in this topic. Although tremendously interesting, it is an entire domain in itself, and would increase the necessary research to facilitate indicator development by about 100%. Neither do we include ICT market size or productivity issues.

2.2 Identification of the Stakeholders and their Interactions

The main groups stakeholders involved in indicator generation and indicator use are as follows (in no particular order):

Table 2.1 – Stakeholders for Telecommunications and Access

Indicator Generation	Indicator Use
Statistical agencies – national and European, ICT observatories,	Industry – telecommunications operators, equipment manufacturers
Policy bodies	Regulators – there is one in each MS
Analysts and Consultants	Policy bodies
Industry	Analysts and Consultants
Regulators	Users – consumers, 'watchdogs'
Publishers – IDC, Forrester etc	Private enterprises and public institutions
Data Generators – such as RIPE, NetWizards etc	

There is a lot of formal interaction between certain groups – especially between regulators and industry (statutory obligations) and regulators and policy-makers (a key channel for policy making). Given the economic strength of the telecoms sector and the perceived European lead in 3G telecoms, there can also be strong relationships between analysts, consultants, data publishers and the industry. In many instances, information transfer is quite open and transparent. Indeed, some measurement and analyst firms are respected as reliable independent data providers that have inform policy within both public regulators and private corporations over a number of decades.

2.3 Statistical Measures and Variables of Interest

Most indicators currently available tend to count 'the number of something' such as mobile ownership, Internet hosts or ISDN lines per 1000 head of population or by percentage of SMEs, for example. There has been a distinct concentration on the penetration of technologies and on access levels (so-called 'readiness' indicators), with less information available on the uses to which this access has been put, or on 'who is doing what' (usage indicators). There is even less information available on the impact of the use of new technologies. For example, there is plenty of material on the numbers of SMEs with access to the Internet. There is less data on what the firms are using the Internet for (e.g. is it mainly passive information collection or are active transactions being carried out?) There is even less information available on the difference that the Internet has made to the company (impact indicators) - its turnover, profit, operating efficiency, or marketing strategies, for example.

Turning our attention to the eEurope priorities – bearing in mind several of the telecommunications and access measures are policy-focused and are not particularly relevant to the collection of statistics – we can see variations in indicator availability:

Table 2.2 – Identification of Actions and of the Availability of Indicators in Telecommunications and Access

Action	Existing Indicators?
Achieve significant reductions in Internet access tariffs towards the lowest levels in the world by reinforcing competition and clear benchmarking at European and national level.	YES, OECD publishes 6 monthly data
Adopt the five directives[29] for the new framework for electronic communications and associated services; Adopt the new Commission Directive on Competition in Communication Services[30].	Unknown, but presumably YES – within the EC
Work towards introducing greater competition in local access networks and unbundling of the local loop.	Partial – OECD statistics, World Bank and national regulators
Improve the co-ordination of the European frequency policy framework. (see next as well)	NO. Need adoption of EC Decision on Regulatory Framework for radio spectrum policy.
Co-ordinated allocation of frequencies for multimedia wireless systems	NO. As previous.
Where necessary, public financing instruments will give increased priority to supporting the development of information infrastructure, notably in the less-favoured regions.	Partial/Unknown Some (not all) MS have universal service obligations. Also a DGREGIO study is due to start on the use of Structural Funds to support the development of the IS
Move towards full conversion to IPv6 through pilot implementation in Europe. Key telecom and manufacturer industries will be mobilised together with service providers and users.	NO. Ad-hoc working group set up to accelerate adoption of Ipv6
Reduce prices for leased lines by increasing competition and ensuring implementation of the Commission Recommendation.	YES, partial. OECD, Regulators and consultancies

Examination of the common types of indicator currently available (see table below) shows that there is relatively little cross-over with the priorities of eEurope. If we want to pursue the creation of eEurope-relevant indicators, then we are likely to end up with a different set of indicators than if we concentrated on looking at 'telecommunications and access' priorities. The table below highlights some of these differences:

[29] These Directives concern the overall framework, access and interconnection, authorisation and licences, universal service and data protection.

[30] Full title: *Commission Directive amending and consolidating Directive 90/388 on Competition in the Markets for Electronic Communication Services*.

Table 2.3 – Common Indicators for eEurope priorities and for Telecommunications and Access Priorities

Potential Focus Areas for Indicators for eEurope Priorities	Potential Focus Areas for Indicators for Telecommunications and Access Priorities
Progress in unbundling the local loop	Measures of adoption of new technologies
Progress in adoption of various Directives	Measures of adoption of new access mechanisms
Benchmark of use of public funds to support LFR infrastructure development	Pricing of new technologies/products
Progress in adoption and rollout of Ipv6	Progress in adoption and rollout of Ipv6
Comparing telecommunications competition across MS	Impact measures of adoption of technologies/access mechanisms
	Composite measures of telecommunications and access 'readiness', use and impact

Under the SIBIS project, most measures of eEurope policy adoption will be collected under workpackage 4, so for the rest of this paper we will concentrate on looking at generic telecommunications and access priorities.

Whilst we are not yet at the stage of defining precisely which indicators should be developed under the SIBIS project, we can begin to codify some initial thoughts. Measures of the **availability** of telecommunications networks and access mechanisms are, generally speaking, already in the public domain. However, their existence is variable (particularly with regard to emerging technologies) and more work could usefully be done in this area. Measures of **accessibility** in terms of cost, frequency or quality (e.g. speed) are less prevalent, and more work could be carried out, whilst measures of **use** (what do organisations/individuals do with connectivity) are scarcer still. **Impact** measures (what difference have telecoms and access made to communication, efficiency, effectiveness, productivity, social democracy, education and training etc) are even rarer. Fortunately, within the context of the SIBIS project, it is possible that some of these more 'extended' questions about impact may be addressed under other activity lines.

2.4 Methodology

As there is already quite a lot of statistical data in the public domain, it would seem useful to try to combine some of the existing measures into new indicators as well as collecting new data for those measures where there are currently gaps. An example of the latter are indicators of policy-related importance, where knowledge is fragmented. However, as it is not yet clear upon which indicators or measures it will be the most appropriate to concentrate, (this will be further defined under the next SIBIS workpackage), the following text on approaches to data collection is somewhat generic.

Data collection is likely to involve both primary and secondary research. Much of the latter has already been done under workpackage 1.3, but this will be expanded and updated under workpackage 2.1. For the former we can envisage using a mixture of short questionnaires (cost effective, giving hard data which can be compared across nations), and telephone or personal interviews. The latter could be of the omnibus variety (particularly for consumer information), or especially tailored for the purpose. Both types of survey would give data on availability/access/use and impact indicators. They have the overriding advantage that they can be customised, and will elicit primary data which is not easily available elsewhere, and which will be directly comparable.

Returning to the topic of composite indicators – combining two or more (probably existing) measures into a composite indicator- it is acknowledged that this approach can be methodologically risky. For example it is quite likely that the base indicators have not been

calculated on the same basis, or using the same sample. However, composite indicators can be very rewarding, useful and interesting. Whilst they may not irrefutably demonstrate a cause and effect relationship, they can be indicative of something, or a propensity to do something – and can often provoke further questions; the answers to which can be particularly illuminating.

Taking a simplistic (hypothetical) example, we might want to look at GDP per capita by Member State (available from Eurostat) and consumer ownership of computers (available from EITO). The results can enable us to see if there is a correlation between wealth and computer ownership. Without looking at the figures, we would instinctively expect there to be a positive correlation. But it may be that a Member State with relatively low GDP per capita shows high ownership of computers. The interest for a policymaker would be to ask 'why' a 'counter-intuitive' situation has occurred. In our fictitious example, the answer could be that the computer purchase for households has been subsidised by the State.

We could then build on this composite indicator by asking a third question. This could either be an existing indicator, or a brand new question which is not covered by existing information – such as asking about the impact of computer ownership has. An example of combining our first two indicators with a publicly available third measure might be to look at revenue from local calls, or the diversity of Internet call packages or the average usage time per connection.

3 Internet for R&D

The SIBIS topic "Internet for R&D" sets out to *first* develop an indicator system on the use of Internet technologies in R&D and *second* test this indicator system by carrying out a benchmarking of European R&D systems. The present chapter intends to give an overview of the structure of the topic area. The first section draws up the boundaries to other topics and provides some basic definitions. Section 2 lists the most important stakeholders and section 3 elaborates on the internal structure of the topic area. The last section will deal with methodological issues.

3.1 Framework for assessing the Area

The OECD defines R&D as creative work which is undertaken on a systematic basis in order to increase the stock of knowledge and the use of this stock of knowledge to devise new applications.[31] This definition of R&D makes use of two elements: The first is on an input level, stating that R&D requires creative and systematic work. The second is on an output level, as R&D should create new knowledge or, in other words, find solutions for problems that cannot be answered with the available knowledge and techniques.

The second part of the definition which focuses on the goal of R&D is of special importance for understanding its uniqueness. Creative and systematic work can be carried out for similar but nevertheless different goals: e.g. an artist's creative work is (usually) justified by itself, whereas the creative work of a scientist always should pursue the goal of increasing knowledge. This does not mean that a researcher's work and its results must be immediately applicable and useful to society. They can also deal with fundamental problems which for the time being "only" increase the understanding of nature, society or a technical field.[32]

The current analysis is limited to R&D and omits the neighbouring and related, but nevertheless different, activities of innovation and education. Though some innovations have their roots in R&D results, they are not the same: the latter can be scientific publications and presentations or inventions which may or may not be used outside of R&D. Innovations, on the other hand, are new products, processes or forms of organisation which have been introduced into the market.[33] For this market introduction, additional activities are typically indispensable, such as market research on available products, competition, possible returns, optimal sales strategies and other activities that are not associated with R&D.[34] R&D is also not the same as education, though scientists often fulfil both functions. While R&D aims at extending the boundaries of knowledge, education primarily has the objective of teaching the important things within these boundaries. Thus, education is the foundation of self-reproduction of science and doubtless the borders between research and education are anything but clear; for example the insights gained in the process of teaching often constitute inputs into research

[31] OECD (1994): The Measurement of Scientific and Technological Activities: Proposed Standard Practice for Surveys of Research and Experimental Development - Frascati Manual 1993. 5th Edition. Paris, p. 29. Though this definition seems to be relatively straightforward, it still leads to a large list of "borderline activities" which cannot generally be included among or excluded from R&D. Some of the easier activities are dealt with by the OECD itself (ibid.): The OECD includes among R&D the administration of R&D projects, personal education only when specifically for R&D purposes, the development of prototypes and pilot plants. It excludes all work that is limited to using the existing stock of knowledge, especially consulting and advisory work, professional practice, the writing of policy-related studies, routine software development, design and drawing for production processes, trial production and routine tests. It also excludes the presentation of results at scientific conferences, and patent and license work.

[32] This form of research is usually called 'basic research'. The OECD defines it as follows: "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." 'Applied research', in contrast, is directed primarily towards a specific practical aim or objective, cf. OECD (1994), op. cit., p. 68-69.

[33] OECD (1997): Proposed Guidelines for Collecting and Interpreting Technological Innovation Data: Oslo Manual. 2nd Edition. Paris, p. 31. ((http://www.oecd.org/publications/e-book/9297031e.pdf).

[34] Research is not limited to the public sector but is carried out to a large extent in the private sector. This research must also be included. The difference stressed here is one between research and other activities.

and vice versa. Nevertheless, in this part of the study it is assumed that research and education can be divided analytically. A separate SIBIS research topic will deal with education issues (see below).

The present topic area does not focus on informatics research or Internet research. In principle, it investigates the utilisation of the Internet and its effects on research in the social sciences and humanities as well as in the natural sciences and engineering. It is clearly impossible to cover the entire world of science within one project and, consequently, it might be necessary to use single areas of research as examples. But it should nevertheless be possible to generalise the findings to some extent and use them as pilot results for future studies.

Until now the terms "the Internet" or "Internet technologies" have been used imprecisely and without any clear definition. However it is also necessary to explicate our understanding of this technology. The Internet is basically considered as a "global network connecting millions of computers".[35] It consists of technical infrastructure, particularly computers ("servers") and data storage devices and connections (narrowband and broadband) between these servers. This infrastructure is used with various information-sharing techniques to transmit, retrieve and display digitised items of information (the measurement and coding is usually performed using additional technologies). The most common techniques are currently the Hyper Text Transfer Protocol (HTTP) of the World Wide Web (WWW), the Simple Mail Transfer Protocol (SMTP) of e-mail and the File Transfer Protocol (FTP).[36]

3.2 Identification of Stakeholders and their Interactions

Who cares about the potential of the Internet for R&D and who is affected by its use? It is possible to distinguish between three different groups which are involved in research activities:

- *R&D personnel:* researchers, technicians, research managers and other staff directly supporting R&D
- *Ancillary organisations:* research-related services, research associations, administrations and foundations
- *General public:* principals and customers of research activities, beneficiaries and claimants

The Internet technologies have changed the daily research activities of researchers and their assistants and support staff in all institutions which carry out R&D (see next section for examples). The Internet has also resulted in important new sources of information and methods for their retrieval which are important for research management. However, the human-technology interaction is certainly not one-way, as researchers influence the potential of Internet technologies, e.g. through the development of new technologies or through making new sources and instruments accessible to network-based applications.

The Internet has also modified the activities of R&D ancillary services. Bibliographic services and publishers, patent services, foundations and other funding organisations and many other services relevant to R&D provide access to information via the Internet. National Research Networks and local campus networks use the Internet for data transfer. In general these ancillary services had to, and still have to, modify their service portfolio to account for the new requirements of researchers triggered and facilitated by the Internet.

Society as a whole can be identified as the most general unit which is affected by the use and effects of Internet technologies in R&D. Certain groups within society, such as its political representatives, administrations, or customers of specific research results, are usually more affected than society as a whole as they want to use research results or modify societal

[35] http://www.webopedia.com/TERM/I/Internet.html

[36] Cf. on all these terms: http://www.webopedia.com.

regulations accordingly. One such group which should take special interest in the results of this part of the SIBIS project are R&D policy makers and administrations, as the decision to politically support and promote the use of Internet technologies should be based on a close analysis of their effects.

The present study will focus on indicators that reflect the utilisation of the Internet by researchers, research managers and the providers of some services for research activities. Within its new strategy of creating a *European research area*, laid down at the Lisbon summit, the European Commission also introduced the goal of increasing pan European networks within the research and development system as well as across its boundaries. Therefore it will create additional value for monitoring European research policy, if indicators can be constructed that measure the Internet-based interaction among researchers, national and European institutions in the field of R&D-policy and other important agents in this field.

3.3 Statistical Measures and Variables of Interest

Whereas in other topic areas it might be possible to summarise available statistics and point to specific gaps or issues that merit further investigation, this is not fruitful in the present topic area. Or, in other words, a summary of the results would not be very informative: no indicators and statistical data exist which could be used for assessing and benchmarking the Internet in R&D. Consequently we will employ a different logic in this section: we will describe the basic structure of the indicator system in order to give the reader an idea what can and should be measured in this topic area. For this purpose, we separate three different perspectives:

- Internet-related ICT infrastructure for R&D
- Integration of new network technologies into research activities
- Computer networks and R&D collaborations

3.3.1 Internet-related ICT infrastructure for R&D

The infrastructure perspective considers Internet technologies as part of the research infrastructure and consequently investigates the extent to which they are used and what impact they have on R&D. The existence of an appropriate ICT infrastructure has become a pre-condition for an efficient R&D system. It is impossible to think of modern science without ubiquitous PCs, supercomputers for tasks which require large computing power, campus networks, National Research Networks and supranational connections, a multitude of computer programs that carry out sophisticated calculations, model schemes and designs, or 'simply' store text and other data and facilitate its retrieval in a user-friendly manner. These are only some examples of currently available ICT infrastructure that has changed research during the past decades. Among scientists, science managers and science policy makers, a broad consensus prevails that R&D systems and ICT infrastructures for R&D will undergo more fundamental changes in the near future.

"There is a need to redefine the ICT "architecture" of science, such that hypotheses formation, problem solving, information processing and computation become a network task, while the main challenge for the individual workstation is to provide appropriate human-computer interaction facilities to support adequately specific research problems."[37]

The changes are demand-driven as well as technology-driven: On the one hand the needs of researchers to collaborate and jointly use specialised and expensive instruments or databases irrespective of their geographic location are growing; on the other hand the increase of computing power and transmission capacity in networks create new options for computational analysis, such as distributed computing, which further fuel the demand for higher ICT

[37] European Technology Assessment Network (1999): Transforming European science through information and communication technologies: challenges and opportunities of the digital age. Final version, p. 34.

performance levels. In this context the concept of GRID technologies is of outstanding importance.

However, the infrastructure perspective deals not only with R&D-related Internet hardware and software, it also extends to 'humanware'. These are the computer skills available to R&D projects which may be embodied in the researchers themselves, in the technical staff they employ or in services they buy. To include these differing topics we have to use a very broad understanding of infrastructure that is not expedient for many other research questions. But this approach is well suited to our purposes, as we undertake this analysis in particular to develop indicators which are suitable to monitor the impact of computer networks on R&D and to devise policies which can optimise these impacts.[38]

3.3.2 The Internet as an input into R&D activities

The present section is based on an action-oriented view of the usage of the Internet for R&D. It looks at separate steps of the research process and specifies where researchers use the Internet to carry out tasks related to their research work. For this purpose three different steps will be distinguished:

- Data collection and information retrieval,
- data analysis and technology development,
- publication and dissemination of research results.

We would like to stress that we do not assume an underlying linear model of R&D. Multiple relations exist between the three different stages and some loops may be necessary before a final research result can be produced. However, it is necessary to reduce this complexity for analytical purposes and we will therefore continue with this rather under-determined scheme of the research process.

Our analysis will concentrate on two issues: On the one hand it looks at the indicators that are used to measure and describe the usage of Internet technologies. On the other hand it investigates the effects of the Internet usage on R&D output, e.g. whether on-line data and information retrieval generates positive impacts on R&D. Such positive impacts could be an increase in researcher productivity, a decrease in R&D costs etc. Recent studies have shown that the use of the Internet among scientists is increasing.[39] In general it is assumed to improve the quality of research[40] though some problems are also mentioned such as the overwhelming quantity of information, its partially poor quality, the danger of plagiarism, the low speed of access and the large degree of commercialisation.[41] A positive attitude towards Internet applications, promotion of their further development and acceptance by R&D policy makers can only be justified, if positive effects can be confirmed.

3.3.3 The Internet as booster to long-distance collaboration

By harnessing the possibilities of the Internet the overall costs of communication will decrease and the demand for communication will increase in institutions which perform R&D work. Communication resources will replace other resources and the structures within organisations

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38 See as an even broader definition of ICT infrastructure in relation to R&D: Bainbridge, W. S. (1999): Information infrastructure issues in the social sciences, in: STI Review No. 24: Special Issue on "The Global Research Village". Paris, p. 124.

39 Cf. Lubanski, A.; Matthew, L. (1998). Socio-economic Impact of the Internet in the Academic Research Environment. Proceedings IRISS '98 International Conference: 25-27 March 1998, Bristol, UK. (http://sosig.ac.uk/iriss/papers/paper18.htm).

40 Ibid.

41 Cf. Day, J.; Bartle, C. (1998): The Internet as an Electronic Information Service: Its Impact on Academic Staff in Higher Education. Proceedings IRISS '98 International Conference: 25-27 March 1998, Bristol, UK. (http://sosig.ac.uk/iriss/ papers/paper06.htm).

will become more communication-intensive.[42] Of course, this increase in communication takes place within each single institution, university department, R&D corporation, R&D department of a private business enterprise, government research institute etc. This effect is included in the foregoing perspective which looks at how Internet technologies have affected different phases of R&D activities. The current perspective focuses on the effects of the Internet on the organisation of R&D activities and more specifically on the development of collaborative R&D. As various authors point out, and the results of empirical research confirm, the increase of R&D collaboration in recent years cannot exclusively be attributed to cheaper and faster modes of electronic communication, but they certainly belong to the factors that account for it.[43]

Additionally, the Internet has made a new type of R&D collaborations possible which depend on the electronic transmission of information. Instead of working together in one place or meeting frequently these collaborations access geographically distant resources, exchange data and information, carry out their analytical work and document the results by means of the Internet. They not only use the Internet but actually could not exist without it. Therefore it seems justifiable to distinguish these new Internet-based collaborations from other forms of R&D collaboration. Two new organisational forms have been documented in the literature: collaboratories[44] and virtual teams. Neither could exist without state-of-the-art research infrastructure such as high-performance computers, networks with high transmission capacities and a variety of computer and network tools. Collaboratories and virtual teams are very similar and sometimes the terms are used synonymously. In general the former is predominantly used in an academic environment and the latter in a private business setting.

3.4 Methodology

The basic problem that renders the development of indicators on the Internet and R&D difficult is a fundamental lack of statistical data. Statements such as the following are frequently found in the literature:

> *There was general agreement at the Conference on the broad tasks that governments will have to fulfil in order to maximise the benefits of ICT for science: … Develop internationally comparable indicators for a quantitative assessment of ongoing developments and performance, including return on investments in this rapidly evolving area. Diversity in the way each discipline, country and region views and is able to organise infrastructure, content and access seems to be the dominant characteristic in the evolution of ICT use in science, and needs to be measured.*[45]

Most indicators on R&D with international coverage are assembled and published by the OECD. Main Science and Technology Indicators (MSTI) is the most important database containing among others data on R&D expenditures, R&D personnel and patents. These indicators deliver useful insights into the inputs for R&D activities and their output, but they are

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42 Malone and Rockart state these as impacts of information technology in general on co-ordination costs, see Malone, T.W.; Rockart, J. (1992): Information technology and the new organisation, in: Proceedings of the 25th Hawaii International Conference on Systems Sciences, vol. 4, pp. 636-643.

43 See Walsh, J. P.; Bayma, T. (1996): The Virtual College: Computer-Mediated Communication and Scientific Work, in: The Information Society, vol. 12, pp. 343-363. - Smith, D.; Katz, S. (2000): Collaborative Approaches to Research. Fundamental Review of Research Policy and Funding. Final Report. The Higher Education Funding Council for England (HEFCE), pp. 27-28.

44 According to Finholt the term '*collaboratory*' was coined in the late eighties and is a hybrid of 'collaborate' and 'laboratory'. He also provides an early definition: "…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." Wulf 1989, p. 19 cited in Finholt, T.A. (2001): Collaboratories, in: B. Cronin (Ed.): Annual Review of Information Science and Technology, vol. 36. (also available at: http://intel.si.umich.edu/crew/technical_reports_alphabetical.htm).

45 From the summary of a OECD conference, Aubert, J.E.; Bayar, V. (1999): Maximising the Benefits of Information Technology for Science: Overview and Major Issues, in: STI Review No. 24: Special Issue on "The Global Research Village". Paris, p. 26.

not detailed enough to tell anything about the usage and significance of ICT. Yet they might serve as parts of an indicator or an index constructed for monitoring ICT usage, as they are functional to normalise and standardise the data and to eliminate the effects of a country's size. The same applies for publication and citation indices.

For finding out to what extent researchers make use of ICT for information search and communication, the easiest way would be to ask them directly. This might be done e.g. by means of an on-line survey, though this method entails a slight danger of introducing a bias in respect to ICT affinity. Another method for assessing ICT usage might be to analyse data on hits of important scientific websites, such as on-line databases, e-journals, or on-line stores for scientific customers. This method, of course, depends on the willingness of webmasters to make information on the provenience of their customers and users available. The same applies to international research associations which should be aware of important remote-controlled research instruments, large scale distributed computing or collaboratories in their domain. Some data on these issues is likely to be available on the Web. A survey on this topic should show how these activities began and what other applications of this technology might yield. Much of this information is likely to be anecdotal, rather than systematic, however.

All in all, it seems that especially qualitative information is relatively accessible and easy to come by, whereas for quantitative facts and figures a questionnaire-based survey of important stakeholders is indispensable.

4 Security and Trust

4.1 Framework for Assessing the Area

Individual concerns about privacy, security, and the use of information about their preferences and activities are an important barrier to the formation of an effective and broad-based information society. If individuals distrust sending the identifying or financial information over the Internet that is needed to complete transactions, the fraction of commercial and societal activities which can benefit from transition to the electronic medium will be significantly restricted. As a result, insufficient protection (or a perception of insufficient protection) of personal privacy and security in these systems is a potentially serious impediment in the development of the information society and, therefore, is important from the policy perspective.

From the viewpoint of the commercial sector, issues in this area are somewhat different. One of the main benefits seen by firms in the formation of an information society is the opportunity to use information about consumers to target their marketing strategies, understand their customer bases, devise new products, and improve the efficiency of their internal operations. If, for example, access to comprehensive information on individual preferences and purchasing habits allows a firm to precisely target its marketing campaign, it may be possible for the company to generate the same level of sales for a fraction of the cost of a "traditional" broad based marketing effort.

Acknowledging that security and trust are important issues in the development of the e-economy and the information society, *e*Europe documents state that "the market should, as far as possible, be left to determine the adequate amount of security for user needs." Without good performance indicators in this area, firms, security suppliers, and consumers will be unable to make informed decisions about the current or desired level of security and privacy.

4.2 Identification of the Stakeholders and their Interactions

Individual consumers stand out as a most important stakeholder in this area. Important data from their perspective include both their beliefs about the level of privacy and security protection that is desirable, and at the same time, their perception of the current level of protection provided by procedural, legal, and technological mechanisms. In addition, a significant number of organizations and coalitions are actively involved in this area that represent various aspects of consumer interests and concerns. Concomitantly, commercial firms in all business sectors – from purely Internet firms to the most traditional "Old Economy" companies – have an important interest in this topic. While the interests of firms and consumers often coincide in the area of security – since both groups gain from prevention of fraud or ICT mediated theft – their interests often diverge in the area of personal privacy and data usage. While firms are concerned about how these issues affect individuals' purchasing and consumption patterns, they also have legitimate concerns about how restrictions on the use of databases, information collection, and other ICT tools might affect their business and limit the economic benefit of the information society. A subset of firms, focusing on technologies such as encryption, smart cards, biometrics, or other protections, have shaped their business strategies around producing technological answers to these concerns. Regulators and policy-makers seek to balance these sets of competing interests in this area for the overall benefit of society-as-a-whole.

4.3 Statistical Measures and Variables of Internet

Indicators in the trust and security area could potentially be important information for both public and private decision makers. These indicators fall into the following broad categories which seek to cover the impacts of these issues on the development of the information society:

- Consumer perceptions about trust and security;
- Actual levels of security threat and security compromise that are occurring;
- Economic impacts of consumer concern about trust and security;
- Economic impacts of commercial practices which, while raising privacy concerns, promote efficiencies and generate economic profits;
- Economic impacts of ICT security breeches and penetrations for governments, firms, and individuals;
- Presence of the infrastructure and related products associated with increasing overall security and trust;
- Nature of all company practices addressing these issues; and
- Enforcement of government and company policies and practices addressing these issues.

Data about citizen perceptions about security and privacy issues surrounding both the Internet and the use of other information gathering technologies can be gathered through traditional survey instruments. Information on consumer perceptions about security, privacy and trust need to be complemented, as much as possible, with indicators of the "actual" conditions which exist in this area. These indicators could be based on the:

- Number of reported complaints of credit card fraud connected with ICT-mediated transactions,
- Number of reported identity thefts, and
- Number of hacking incidents resulting in theft of personal information.

While some of these data may be difficult to obtain because of legitimate concern of commercial firms about reporting information that questions their security practices, anonymous reporting schemes can be used to induce participation.

While assessing the economic costs and benefits associated with these activities are difficult, it is critical to support effective decision-making in this area. Without indicators to facilitate comparison of the economic benefits of broad commercial databases with the potential reduction in e-commerce generated by consumer unease about them, any conclusions will be speculative. Potential indicators of the value of these broad commercial databases of personal information include the:

- Sales prices of company data collections, and
- Company estimates of how their use has reduced the overall cost of their operations.

Potential indicators of the amount of e-commerce that does not occur due to consumer fears of on-line crime or loss of privacy include:

- Counts of the number of on-line purchases that are aborted at the point where personal or credit card information is requested to complete the transaction.

While some estimates of the economic costs of on-line crime and hacking do exist, better indicators need to be developed. The best possibilities involve working closely with the private sector to obtain specific information on their vulnerabilities or losses without revealing their specific identities. Other indicators could include the frequency and extent of virus releases or the frequency and impact of denial of service attacks on web sites.

The concerns of citizen regarding the general security of the Internet tend to focus on two types of infrastructure – (1) "barrier" technologies to mitigate privacy and security concerns and (2) legal/policy that restrict the offending behaviour or punish abuses in this area. Both of these activities are important indicators of how governments and social systems are addressing security concerns. In the technological area, potential indicators include the:

- Number of secure Internet servers in use,
- Amount of encryption or public key cryptography in use, and
- Use of identification technologies such as smart cards or biometrics.

In the policy area, potential indicators include the:

- Operative characteristics of company privacy policies,
- Options for preventing companies from changing their privacy policies,
- Options for preventing the use of data in ways counter to their stated policies,
- Legislative restrictions on the use and collection of personal information, and
- Specialized legal frameworks to detect electronic crime and address the special requirements for apprehending and prosecuting offenders in this realm.

In addition to considering the content of legal or policy frameworks, indicators should be developed to judge the effectiveness of implementation or enforcement of these requirements. Such indicators of effectiveness could include the:

- Success rates of prosecuting electronic crimes, and
- Success rates of both civil and criminal cases involving misuse of data.

4.4 Methodology

Surveys are not the most suitable research instruments to track patterns of diffusion and adoption since they only measure *perceptions* about the issue at hand, not the actual empirical magnitude of the phenomenon. The gap between perceptions and reality might be especially great when there is a lack of reliable, standardized public measures – yet it is especially in those cases that one has to resort to surveys.

Security and trust is a sensitive issue given the direct impact intrusions might have on sensitive data, be it personal privacy or strategic company information. The current lack of widely accepted objective measures might foster widespread feelings of distrust. The vagueness surrounding security and trust matters is reinforced by the inherent tendency of the two primal sources of direct empirical data, the 'victims' of cyber crime (e.g., banks with substantial operations over public networks) and the cyber crime fighters (suppliers of security & trust products and services), to respectively downplay and exaggerate the magnitude of cyber crime and its (financial) consequences.

Although perceptions are not a reliable proxy for the estimation of the actual occurrence of cyber crime they are important as a variable in itself since the behaviour of firms and consumers is based on their perceptions, not on the actual situation. A negative public image of the trustworthiness of the commercial Internet infrastructure is as much on obstruction to the uptake of e-commerce as the actual occurrence of cyber crime (see Figure 4.1)

Figure 4.1 – Conceptual Framework for Security & Trust Methodology

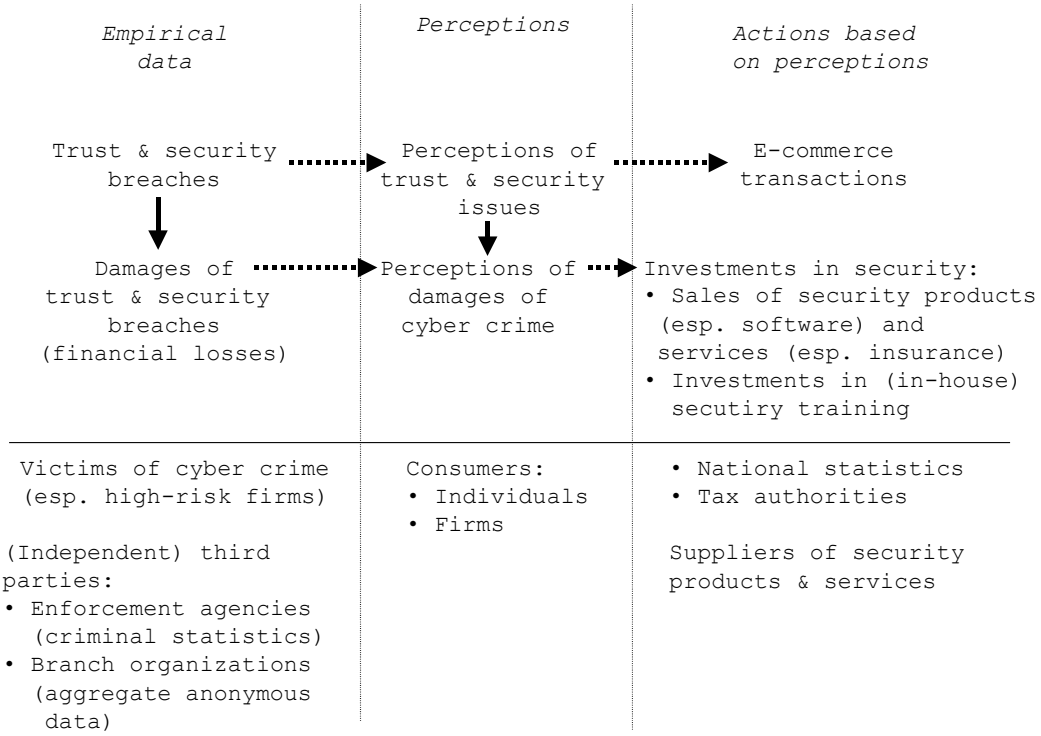


Figure 4.1 depicts each of the three types of variables that were identified in the analysis above. At the bottom of the figure are the main sources of information for that variable.

Victims of cyber crime are the most direct sources of empirical data on trust & security breaches. The actual discovery of cyber theft is severely hampered by the fact that there is no physical removal of the valuable asset. The copying of data is only known through ex post log files or through the subsequent (criminal) acts that are based on the stolen information. Even when firms are aware of the occurrence of intrusions, they are not inclined to share this information, considering the information as a potential commercial threat.

Given the sensitivity of the information, a 'pull' approach rather than a 'push' approach might be the most appropriate way to gather this type of data. That is, the analysis will be limited to those cases that are reported to third parties. These are either generic law-enforcement(policy) or mission-oriented (semi) governmental agencies or branch organizations.

In Europe, computer crime is generally regarded as traditional crime albeit committed with new, high-tech devices. Statistics on computer crime is naturally found as a subcategory in conventional crime figures. The category is based on a narrow definition of computer-related crime and does not include offences such as content-related offences (e.g., child pornography), copyright infringements etceteras.

In the USA, the view has emerged that computer crime cannot be analogised to traditional crime and that combating it requires discrete legislation and enforcement. Specialized mission oriented agencies (e.g., computer fraud agency) have been established which keep record on a broad range of computer-related offences. These are independent branch-specific clearing houses. They get around the confidentiality problem by recording and reporting intrusions only at an aggregate industry level so that cases cannot be traced back to individual organizations. These statistics are still based on reported, not actual, cases.

Most reliable coverage of actual occurrence of security breaches is done by specialized agencies (computer emergency teams) but their statistics are not based on geographical territories but on types of platform or intrusion. These data do not cover the *damage* that is caused by the intrusions. Intrusion is a wide-spread phenomenon but the opinions on the

magnitude of the financial losses that are born due to computer crime are very much dissented. Payments done by insurance companies might be the most reliable source of information in this matter (see below).

Insofar as surveys are meant to measure the perception of consumers with regard to matters of security and trust conventional attitude surveys will do. When perceptions are used as proxies for the actual occurrence of intrusions, respondents should be asked to give concrete quantitative estimates. Significant deviance in the estimates in a homogenous group of respondents points at a substantial gap between perceptions and reality.

The (potential) value of broad commercial databases of personal information is rather difficult to estimate. Generic data sets such as sold by commercial parties have a very different value to individual firms. Data on consumers is often 'embedded' in the organization and hence difficult to separate from the overall operations of the firm. Isolating the specific value of the data is a delicate matter as the value of the data itself might be limited. The price on the market that is been paid for generic datasets says more about the willingness to pay than about the inherent value of the product.

Security and trust is an enabler for about any of the areas that is covered by the *e*Europe Actions (e.g., electronic commerce, e-government). Trends in these areas (which are already documented by EuroStat in the Action Progress Reports) are an indication for the changes in the underlying drivers, such as security and trust. The main problem here is that security and trust is just one of the drivers and that the determination of the impact of a change in the variables requires a comparison of the actual with the potential magnitude of the behaviour (e.g., actual and potential number (and magnitude) of e-commerce transactions and payments over the Internet).

The demand for trust & security products and services is an obvious measure for the magnitude of computer crime. Referring to Figure 4.1, though, it must be noted that the size of the market for such products is based on the perceptions of consumers on the actual occurrence of trust and security breaches. Security firms thrive on the uncertainty that currently surrounds cyber crime. It is not in their interest to close or at least narrow the gap between perceptions and reality. Nevertheless, according to conventional (micro)economic wisdom in the long run the willingness to pay will be based on the actual opportunity costs that are saved by purchasing the products and services. The main category of security products is dedicated software (e.g., virus scanners, fire-walls). A difficulty here is that security features are often embedded in generic software applications (e.g., servers). There is however a market niche for secure servers. The number of SSL-licences sold is another measure. The OECD has world-wide figures on the number of secure Internet servers. Data on the trust dimension (esp. authentication) might be available from (commercial) providers for so-called trusted third party services (e.g., Verisign). This is however proprietary data and given the strategic nature of the data (and the limited number of players in this market) firms might not be willing to make the information public.

A last category is the investment in people. Accredited courses for computer security experts have been established but are still very much in their infant stage. The number of licensed security experts is a proxy for the supply of (and hence ultimately for the demand for) security products and services. Firms also spend considerable amounts of money on in-house security training. This kind of data can be gathered by means of surveys.

5 Education

5.1 Framework for Assessing the Area

5.1.1 Introduction

In this chapter we provide a brief outline of the major factors setting the policy context for current societal changes of relevance to the development and definition of new and additional indicators in the areas of education for the information society as a knowledge economy.

5.1.2 Background

In order to achieve the goals set out from the European Council's summit in Lisbon that Europe is to become the world's leading economy the central role of education in transforming education was highlighted in the Ministers' communication.

This transformation process is of a dual nature:

- On one hand the educational system will have to adapt to a knowledge economy both in terms of organisational settings, infrastructures and partnerships, pedagogy, curricula and teachers' qualifications.
- On the other hand users of education at all levels and ages will need to develop another mind-set moving from an instruction based understanding of education to a paradigm where the individual most likely will be expected to take a much larger co-responsibility for identifying and continuously developing his/ her skills basis in a variety of ways and settings. Like wise also firms and institutions are in the process of adapting to a business environment where skills and knowledge play a much more central role in overall economic performance.

Whether we talk about policy developments related to educational systems or the adaptation process of the individual, firms and organisations to living, learning and working in a knowledge economy – ICT is viewed as a critical enabler.

This constitutes the background for the development of new and supplementary indicators in the area of education.

Education is in this context understood as a formally institutionalised process of knowledge transfer and knowledge development, as supposed to informal learning arrangements taking place through various community of practice arrangements, on the job training and peer learning. Those processes will be covered in the workpackage.

Much of the policy debate on education for the information society has focussed on an extension of the definition of education in light of changes in from what has been defined from "*an old economy"* to "*a new economy".*

5.1.3 Keys to the Old and New Economies

The table gives a general picture of characteristics in the old and the new economy.

Table 5.1 – Evolutions of Issues in the Old Economy and the New Economy

ISSUE	OLD ECONOMY	NEW ECONOMY
Markets	Stable	Dynamic
Scope of Competition	National	Global
Organisational Form	Hierarchical	Networked
Organisation of production	Mass production	Flexible production
Key drivers of growth	Capital/labour	Knowledge/innovation
Key technology Driver	Mechanisation	Digitalisation
Source of competitive advantage	Economies of scale	Time to market, innovation
Relations with other firms	Single mover	Alliances and collaboration
WORKFORCE		
Policy Goal	Full employment	Employability
Skills	Job specific	Multidimensional (deep and broad foundation skills)
Requisite Education	A skill- A degree	Life Long Learning

Ref.: Atkinson R., *" The New economy Index " Progressive* Policy Institute, 1998

A trend in the new economy is that innovation cycles are getting shorter[46]. This means on one hand that all innovation and innovation related factors like human capital and education, skills and knowledge increases in importance throughout life expressed in the policy focus on *life long learning*, but it also means that the nature of demands for skills and knowledge changes with greater focus on construction of new knowledge as a central educational domain rather than primarily focusing on acquisition of existing knowledge repositories.

The following table points out some key differences regarding education in the industrial society and the knowledge society.

Table 5.2 – Key Differences Regarding Education in the Industrial Society and the Knowledge Society

	Industrial Society	**New Economy/ Knowledge Society**
Education structure	Learning of practical skills and factual codified knowledge. Separation of professional and practical skills. School/practical training dichotomy	Learning codified knowledge as well as constructing/ discovering new knowledge domains in areas of high innovation. Practice/theory dimensions change through experimentation, testing….
Education goal	Educated/trained for a specific job/trade. Profession concept	Acquire deep and broad competencies with a view to job and competence mobility in an unstable and ever changing job market
Teaching form	Instruction, practical training, classroom, institutional setting	Construction, discovery, simulation, analysis, evaluation in relation to different problems and realities – anywhere, anytime

[46] "The new Economy" working paper IPTS, Spain, 2000

	Industrial Society	New Economy/ Knowledge Society
Organisation of teaching/learning	Subjects class, institutions are the organising elements	Problem areas, multidisciplinary, multiple resources is the given context -
Teacher's role	Professional authority. Conveys knowledge	Supervisor, tutor, "devils advocate" guided learning towards enhanced autonomy
Didactical space	Teacher's responsibility: motivate and activate student	Student shares responsibility for the development of the learning trajectory.
Learning concept	Focus on teaching as communication of externally determined goals and institutionally codified knowledge. Learning as an individual process oriented towards learning skills and knowledge	Learning occurs in a context, in a continual process –discovery, experimentation.
Learning processes	Teacher responsible for reaching determined goals. Goals determined from the outside. Focus on results	Student and teacher co-operate to define and reach goals. Learning to learn is a central process goal.

Ref. Hanne Shapiro, "*Pædagogisk Grundlagsnotat*," Reform 2000, 1999, Danish Ministry of Education.

5.1.4 Lifelong learning

Life-long learning is regarded as formal and informal education within and outside the educational system throughout life, though primarily with focus on the period individuals are or potentially are engaged in the labour market. Though primarily argued from an economic point of view education is aimed at developing qualifications among citizens that go beyond technical ICT qualifications with focus on higher order skills to ensure employability and adaptability of the individual to the demands of a knowledge economy.

This characterises the basic philosophy in many national, regional and sectoral information society policies, for which reason education is not a task to be carried out by the educational system alone, but in various partnership arrangements.

Apart from the changes in everyday life and working life that derive from technology in itself, characterised by the Futures Project[47] ICT creates possibilities of developing new forms of educational settings and infrastructures.

5.1.5 E –learning

In the policy debates on the information society and knowledge economy E-learning is seen as an essential component through the entire educational system and in a life long learning perspective. And not only for acquiring ICT skills and with that also emphasis on new partnerships and new stakeholders at the educational scene. E-learning can be used as a concept for electronic, creation, retrieval, recreation and sharing and distribution of knowledge resources and education (real-time asynchronous) in a singular mode or collaboratively an distributed E-Learning creates new pedagogical opportunities, especially with broad band communications an mobile access devices as well as new roles and responsibilities for the educational stakeholders.

Another important area for the ICT educational level is the ability of the companies to internally enhance learning and development of competencies. However, this perspective will not be treated in this chapter, please refer to topic area 5 Work, skills and employment. Education in topic area 4 is delimited to pre-labour market education, that is education ranging from primary to tertiary school.

[47] Futures Final 2000, IPTS, Spain.

5.2 Identification of the Stakeholders and their Interactions

In this chapter we identify stakeholders and their interactions in the field of education.

With the changes in how education is provided through an increased use of ICT combined with the life long learning perspective on education the educational stakeholders are no longer limited to the public sector and the institutional school system alone. If the need for education and training in the information society can be described through the concept of life-long learning, it seems natural to regard every institutionalised and social context a person gets involved with through all stages of life as an educational stakeholder. This is of course a theoretical implication of the concept that needs delimitation, but still, a broad concept of stakeholders is useful to keep focus on the substance of life-long learning. To illustrate the need for a broader concept of stakeholders in education, there are numerous examples from the European Schoolnet in partnership with IBM [48], to an example from the United States that coming parents wish to create special learning environments for their unborn children. Companies have specialised in stimulating the development of creativity and learning capabilities of the embryo with music and sounds. Some kindergartens offer access to computers; ICT is integrated with toys in order to stimulate creativity and motivation to learn etc.

In the work with this topic area we will however use a bit more narrow perspective on stakeholders. The most important stakeholders are:

Table 5.3 – Identification of Stakeholders in Education

Policy makers	Supranational-, national, regional and municipality policy makers and authorities
The industry	Publishing industry as digital resource base or directly accessed by group Producers of educational software (IBM, Microsoft) Entertainment Industry (LEGO; Disney)
R&D	Both public and commercial research and development environments
Educational Institutions	Primary Schools Vocational Education Higher Education
Users	Pupils and students Teachers Family

The interest and motivation to learning about ICT is strengthened with access to a computer or other ICT devices. Not least the game industry, digitised toys as well as mobile phones seem to be a major driver in children' s interest in computers and ICT in a broader sense.
Apart from family and kindergarten as stakeholders, ICT education can be regarded as starting from primary school and throughout the entire school system. Some of the most important stakeholders in this respect are primary, secondary and upper secondary schools. In most of the EU countries, ICT is included in the curricula as an integrated part of the training in primary school. ICT is included in the curricula for upper secondary school in all of the EU countries except from Belgium, Holland and Italy in 1997/98[49] (see EURYDICE). It differs whether ICT is included as an independent element of the educational provision or as an integrated part.

Policy makers and administrative authorities put up the framework for learning in society by political visions and budgets. Political priorities decide the focus and form the effort put into ICT in education. As we have seen from the policy document review, ICT has a high priority in national action plans for education. The government decides the political framework for ICT education and ICT integrated with education. Administrative authorities with responsibility for

[48] http://www.eun.org

[49] See: EU Commission, Eurydice (1999/2000): Key data on education in Europe

the school system execute the action plans in collaboration with schools and education facilities.

Large commercial IT players such as IBM, Microsoft, Arthur Andersen are today collaborating with educational institutions, from primary school to corporate university, to develop new learning concepts. In the future we can expect that public-private collaborating becomes even more common.

Research facilities play a role in education too. The content of knowledge in education is kept up to date and developed by interaction between education facilities, schools, research facilities and companies. The quality and relevance of education is on the one hand dependent on the immediate usefulness for companies and on the other hand education must at the same time ensure innovation in companies based on new knowledge and competencies.

Teachers as promoters of knowledge are important stakeholders in education and many national action plans therefore have focus on developing the ICT skills of teachers. This applies particularly to teachers in primary, secondary and upper secondary school because of their responsibility to promote the basic attitude to ICT. This responsibility lies not only with the teachers, but also with the schools and administrative authorities.

Finally, the pupils and students are themselves of cause important stakeholders in education. Training and learning can only take effect if pupils and students want to learn and have the motivation for it. The family and the teachers take part in developing this basic motivation but just as important is the ability of *learning to learn* throughout life.

5.3 Statistical Measures and Variables of Interest

To be trained is to acquire new knowledge and competencies by learning. With this as a prelude for a definition of training and education, serving as an example, it becomes obvious that concepts like knowledge, competencies and learning are difficult to measure. A careful discussion of possible and relevant measure is needed and on tops of that a clarification of the depth and method of the measurements is useful.

The aim is to develop appropriate statistical measures and indicator for policy making at European level. Therefore, the question is how education can be measured and benchmarked. We will now examine which variables could be potentially relevant if viewed from the perspective of an individual, company or society.

From a societal or political perspective the purpose of education is to ensure an ongoing development of society and preservation of the welfare society. From a company perspective the purpose of education is to obtain changes in the achievement of goals. From the perspective of an individual the purpose of education is among others to obtain, develop or preserve employability. Thus, education has different motives dependent on the perspective and can be brought about on different initiatives. Education is supposed to create an effect, which is what we wish to establish a measurement for. However, the effect of education is different on different levels of analysis, which is why the potentially relevant variables are very different, too. Let us now briefly analyse the effect of education with an employed person acquiring new knowledge and competencies as a starting point:

➔	Education/training
Leads to	reaction from the employee
which leads to	learning
which leads to	changes in job behaviour
which leads to	changes in the company
which leads to	changes in achievement of goals of the company
which leads to	changes in (competition on) the market
which leads to	changes in society

Source: Inspired from Nils Asmussen (1996): Uddannelse, udvikling og evaluering.

For each of these levels one could state several relevant points of measurement for the effect of education and training. Note that the value of information inherent in the points of measurement is very much dependent on the perspective taken as a point of view. Also, the difficulties and expenses joined with establishing the measurements should be considered.

The levels interact with one another and one level cannot be regarded independently from the others, whereas the possibility of making causality probable between training and the effect of training is reduced through up the levels. In other words validity is an important challenge when we want to measure the effect of training and education.

As outlined in report 1.2. we can see from the policy documents reviewed, that some general goals for education can be pointed out. Those measures/indicators are:

- More computers in the schools
- More students and candidates with ICT training and education
- More students and candidates with basic ICT competencies
- More teachers with ICT skills and competencies
- Better access to virtual knowledge sources for students and teachers
- Development of high-quality computer-based training and distance learning
- Developing virtual networks between schools and between teachers

In order to measure the progress towards the knowledge society there is a need for statistical indicators on education and ICT. At this stage, the following main indicators are located in statistical documents from the Scandinavian countries, United Kingdom, the OECD and EU:

- The number of students graduated from ICT studies
- Availability of computers with Internet access, with multi-media facilities and in general, at different school levels (primary, secondary, graduate)
- The students' use of computers in schools, at home, elsewhere
- The schools use of electronic communication services (e.g. video conferencing)
- The purpose of the use (homework, play, etc.)
- The number of pupils/teachers with personal e-mail address
- The ICT budget
- The number of schools with a ICT development plan

In 2000 Andersen Consulting performed an analysis of the ICT readiness in three regions of Denmark[50]. This contains potential relevant indicators and can be thought of as a interesting starting point.

[50] *The ICT readiness in three regions of Denmark*, Andersen Consulting, 2000

In order to measure the ICT readiness in these regions Andersen has developed a model, which focuses on the citizens, the private sector, the public sector, and the educational sector.

The ICT readiness of the regions is measured with a frame model for behaviour, which contains six steps. The six steps are grouped into two, main areas; frame *conditions* and *network behaviour*. *The frame conditions* are regarded as citizens access to computers and their ICT skills. ICT skills are measured by the ability of the use of different Internet related software tools. The *network behaviour* is regarded as the activities performed by individuals or companies. The network behaviour is grouped into the following four types of behaviour:

- **Information**, which measures the level of information exchange via the Internet. E.g. search of information, news, marketing, and competitor surveillance.
- **Communication,** which measures the prevalence of Internet based dialogue, e.g. via e-mail, chatting, and advertising.
- **Transaction,** which measures the amount of trade or other transactions, e.g. banking.
- **Integration,** which measures the level of electronic coherence of Internet users, that is when data from one individual is automatically distributed to other individuals.

The model of Andersen Consulting widely applies to the area of education because of its useful distinction between conditions and behaviour. Also, the focus areas for measuring network behaviour in the Andersen model basically reflects the elements needed to be measured regarding the effect of education.

Inspiration from the Andersen model combined with our former discussions gives us at this stage some tentative suggestions to the focus of the development of statistical indicators on education.

As we can see from the already existing measures and variables they are mostly aimed at outlining the technological conditions under which education is performed in respect of the use and penetration of ICT in education. However, the effect of education on skills, performance and behaviour is in fact not covered in this framework. In the next section we will approach a methodology for addressing this dimension.

5.4 Methodology

It would be useful to develop statistical indicators, which aim at outlining and describing the use and effect of education on the relevant levels according to the discussion in the previous section. This development would be a qualitative and useful supplement to the existing statistical material in the area of education.

An important objective for education in information society is to develop the motivation and ability of the citizens to take part in society and contribute to the continuous development of the society. This takes on the one hand an adequate technological infrastructure (e.g. availability of computers and access to the Internet) for performing contemporary education and on the other hand it takes a sufficient level of the necessary skills among citizens. With an adequate technological infrastructure provided and a development of the ICT related skills of the citizens via education, the society eventually observes changes in citizen and company behaviour.

To be able to draw a more complete picture of the present situation and the progress to come, there is a need for both new and more sophisticated (detailed) indicators, such as:

- Teachers with ICT skills/competencies measured on different competence levels
- Programmes to upgrade teachers skills- holistic view (not only functional aspects of ICT)
- Whether ICT is an independent subject or also integrated in others subjects

- Programmes and materials available and skilling complexity (to train a specific skill versus development of higher order skills)
- Whether ICT is an integrated part of the training of teachers
- The number of computer-based training programmes and distance learning programmes addressed to public schools
- Educational portals available (target groups, content, pricing of these)
- Digital educational materials available for different subjects/ themes at different levels.
- Availability and pricing of networks/infrastructures for educational purposes
- Publicly funded and documented multidisciplinary research on ICT and Education in its broadest sense (user behaviour, cognitive advantages, usability, design issues in relation to learning paradigms)
- Publicly available sites that certifies digital educational material, sw, and programmes for educational purposes
- The use of computer-based training programmes and distance learning programmes
- The quality (speed, age) of computers or Internet access

Possible areas can then again be defined at different levels:

- Use of technology as a tool (specific applications)
- Use of technology in creative processes
- Use of ICT for analytical purposes (forecasting, statistical analysis….)
- Use of ICT for collaborative purposes
- USE of ICT for information purposes (retrieval, analysis….)
- USE of ICT in communication
- Use of ICT for integrative purposes

We propose a methodology, which focus on:

- **Technological conditions**: The technological conditions and infrastructure for performing education, measured on variables such as:
  - Integration of ICT in curricula on school levels spanning from the primary to the tertiary level
  - Availability of computers and Internet access in schools, universities etc.

The effect of education under these conditions we propose to address by the following areas:

- **ICT qualifications and ICT readiness**: The readiness of the citizens to take part in information society, e.g. measured on variables such as:
  - Ability to use relevant ICT tools
- **Citizen and company behaviour:**
  - Information
  - Communication
  - Transaction
  - Integration
  - Collaboration
  - Creativity
  - Tool
  - Analysis

Developing and operationalising this tentative framework is now needed.

6 Work, Employment and Skills

6.1 Framework for Assessing the Area

The domain explores how information society developments affect supply and demand of human skills, how these interact with forms of work organisation and employment patterns, and in which ways information and communication technologies (ICTs) act as enablers and shapers of change. The concept and idea of new ways of working has been described as a new paradigm. It is necessary to conceptualise this paradigm shift in sufficient detail so that the underlying developments can be mapped using existent statistics (as well as fresh data where necessary). Tackling this task has only just begun. SIBIS will build on the work that has been done in this area. It will develop additional or modified indicators and ways of gathering the adequate data, with the aim of contributing to a better statistical representation of the shift in paradigm that is associated with the dawn of the information society.

Skills can be conceptualised as the necessary basis (precondition) for the productive deployment of individuals in the production process (application) which in turn creates the foundation for employment (work outcomes). The information society brings with it a new relationship between skills, work and employment, and new requirements which have to be met by

- individuals, to stay competitive on the labour market and to choose a way of working that maximises personal benefits;
- companies, to adapt the deployment of the factors of production, in particular labour, to current market environments; and
- the state, to provide services and regulatory frameworks that support employment structures that serve the public welfare.

6.1.1 Skills

A central characteristic of the information society, as well as all societies, is the need to apply knowledge and skills efficiently and effectively. In the information society, these requirements focus on general skills needed to make use of ICTs, as well as the specialised, technical knowledge needed to compete in increasingly knowledge-intensive industries and activities. We define skill broadly, as "a learned power of doing something competently"[51].

New **skill requirements** follow from the concept of the Information Society for a number of reasons:

- The technology that underlays the information society, namely ICTs such as the Internet, itself forms an industry of considerable size; companies that operate in this industry depend on the availability of skills that are in line with the dynamic requirements of the market. As in other industries that rely to a great extent on innovation as their main driving force, specific skills that have been acquired in the past are in danger of becoming obsolete extremely fast; they are constantly being replaced by new skill requirements.
- The nature of ICT-related innovation implies that ICT are a basic technology that affects the foundations of the whole economy in one way or another. It impacts on all economic sectors, as ICTs are applied throughout the economy to increase productivity and enable innovation. Consequently, ICT-related skills are in demand in all companies, either as specialist skills for the operation and maintenance of ICT equipment, or as user skills for applying the technology to support the aims of the organisation.
- People (as citizens or consumers) need skills in using ICTs for them to be in the individual as well as public interest. These skills are not directly related to the competitiveness of companies, but the reality shows that companies benefit from domestic markets in which they can test their products in. The more advanced a population is with respect to the

[51] Source: Merriam-Webster Collegiate Dictionary

availability of ICT user skills, the better the conditions for companies that sell innovative ICT-related products.

- The application of ICTs has also affected the demand for skills that are not related to ICTs themselves. These indirect effects result, in particular, from the shortening of product life cycles that is being enabled by technology. The intensity of research and development associated with creating new products has steadily increased. Competitive forces are bound to lead to a further acceleration of the process of translating innovation into marketable products and processes. As new products and processes are associated with new skill requirements, skill life cycles, too, have shortened and will decrease further in the future.

Whether ICTs are the focus of the job or facilitate it, whether the job is inside an industry that produces ICTs or in an industry that uses them, new skills will be needed by the workers who perform the work. The increasing speed with which market environments change with regard to technology, the structure of the economy and the regulatory framework, have affected the role of skill requirements in the society at large as well as at the personal level.

The **provision of skills** must be adapted to account for changes in skill requirements. Traditionally, basic skills and qualifications that are necessary to compete in the labour market were acquired in the stages of formal education in school, vocational training, universities, gradual schools, etc. These set the ground for the following stage(s) of gainful work. In the information society, training and working must to some extent take place in parallel, interacting with each other.

The shortening of skill life cycles has resulted in skills 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 but have to constantly adapt them to the demands of the labour market. This belief is behind the concepts of Lifelong Learning and Continuous Training. Distinctions between education and work become increasingly blurred. Education needs to become a life long pursuit for virtually everyone. Ideally, skills would be acquired and refined throughout the decades that one is participating in the labour force, rather than during the two decades or so that precede the active adult work life.

Lifelong Learning has become a top priority in the context of employment, especially since the Lisbon Summit. This becomes evident in the Employment Guidelines 4 and 5 on the issue of "Developing skills for the new labour market in the context of Lifelong Learning." In line with the EU we define Lifelong Learning as

> *encompassing all purposeful learning activity, whether formal or informal, undertaken on an ongoing basis with the aim to improve skills, knowledge and competence*[52]

Lifelong learning activities often take place outside of the formal education and qualification system. They require that private education and training systems (e.g. company-provided training) are put to best use. Additionally, the role of universities has to be extended into the provision of Lifelong Learning services. Training may occur as workers transition from one position to another. Training must also occur for workers who remain in the same position. There is a need for significant efforts to be put into training of existent staff, because acquiring new skills through new recruitment on the labour market involves high transaction costs and the loss of tacit knowledge embodied in existent staff; it is also made difficult when skill shortages exist in the labour market.

ICTs are not only a major cause for new skill requirements, but they also provide solutions for meeting them. For example, the training may make use of the Internet to substitute or supplement traditional training. Such a case is distance learning or *eLearning*, where training that traditionally would have occurred in a classroom takes place via an ICT link. eLearning can help meeting the challenge posed by the Information Society: "A requirement that cuts

[52] Proposal for a Council Decision on guidelines for Member States' employment policies for the year 2001, p.3.

across all education settings is the need to significantly improve the efficiency of the learning process and thereby control the cost of an exploding demand for education and training"[53]. SIBIS will also have to map developments in the application of eLearning technologies.

To distinguish this topic from Education (Topic 4), the discussion on skills in this Topic Research focuses on the

> *acquisition of employment-related knowledge and skills after the (mostly uninterrupted) pre-work phase of education (usually consisting of nursery, primary and secondary school, and maybe vocational training, gradual school or university, etc.) has been completed.*

According to this understanding, Topic 4 (Education) deals with institutional structures and activities of education which prepares individuals before entering the labour market for the first time, while Topic 5 (Work, skills and employment) deals with activities that take place after entering the labour market, either inside or outside of employment relationships.

6.1.2 Work and Work Organisation

The concept of work according to the understanding of social scientists as well as the general public has changed. This change has occurred along the following dimensions:

Working time*:* This includes the variables

- average working time per day, month, year, etc.;
- working time distribution across daytime, week, months, etc.;
- working time variability (which might be attuned to the demands of business, e.g. shift work, or to the preferences of workers, e.g. flexitime).

Working place: All types of telework are examples for changes that concern the spatial/locational organisation of work. Tele-cooperation, where the location of work stays more or less the same but the spatial organisation of teamwork and collaboration is geographically extended over IT networks, is another example.

Type of contract: This refers to the contract that underlays the relationship between worker and the organisation that utilises the work products, e.g. a contract of employment or a contractor/client-relationship that is based on self-employment. Differences in the duration of employment contracts affect average job tenure. Moreover, the contract defines the extent to which compensation is based on the input (working time) or the output (productivity) of work.

Applied skills (work content): The skills workers apply in the production process define the content of their work (and vice versa). Work content has been hugely affected by the increasing 'informatisation' of work and changes to the variability of work tasks and access to work-related decision making. The latter is often discussed among the header job enrichment and job enlargement.

These dimensions are not be understood as being mutually exclusive, as multiple relationships exist between them. Due to the complexity of flexibility developments on hand, it is also not appropriate to try to draw a clear line between 'traditional' and 'new ways of working'. Rather, a more useful approach is to think of jobs as being classified along a number of spectra/dimensions.

There is a widespread consensus among researchers that, although change tends to be gradual by nature, two distinct periods can be differentiated with regard to dominating social concepts of work in recent times. The first is the post-WWII period of relative stability, the second is the period of economic restructuring that began in the first half of the 1970s, with an

[53] European Commission, DG XIII: Technologies for Knowledge and Skills Acquisition. Proposal for a Research Agenda. January 1998.

additional push in intensity in the 1980s and 1990s enabled by ICTs. Both periods where accompanied by what we want to call a work paradigm, i.e. a consensus about how work had to be 'properly' organised and supported by the socio-political framework. We call these the 'post WWII work paradigm' and the '21st century work paradigm'. At the core of the 'post WWII work paradigm' is what is called the 'regular employment relationship', typical elements of which are full-time, permanent jobs with a contract of employment, even and stable distribution of working hours over a fixed number of days per week, and long job tenures.

It is important to note that we talk about paradigms here, i.e. models with a strong normative component which do not necessarily reflect reality in an adequate way. 'Regular employment relationships' have never been as widespread in the decades after WWII as the term implies. Nevertheless, these paradigms are of exceptional importance because labour law and the regulation of social security standards tend to be based on them.

In general, the transition from the previous to the recent paradigm is characterised by developments toward greater flexibility of labour deployment. A changing economic environment together with shifts in social attitudes and the widespread application of ICTs are believed to have resulted in greater spatial, contractual and temporal flexibility, shifts towards more self-provided social security provision, the need for multi-tasking and significantly more dynamic (social) skill developments. ICTs are enablers of change but they do not predetermine outcomes. They do not e.g. push labour markets towards specific configurations, but open up new possibilities for organising work. The way ICTs are applied to change the organisation of work is to a great extent dependent on the bargaining power of employers vis-à-vis workers, and on regulation by the state.

SIBIS takes a normative view on new ways of working. We are interested in models of work organisation that harness the potential of ICTs to reconcile the interests of workers and employers by allowing greater flexibility for *both* groups of actors.

Against this background, new ways of working in the information society are for this research defined as

> *those work forms which divert from the post-WWII work paradigm and/but which are made economically as well as socially feasible by the use of ICTs.*

The latter part of the definition acts as the major way to differentiate new ways of working against traditional atypical work forms such as shift-work and piece-work in manufacturing and self-employment in retail, small trade and the primary sector.

SIBIS research into mapping new ways of working in the information society will be structured along the dimensions of change towards greater flexibility, as outlined above: working time, working place, type of contract, and applied skills. We believe that all major parameters of the change in the organisation of work can be captured using this framework.

6.1.3 Employment

Employment is the outcome of the labour market procedures that translate skills into work. Whereas skills and – at least in most cases – work are not ends in itself, employment is the socially accepted system through which the capabilities, preferences and needs of individuals are brought to a match. Ultimately, the impact of ICTs on skills and the organisation of work have to be measured according to their contribution to the goal of socially and individually satisfactory forms of employment.

Accordingly, SIBIS should collect and, where necessary, develop indicators for measuring the **outcome** of changes in the ways of working at the **individual** as well as the **aggregate** level. Job satisfaction, for example, is an outcome of work at the individual worker's level that has to be monitored to be able to assess the sustainability of working arrangements. It is matched by productivity which is a indicator of the suitability of working arrangements from companies' viewpoint. Employment rates are an examples for indicators that measure outcomes at the aggregate level.

There have been numerous attempts to conceptualise and measure the contribution of ICTs to trends in the structure and size of employment, with varying degrees of success. Basically, a number of correlations between ICTs and the level and structure of employment exist:

- the production of ICTs creates employment opportunities;
- the application of ICTs:
  - changes production processes inside of companies;
  - affects the processes of transaction between companies;
  - makes possible new means of distribution;
  - enables new ways of managing labour on company level;
  - enables new ways of regulating employment by the state.

All of these have manifold implications for the structure and overall level of employment, and also on macro-economic variables that measure economic activities and output (which in turn influence employment).

A better understanding of the correlation between ICTs production and application and effects on employment is needed to guide policy making on EU and Member State level. SIBIS will discuss ways how to gather the data that is required for such analysis.

Recent research has confirmed that tackling skill mismatches on the labour market implies that it will not be sufficient to train the current labour force, and to qualify tomorrow's new entrants to the labour force by providing adequate education. It will also be necessary to tap *latent* labour supplies. Therefore, measuring the extent of skill supply and demand at present and, in particular, projections and estimates of their future development need to take into account a differentiated view at labour market participation. For these reasons, all indicators to be developed to measure ICT-related developments in employment patterns will have to allow for differentiation, especially with regard to gender.

6.2 Identification of the Stakeholders and their Interactions

The main stakeholders in this topic are:

- Employers: Employing organisations form the demand side in the labour market. As such, they translate their labour deployment requirements into demand for types of workers regarding specific skills, location, temporal availability, etc. Bargaining between employers and workers will to a large extent determine the diffusion and actual configuration of new, flexible ways of working. Additional to the open labour market, internal labour markets are of prime importance, especially concerning the creation of skills among the existent workforce. Internal and open labour markets interact in cases when new skills are required. In such a situation, in principal two options are available; first, acquisition of skills by recruiting new workers on the open labour market; second, development of skills by training existent staff.
- Workers: The aggregated capabilities and preferences of workers constitute the supply side of the labour market. New skills are constantly added to the open labour market by new entrants who have just finished their education, by inflow of foreign workers, by training measures through which unemployed should gain skills that are in demand, and by self-learning activities of job-seekers. People in work gain skills informally through their everyday working experience, and/or formally through employer-supplied training or training measures provided by third parties.
- Public regulators in the field of employment policy: The state takes a central role in the labour market by creating the framework in which labour can be traded between workers and employers. Many observes think that state intervention is to a large extent responsible for the differences in the performance of labour markets between the Member

States of the EU, and beyond. This applies, in particular, to the speed and nature of the diffusion of atypical ways of working, including ICT-enabled work forms.

- Social partners and other non-government regulators: Traditionally, social partners play a major role in national employment policies in the EU. The results of the collective bargaining process have far-reaching implications for work organisation. In particular, attitudes towards the application of ICTs and new ways of working influence decisions taken on the company level and thereby can significantly affect the diffusion process.
- Providers of educational services: Companies and educational institutions run by the state or by private bodies such as unions and professional associations will provide services for formal education. They will be paid for by the state, employers and/or the recipients.
- Providers of educational technology: Using ICTs for education offers huge potentials. The technology is developed and marketed by software firms specialised on eLearning products as well as traditional suppliers of teaching aids who transfer their content to the digital domain.
- Users of educational services: Private citizens, workers and unemployed participants of the labour market, as well as companies and other organisations are the primary consumers of training programs. In general, training the unemployed and the youth is the responsibility of the state, while individuals who hold positions in companies are trained by their employer.
- Regulators in the field of education: Education is regulated by government on EU, national country, regional and local level; the division of power over policy making in this field differs strongly between EU Member States. Regulation will probably be required to ensure that training paid for by public bodies provides real value, and to ensure that private sector training activities serve the public interest (in particular with regard to the access of disadvantaged labour force segments to training and education).

6.3 Statistical Measures and Variables of Interest

In the new section on "horizontal objectives", the Employment Guidelines 2001 address (as one of the five objectives described) the need for quantitative indicators:[54]

> *"The Member States and the Commission should strengthen the development of quantitative common indicators in order to evaluate adequately progress under all four pillars and to underpin the setting of benchmarks and the identification of good practice. The Social Partners should develop appropriate indicators and benchmarks and supporting statistical databases to measure progress in the actions for which they are responsible."*

The SIBIS project should try to serve this explicit demand for indicators in the area of work, employment and skills, but keeping in mind a clear focus on developments that touch on the impact of ICTs and the Information Society. In order to do so we suggest to use the "four pillars" of the EU employment guidelines as a help to identify and select indicators for which the supply of data would provide high value for the EU policy making. These four pillars are:

- Improving employability (I)
- Developing entrepreneurship and job creation (II)
- Encouraging adaptability of businesses and their employees (III)
- Strengthening equal opportunities policies for women and men (IV)

[54] EC (2000): Employment Guidelines 2001. Proposal for Council Decision.

6.3.1 Improving Employability

Inside of this pillar, three topics have special relevance for SIBIS: (State-provided) Lifelong Learning, the development of skills related to the Information Society, and policies to improve the efficiency of job matching.

Indicators that measure (state-provided) *Lifelong Learning* activities are not well covered by official statistics. Currently, the major official indicator for Lifelong Learning is the participation rate in training activities. The Labour Force Survey by Eurostat measures "participation in training and education activities during the last four weeks". This indicator adequately maps participation in formal, full-time training schemes, targeted mostly at unemployed persons. However, it is based on the traditional assumption of a succession of phases which are either dedicated to learning or to working. As the concept of Lifelong Learning stresses the need to do both, learning and working, in parallel, new indicators for measuring learning which is only a secondary activity need to be developed, also including training that is neither provided by the state nor by companies but by individuals themselves or by other institutions. Example for indicators include:

- self-learning activities, differentiated according to types of skills acquired;
- participation in training as a secondary activity, in parallel with employment (see discussion of pillar III below);
- participation in training that is provided by non-state, public institutions such as unions, church organisations, self-help groups etc.

The best (and maybe only reliable) way to gather data for these indicators appear to be surveys targeted at the general population. Surveys that only include individuals not in paid work might also collect much of the data possible, but Lifelong Learning activities inside of employment relationships have also to be covered (see Pillar III).

Very often there is mention of eLearning schemes that make use of ICTs to efficiently deliver training services to recipients. Indicators that measure the availability of such services and the reach, frequency and intensity of use must be developed. A more in-depth analysis should also identify

- the types of skills that lend themselves to Internet training,
- the use of the Internet for synchronous teaching across long distances (see also SIBIS Topic 4),
- the use of the Internet for individualised teaching,
- the use of the Internet to meet the specific training needs of the (long-term and hard-to-place) unemployed.

There are reasons to believe that eLearning technologies can be efficient only for a limited share of training tasks. As long as there is no deeper knowledge of the spread and success of existent eLearning schemes and technologies, their value for the objective of boosting Lifelong Learning will remain uncertain[55].

Indicators to measure *Information Society skills* need to show how well individuals, as workers or job-seekers, can function in the electronic society. Digital literacy is an essential element for the employability and adaptability of the general workforce. But concepts and data for "digital literacy" are only poorly developed, so far. Which skills do employees need to get a job, how do they acquire these skills and how wide-spread are they currently? Information Society skills with relevance for our Topic consist of

- technical skills,
- communication skills,
- skills in acquiring and using information,

[55] see Footnote 53.

- self-learning and self-assessment skills,
- participation skills (i.e. skills in exerting influence on information society policy).

A basic indicator would be the share of the workforce with basic computing skills. A more detailed indicator would also examine the level of proficiency in specific ICT related skills. Possible indicators include:

- percentage of workers able to complete specified technical tasks, such as using e-mail, using a browser, creating webpages;
- percentage of workers who communicate with friends/colleagues/business contacts/etc. via electronic media;
- percentage of workers who can know how to find specific information on the Internet, and how to assess and use it;
- percentage of users who know about political participation rights and possibilities on the Internet.

A specific issue within this topic is the widely discussed "skills gap", i.e. the unsatisfied demand for ICT specialists. Market research organisations, especially IDC, have started to calculate the size of the skills gap, i.e. to assess the demand for and supply of ICT specialists needed in each of the EU Member States. Resulting statistics have been published recently in a special section of the EITO Report 2001. There is a need for alternative projection based on different assumptions, as results tend to be heavily influences by a small number of assumptions about which there is not always much consensus.

The Internet opens up new possibilities to improve the efficiency of *job matching*. 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. Hardly anything is known about the degree to which these Internet-based services have made matching more efficient and more effective, and how job-seekers and recruiters use them in combination with traditional channels of communication.

6.3.2 Developing Entrepreneurship and Job Creation

This pillar is only of low direct relevance for our Topic. A question of some importance concerns the extent of employment in industries that supply ICTs and, in particular, the role of start-ups and SMEs in these industries. Data for research into these issues is largely available, but has often not been analysed in sufficient detail.

6.3.3 Encouraging Adaptability of Businesses and their Employees

This pillar concerns the organisation of work in companies and thereby touches upon a large number of organisational innovations that have been made possible by ICTs. It also touches on the issue of Lifelong Learning insofar this takes place inside of employment relationships, i.e. in parallel with working (either as a supplement, or as an integral part of the work itself).

A key word here is "modernisation of work", which is also one of the three main challenges listed by the *e*Europe Action Plan. The concept of modernisation, however, does not lend itself easily to measurement as operationalisation requires a clear consensus about what 'modern' means. Currently the objective is only described in vague terms and clearly lacks appropriate indicators. Guideline No. 14 indicates the following concepts to approach this objective (for instance):

- "flexible working arrangements"
- "achieving the right balance between flexibility and security"
- "increasing the quality of jobs"

- "Subjects to be covered may, for example, include the introduction of new technologies, new forms of work (e.g. telework) and working time issues such as the expression of working time as an annual figure, the reduction of working time, the reduction of overtime, the development of part-time working, and access to career brakes".

There is a clear lack of concepts how to monitor and measure the changes in the way work is accomplished in the information society. Occasional studies such as ECaTT focus on certain aspects, quite often those which are well 'visible' such as teleworking. The Eurobarometer survey asks for uses of computers at work. More efforts and additional indicators, based on a well developed conceptual understanding of the developments that underlay change in this area, are needed. Changes in the structure and mobility of the workforce need to be examined and measured. These include:

- changes in work content, i.e. time devoted to specific activities,
- working time variability and interrelationship with spatial flexibility (telework),
- proportion of the workforce engaged in ICT-related work settings such as tele-cooperation,
- intensity and daily organisation of telecommuting,
- changes in the length of time people work at a particular company (job tenure), and
- practice of outcome-related compensation models.

Continuous training at the place of employment is a point mentioned in the Guidelines. We need indicators that map (formal as well as informal) training activities that take place in parallel with work and that are provided by employers. Another set of indicators should deal with eLearning schemes in companies, as eLearning might allow them to efficiently provide continuous training to workers at their workplace.

Whereas companies will increasingly be asked to provide continuous learning for their employees, they also have to take care of organisational learning, i.e. knowledge management on the company level. Only if organisations are able to systematically preserve and exploit the know-how of their workforce will they be inclined to invest in training activities. Therefore knowledge management has a close relationship to Lifelong Learning and should be adequately mapped using statistical indicators.

Finally, data that not only maps the spread of flexible work practices, but also worker's satisfaction with them and effects on the quality of jobs, is still scarce. It is badly needed if policy makers want to make sound decisions about which ways of working should be supported and which should be deterred.

6.3.4 Strengthening Equal Opportunities Policies for Women and Men

The EU Employment Guidelines mention gender mainstreaming as a major objective of employment policies. Mapping Information Society developments must take into account gender differences in access to and use of ICTs. The best way to monitor the relationship between Information Society developments and gender issues in our Topic appears to be to seek for statistics that allow for gender differentiation throughout our indicator development work.

This pillar also stresses the role of arrangements that reconcile work and family life, as a measure to improve women's position in the labour market. ICTs can help meet this requirement, e.g. by making possible different types of telework. However, care must be taken not to generalise from instances in which ICTs have benefited those who have to reconcile work and family life. There is also evidence of ICT-supported work forms that may turn out to be harmful to gender equality insofar that women are represented above-average in them, such as some call centre employment.

Although this pillar explicitly mentions only gender disparities, opening up the Information Society for all also implies the need to monitor the extent to which groups on the margin such

as the disabled, immigrants, 'late life' learners and other learners with special education needs participate in the Information Society. This, again, can best be achieved by providing data that allows for disaggregation and in-depth analysis of smaller subgroups. In particular, the methodology for data gathering must be checked to ensure that margin groups are not systematically misrepresented in the sample drawn (as would be the case e.g. in Internet user surveys).

6.4 Methodology

The following table gives an overview of

- how indicators in the Topic 'work, skills and employment' can be categorised,
- how they relate to the four Pillars of the EU Employment Guidelines,
- what the role of ICTs in this category of indicators is,
- and what methods we suggest to gather data in cases where gaps in data coverage exist which in our opinion have to be filled to allow for proper analysis of developments regarding the four pillars of EU employment policy.[56]

Table 6.1 – Overview: Statistical Coverage of Topic "Work, Eemployment and Skills"

Thematic area			Suggested sub-domain	Relevance for EU Employment Guidelines Pillars	Role of ICTs	Suggested methods of data gathering
SKILLS	WORK	EMPLOYMENT				
			Skill provision			
			• Acquiring Information Society-related skills	Pillar I	ICT as tool for teaching skills (eLearning)	inventory of training schemes; representative population survey; survey of organisations in education sector
			• Lifelong learning inside of employment relationships	Pillar III	ICT as enabler of Lifelong Learning; eLearning	representative population survey; representative business survey
			• Lifelong learning outside of employment relationships	Pillar I	ICT as enabler of Lifelong Learning; eLearning	representative population survey
			Skill requirements			
			• Skills gap for professionals in ICT	Pillar I	skills needed are directly related to ICT	scenario development; surveys of companies
			• Skills needed for Digital Literacy	Pillar I	skills related to ICT	expert survey; stocktaking of past research

[56] The suggestions for structuring the topic in this overview are preliminary. It will be finalised in WP 2.

			Applied skills/ Work content			
			• Informatisation of work	Pillar III	ICT as major components of work content	representative population survey; in-depth analysis of existent data
			• Access to decision making (job enrichment, job enlargement)	Pillar III	Flexibility enabled by ICTs	representative population survey; survey of HR managers; business survey
			• Variability of work content	Pillar III	Flexibility enabled by ICTs	representative population survey; survey of HR managers; business survey
			Time of work			
			• Average working time	Pillar III	no direct	representative population survey; business survey
			• Working time distribution	Pillar III	Flexibility enabled by ICTs	representative population survey; business survey
			• Working time variability	Pillar III	Flexibility enabled by ICTs	representative population survey; business survey
			Place of work			
			• Flexible work locations (e.g. home-based telework)	Pillars III, IV	Flexibility enabled by ICTs	representative population survey; business survey
			• Tele-cooperation	Pillar III	Application of ICTs for collaboration	representative population survey
			Contract of work			
			• type of contract (employment status, duration, etc.)	Pillar III	ICT is an enabler of atypical ways of working	existent data to be supplemented by additional data e.g. on voluntariness; representative population survey
			• outcome-related compensation	Pillar III	no direct	representative population survey; business survey
			• job tenure	Pillar III	no direct	in-depth analysis of existent data; representative population survey
			Outcomes on individual level			
			• Job satisfaction	Pillar III	effect of ICT-related new ways of working on job satisfaction	in-depth analysis of existent data; representative population survey
			Outcomes on aggregate level			
			• employment / unemployment rates	all Pillars	analyse effect of ICT on overall employment	existent data sufficient
			• employment by sector	all Pillars	analyse effect of ICT on employment in sectors	existent data sufficient

			• employment in ICT-related start-ups	Pillar II	ICT directly contributes to new employment	survey of start-ups and new enterprises; in-depth analysis of existent data on start-ups
			• Productivity	all Pillars	effect of IT investments on productivity	existent data sufficient

7 Social Inclusion

7.1 Framework for Assessing the Area

7.1.1 Summary

The sections to follow deal with the setting boundaries for the domain of social inclusion and the Information Society or popularly referred to as e-inclusion. It follows on from the initial framework establishment undertaken earlier, and builds on identifying the main issues pertinent to this topic. Thus the main stakeholders in this area are identified. Next, statistical measures and variables of interest are reviewed, based on focusing on some particular stakeholders and related interactions. The chapter concludes with a review of relevant methodological issues.

7.1.2 Setting the Topic Framework

At the outset, it is useful to acknowledge that the framework setting exercise for the Topic inevitably has been influenced by some aspects arising from the wider area o social inclusion in general. Thus some existing theoretical background, concepts and even indicators in relation to social inclusion in general are often 'transplanted' on the topic of e-inclusion, given their continued relevance. Hence even predispositions to view divisions in relation to the Information Society as been just an extension of divisions from "pre-Information Society", i.e. with just another added dimension to general social inclusion agenda being access to, and usage of, information and communication technologies (ICTs). It is contended that while keeping the relevant issues from general social inclusion area in mind, the best way to approach e-inclusion is to seek to highlight the issues that identify it as a stand alone topic in its own right.

The framework is then structured in the way that offers a multi-perspective view on this complex topic. The framework sought to intergrate relevant contemporary issues - perspectives on digital inclusion, arising mainly from the research conducted into this area, together with the policy concerns and arising actions, actions that are undertaken and / or being planned.

Indeed, considering the topic from various (albeit related) perspectives has proved to be necessary in order to capture it in more depth. Accordingly, it has been suggested that the area of digital inclusion can be observed from the four relevant perspectives. These are:

- Continuity and concurrence regarding social inclusion and inclusion in the Information Society (e-inclusion), perspective
- Perspective on ICTs as enabling tools, 'malleable' perspective
- Perspective on opportunities and threats focusing on e-inclusion barriers, and
- E-inclusion and interactivity perspective

Thus, the first perspective is the one acknowledging the relevant elements of certain *continuity* with general social inclusion area. Another way of labeling this perspective could be the concurrence of social inclusion and e-inclusion. In this aspect it can also be seen as conceptually similar to the approach taken in most of the existing studies (e.g. Eurobarometer studies, US Department of Commerce Falling through the Net studies, etc.). It as such represent the main departure point for the Topic investigation.

The second perspective is concerned with attempts to promote usage of ICT tools and applications as a mean for, and with the aim of, improving the position of those already disadvantaged (in terms of general social inclusion). This perspective then assumes technology to be somewhat malleable , while its usefulness as a policy tools also comes into play.

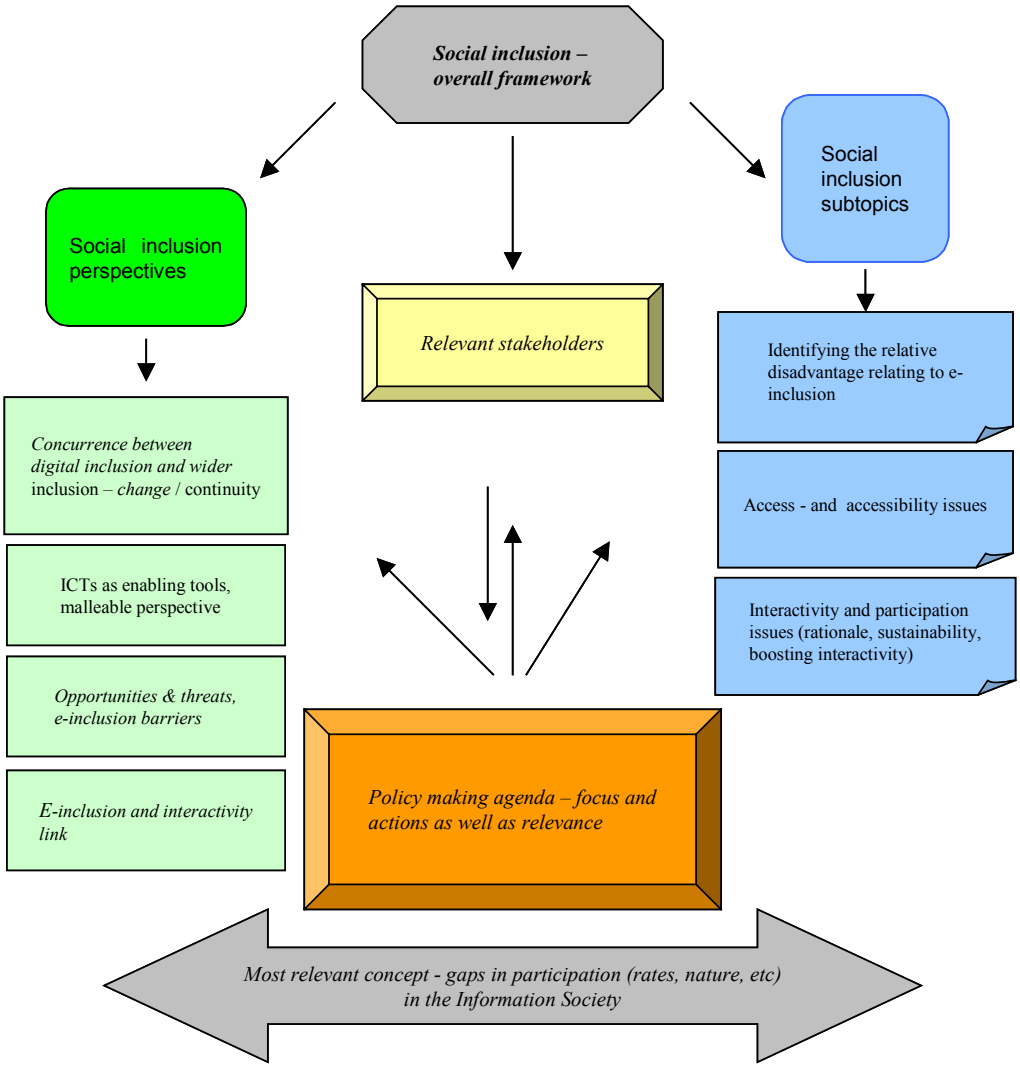
The third perspective can assist with highlighting the [mainly, the consensus is, adverse] potential implications of non participation and exclusion from the Information Society. While this lack of participation can further disadvantage those already socially / economically disadvantaged (aspects also relevant for the first perspective), it is also important to recognise that there is a potential to improve their position by using the new ICTs and availing of the positive contribution ICTs can make.

The fourth perspective is concerned with the issue of interactivity, i.e. ICT mediated interactions. An additional but related issue here is the sustainability [of participation in the Information Society], the main contention being that sufficient levels of interactivity are conducive and indeed necessary to ensuring the sustainability of the whole concept behind an information society. Participation in a broad sense refers to the issues such as for example, going and staying online , using ICTs to contact others for social purposes, availing on public information services available online, etc. An important subtheme here is the issue of reciprocity in terms of the flow of information that has in an abstract, by and large being unidirectional from the point of view of citizens. Indeed it can still be summarised as [a single] point to point type or of 'source-to-receiver only' type. Both in terms of future information society developments as well as in terms of potential for increasing some aspects of social capital, reciprocal information flows are st to gain in significance.

In a wider sense, this perspective is concerned with all interactions mediated with ICTs and characterising the Information Society, 'covering' potential new routes for a wider social interaction, and in a similar vein, new basis for social inclusion via enhanced social participation, and equivalent potential improvements in social and civic participation, social capital building and ultimately, wider social cohesion. Equally, it ' covers' the interaction between the relevant stakeholders for this Topic (elaborated upon in the following subsection). This theme offers potentially a very strong base for indicator building , especially in terms of future developments in this area.

The framework for assessing the area of social inclusion and information society can be depicted as illustrated in the figure overleaf) with a multidimensionality being the key theme.

Figure 7.1 - Setting up the framework for assessing social inclusion and information society – relevant perspectives and aspects



7.2 Identification of the Stakeholders and their Interactions

Following on from the previous section it is at this point necessary to consider relevant groups of stakeholders. These would include - in broad terms, and mirroring the stakeholders relevant for other topics researched by the SIBIS project - government representatives and bodies, private firms, and individuals. However, in relation to the topic of social inclusion, we need to consider these groups more closely and, furthermore, to examine if any additional stakeholders are ought to be explicitly mentioned. In relation to the government and public [sector] bodies, the relevant stakeholders would be:

- social welfare department and equivalent,
- department of education and its affiliates (including also both private and public schools and colleges and universities),
- department of enterprise / labour,
- department of health ,
- information society task forces (these have been set up in many countries in various forms), local civic bodies and equivalent, and public libraries,
- government agencies and government sponsored agencies providing
  - public internet access points (PIAPS) or electronic gateways,

- broad support to people with disabilities,
- training and education services to the marginalised and disadvantaged groups and individuals,
- support & services in the area of tackling urban / rural / ethnic deprivation,
- advisory and related services to the government in dealing with the topic of exclusion / inclusion,.

The crucial aspect regarding the above government departments and various public sector / administrative organisations is the provision of relevant information and increasingly, their services electronically. Indeed, together with the relevant content provision, this is the cornerstone for the enhancement of the participation in the information society .[57]

In relation to the business or the private sector, relevant stakeholders include private agencies involved in the provision of online content - electronic media and content providers, Internet service providers, telecom operators / companies (these are now largely privately owned), those involved in advising government(s) Assistive Technology industry, software industry and private electronic media and publishing, and those in partnership with public sector on various projects dealing with social inclusion. Indeed, in addition to joining public – private partnerships there has been some evidence of increasing community engagement by private companies with the aim of enhancing inclusion in the information society through relevant initiatives such as sponsoring.

Given the variety characterising these of stakeholders, the range of interactions is equally wide. In relation to the individuals, or citizens particular attention needs to be given to the groups that are relatively more vulnerable and have relatively higher propensity to be excluded (this holds true for both traditional and "digital" exclusion). These include the elderly, the disabled, and the socio-economically relatively less well of and disadvantaged. In the context of the Topic, it might be required to identify a category, which can both coincide and cut across these groups, being the group of so-called "late adopters" of new technologies. Finally, there are those that have ceased participating in the information society i.e. that have 'dropped out' those that were once 'connected' but have forgone (or had to) the internet access for some reason or another (potential reasons include cost, perceived lack of useful information and irrelevant content, but also 'voluntary' exclusion).

It is useful to consider some additional stakeholders that are not readily classifiable under the above typology. These are non-governmental organisations and community organisations. While this group can be, and generally is sponsored by the government (and could then be subsumed under this heading), it also can be sponsored by some relevant stakeholders from the private sector[58], and indeed by citizens themselves as individuals, not least in terms of their work in these. The relevance of this group is reinforced by their potential role as awareness agents in terms of promoting Internet access at the community level.

Another subgroup of 'stakeholders' worth mentioning consists of ICT mediated associations of (usually) individuals. These are - virtual communities (Internet-based groups formed around common matters of interest), and communities on line (where the existing communities structures have largely provided a basis for ICT mediated aspects of community life). Again, this group as a whole could be subsumed under the citizens – individual stakeholder group, but research shows that other stakeholders are usually involved as well (e.g. funding, ICT related support, etc.)

Given the variety characterising these of stakeholders, the range of interactions is equally wide. These interactions can initially be seen to belong to the following areas:

- Government to person / person to government interactions and public service provision. Here, these services can be examined in terms of provision of relevant content, user friendliness, and adoptions of design for all concepts, their reliability, confidentiality, and their uptake. In addition, it might be possible to subsequently examine if, and to what

[57] Although relevant for the Topic, this area is well covered in another Sibis topic, e-government.

[58] E.g. The Benton Foundation in the US, etc

extent these on line interactions have contributed to the aims that are aspired to, including the wider policy aims that e-services could contribute to e.g. a 'better informed citizen' aim. There is also a potential for a positive contribution towards increasing civic participation, e-democracy, etc.

- Government to community interactions
- Private sector and individual interactions
- Individual to individual interactions,
- Individual to community interactions and intra-community (ies) interaction, and
- Business / public sector to individual interactions – online communications and transactions

7.3 Statistical Measures and Variables of Interest

This section seeks to identify the most appropriate (existing) measures and variables needed to construct indicators for the topic, based on the framework and stakeholder discussion from the previous sections. However, there is an additional dimension to this section stemming from the need to consider the current policy framework, with the view of aligning the relevant issues from the theme of social inclusion and the Information Society with the goals and actions of eEurope .

One of the implications from the previous section summarising the relevant stakeholders and potential interactions is that the set of indicators that would capture all of these is beyond the scope of the project. Hence the focus on two sets of indicators. The first set of indicators can be derived from general indicators measuring the overall (development of) Information Society, that is to say, measuring the diffusion and the uptake of ICTs. In order to construct the corresponding indicators of e-inclusion, it is necessary to add variables that facilitate measuring distribution of these technologies among various groups / individuals at a national / administrative level. Some of these indicators that are arrived / can be arrived at in this way, are listed bellow:

- Share of individuals or households with internet access by income level, education achievement level, age, gender, presence of a disability, household composition and depending on race / ethnic group belonging
- Share of individuals / households with a computer by income, education, background, composition of household,
- Share of individuals / households with a high speed internet access
- Reasons for individuals / households with a computer / web TV never accessing the Internet, that is to say, reasons for not accessing the Internet despite the apparent availability of tools
- Reasons for not having internet access in the first place – perception of relevant barriers by non-users
- Reasons for 'dropping out' / leaving / discontinuing the Internet access and using services over this medium
- Internet use by gender, age, income level and labour force status,
- Internet access, computer use experience and regular use of a computer by a presence of a disability
- Income, age employment status (distribution) for persons with disabilities (in order to use these as secondary, function variables)
- Internet use by age and disability status
- E-mail use by age, e-mail [usage] diffusion in general

- Possession of relevant skills deemed necessary for active participation in the Information Society e.g. focus on digital skills such as finding information on the Internet, providing information over the Internet, utilisation of this mode of communication in other ways etc

In addition to the above indicators, some additional ones are needed in relation to the so-called supply side. They relate to the provision aspect and the most relevant issue here for the Topic focuses on accessibility and user friendliness. The indicators under this heading can be directly related to the eEurope actions in this area, that is to say, the indicators can be used for measuring the achievement of these actions. For example, the awareness of the Web Accessibility Initiative and its adoption (eEurope actions focused on public websites) can be evaluated and monitored.

The scope for creating indicators of social inclusion is extremely broad not least given the scope of all relevant interactions. It is deemed necessary to focus relatively more on some interactions, which will in turn necessitate a more detailed approach to the process of indicator generation. Thus the main focus will be on individuals and all related indicators that gauge various aspects related to their participation in and on another level, the interaction with the Information Society. One particular aspect deemed to impinge on their levels and rates of participation is also suggested to be covered. Thus it has been suggested to cover this area by examining the prevailing picture regarding accessibility provisions.

As a summary of the discussion above, it is useful to provide an overview of the most relevant indicators for the Topic (below).

Table 7-1.

No.	Domain	Sub-Domain	Indicator Name	Selected for Sibis
1	Access	Differential levels / e-disadvantage	Differential levels of access and use by the existence of health / limiting condition	X
2	Access and use	Differential levels -	The existence of digital divide / gaps by socio-economic factors / determinants	X
3	Access and use	Differential levels	The existence of differential levels of access in terms of speed (broadband) amongst the Internet users	X
4	Access and use	Differential levels	Use of ICTs by ethnic minority / race groups	-
5	Access	Awareness	Access possibilities (place of access) for using the Internet	
6	Access	Awareness	Usage of PIAPS / free internet access points	X
7	Access	Skills	Ability to find / retrieve information on the Internet (op. Via search)	X
8	Access	Skills	Ability to utilise Internet-based / associated modes of communication (e.g. Using the Internet for making telephone calls)	X
9	Access	Skills	Ability to source (the origins) of Internet-based information	X
10	Access	Skills	Ability to provide information over the Internet via creating WebPages	X
11	Participation	Sustainability	Length of experience with using the Internet	X
12	Participation	Rationale	Impact of short term unavailability of the Internet on social enfranchisement	X
13	Participation	Sustainability	Share of lapsed Internet users / drop–outs	X

No.	Domain	Sub-Domain	Indicator Name	Selected for Sibis
14	Participation	Interactivity / content creation	Prevalence of sufficient skills to create a personal web page (also utilised as a measure of potential interactivity / reciprocal info-flows)	X
15	Participation	Interactivity (potential)	Patterns of use after improving the Internet connection (measured in time)	X
16	Participation	e-connectivity potential	Share of e-mail communication availability amongst friends/ relatives	X
17	Participation	e-connectivity actual	Usage of e-mail based communication amongst friends / relatives	X
18	Participation	sustainability	Length of time / experience of using the Internet	X
19	Participation	Rationale	ICT role in reinforcing the existing communities / community initiatives	-
20	Participation	Interactivity / e-connectivity	Spread of virtual communities (e.g. single or multi-issue discussion forums, etc)	-
21	Participation	Interactivity / e-connectivity	The diffusion of the Internet in Voluntary and NGO sector organisations	-
22	participation	barriers	Individual perceptions regarding the level of skills required for using the Internet (non users)	X
23	participation	barriers	Perceptions regarding compatibility between the Internet and self	X
24	participation	barriers	Perceptions regarding affordability of Internet access at home – non users / a variation of existing indicators	X
25	Accessibility	provision	Corporate website accessibility – [the level of] priority attached to special needs groups' access	X
26	Accessibility	provision	Corporate website adaptability potential [to take into account the special needs./ user requirements]	X
27	Accessibility	provision	Adherence to formal accessibility guidelines [a close proxy for Web Accessibility Initiative]	X
28	Accessibility	provision	Corporate website accessibility being evaluated (either internally / externally / both)	X

7.4 Methodology

This section briefly outlines issues such as choosing research methods, conducting relevant observations, and some methodological issues that relate to conceptual framework and the methods chosen.

The starting premise for this section is that the choice regarding the crux of the main research method that is to say, the survey research using the CATI technique has been selected from the perspective of the Project. While it is worth pointing out that many commentators in the field of social inclusion in general have a number of reservations in relation to this particular research method and technique, this technique has been constantly improving in terms of validity. With regard to the survey of general population, the methodology as outlined above, inevitably has some limitations in terms of fully capturing some Topic relevant issues. It could be suggested that these limitations mainly relate to capturing all relevant individuals and

subgroups (i.e. the issue of sampling), as well as to capturing their experiences adequately and in a reliable way (i.e. the issue of a research technique selection).

The issue of appropriateness of CATI is in the first instance, mainly related to the concerns about the use of telephone surveys in general and whether it is a reliable way of collecting information from individuals. However, some research into this issue suggests that telephone surveys are at least as successful as face-to-face interviews, especially for eliciting non-sensitive factual information. Thus in the UK, LFS is now partially conducted using CATI and no differences in reliability arising from the adoption of is has been found , with claims that the measures obtained by telephone are in some situations are even more valid (Purdon & Thomas, *Sociological Research*, University of Surrey). In case of conducting research into a sensitive or potentially embarrassing issues and forms of social behaviour, evidence form the field is not fully conclusive (ibid). In any case, even though some people might feel embarrassed about their lack of access and use of ICTs, this research issue that Sibis is concerned with is not believed to be even nearly as sensitive as some other forms of social behaviour (e.g. stigmatised social practices, etc). The implications for Sibis are that there is nothing to support the view that telephone methods systematically improve or damage data quality compared with face-to-face methods.

What needs to be acknowledged however, is that the technique has some insufficiencies in terms of reaching some individuals and subgroups , while there also are likely to be some implications in terms of response rates i.e. whether the prospective respondent agrees to be interviewed in the first place or not, as a result of higher potential for refusal depending on the perceived lack of familiarity with the topic.

While it is certainly necessary to keep the above potential difficulties in mind, it has to be said that quantitative research techniques have been indispensable for researching various aspects of social inclusion (and the lack of it).

In relation to methodological issues regarding the development of conceptual framework, there are two main issues that need to be considered. Firstly, the framework of research enquiry is based on measuring *the gap* between the various groups and / or individuals in relation to their proximity to the Information Society. The second issue relates to conceptualising participation in the Information society or so-called *proximity*. This is done by (in part) using concept of access, which can be visualised as having four dimensions. The first one deals with the way in which access has been conceptualised to represent the ability to use Information Society tools, mainly the Internet and related tools.

The overall framework outlined in the previous section encompasses a broad range of indicators and a broad range of inclusion stakeholders. Inevitably, it was not possible to address all of this within the scope of the SIBIS project's work on eInclusion indicator development and testing. The approach adopted, therefore, was to focus on developing and testing indicators on those aspects that were most amenable to being addressed by the main SIBIS vehicles (the representative surveys of the general public and of decision-makers in European enterprises). These vehicles are usually described as "omnibus" surveys which combine questions on different, albeit in the case of Sibis, related topics. The approach adopted allowed to utilize both of these surveys for the purpose of generating relevant indicators for the Topic.

Thus the omnibus survey of general population was perceived as the best tool for gathering all relevant socio-economic / demographic variables that are indispensable for researching the presence of the digital divide among the subgroups of population. The benefits of this approach are two-fold. On the one hand it provides the potential for utilisation of the available longitudinal data (and provides an important input for this at the same time). On the other, it offers basis for further studies that might focus on a particular ‘at risk ‘ group, or any set of individuals whose lack of participation in the Information Society is particularly discernible and a cause for concern.

The approach taken to researching the Topic also facilitated utilisation of the survey of decision makes in the establishments. The rationale behind this was to assess some aspects of accessibility from the point of view of content (information, product and service) providers.

Research into this issue was deemed as important, especially in terms the attention given to the whole accessibility theme in the current policy framework (e.g. attention to the “Design for All” principle and Web Accessibility Initiative). The approach acknowledges the required competencies to answer potentially technically demanding questions in this regard.

8 e-Commerce

8.1 Framework for Assessing the Area

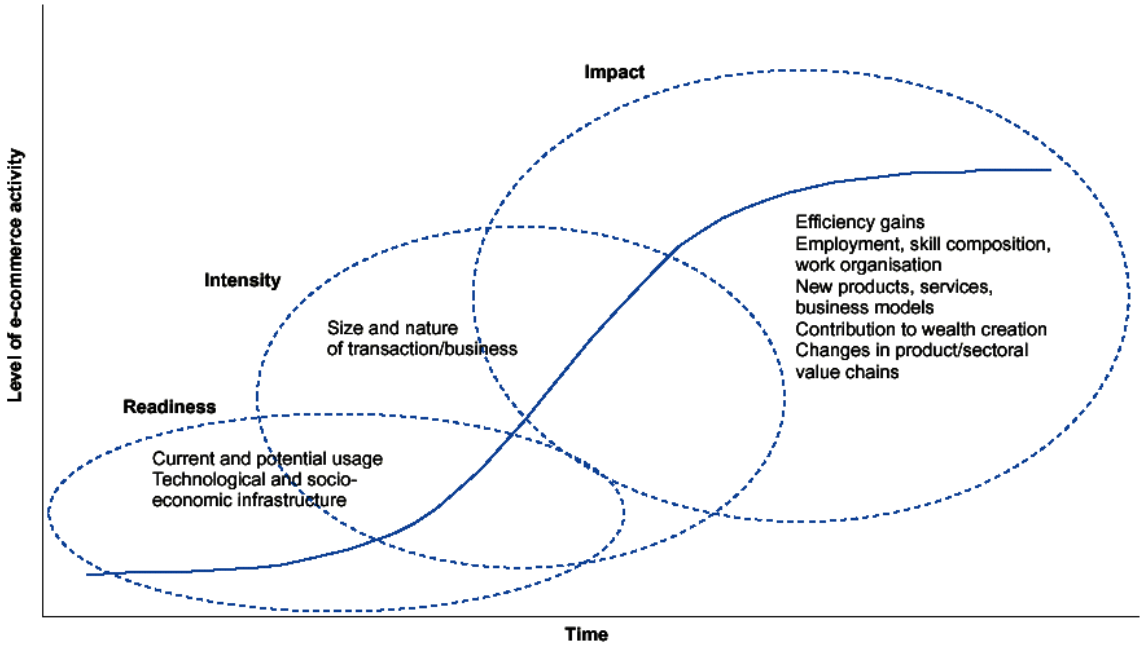
Electronic commerce (E-commerce) presents enormous possibilities for transforming business processes and commercial behaviour, as well as the broader socio-economic system in terms of consumer and government-societal interaction. Consequently, e-commerce activity has attracted the attention of policy makers and the media, as well as commerce and consumers looking to exploit its potential. With this interest there is a universal consensus that reliable e-commerce metrics are needed to track developments in this medium, and understand its impact on our economies and societies.

As a result of this interest, several agencies, governments, statistical offices, as well as private research organisations have undertaken statistical exercises aimed at capturing the most notable aspects of e-commerce and ICT usage. Within the domain of e-commerce there has been great strides in mapping these developments, however, there still remains a need to better articulate, through more in-depth assessment or through more sophisticated cross elaboration, than techniques previously used to measure the commencement and early take-off of the phenomenon. There is a need for indicators to capture the "intensity" and "impacts" of e-commerce, rather than measurements of the diffusion of ICTs used for e-commerce (based on "readiness" indicators).

Project SIBIS adopted a definition endorsed by OECD, 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). SIBIS decided to follow this guide, which is useful to outline the gaps between existing indicators and needs for innovative ones.

The OECD developed a useful framework defining three areas of e-commerce measurement based on policy makers and other user 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.

Figure 8.1 Diffusion of e-commerce in terms of Readiness, Intensity and Impacts



8.2 Identification of the Stakeholders and their Interactions

The e-commerce process can be divided into 5 different steps: gathering of information, placing an order/purchasing, delivery, payment, customer support. Stakeholders involved vary according to the phase we take into consideration and according to the definition of e-commerce we apply.
Two main groups of stakeholders can be identified:

- Core stakeholders, that is E-commerce users: the actors directly involved in the electronic transactions, usually segmented as businesses, consumers, government;
- All other stakeholders, from ICT suppliers and service providers, to actors involved in enabling or creating the conditions for e-commerce development such as regulators, industry associations.

E-commerce users are directly involved in commercial transactions and can play the role either of buyers or sellers (suppliers of the goods-services sold), sometimes both at the same time. To allow measurement, their interactions are most often segmented in the following typologies, depending on the role played by the different user categories.

8.2.1 Business-to-business electronic commerce (B2B)

B2B e-commerce refers to the implementation of electronic transactions between firms, which according to the OECD definition of online sales/purchases include ordering, possibly payment and delivery. A simple form of B2B well established for several years in firms is electronic data interchange (EDI) over private networks. The term B2B however is also used very often to refer to online 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). Electronic transactions within establishments of the same firm are also a relevant form of e-business.

8.2.2 Business-to-Consumer electronic commerce (B2C)

B2C corresponds to "electronic retailing", i.e. any electronic trading transaction where the purchaser is the end user of the products and services bought.

8.2.3 Business-to-Government electronic commerce (B2G)

In B2G government administrations purchase goods and services online from businesses: this is often called also public e-procurement. Its development is a strategic policy target for EU Governments and the Commission, explicitly stated in the eEurope Action Plans, because of expected benefits in terms of efficiency, effectiveness and cost reductions. Moreover, public e-procurement is hoped to become a driver of the adoption of e-commerce practices by the private sector. The structure of B2G interactions can be rather similar to B2B (since it takes place between firms and organisations, not individuals) but there are several additional constraints and specificities, varying by country and type of public administration.

8.2.4 Consumer-to-Consumer (C2C)

This type of e-commerce is based on direct transactions between consumers themselves: the best known example is the online auction service brought to success by E-Bay. C2C auctions are only one of the possible business models growing out of peer-to-peer communication, which is potentially very disruptive to existing commercial relationships (as the examples of Napster and, less drastically, open software have proven). This is certainly an area of great potential interest for innovative indicators development, but also of great complexity.

8.3 Statistical Measures and Variables of Interest

E-commerce plays a vital role in the development of the Information Society. By monitoring e-commerce it is possible to provide information on the state of digitisation of large sections of the economy.

Indicators suitable to analyse e-commerce may be clustered as follows:

- **Readiness indicators** – Indicators relating to the basic conditions for using e-commerce. This includes accessibility to the Internet, ICT infrastructure equipment and user profiles;
- **Intensity indicators** - Indicators that provide a picture of the intensity of e-commerce application and usage. Examples include standard usage figures, types of usage, type and number of processes that can be/are performed electronically, adoption patterns broken down into products/countries/sectors, current and expected market growth for e-commerce, etc;
- **Impact indicators** - Indicators that measure the effects/implications of using e-commerce such as changes to internal management of business processes, as well as the broader socio-economic, legal and societal implications.

The usability/adaptability of these indicators may vary significantly between countries, according to the level of diffusion of e-commerce. For example, in those regions where the adoption of e-commerce is at an early stage, analyses tend to focus on the conditions enabling the implementation of e-commerce (typically represented by readiness indicators). Once e-commerce has reached a sufficient level of diffusion, there is a stronger need for indicators that measure the intensity of use of e-commerce (intensity indicators). Only when e-commerce has diffused widely will there be a strong need for impact indicators. These are able to provide a picture of the changes in the economy and in society that have resulted from the introduction of e-commerce.

8.4 Methodology

Statistical sources available so far tend to focus on readiness indicators and, in particular, on the development of BtC e-commerce: socio-economic user-profiles (age, sex, income of residential internet users…); ICT equipment in private households (availability of a PC, Internet connections in households…); types of use of the Internet (e-mail, web, newsgroups…); and, in some cases, barriers preventing the diffusion of the Internet and e-commerce.

Readiness indicators on BtB are well covered in the literature. Existing analyses give a quite detailed picture of the number of enterprises offering BtB solutions, the business branches in which they are active and, in most cases, the use of advanced ICTs within enterprises (e-mail, video conferencing, EDI, Website presence, etc.). In some cases, it is possible to find data concerning business functions usually supported electronically as well as information regarding barriers preventing businesses from using BtB applications.

The area of intensity indicators is covered only partly: there is still scarce information on the purchasing behaviour of consumers. Information regarding enterprises purchasing goods on-line is still sketchy: some studies provide data concerning the supply of goods over the Internet (methods of delivery, methods of payment, after sales services offered, etc.) or the number of transactions concluded on-line. On the other hand, statistics on investments in types of ICT equipment by enterprises, on expenditure in advertising and on the geographic dimension of BtB are still scarce. The same applies to BtB Intensity indicators on the demand side: there is a shortage in the availability of data on the volume of on-line transactions concluded by businesses and on the ways these transactions were carried out.

Definitely, the research area that is least covered by existing statistical sources is that of impact indicators. Data on customer satisfaction, in terms of saving of time and money, willingness to purchase again on-line, or use of the Internet for other activities are very scarce.

The same applies to the analysis of impacts of BtB on businesses' internal organisation (e.g. substitution of business processes and value added regarding management). New business models and patterns of competition have emerged which have far-reaching effects on prices and market structures. Thus, some sectors benefit from the influence of e-commerce, while others lag.

Beside the shortage of data, statistics still indicate some relevant boundaries that prevent having a satisfactory picture of e-commerce.

Indicators used in studies measuring the diffusion or impact of ICT and e-commerce are very often based on assessment criteria that have been developed for industry structures that are no longer in existence. For this reason, they may not properly represent the changes that take place under the influence of the digital economy.

Definitions of e-commerce are not used consistently, and it is not always clear what exactly should be counted as e-commerce transactions and how to deal with combinations with traditional means of communication (fax, telephone etc.) in e-commerce statistics. Differences in definitions in conjunction with differences in survey methodologies (often made worse by a lack of information on methodological procedures such as questionnaire used) have the effect that data stemming from different surveys or statistical studies are difficult to compare.

A Dutch policy document, "Measuring the e-commerce – Recommendation for a Dutch e-commerce monitor", (Dialogic Innovatie & Interactie, Utrecht, July 1999), provides useful guidelines for a methodology for an e-commerce monitoring exercise. According to this document, once a basic set of readiness, intensity and impact indicators will be available, the next step should be to focus on more complex data. These complex indicators may focus on various aspects, such as: changes in the position of a company in the value chain, cost structures, savings made in businesses and consequences for businesses organisation, effects on taxation, etc.

The statistical representation of BtB e-commerce needs to be reorganised according to the distinction between "end-use-e-commerce" and "process-e-commerce". A methodology should be used that is able to provide data that distinguish between the *active* provision of e-commerce facilities (in the case of companies selling their products on-line) with particular attention to the co-ordination of back and front office processes and their *passive* role as user of BtB services.

So far, a strong effort has been invested in the production of market forecasting statistics. Among these is the value of products traded on-line. However, this measure will soon be considered insufficient as an indicator of value added created by e-commerce. Therefore, the Dutch policy document recommends that future analysis should be focused on providing insights into the rate of adoption of e-commerce, the implementation of on-line business processes, and the changes to the organisation of production which result from BtB and BtC e-commerce.

Last but not least, the indicators to be developed should give a good representation of all relevant market sectors to allow an analysis of sectoral differences in adoption rates, and monitoring early and late adopters business branches.

9 e-Government

9.1 Framework for Assessing the Area

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

- Government to citizen (GtC),
- Government to business (GtB), and
- Government to government (GtG).

In all cases, the relationship is between the two parties so that GtC designates just as well interactions that originate with government as with the citizen. Likewise, GtB designates interactions between businesses and government. GtG is self-explanatory.

By necessity, e-government comprises a number of functions currently filled 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 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 how GtC, GtB and GtG interactions occur today and how they may be improved in the future.

Prisma proposes five steps to evaluate the progression of e-government.

1. Government entities post information about themselves,
2. Citizens and businesses are able to provide information about themselves,
3. Two way exchanges of information and value can occur between government and citizens or businesses,
4. A portal that integrates the complete range of government roles and paths to them based on need and situations rather than department or agency,
5. Digital democracy—transparent, open and accountable government.

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.

9.2 Identification of the Stakeholders and their Interactions

To see how government can adopt information and communication technologies to implement e-government, it is necessary to understand who is affected by the development of e-government. Depending on whether one considers GtC, GtB or GtG, the stakeholders are governments and either citizens or businesses. Even in the case of GtG, the stakeholders include citizens and businesses, since information about them may transit from one government agency to another. Likewise, citizens may be stakeholders in GtB, and businesses in GtC, when information about them is provided to businesses and citizens, respectively, by government.

On the simplest level, government provides citizens, businesses and other government agencies with information and services. This is usually obtained by visiting government offices, by requesting information in writing, or by telephone. With the advent of the Internet, government web-sites have replaced or duplicated some of these sources of information and services. Citizens and businesses also provide information to their government. Again, this may require office visits, mail, or telephone interaction. Government web-sites now offer new options to interact with the government electronically. As a result, government efficiency is increasing, because the labour of data entry by government employees is eliminated. It also provides improved accountability by making information more readily available among government agencies.

The range of services that may be provided by e-government spans from simple information sites to fully interactive experiences where users and government engage in a dialog mediated by information technology. Examples of areas where government and citizens or businesses communicate include, among others:

- Access to laws, rules, and regulations
- Information on parks and recreation
- Personal and corporate income taxes
- Unemployment or disability compensation
- Social security
- Personal documents
- Car registration
- Application for building permits
- Declarations to the police
- Public libraries
- Change of address announcements
- Census bureau surveys
- Corporate taxes
- New company registrations
- Submission of data to statistical offices...

This list is by no means exhaustive and serves to illustrate areas where e-government has or will make its presence felt.

The success of e-government depends on all the parties involved in e-government transactions. When seeking information from government, citizens, businesses and other government agencies must be able to easily find what they need and be confident that whatever information is available on-line is current and accurate. When providing information to government, all will want to feel secure in the knowledge that the information provided is recorded accurately and that their privacy is maintained. To that end, it is important to systematically analyse government links and to provide all with information regarding the level of security achieved.

Each of the three areas of e-government has different needs and we consider the three areas separately.

9.2.1 Government to Citizen

A citizen is defined as a member of a state.[59] A citizen is a natural person, as opposed to an artificial person, such as a corporation. The citizen has a number of relations to the state. These include, among others, those of: client, customer, voter, subject (to laws and regulations), claimants, beneficiaries, etc. GtC interactions vary in their level of complexity

[59] Webster's Ninth Collegiate Dictionary. Merriam-Webster Inc.: Springfield, MA. 1991.

and in the symmetry of the transaction. In the simplest interaction, citizens may wish to obtain general information from government, such as regarding laws or regulations, where secure communication and knowledge of the citizens' identity is not necessary. On a more complex level, citizens may provide information to government by identifying themselves, in which case they may require protection of their privacy. Finally, instances may occur where information flows between parties in both directions and secured communication is also desirable.

9.2.2 Government to Business

Entities that are not natural persons interact with the state in ways that mirror the actions of citizens. Their creation is registered with the government and their progress is tracked in numerous ways during the course of their existence. They pay taxes and must abide by regulations. They may be subject to periodic inspections. Clearly information flows between government and businesses exist. Business here includes for-profit and not-for-profit commercial operations, non-government organization, professional associations.

While businesses do not vote, by analogy with citizens, businesses have a number of relations to government. These include, among others, those of: client, customer, subject (to laws and regulations), claimants, beneficiaries, etc. In addition, businesses may act as providers to government in instances where government contracts services to businesses or operates in conjunction with them. As with GtC, GtB interactions vary in their level of complexity and in the symmetry of the transaction. Again, businesses may wish to obtain general information from government, where secure communication and knowledge of the business's identity is not necessary. On a more complex level, businesses may provide information to government by identifying themselves, in which case they may require protection of their privacy. Finally, instances may occur where information flows between parties in both directions and secured communication is also desirable.

9.2.3 Government to Government

The operation of government may proceed more smoothly following the adoption of ICTs, since these may allow government to operate more effectively and efficiently. E-government initiatives may result in improved communications and processes because record keeping and service uniformity will be ensured. GtG services may facilitate GtC and GtB operations by creating a single point of contact for services that currently require the interaction with a number of agencies.

Just as in the case of GtC and GtB, the implementation of GtG will call for a re-examination of how government agencies are organised today. Looking at Prisma's step 4 suggests that ICTs may mask difficulties inherent in the way that some government entities are organised today. This is because the portal would serve the role of front office that interacts with the client. The exchange of information between agencies that a powerful portal might require may point to new arrangements of these agencies or different roles for each one. Fundamentally, the successful implementation of e-government depends on how readily accessible government becomes via the Internet. It also depends on how willing citizens are to transact with government in new ways.

These relationships between different government institutions may occur at different levels or may even cross from one level to another. For example, they may include supranational, national, regional and municipal levels. As with the exchanges that occur between citizens and government, e-government exchanges between government agencies may be a two-way process, where a user provides information to trigger the flow of information back. In other instances, however, government agencies may provide information to each other in a format similar to an information kiosk, where an individual at one government agency can browse the site of another agency while providing minimal inputs to guide the search. Finally, information exchanges between government agencies may include the transfer of large databases from one agency to another to complete existing data.

The ability and willingness of government agencies to provide information to one another reflects the level of trust that exists between them. It also depends on how compatible their information systems are. Historically, some government agencies have jealously guarded their information as a way to maintain control over it. It has become apparent, however, that sharing information among agencies can improve not only the position of the two parties, but also improve how they are perceived by third parties.

In the United States, RaDiUS, a complex database that provides information about federally funded research and development (R&D), illustrates one implementation of e-government across agencies. RaDiUS was developed and is administered by RAND, a private corporation. By maintaining a distance between itself and the government agencies that provide information about R&D funding, RAND gains the trust of the agencies that provide it information. Because it can obtain more complete information as an "outsider" than any "insider" could, RAND can then provide government agencies information about funding activities that would not be available from any single source. One particularly illustrative application of RaDiUS has been the request by some cities and regions to learn what federally funded research activities occur in their jurisdictions. Prior to the existence of RaDiUS, this would have required extensive research across government agencies to learn what activities each one sponsored.

The success of RaDiUS depends heavily on the fact that its data inputs are collected unobtrusively. A number of government activities create the records that provide the basis of the data for RaDiUS. Thus, indicators of activity exist and can be relatively easily accessed and analysed, but their collection does not require surveys.

9.3 Statistical Measures and Variables of Interest

Indicators of the success of e-government should not only look at the services that are provided by government but also at how citizens, businesses and governments make use of these services and what their expectations are. Indicators should point to areas where barriers exist to the adoption of e-government. They should also help understand the nature and extent of the barriers. Finally, indicators should suggest ways that e-government can improve.

Looking at the goals of *e*Europe 2002 and considering how e-government interactions have evolved, it is possible to identify the type of indicators that would be useful to assess its success. Measures of effectiveness can be obtained by looking at the types of transactions that occur on-line and comparing them to the traditional modes of interaction. In this way, one can determine which transactions lend themselves best to an on-line version. Specifically, looking at the goals in *e*Europe 2002, one can look at which public services occur on-line. They include:

- Number of successful on-line GtC, GtB and GtG transactions,
- Number of traditional GtC, GtB and GtG transactions, and
- Number of attempts at carrying out on-line GtC, GtB and GtG transactions.

In addition, Prisma's five steps to e-government suggest indicators to gauge the progress of government. Thus one may consider the extent to which:

- government agencies post information about themselves on-line,
- citizens and businesses can provide information about themselves on-line,
- citizens, businesses and governments can participate in two way exchanges of value,
- portals integrate government roles and provide paths to them based on need and situation rather than department or agency.

The fifth step is more abstract, since the measure of transparency, openness and accountability may be somewhat subjective.

Other relevant measures focus on the perceived importance the Internet as a source of information on government. Potential indicators of this include:

- Percent of government documents, reports, etc., available on-line,
- Number of times government on-line documents are accessed, and
- Currency of information available on government sites.

The indicators listed above provide some insight into the acceptance and use of e-government. They also point to the success of trying to adapt to new modes of interaction with government. Looking more closely at ways to access government on-line, it might also be possible to determine how well users of e-government are able to navigate government services on-line by studying unsuccessful attempts. Potential indicators of this include:

- Types of activities resulting in an unsuccessful transaction (user gets lost, incorrect routing on site, etc.), and
- Customer satisfaction with on-line government interaction.

After studying how well on-line interactions proceed, one may inquire about barriers to the implementation of e-government. These may range from costs barrier to insufficient training in the use of the Internet, to distrust of e-government. Cost barriers may be remedied by creating and maintaining public access terminals at libraries and schools. Training issues are making education readily available. Access and education are treated as separate topics separately and so are not considered in this section. Distrust may be remedied through education, but it may also represent a general unease with the amount and type of information that government makes available. Clearly, providing sufficient safeguards to protect the privacy of everyone is of great importance.

Specific e-government benchmarking indicators are provided in the eEurope Action Plan.[60]

Public Services for Citizens

1. Income taxes: declaration, notification of assessment
2. Job search services by labour offices
3. Social security contributions (3 out of the following 4):
   - Unemployment benefits
   - Child allowances
   - Medical costs (reimbursement or direct settlement)
   - Student grants
4. Personal documents (passport and driver's licence)
5. Car registration (new, used and imported cars)
6. Application for building permission
7. Declaration to the police (e.g. in case of theft)
8. Public libraries (availability of catalogues, search tools)
9. Certificates (birth, marriage): request and delivery
10. Enrolment in higher education / university
11. Announcement of moving (change of address)
12. Health related services (e.g.interactive advice on the availability of services in different hospitals; appointments for hospitals.)

Public Services for Businesses

1. Social contribution for employees
2. Corporation tax: declaration, notification

[60] Common list of basic public services. Available in pdf format at http://europa.eu.int/information_society/eeurope/action_plan/pdf/basicpublicservices.pdf, accessed on 5 July, 2001.

3. VAT: declaration, notification
4. Registration of a new company
5. Submission of data to statistical offices
6. Customs declarations
7. Environment-related permits (incl. reporting)
8. Public procurement

Information about on-line and traditional transactions should be available from government offices that maintain on-line access. Additional information about failed attempts at on-line transactions should also be available from government offices that maintain a presence on-line. Surveys may be needed among on-line and traditional users of government services to determine why they use one option or the other. Such a survey would also provide the opportunity to understand what happens to make on-line transactions unsuccessful and how this might be changed. In addition, information about customer satisfaction with on-line government transactions could be obtained at that time.

9.4 Methodology

Conferences have been organized to assess the development of e-government in Europe. Of particular interest is *From User To Citizen: The Citizen And The Global Information Society* (EU ISPO, April 1998). At the time, it appeared that many citizens, both as consumers and users of computer-based products, remained unconvinced by the rhetoric of policy-makers and industry leaders. The success of e-government depends on conveying to citizens that the information society has the potential to be a force for liberation, improving the quality of life. Specifically with respect to e-government, new technologies have the potential to reinforce and strengthen the rights of all by providing instant access to a wide range of public information and government services. Improved access may increase the capacity of citizens to participate in the process of decision-making and to oversee the affairs of government, both locally and nationally.

Information obtained in *From User to Citizen: The Citizen And The Global Information Society* provides a context to consider e-government, but it lacks the statistical indicators needed to measure the success of e-government in society. It provides context to explain why the successful implementation of e-government is not guaranteed. Thus, social exclusion must be avoided, information security and confidential and safe transactions must be guaranteed. A challenging way forward is to prepare a clear statement of citizens' rights, which can be used as a benchmark by which public policy and information society structures can be judged. Such a statement, in line with the recent Commission Call for an International Charter and coupled with practical confidence-building measures, can nourish the process of change and give meaning to a vision of humanity within the Information Society.

Some reports exist, which provide useful indicators of the success of e-government. In addition, some outline strategies to meet the goals of e-government. The Dutch government has proposed a plan in *Towards Optimum Availability Of Public Sector Information* (Dutch Ministry of the Interior and Kingdom Relations, April 2000). The objective of this memorandum is to develop a framework for the commercial use of public sector databases and a more precise definition of the term ‘basic information of the democratic constitutional state’. The stated goals are to ensure that the public sector information is as widely accessible and available to citizens as possible, to clarify the legal framework, to remove the obstacles to using Web information, and to make “other information” (besides ‘Basic information of the democratic constitutional state’ and Web information) more accessible and usable to a wider audience.

The success of e-government can be measured in a number of ways. Frequency of use, ease of use, and satisfaction with the service are straightforward measures. The measures relate to the goals stated in *e*Europe 2002 of establishing government on-line by providing electronic access to public services. Specifically, they are:

- Efforts by public administrations, at all levels, to exploit new technologies to make information as accessible as possible, and
- Member States should provide generalized electronic access to main basic public services by 2003.

Along with the goals stated in *e*Europe 2002 were a few indicators. These provide only guidance in finding or developing indicators of the success of e-government. They include:

- Percentage of public service interactions carried out on-line, and
- Percentage of public procurement carried out on-line.

A recent document, *25% Electronic Public Service Delivery In The Netherlands* (Dutch Ministry of the Interior and Kingdom Relations , January 2001), sets baseline measures to evaluate the improvement of e-government over time. The Netherlands Economics Institute (NEI) has carried out a zero measurement. This zero measurement relates to the efforts of the present government to make available at least a quarter of all public services electronically by 2002. The zero measurement involves calculation of the percentage of electronic services provided by the government sector. The measurement assesses the present availability of public services on the Internet, the effective and efficient accessibility of government information to citizens. Based on this study, whereas at least 25% of all public services should be available electronically by 2002, the degree of electronic service make available is currently less than a quarter.

Other documents such as e*Government: Ready or Not?*(The Henley Centre, 1 July 2000) provide some statistical indicators of e-government. Here we consider highlights of the document. Among the indicators provided within the document, it lists various services that citizens are interested in accessing electronically, along with the percentage of respondents who expressed interest. It provides reasons why citizens are interested in accessing government electronically. The answers are broken down by age group. The report also shows why citizens might not be interested in the implementation of e-government. In addition, it lists the types of devices that citizens might use to access government. Data such as these can be integrated directly into an analysis of e-government.

10 e-Health

10.1 Framework for Assessing the Area

10.1.1 Problem description

Developing good indicators to benchmark the emergence of eHealth activity is important for guiding policies related to eHealth as mentioned in the context of the eEurope initiative.

On the one hand, the proliferation of online eHealth 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 misuse) 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?

On the other hand, there are many opportunities for increasing the efficiency and effectiveness of the more "traditional" (i.e. off-line) health services through exploitation of the new opportunities presented by Information Society Technologies. Indicators are needed for benchmarking the extent to which these opportunities are being realised and to point to the types of policy initiatives that may be needed to encourage the diffusion of good practice.

Developing and applying indicators for benchmarking the eHealth domain is a challenging task. One challenge comes from the fact that the healthcare domain covers a very large and complex sector, comprising many different players and activities. As a consequence, the variety of possible of eHealth applications is very broad and includes such widely different activities as self-initiated online information seeking by members of the public, patient-doctor interactions for administrative and/or clinical purposes, health provider-administration interactions for activity reporting and/or reimbursement, formal or informal ongoing education for healthcare professionals, administration-administration interaction for exchange of data, and data mining for research/ epidemiological purposes.

In relation to eHealth indicator development, the significant cross-country variations in the organisation of healthcare and healthcare practices, coupled with the relatively immature status of eHealth activity at present add to this complexity. For example, telephone consultation with one's doctor is extensively used (and reimbursed) in some countries, not used very much in others and even disallowed in some. Diversity and immaturity are also evident in other features of the sector. One important example is reflected in the extent to which provision of "official" health websites and/or portals hosted by national/regional health authorities varies across countries and generally lags behind the mushrooming private and/or voluntary sector activity in this area. Another example is in the varying availability of dedicated/customised health networks to which health professionals and organisations can connect and on which they can interact.

Such examples point to the importance of "infrastructural" availability as an indicator of eHealth development and as a prerequisite for many forms of eHealth activity, and to the importance of taking contextual factors into account in seeking to benchmark eHealth activity in Europe. A given form of eHealth activity (e.g. electronic interaction with one’s doctor) may be possible, deemed desirable and/or encouraged in some countries whilst being disallowed, deemed undesirable and/or discouraged in others.

Table 10.1 Framework for describing eHealth system usage

1. Users	2. Usage	3. Systems	4. Issues	5. Questions
· Practitioners · Patients · General Public · Educational and support services · Purchasers and reimbursers · Policy/ administration	· Clinical investigation · Education · Information acquisition Information transmission · Support provision	· Patient-practitioner consultation · Practitioner-practitioner consultation · Clinical investigations in health care · Remote monitoring of patients · Remote diagnosis in health care · Remote treatment in health care · Facilities management of remote health care services · Providing information to patients · Continuing education to practitioners · Transfer of information throughout health care services · On-line health information · The exchange of patient data	· Quality · Privacy · Confidentiality · Reliability · Effectiveness	· Efficacy · Practicality · Value added · Clinical utility · Confidentiality · Privacy · Usability · Cost · Reliability · Satisfaction

10.1.2 Framework for assessing the area

A framework for indicator identification was developed in WP 2 and is represented in Table 10.1. A somewhat simplified version is developed in Table 10.2. This basic framework collapses the six types of player into four main "user groups".

Table 10.2 Basic framework for eHealth indicator identification

Indicator Domains	Relevant health care players				
	Public	Health care providers		Educational/ Support	Administration
		Individuals	Enterprises		
Readiness	Main focus of SIBIS				
Usage					
Evaluative/Outcome					

First there is the general public, a grouping that includes all citizens who may be interested in and/or use eHealth applications in an informal or self-directed manner or who may be interacting with healthcare agencies in relation to administrative matters, those who are patients at a given point in time and hence involved in a formal client-professional relationship and interaction, and those who are carers and who are interested in and/or using eHealth applications on behalf of those that they care for.

Second there are healthcare providers, within which group are included both individuals working in a healthcare delivery context and organisations/enterprises involved in direct healthcare provision. There can be some blurring of the boundaries, such as in the case of single-handed GP practices where the user may be both an individual professional and an "enterprise".

Third there are educational and support services, within which group are included both providers of initial and ongoing training for professionals, and those that provide information and other forms of support for practicing professionals and/or consumers. Finally, there are the larger administrative players, such as health authorities, public and private insurance organisations / reimbursers and so on.

For purposes of indicator testing and data collection in SIBIS, the focus has been primarily on the general public user group as dictated by the survey approaches being utilised.

Table 10.2 also indicates three main levels of indicator. First there are indicators of "readiness". Readiness indicators fall into two main categories, one addressing characteristics of the user group in question (such as attitudes, skills and so on) and the other

addressing infrastructural prerequisites (such as the availability of online services, health networks and so on) and contextual factors (such as the extent to which policy and/or professional orientations are supportive of particular eHealth activities). Second there are indicators of "usage", addressing types and amounts of usage of eHealth applications. Finally, there are "evaluative or outcome" indicators of eHealth activity, including indicators reflecting the assessments of users themselves and indicators reflecting expert judgement and/or the extent of conformance with agreed criteria in relation to quality of eHealth services, desirable eHealth activities and "good" outcomes.

10.2 Identification of the Stakeholders and their Interactions

The healthcare sector comprises a complex mix of institutions, businesses, professionals and users. Earlier work in SIBIS identified a variety of users of eHealth systems - practitioners, patients, general public, educational and support services, purchasers and reimbursers, and policy/administration. For present purposes these can be re-organised into six main sets of players:

- Consumers
- Traditional direct healthcare providers
- Educational and support services
- Purchasers/reimbursers
- Policy/administration
- New online healthcare players.

Table 10.3 gives some examples of each of the main types of player.

Table 10.3 Main types of healthcare player

Main types	Examples
Consumers	Citizens Patients Carers
Traditional direct healthcare providers	Office-based doctors Health centres Hospitals Imaging/laboratory facilities Pharmacies Community nursing services Other paramedical/sociomedical services
Traditional educational and support services	Medical colleges Continuing medical education services Information and other support services for professionals and/or consumers
Purchasers/reimbursers	National and local government Public insurance organisations Private insurance organisations
Policy/administration	Health Ministries Local authorities/municipalities Various other public agencies
New online players	Health information Clinical services Pharmaceutical sale/purchase

There is considerable variation across national health systems in Europe in the structure, organisation and numbers of the different types of traditional player.

Consumers

These are the users of healthcare services. Consumers move between different roles, including the general role of citizen with healthcare interests, of patient with a specific relationship with one or more provider, and of carer providing support for other patients and citizens.

Traditional direct healthcare providers

These are the individuals and organisations that provide direct healthcare services, such as diagnosis, treatment and rehabilitation. This category includes a wide variety of types of player, from individual doctors in their own offices to large hospitals.

Traditional educational and support services

These are the services that provide the initial and ongoing training for professionals, and those that provide information and other forms of support for practising professionals and/or consumers.

Purchasers/reimbursers

These are the organisations that pay for the health services that are provided to consumers. They include central and local government (where financing is from general or local taxation), public insurance funds and private insurers.

Policy/administration

These are the administrations and other public agencies that manage the overall healthcare sector and the various players. They include national, regional and local governments and public agencies such as offices of disease surveillance and health statistics.

New online healthcare players

These are the new players that have emerged with the development of the Internet and web. Included are new health-information providers, providers of online clinical services and online sellers of pharmaceuticals.

10.2.2 Interactions between the stakeholders

Table 10.4 gives an indication of some of the main forms of interaction between the different types of player. These give an indication of the wide variety of types of eHealth services and applications of potential relevance for the different stakeholders.

Table 10.4 Some of the main interoperations between the players

	Consumers	Traditional direct healthcare providers	Educational and support services	Purchasers/ Reimbursers	Policy/ Administration	New online healthcare players
Consumers	Peer support & Self-help Groups	Health information Administrative info/interaction Clinical interaction	Health information	Claims Payments	Health information Administrative information and interaction	Health information Administrative interaction Clinical interaction Purchase of pharmaceuticals
Direct healthcare providers		Clinical information Patient referral/ transfer Opinion/ support Prescriptions	On-site and remote education/ training Initial and continuing education/ training Information and expert support	Billing Payments	Activity reporting Notifiable diseases	
Educational and support services			Remote education/ training			
Purchasers/ Reimbursers				Inter-agency reimburse-ment	Activity reporting	
Policy/ Admin.					Information exchange	

Source: adapted from SATS, 2000[61]

10.3 Statistical Measures and Variables of Interest

The overall framework outlined at the beginning of this chapter encompasses a broad range of indicators and a broad range of healthcare players and activities. Inevitably, it was not possible to address all of this within the scope of the SIBIS project's work on eHealth indicator development and testing. The approach adopted, therefore, was to focus on developing and testing indicators on those aspects that were most amenable to being addressed by the main SIBIS vehicles (the representative surveys of the general public and of decision-makers in European enterprises). The other aspects are to be taken into account in the elaboration of proposals for possible future work (outside of the SIBIS project) on indicator development and application.

Of the two "omnibus" surveys to be carried out in SIBIS, only the general population survey (GPS) is suitable for e-Health indicator testing and data gathering. The DMS decision-maker survey is not an appropriate vehicle for sampling and questioning decision-makers in healthcare organisations as the methodology could not ensure that a sufficient and representative sample of healthcare organisations would be included nor could a separate survey instrument specifically tailored to eHealth questions be constructed and used. As a consequence, the indicator testing and data collection in SIBIS concentrated on eHealth usage by the general public. Also, the focus was on what could be addressed via the survey approach and consequently excluded indicators of infrastructural/contextual "readiness" and "outcome/ evaluative" indicators reflecting expert/policy evaluation.

In identifying eHealth indicators for utilisation within the general population survey, some important considerations needed to be taken into account. One of these concerned the considerable variation across Member States (and the US) in the organisation and delivery of

[61] Study on the use of advanced telecommunications services by healthcare establishments and possible implications for telecommunications regulatory policy of the European Union. Report to the European Commission. empirica/WRC: Bonn/Dublin. October 2002.

healthcare services and, consequently, in the type and nature of patient-doctor interactions that are relevant and important. Another concerned the general lack of maturity in the development of formal online "doctor-patient" interactive services. It was therefore decided that the focus of the SIBIS survey would be on more informal, self-directed searching for health-related information on the Internet and that more formal administrative and/or interactions would have to be the subject of other studies outside of the scope of SIBIS.

Taking into consideration also the limitations on the number of questions on eHealth that could be accommodated in the "omnibus" SIBIS survey, this was felt to be the best use of resources in relation to eHealth indicator development and testing within SIBIS. Even then, as is the case in all surveys, it was not possible to include all items of potential interest (for example, online purchase of pharmaceuticals was omitted from this survey but is something that will be important to benchmark at a relatively early stage in the future because of its public health significance).

The indicators selected for testing and data gathering in SIBIS are listed in Table 10.5. There are also some other sources of data relevant to indicator development for the general public and these are also listed in Table 10.5. Finally, there are also some European wide data available on some relevant indicators for one group of healthcare providers (General Practitioners) and these are also included in Table 10.5.

Table 10.5 Indicators relevant for the Topic, summarised

No.	User group	Indicator area	Indicator name	Existing indicators	Used in SIBIS	
					Used in survey	Data from other sources used
1	Public	Usage	Seeking health-related information on the Internet	X (variations used in EB 53[62], Flash EB's 87, 103, 112 and 125[63])	X (SIBIS variant)	
2	Public	Outcome	Finding health-related information on the Internet		X	
3	Public	Outcome	Suitability of health-related information found on the Internet		X	
4	Public	Readiness (User & Infrastructural)	Sufficiency of mother-tongue websites		X	
5	Public	Usage	Reasons for seeking health-related information on the Internet		X	
6	Public	Readiness	Perceived trustworthiness of providers of health-related information		X	
7	Public	Readiness (User)	Interest in online doctor's advice	X (EB 50.1[64])		X
8	Public	Readiness (User)	Willingness to pay for online eHealth	X (EB 50.1)		X
9	Public (50+)	Readiness (User	Interest in various eHealth applications	X (SeniorWatch[65])		X
10	Healthcare provider	Readiness (Infrastructural)	Use of IT in practice	X (Flash EB's 80 and 104[66])		X
11	Healthcare provider	Readiness (Infrastructural)	Connection of IT equipment to Internet or dedicated GP's network	X (Flash EB's 80 and 104)		X
12	Healthcare provider	Usage	Uses of Internet or dedicated general practitioner's network	X (Flash EB 104)		X

[62] Eurobarometer 53.0 (2000): Measuring Information Society

[63] Flash Eurobarometer studies on "Internet and the public at large" - 112 (21/01/2002) survey of November 2001; 103 (08/11/01) survey of June 2001; 97 (05/04/01) survey of February 2001; 125 (July 2002) survey of May-June 2002

[64] Eurobarometer 50.1 (1999): Measuring Information Society. Survey of Autumn 1998

[65] SeniorWatch (2002) Older People and Information Society Technology. Deliverable No. 5.1. Survey of Summer 2001.

[66] Flash Eurobarometer studies on " 'MIS' Medecins Generalistes" - 80 (May, 2000) survey of April-May 2000; 104 (21/11/01) survey of June-July 2001.

No.	User group	Indicator area	Indicator name	Existing indicators	Used in SIBIS	
					Used in survey	Data from other sources used
13	Healthcare provider	Usage	Type of patient consent for transferring (identifiable) patient data	X (Flash EB 104)		X
14	Healthcare provider	Usage	Use of electronic signature in communication patient data	X (Flash EB 104)		X
15	Healthcare provider	Usage	Use of Electronic Health Care Record (EHCR)	X (Flash EB 104)		X
16	Healthcare provider	Usage	Use of website for practice	X (Flash EB 104)		X

10.4 Methodology

10.4.1 Definitions and terminology

In the health area, as in other areas, great care needs to be taken in ensuring similar meanings of terminology across languages and cultures. Even the basic definition of what constitutes "health-related" information/activity needs careful consideration. For example, should some or all of the variety of "lifestyle" information/activity (e.g. nutrition/diet, health/fitness and so on) be included. For future benchmarking exercises more precision and specificity would be useful in relation to this indicator and the question(s) associated with it. More generally, careful consideration needs to be given to definitions of all types of eHealth activity.

10.4.2 Specificity in relation to eHealth activities

Related to this is the issue of specificity of the eHealth activities being benchmarked. In the case of the general public, for example, precise benchmarking of the extent of "seeking a second medical opinion" requires specificity in relation to how this is actually being done (formal online consultation with another doctor is very different to looking for information on the topic to help confirm or disconfirm an initial diagnosis). In the case of healthcare providers, for example, precise benchmarking of the extent of transfer of "patient identifiable data" (as addressed in the Eurobarometer GP survey) also requires specificity in relation to how this is actually being done (whether or not data with information that would allow the patient to be identified is encrypted will influence who can actually read the data and identify the patient).

These are examples of a more general need to have more specificity/precision in relation to who/what the interaction is with in carrying out a given eHealth activity and what exactly is the nature of the interaction. In the case of general public searching for health-related information, for example, it would be useful to differentiate between online interaction with one's own doctor or other specified provider and more informal browsing of health websites, as well as specifying what types of interaction are involved (passive information acquisition, question-and-answer, and so on). This requires questioning about the actual parties involved (or websites visited) in the interaction and the types of interaction that are involved.

Another aspect of this concerns the relevant eHealth applications/services that should be addressed in benchmarking. In fact, this is something that can be quite context dependent (particular eHealth activities it may not be an option in some countries, for example) and that will evolve over time as the availability and take-up of applications/services evolves. Benchmarking activities may need to give attention both to patterns of usage of applications/services that are already being used to an appreciable extent and to providing an "early warning" service in relation to new and emerging applications/services.

10.4.3 Amount of usage

Another aspect concerns the assessment of amount of usage of eHealth applications and services. Issues to be considered include the reference period to be used (in SIBIS and the other studies this varied from no reference period to 4 weeks, 3 months and 12 months) and how to measure frequency of use and relate this to health needs. In order to have comparable results across surveys it will be important to harmonize reference periods. It also needs to be remembered that usage within a recent reference period (e.g. last 4 weeks) is unlikely to be a very satisfactory proxy for regularity of usage in the case of eHealth given that, depending on the definition adopted and the particular activity in question, it is something that may sometimes but not always be done on an "as needs" basis rather than a regular basis.

Related to this is the question of extent/frequency of eHealth activity. Again, it will be important to contextualise data on this so that we know what specific activities are being carried out frequently/infrequently and what contextual factors are related to this (e.g. presence of a particular disease/condition).

10.4.4 Contextualising data

The issue of contextualising indicator data is of central importance for benchmarking the eHealth area. This can be partly addressed through questioning in surveys, by ensuring that relevant information on users (socio-demographic) and their health needs (arising from specific diseases/conditions of their own or of those that they care for) and their healthcare context (who are the main healthcare parties that they engage with and for what types of transactions, are they public or patients, what is their reimbursement situation and so on) is captured. It also requires data from other sources to enable interpretation (for example, in relation to the normative/cultural and structural aspects of the healthcare system within which they operate) and evaluation (for example, are the health sites visited of good quality, are the eHealth activities resulting in better health outcomes).

10.4.5 Need for a multi-level approach

Finally, multi-method approaches are needed to comprehensively benchmark the eHealth domain. Surveys of the general public and other healthcare players have a key role to play, but other complementary approaches could also be included in the future. Apart from gathering contextual data on cultural factors and on service organisation at national/regional level, it would also be worth considering automatic data mining of activity data from health web-sites. This might be easier to implement for "official" or public sites of course.