THE FISTERA DELPHI

FUTURE CHALLENGES, APPLICATIONS AND PRIORITIES FOR SOCIALLY BENEFICIAL INFORMATION SOCIETY TECHNOLOGIES

PARTNER RESPONSIBLE: PREST / WP 4 – IST FUTURES FORUM
THE UNIVERSITY OF MANCHESTER, UK

Executive Summary

The European Union and its 25 member states, as well as many other governments around the World, are studying carefully the social dimensions of Information Society Technology and its various applications in different areas of social and economic life. Having this in mind, The FISTERA Delphi set out to determine expert views of the following issues:

❖ What are the main challenges that R&D needs to address in Information Society Technologies (IST)?

❖ What are the main impediments for developing IST applications?

❖ What actions should the European Union (EU) implement to achieve more effective and socially beneficial IST development and application?

❖ How do specific IST Application Areas (e.g. Government, Health, Education, etc.) contribute to specific EU goals (e.g. job and wealth creation, competitiveness, etc.)?

❖ Which IST Application Areas are liable to contribute most significantly to the success of European knowledge economies?

❖ What are the EU's capabilities for generating IST applications and for industrial exploitation of IST?

❖ How well prepared are public and private research sectors to seize the opportunities presented by developing IST?

❖ Which stakeholders can contribute most to the development of specific IST Application Areas?

SCOPE

The FISTERA Delphi examined the period to 2010 and beyond. 2010 is the date to which the Lisbon Objectives (i.e. improvement of job & wealth creation; competitiveness; social cohesion & inclusion; and environmental quality in the European Union) are oriented, and is thus an important reference point. But the full implications of many emerging IST applications are unlikely to be fully realised until after that date, and the European Information Society will certainly continue to evolve beyond then.

The study is intended to inform discussions around the future Framework Programme (FP7). It is mainly focused on prospects for the EU25, and many of the experts consulted come from the EU15 and New Member States (NMS); but we also have some participation from experts from other countries. Where appropriate, results are disaggregated by region, so we can compare views of experts from different locations.

THE METHOD

Delphi method involves surveying informed participants about an issue. Technology-oriented Delphis are most familiarly used to obtain forecasts of when or how far technologies are likely to develop – that is for forecasting purposes. However, the Delphi technique can be used to address other sorts of expert opinion. For instance, even the more predictive Delphis often go beyond the basic forecasting to ask about national capabilities, social and economic implications of the developments studied, and so on. The present study sought to gather views

about the potential of various IST application areas to contribute to EU goals, the particular types of application that were most promising, and where EU capabilities were strongest.

Delphi method differs from a conventional survey in that participants are invited to reassess their initial judgements in the light of the overall pattern of results. This survey went through two rounds, and was conducted online – allowing for comparatively rapid processing of results. The survey design evidently worked in terms of securing participation from a large number of informants. The majority of the respondents also indicated their occupational sectors or roles in terms of IST and this information was used to generate analysis for three types of occupational sectors (Policy, Business and Science-base researches).

Below we present some highlights of the results from the Delphi. Many more results, and more detail on these results, are available in the main report that follows. We have not sought to interpret these results, though we do note some of their most striking features and surprising points. The next step of WorkPackage 4 of FISTERA involves constituting an online "IST FUTURES FORUM" in which we will be asking experts to explicate, comment on, and elaborate the results.

AN OVERVIEWS OF MAIN RESULTS

❖ We asked how far EU organisations associated with IST and applications areas were capable of developing and exploiting IST in the various areas. The typical picture was that most EU organisations were felt to be average, while a few were felt to be cutting-edge.

❖ A very similar picture emerged when we asked about the preparedness of research communities to seize new IST opportunities in the various application areas. Again, it was common for most researchers to be felt to be "moderately" well-prepared, with only a couple of areas (e.g. transport) being seen as ones where researchers are generally well-prepared. There may be a slight tendency for the situation to be somewhat better for private sector.

❖ The outstanding result of the survey is the strong endorsement given to one particular application area - "Education and Learning". This repeatedly emerges as an application area for IST that contributes to numerous EU social and economic goals and is central to the construction of a European knowledge society. It is, however, a typical application area in terms of European capabilities and preparedness being average and moderate, respectively.

❖ Education emerges as an area that is important across a range of six EU goals. More generally, however, there is some divide between applications which are seen as contributing to more "social" goals (social cohesion, social inclusion), and those which contribute more to "economic" goals (competitiveness, job creation, wealth creation). (Environmental goals are rather more closely associated with the economic than the social goals, in terms of the application areas that contribute most to them.)

❖ IST applications in government, social welfare and public services, and cultural diversity contribute to many EU goals. However, applications in work organisation and in management are seen as contributing particularly strongly to the economic goals.

❖ It will be interesting to explore further in the IST Futures Forum why application areas like leisure and recreation, ageing and security were seen as contributing to EU goals to a limited extent only. This is rather surprising given the huge markets that exist around these areas, and the implications for job and wealth creation that follow.

❖ There was not a strong consensus on the major problems impeding development of IST applications, with none of the problems standing out as compared to others. The main problems were seen as those concerning social inequalities in access to IST, and lack of adequate finance for innovations

❖ The challenges seen as confronting Research and Development in EU IST were more differentiated in terms of the numbers of respondents identifying them as important. The two issues which received most endorsement were establishing more user-friendly systems, and enhancing the security of transactions and personal information. (Note: a possibility that we shall explore with the IST Futures Forum is that here "security" is taken to refer to the development of IST systems that are less vulnerable to hackers, viruses, etc. while the application area of "security" is seen more as involving counterterrorism and similar issues around physical wellbeing.) Interestingly, improving IPR protection came last among the challenges we proposed.

❖ There was similarly a fairly strong pattern of emphasis where it came to actions that the EU would need to undertake, with the two topics *Social and institutional innovations*, and *Reducing the "digital divide"* coming ahead of many other actions – including such familiar ones as *Improving the communications infrastructure*; *Developing new & improved IST applications*, and achieving *Better IST training and awareness programmes*

❖ There are many intriguing variations across regions and occupational groups, though most of the outstanding results are replicated across these different disaggregations more often than not. We shall be using the IST Futures Forum to examine explanations of these variations in more detail. Through the report we have also tried to highlight those results where regional or occupational views differed.

❖ Results also showed that the majority of respondents see *National governments*, *Large firms in IST* and Small *and medium sized firms in IST* as the 'key players' improving IST applications in nearly all areas. In this respect the EU is believed to significantly contribute to the improvement of applications in four main areas: Social welfare and public services; Cultural diversity; Transport & Work organisation.
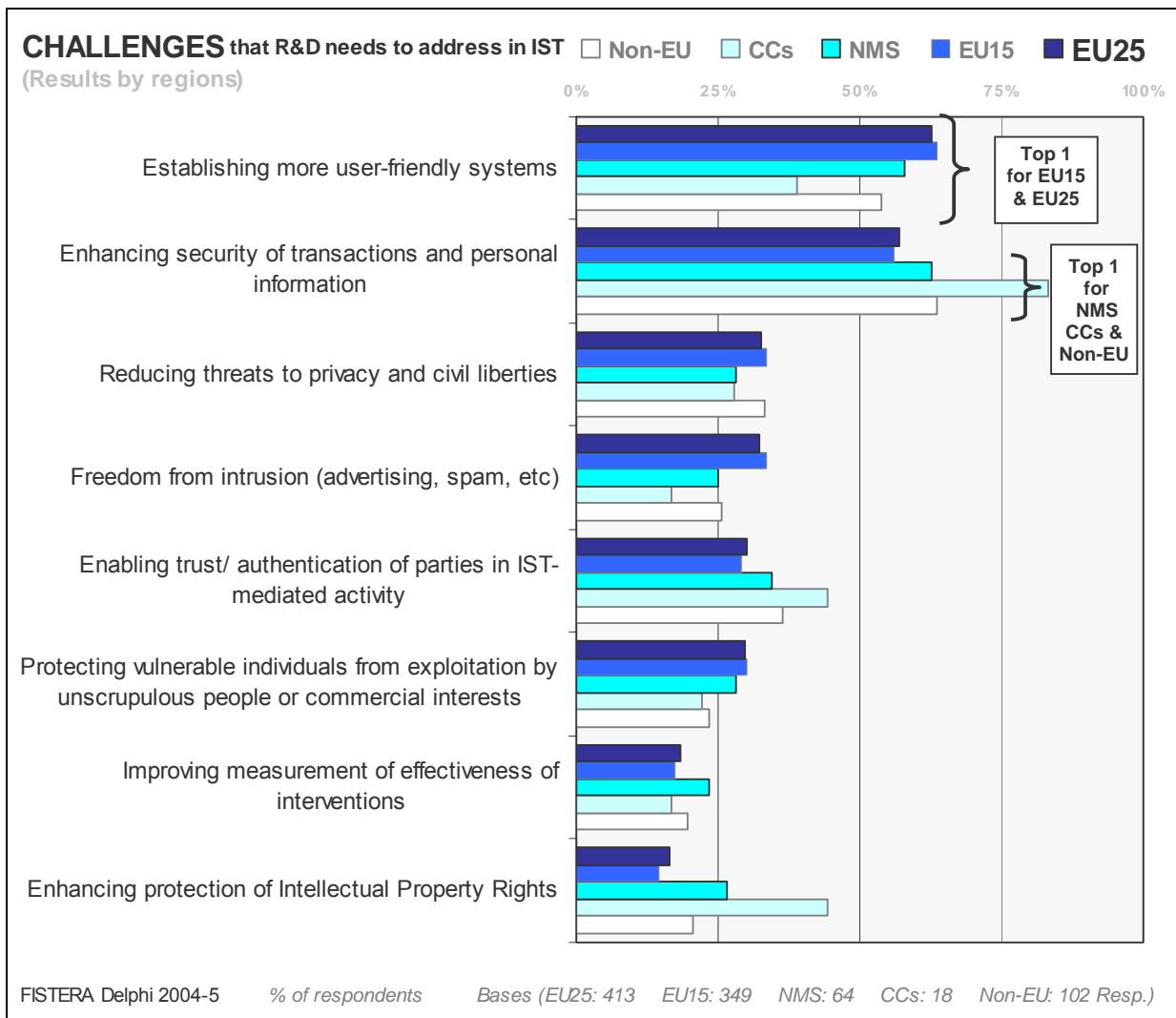
The following pages present a number of illustrative graphical representations of data connected with the results discussed above. We provide information on challenges (Figure ES1), impediments (ES2), and actions (ES3), with typical disaggregations by region, occupation, gender. Several of the charts concern the questions about specific applications of IST, where we provide information concerning the overall contributions that applications are expected to have for six EU goals (ES4, ES5), and present results for one particular goal (ES6, Social Cohesion). We then present a table containing a large amount of information on the perceived contributions, of applications to the EU knowledge economy, and the EU's capabilities and preparedness to seize these (ES7). The concluding charts examine the role of different stakeholders in advancing EU IST applications (ES8), and finally provide an example of how we have asked participants to indicate which of the more detailed applications within a general application area are most important (ES9).

About R&D challenges in IST (regional analysis)

The FISTERA Delphi presents results of participants from different geographical locations. The EU25 views have been selected as the base for most comparisons and chart arrangements. Through the report the reader will find many figures and tables where the arrangement of options reflects the ranking of EU25 respondents. For example, Figure ES1 (R&D challenges in IST) shows in second place '*Enhancing security of transactions and personal information*' (most voted challenge by New Member States respondents) because the option '*Establishing more user-friendly systems*' (most voted challenge by EU15 participants) prevailed in term of votes. We should also point out to that, in spite of the low number of response, we have been asked to explicitly indicate the views of the 18 participants from three Candidate Countries (Bulgaria, Romania and Turkey – Croatia is also a candidate country but no participant selected it as country of origin). CCs views are also included in the Non-EU group.

Figure ES1 can tell us that practically all regions agree on the importance of the top two challenges.

ES1: Regional views on R&D challenges in IST

CHALLENGES that R&D needs to address in IST — Non-EU, CCs, NMS, EU15, EU25 (Results by regions)

- Establishing more user-friendly systems — Top 1 for EU15 & EU25
- Enhancing security of transactions and personal information — Top 1 for NMS CCs & Non-EU
- Reducing threats to privacy and civil liberties
- Freedom from intrusion (advertising, spam, etc)
- Enabling trust/ authentication of parties in IST-mediated activity
- Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests
- Improving measurement of effectiveness of interventions
- Enhancing protection of Intellectual Property Rights

FISTERA Delphi 2004-5   % of respondents   Bases (EU25: 413   EU15: 349   NMS: 64   CCs: 18   Non-EU: 102 Resp.)

About impediments for developing IST applications (results by rounds)

Delphi surveys are instruments which normally involve two or more consultation rounds. The main reason for addressing respondents for the second time is to inform preliminary results (Round 1) and ask them to reflect and feedback a final judgement (Round 2). The rationale behind the process is that participants tend to reach a more consensual position towards the apparent key options and flat distributions of opinions tend to decrease.

Figure ES2 presents the results by consultation rounds. Round 1 show the views of 363 respondents. These results where processed and a 'draft' report was sent to participants. For Round 2, the Delphi software used 'dialog boxes' (PopUp windows) to show Round 1 results next to each question. For this reason, Round 2 allowed the participation of 152 new comers who we consider 'new informed participants'. Some 90 participants from Round 1 reassessed their initial judgements but many others confirmed their views via email so this is why we created a third category called BRC (both rounds combined). BRC results include Round 2 responses plus those views from Round 1 who did not take part in Round 2, in total 515 participants. The chart below refers to the question about problems or impediments for developing IST applications. This is one of the very few cases where there is no clear set of agreed topics, which means that rarely more than 50% of participants voted a given option. But we thought that this chart illustrate the usefulness of second round consultations.

ES2: Views on impediments for developing IST applications (by consultation rounds)
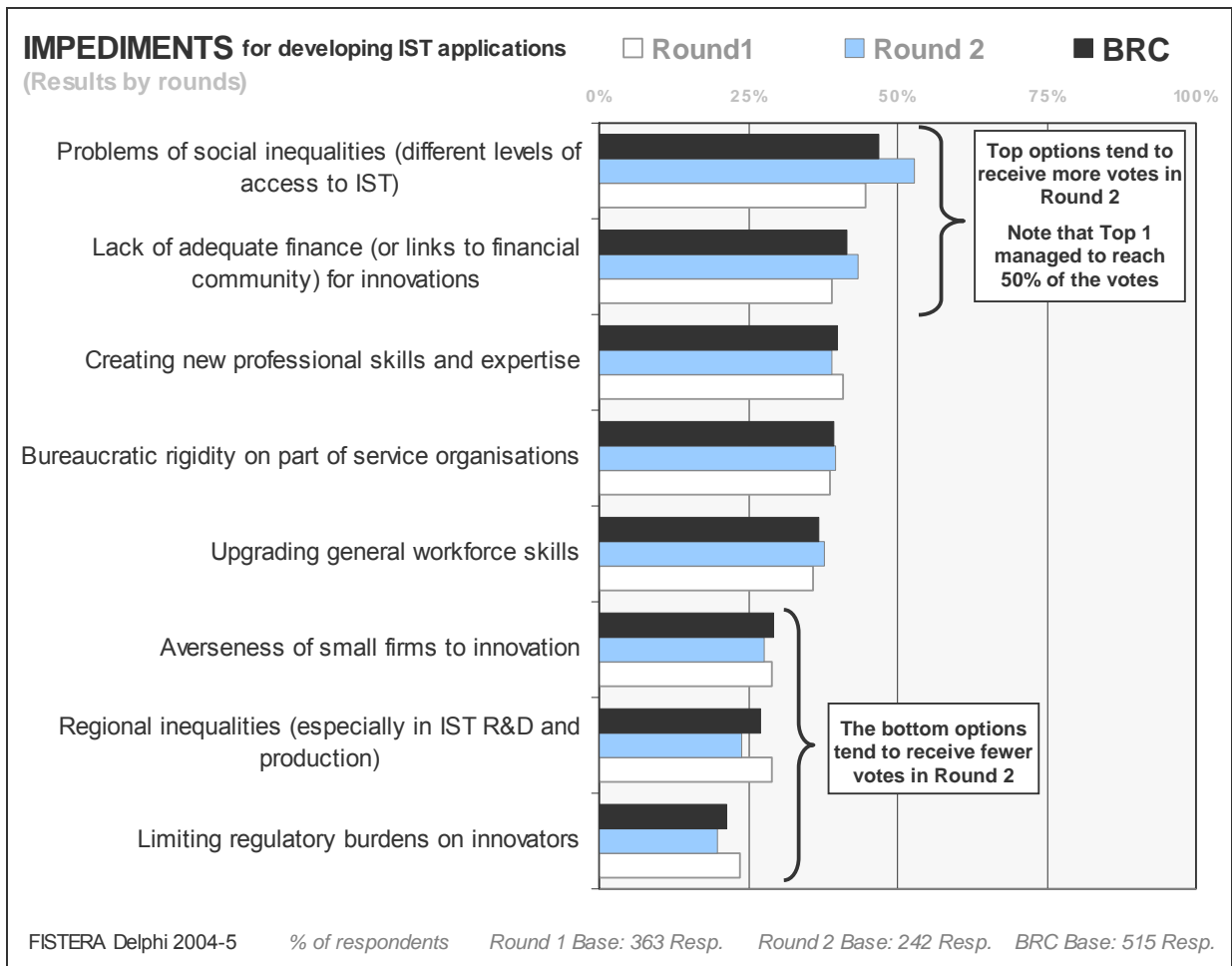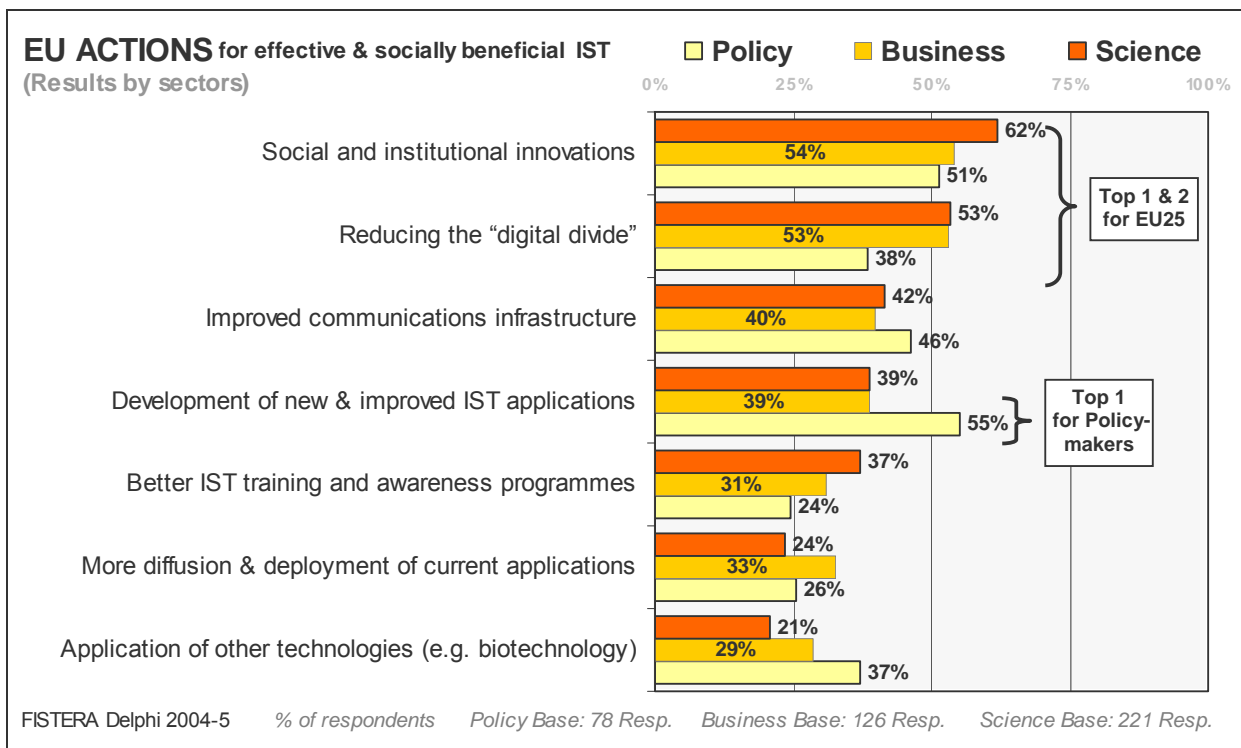
About actions for effective and socially beneficial IST (occupational analysis)

One major concern about Information Society Technologies is what can be done to make them more effective and socially beneficial. The FISTERA Delphi addressed this issue by asking participants to select three out of seven suggested actions.

Figure ES3 has been selected again for two reasons. The first is to introduce to the reader the type of occupational analysis included through out the report. This analysis clusters respondents into three main categories (Policy, Business, and Science-base sectors). The second is show the utility of the analysis. For example, bearing in mind that the options are always listed in terms of EU25 rankings; Figure ES3 shows that the Business and Science-base sectors confirm EU25 findings for the first two actions, whereas for Policy-makers the *Development of new & improved IST applications* (rank 4 in EU25) is considered as the most important action (55%).

ES3: Occupational views on EU Actions for effective and socially beneficial IST

EU ACTIONS for effective & socially beneficial IST   □ **Policy**   ■ **Business**   ■ **Science**
(Results by sectors)

Action	Science	Business	Policy
Social and institutional innovations	62%	54%	51%
Reducing the "digital divide"	53%	53%	38%
Improved communications infrastructure	42%	40%	46%
Development of new & improved IST applications	39%	39%	55%
Better IST training and awareness programmes	37%	31%	24%
More diffusion & deployment of current applications	24%	33%	26%
Application of other technologies (e.g. biotechnology)	21%	29%	37%

Top 1 & 2 for EU25

Top 1 for Policy-makers

FISTERA Delphi 2004-5   *% of respondents*   *Policy Base: 78 Resp.*   *Business Base: 126 Resp.*   *Science Base: 221 Resp.*
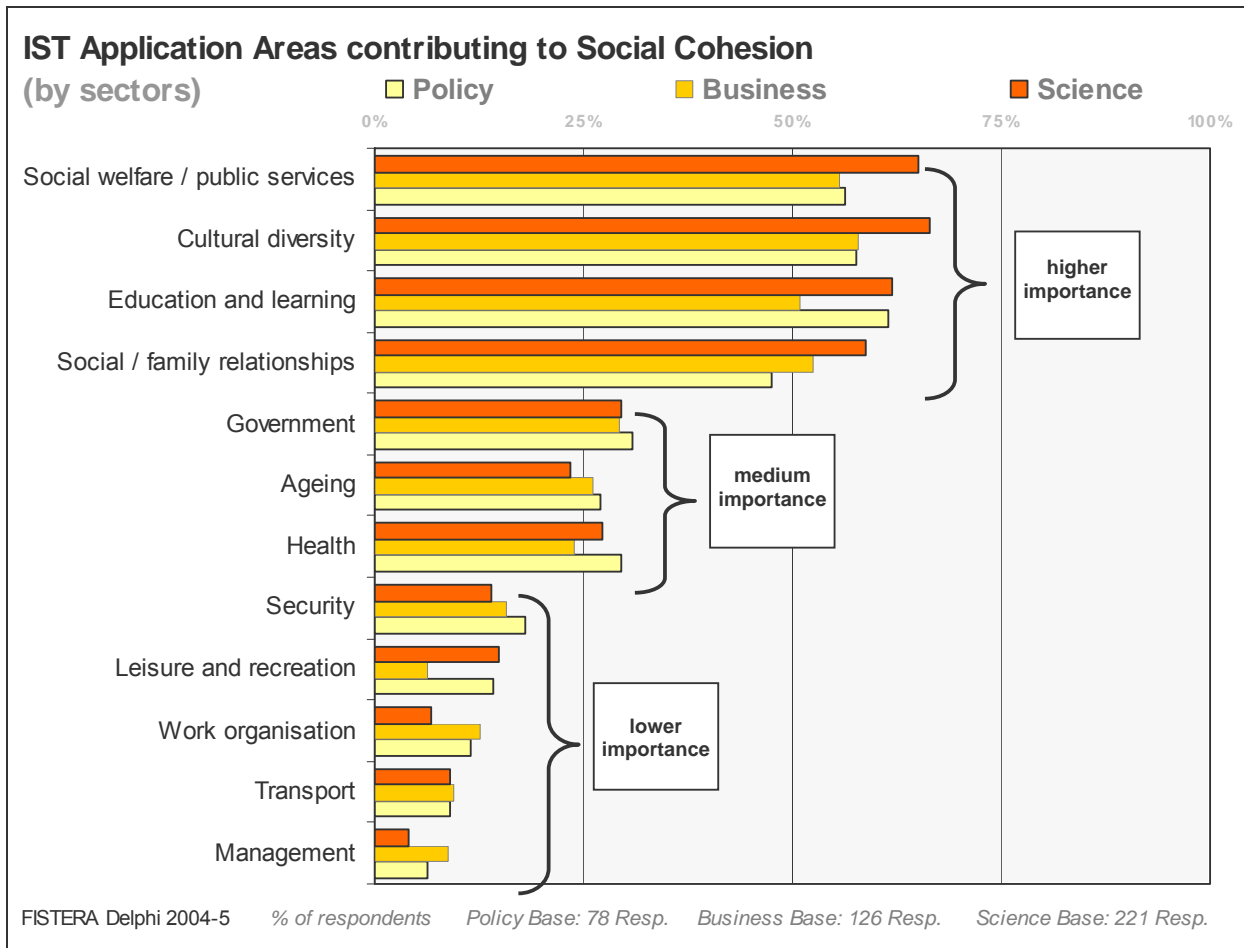
About IST Application Areas contributing to specific EU goals

The FISTERA Delphi also asked participants to select from a list of 12 IST Application Areas (see options on the Y axes of the chart below) the five areas which they considered are the more likely to contribute to the achievement of six specific EU objectives: Job creation, wealth creation, competitiveness, social cohesion, social inclusion and environmental quality.

Figure ES4 shows the results of the occupational analysis for the specific EU objective of improving Social Cohesion. Those areas voted by more than 50% of participants are considered of *higher importance*.

**ES4: Occupational views on IST areas contributing to Social Cohesion**

About IST Application Areas contributing to the Lisbon Agenda

The above chart (Figure ES4) showed how each of the 12 application areas is thought to contribute to one of the EU objectives. Figure ES5 presents an aggregated analysis of the results in an effort to provide each of the considered regions with a hopefully useful 'Recipe for targeting EU goals'.

Recognising that the aggregation of votes across different EU goals can be problematic, we have included in this chart the proportion of votes (where high) for the individual objectives. In Figure ES5 the scale of X axis is set to 600% since the chart shows the aggregation of levels of agreement for the contribution of the application areas to each of the Lisbon Objectives (coloured sections). If one of the application areas would have received 100% votes for each goal then the size of the bar would be 600%. The main reason for taking this graphical representation relies on the fact that we believe the important proportions that needed to be kept in the analysis are those of the individual sections or goals. The char also indicates the values where the participants reach – or are close to – a consensus (more than 45% of votes).

ES5: IST Application Areas contributing to the Lisbon Agenda
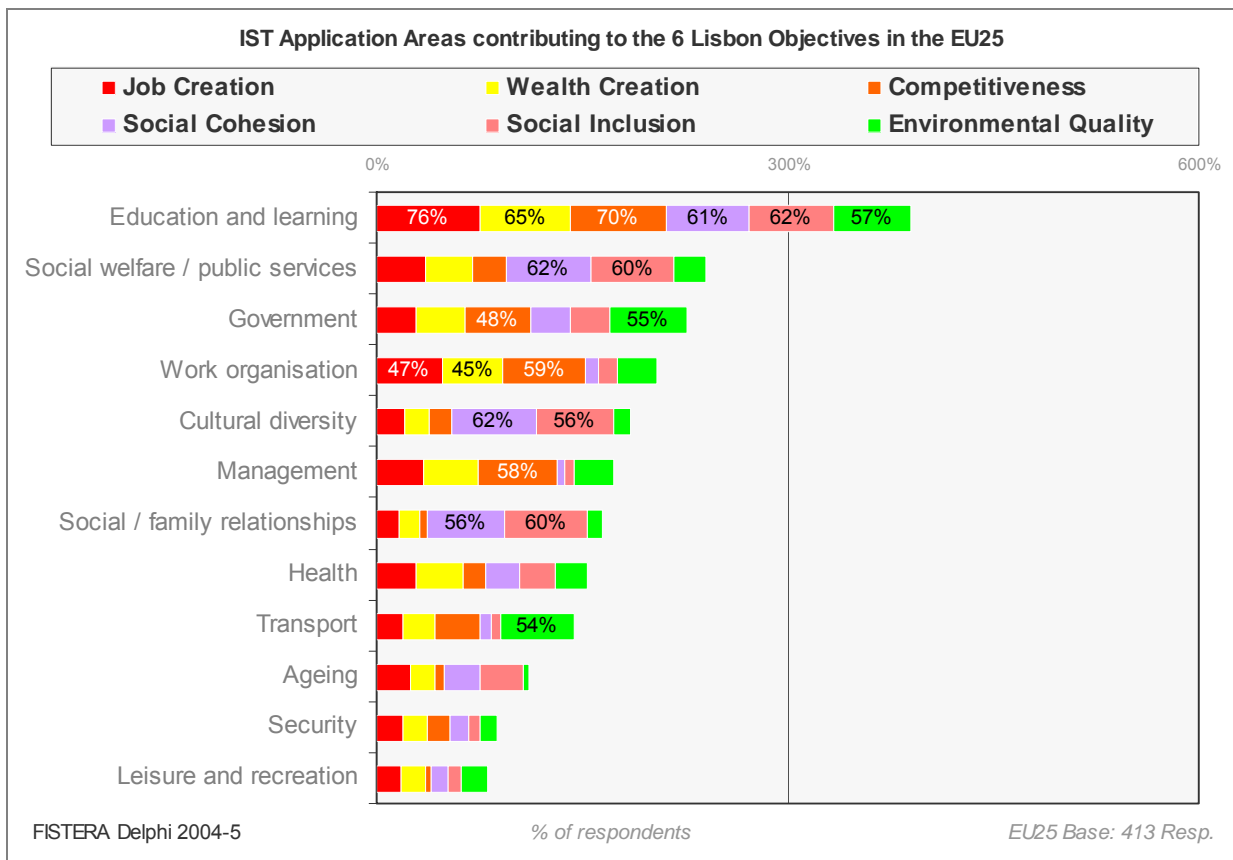
About IST Application Areas contributing to European knowledge economies

The previous chart focused on areas contributing to the "**six EU goals targeted at Lisbon**". But we must agree that there are other goals in addition to the six considered in Lisbon which may as well contribute the success of knowledge-based economies in Europe.

Section 2.5 of the report shows the results of a prioritisation exercise which asked participants to rank from 1 to 5 those innovative IST applications areas that would contribute to the "**success of European knowledge economies**" in the decade after 2010. Table ES6 presents the results for the EU25 region.

ES6: IST Application Areas contributing to the success of European knowledge economies

Application Areas	Rank	Total score	Votes	No of times:				
				1st	2nd	3rd	4th	5th
Education and learning	1	1489	363	193	75	52	25	18
Government	2	623	221	31	42	45	62	41
Health	3	593	188	40	49	34	30	35
Work organisation	4	590	205	29	46	43	45	42
Management	5	492	167	24	35	47	30	31
Cultural diversity	6	463	161	35	30	21	30	45
Social welfare / public services	7	441	165	10	36	39	50	30
Transport	8	379	136	14	26	37	35	24
Security	9	361	144	11	24	35	31	43
Ageing	10	258	96	12	20	15	24	25
Social / family relationships	11	198	63	18	11	11	8	15
Leisure and recreation	12	157	66	3	13	14	12	24
Total score = (1st position votes * 5) + (2nd position votes * 4) + (3rd position votes * 3) + (4th position votes * 2) + (5th position votes * 1)								
Number of participants who voted on each position				420	407	393	382	373

About EU R&D capabilities and preparedness

Section 3.1 of the report centres the attention on EU capabilities in IST in comparison to the World and the preparedness of the key EU research communities in the **public** and **private** sectors. We should bear in mind that for this section the survey had 12 independent sub-sections ('Panoramic Delphis') and that participants were asked to focus on one or two areas that relate most closely to their own field of expertise or experience. Table ES7 shows the overall results.
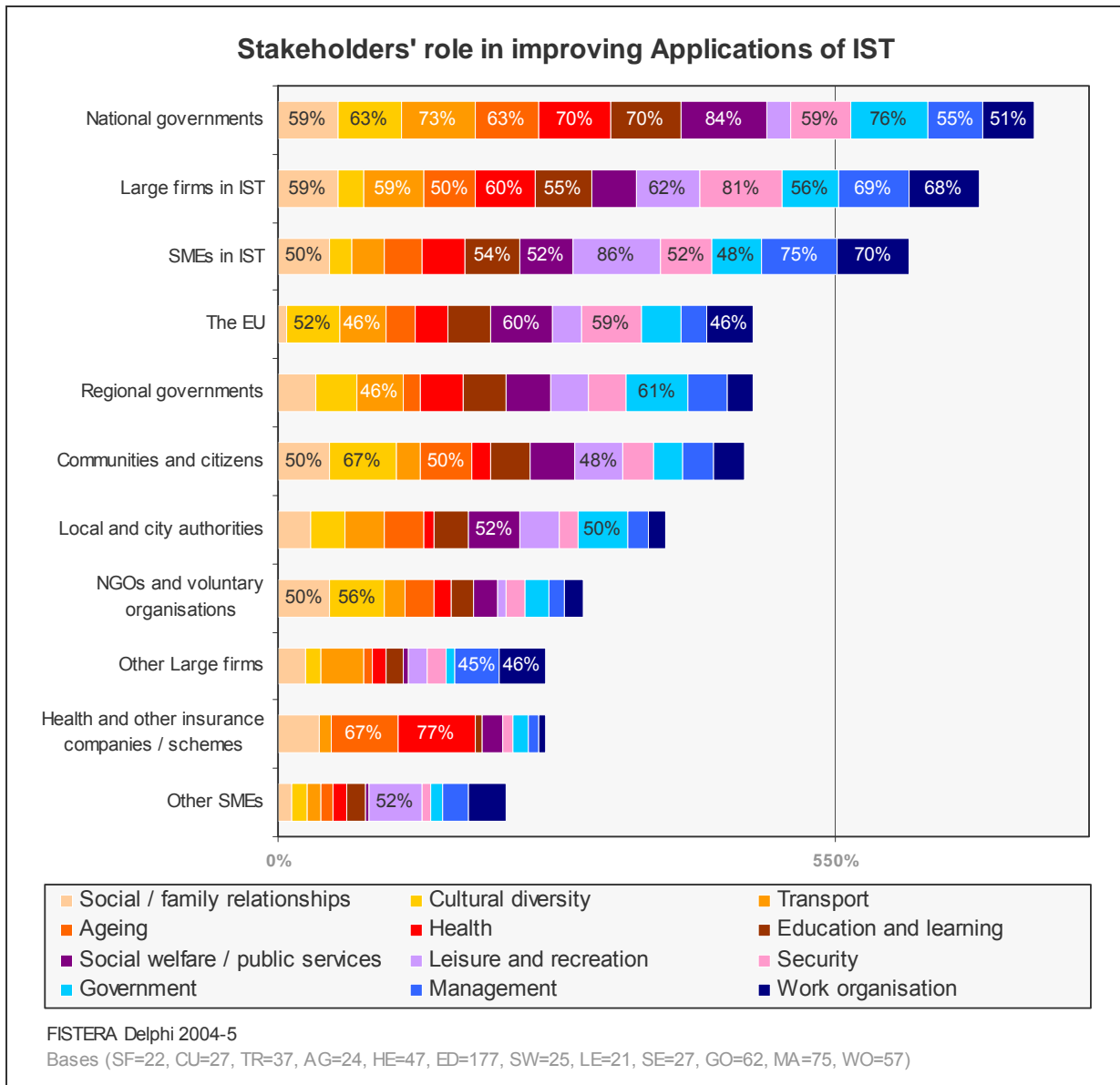
ES7: EU R&D capabilities and preparedness

Panoramic View of EU R&D Capabilities & Preparedness (Areas)	Number of Resps.	Importance for the European Knowledge Economy	EU R&D capabilities compared to the World — For generation of IST applications (Most are)	But few	For industrial exploitation of IST (Most are)	But few	Preparedness in the Public Sector — poor	moderate	well	Preparedness in the Private Sector — poor	moderate	well
Social / family relationships	34						F	M	F	F	M	F
Cultural diversity	23						M	F	F	F	F	F
Transport	33						F	M	M	F	F	M
Ageing	22						F	F	F	F	F	F
Health	46						F	M	F	F	F	F
Education and learning	165						F	M	F	F	M	F
Social welfare / public services	25						M	M	F	F	M	F
Leisure and recreation	19						F	M	F	F	M	F
Security	24						M	F	F	F	M	F
Government	58						F	M	F	F	M	F
Management	71						F	M	F	F	M	M
Work organisation	54						F	M	F	F	M	F

Key to importance column: irrelevant, unimportant, moderately imp., very important, essential.
Key to EU R&D capabilities: cutting-edge, average, lagging-behind.
Preparedness key: None = N, Few = F, Many = M, All = A.

About the role of stakeholders in improving applications of IST

In the report, Section 3.3 (Figure ES8) looks at those stakeholders who are more likely to play a key role in improving applications of IST in each area. The aggregation of votes again provides us with an overview of this in terms of the major contributors: **national governments**, **large firms in IST**, **SME in IST**, **the EU**, and **regional governments.**
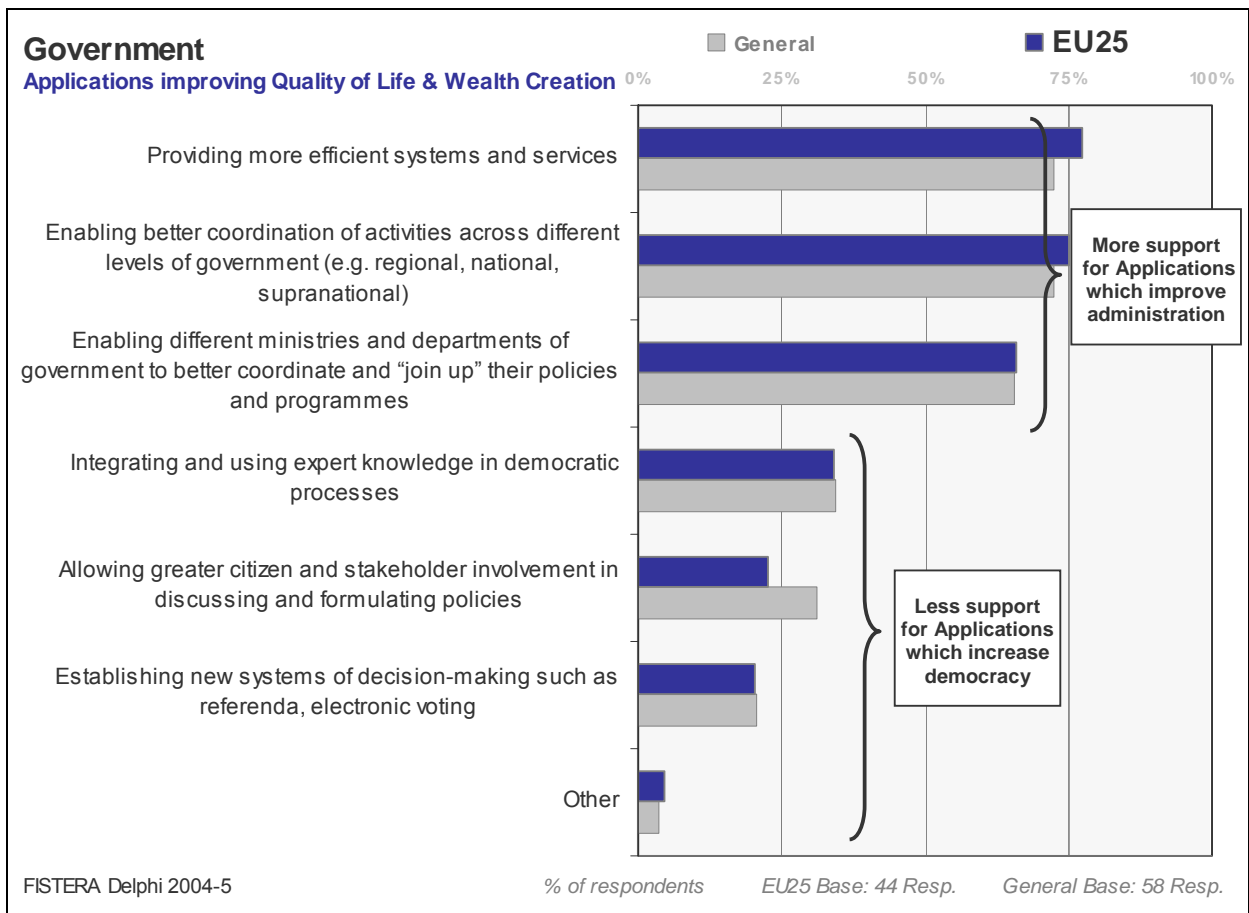
ES8: Stakeholder improving applications of IST

Stakeholders' role in improving Applications of IST

FISTERA Delphi 2004-5
Bases (SF=22, CU=27, TR=37, AG=24, HE=47, ED=177, SW=25, LE=21, SE=27, GO=62, MA=75, WO=57)

About IST applications to the areas

The FISTERA Delphi also asked participants to indicate applications to each area which were more likely to improve quality of life and wealth creation. Figure ES9 shows the results for applications to Government area. Some of the results of this section have raised interesting questions which derived from the 'type' of message given by the experts involved. For example, here we could ask ourselves why do administrative-type applications (e.g. enabling coordination of activities or institutions) prevail from those which could increase democracy (e.g. establishing new systems to make decision-making more public)?

ES9: IST applications to Government

Government

Applications improving Quality of Life & Wealth Creation

	General	EU25

Providing more efficient systems and services

Enabling better coordination of activities across different levels of government (e.g. regional, national, supranational)

Enabling different ministries and departments of government to better coordinate and "join up" their policies and programmes

More support for Applications which improve administration

Integrating and using expert knowledge in democratic processes

Allowing greater citizen and stakeholder involvement in discussing and formulating policies

Less support for Applications which increase democracy

Establishing new systems of decision-making such as referenda, electronic voting

Other

FISTERA Delphi 2004-5   *% of respondents*   *EU25 Base: 44 Resp.*   *General Base: 58 Resp.*

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PARTNER RESPONSIBLE: PREST / WP 4 – IST FUTURES FORUM
THE UNIVERSITY OF MANCHESTER, UK

AUTHORS:

The present report was prepared by Rafael Popper and Ian Miles of PREST (Policy Research in Engineering, Science and Technology), Institute of Innovation Research of the Manchester Business School - The University of Manchester.

The 'panoramic descriptions' of selected IST areas are taken from the Delphi questionnaire and they were produced by WorkPackage 4 Team of the University of Manchester (Lawrence Green and the authors). They are based on various literature review processes and discussions around recent IST-related scenario reports.

Note:

This report is being circulated for dissemination purposes but the English has not been properly checked, so apologies for any possible misspellings and other minor editing errors.

WHAT IS **FISTERA?**

FISTERA is a Thematic Network on Foresight on Information Society Technologies in the European Research Area. The FISTERA network is supported by the European Community under the FP5 specific program for research, technological development and demonstration on a user-friendly information society (1998-2002). The aim of the FISTERA Thematic Network is bring together on a systematic and extended basis, actors and insights in national foresight exercises on IST in the Enlarged Europe.

Main objectives:

♦ Compare results of national foresight exercises and exchange visions on the future of IST

♦ Provide a new forum for interactive consensus building on future visions for IST

♦ Contribute to the European Research Area through benchmarking and community building, by providing a dynamic pan European platform on foresight on IST

In order to meet these three key objectives, FISTERA has:

♦ Reviewed and analyse the national foresight exercise outcomes (a country synthesis report)

♦ Built aggregate pan European Technology trajectories (a roadmap of potential developments of key emerging technologies)

♦ Mapped the European IST actor space (a SWOT analysis of the EU IST actor space)

♦ Provided an IST Futures Forum (strategically selected scenario exercises that will look at wider aspects of applications of IST)

♦ Disseminated the results to a targeted audience by various means (a dynamic website at the address http://fistera.jrc.es, an e-mail alert service, publications, conference presentations, a "road-show" of workshops and a final conference)

Network Membership:

Core partners (coordinators, work package leaders):

- JRC-IPTS (Institute for Prospective Technological Studies), part of the European Commission's Joint Research Centre, Scientific Coordinator of the network.

- FZK - ITAS (Forschungszentrum Karlsruhe GmbH in der Helmholtz-Gemeinschaft, Institut für Technikfolgenabschätzung und Systemanalyse), Germany.

- Telecom Italia (TILAB), Italy.

- ARCsys (ARC Seibersdorf research GmbH, Division Systems Research Technology-Economy-Environment, Seibersdorf), Austria.

- PREST (Policy Research in Engineering, Science and Technology) of the University of Manchester, United Kingdom.

- GC (Gopa-Cartermill), Belgium, Administrative and Financial Co-ordinator.

The group of **Members**, which is expected to grow over the duration of the contract, currently includes the following organisations: TNO-STB (The Netherlands), Danish Teknologisk Institut (Denmark), TecnoCampusMataró (Spain), Observatório de Prospectiva da Engenharia e da Tecnologia-OPET (Portugal), ARC Fund (Bulgaria), IQSOFT (Hungary), Tubitak (Turkey), The Researchers' Association of Slovenia (Slovenia), NMRC, University College Cork (Ireland) and BRIE-Berkeley University (USA). In addition, McCaughan Associates (McCA) runs a group of High-level Experts to the Network Management Committee.

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Foreword

It is widely recognised that applications of Information Society Technologies (IST) possess significant potential to facilitate improvement in areas such as industrial productivity, economic competitiveness, and the quality of life of EU citizens. Despite the large-scale introduction of IST over recent decades, this potential remains underexploited. In part this reflects the learning required to make effective use of the technology; in part it is a near-inevitable consequence of the ongoing rapid evolution of almost all forms of IST. Arguably, it may also reflect the uneven participation of various users and other stakeholders in shaping the process and outcomes of technological change.

The European Commission has been promoting public policies that aim to prepare the ground for the realisation of an Information Society within which new technologies and applications that contribute to social needs and market development can emerge and flourish. The FISTERA project was launched in 2002, with the aim of informing decisions about the role of IST Research and Development within the European research Area (ERA). This report constitutes a key deliverable from Work Package 4 of the project. The FISTERA Delphi study examines perceptions concerning the role of IST applications in relation to the main EU socio-economic goals (as represented, for instance, in the Lisbon Agenda). In this report the overall results are considered. Particular emphasis is dedicated to examining the views of Delphi respondents from various regional groupings (including current EU members, the former EU15, New Member States, candidate countries, and non-EU states).

The FISTERA team at PREST hopes that the publication of The FISTERA Delphi results will provide a timely and relevant contribution to ongoing EU discussions on the Seventh Framework Programme, and in particular, the future role and direction of the IST programme within this.

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PREST FISTERA TEAM

R. Popper, I. Miles, L. Green and K. Flanagan

Preface

This report presents the results of The FISTERA Delphi on Information Society Technologies. FISTERA is a thematic network supported by the European Community under the FP5 specific program for research, technological development and demonstration in relation to a 'user-friendly Information Society' (1998-2002). The aim of the Network is to bring together on a systematic and extended basis, actors and insights in national foresight exercises on IST in the Enlarged Europe.

> This report is a major deliverable of WorkPackage 4 (IST Futures Forum) led by PREST. The main objectives of WP4 are to:
>
> ❖ Promote a greater understanding of, and European consensus on, the feasibility and desirability of alternative visions of the future for IST, building upon technology trajectories and the mapping of key capabilities and actors in Europe
>
> ❖ Generate new scenarios from the emerging results of the project and - with the active participation of IST experts in discussion and debate - generate visions that will stimulate strategic thinking and assist in the monitoring of progress

The Delphi study, conducted in 2004-5, involved three types of expert: **Policy-makers**, the **Business sector** and **Researchers in the Science base**. It is anticipated that it will be of interest to these three groups, and more widely.

In total the survey elicited questionnaires from 515 individuals. Although we allowed experts to remain anonymous (as most Delphi surveys do), we have managed to build a database of 568 contacts (515 respondents plus 53 visitors) interested in the study. The report presents results by regions, allowing us to consider results for the EU25 (and within this the EU15 and New Member States), Candidate Countries and other non-EU countries. (102 responses come from this latter group; among non-EU countries the following 10 countries had between 5 and 17 respondents - Bulgaria, Canada, Israel, Norway, Peru, Romania, Switzerland, Turkey, USA and Venezuela).

The Delphi survey was designed in a modular form and divided into three sections. Sections One and Two asked about broad areas of interest ('R&D and social needs', and 'EU goals and IST areas' respectively) and the third section was divided into twelve 'application area' subsections:

1) Social / family relationships	5) Health	9) Security
2) Cultural diversity	6) Education and learning	10) Government
3) Transport	7) Social welfare / public services	11) Management
4) Ageing	8) Leisure and recreation	12) Work organisation

In Section Three, we requested that participants focus their attention on the one or two subsections to which their work or experience has most direct relevance.

Finally, we would like to say that while we highlight important features in this report, we have not set out to interpret them substantively. This task is undertaken with support from participants using an interactive discussion forum over the Internet. The forum can be accessed at http://les.man.ac.uk/prest/fistera/forum/

We acknowledge that the Delphi generated a great deal of valuable information at aggregate level. Thus, one of the key aims of the Forum is to probe more deeply, seeking to move towards a more detailed explication and interpretation of the most important findings from the Delphi. The perspectives and insights generated by the Forum will be used to feed discussions in the planned Scenarios Workshop, and more broadly, to inform development of the IST research agenda in the forthcoming EU Framework Programme.

Acknowledgements

PREST FISTERA team would like to thank the support and technical assistance provided by Calibrum Corporation (http://www.calibrum.com) in the use of their online foresight package and Delphi software (Surveylet).

Special thanks are extended to our colleague Michael Rader for his valuable contributions in the design of various questions in the survey. We obviously wish to express our gratitude to all contributions to this research as well as the support of various organisations, professionals and friends during the promotion of the study. To Jennifer Harper we would like to thank the promotion done through the eForesee network which proved to have high impact in response but we believe that her best certainly most effective support was by word of mouth. We would like to thank the ForSociety project for allowing us to present the first round results and for the effect that this had on response rate increase. We would also like to thank our Cuban colleague Juan Fernandez and our Spanish colleague Manuel Fernandez Lopez, who voluntarily promoted the exercise and provided contacts in their region and elsewhere.

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We appreciate the support of each partner for the promotion in their regions as well as for relevant suggestions for improvement and preparation of this report, and special thanks in this respect go to IPTS, specially Corina Pascu, Ramón Compañó, and Jean Claude Burgelmann.

Finally we should say that we are grateful for the contributions of the hundreds of experts who provided the input for this report. Of course, the authors are fully responsible for any possible omissions and insufficiencies that may appear here.

We hope that the present results transform into inputs for your future work.

Introduction

The FISTERA Delphi is a process which has been enriched by several findings from desk-research activities carried out by the PREST FISTERA team. The most influential one has been a report produced in February 2004 which made a review of five recent foresight studies with a focus on IST, Information Society, and the Knowledge Society (EUFORIA, STAR, SEAMATE, ISTAG and FLOWS) and also examined some earlier studies related to Information Society Technologies (i.e. the FAST programme). Apart from these inputs, researchers from PREST and ITAS arranged several meetings to discuss topics of mutual interest for the study, and the way in which these might be formulated in the various sections of The FISTERA Delphi. The results of these activities were presented and further discussed in a workshop held at IPTS (Seville) where we examined the key socio-economic driving forces and challenges in IST. The workshop was used to test the structure and relevance of the questions of the Delphi and participants' feedback allowed us to increase the user-friendliness of the questionnaire. The exercise was officially launched a week later.

In this introductory section we would like to clarify several issues about The FISTERA Delphi report and also present an overview of the main results. First, a few comments on **methodological issues** that need to be borne in mind in interpreting results:

❖ The FISTERA Delphi has been a 7-months process which was launched during the summer 2004 and which stopped February 1st, 2005.

❖ Participation in the survey was considerably high (515 respondents). The chart below illustrates the way in which final results (BRC) has been obtained. Round 1 gathered views from some 363 respondents and Round 2 involved 242, of which 152 were new 'informed participants'[1].
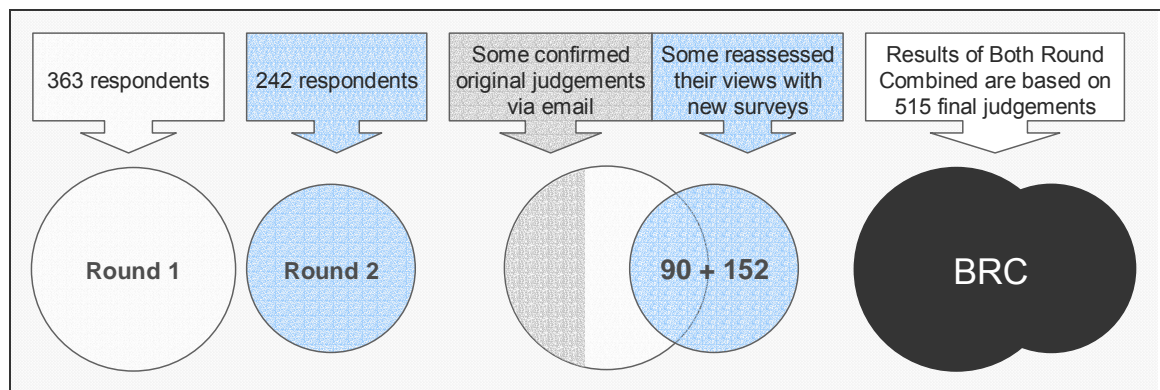
❖ Regarding the origin of participants and how this influenced on the results, we would like to mention that respondents from New Member States (NMS) have played an important role in shaping the EU25 results. This is noticeable in issues where there is some divergence in opinions, for example, while looking at IST application areas contributing to the *social cohesion* and *environmental quality* goals, NMS views strongly influenced on determining the top ones. (Sometimes the proportion that NMS votes assigned to their top priority issues/areas was much higher than the given by EU15 participants).

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[1] The Delphi software used in The FISTERA Delphi allowed participants in the second round to see Round 1 results for each question, thus making it possible for new people to take part in the survey.

❖ We should be aware that the Non-EU region results combine the views of participants from 23 countries with very different IST capabilities. Having this in mind the reader may find rather interesting those findings where non-EU respondents show strong consensus but should be cautious in drawing conclusions where opinions diverge

❖ Respondents have also shown their commitment in various ways:

    o First, we can see that most participants completed all questions in sections 1 and 2; and sometimes got involved in more than one of the twelve mini-surveys in section 3.

    o Second, participants have provided useful feedback (comments and suggestions) which were posted using the open-ended questions of the survey and via email.

    o Third, some participants have encouraged other colleagues from their own organisations to contribute to the study. (This is a conclusion we draw from various questionnaires arriving from the same organisation at relatively very short time difference).

❖ In terms of the look-and-feel of the questionnaire, we can say that it had an attractive layout and design. Perhaps the most recent evidence of the success of its structural design is a methodologically parallel Biotechnology Delphi launched by COLCIENCIAS (Institute for the Development of Science and Technology) in December 2004.

❖ Finally, The FISTERA Delphi has shown that the second round was useful to increase consensus on many issues. This can be seen in charts where we present the results by consultation rounds. Round 2 also allowed the participation of new 'informed' respondents since the Delphi system provided a way to present Round 1 results next to each question.

Second, we should make a few comments on **general outstanding features** of the report:

❖ The FISTERA Delphi has been design to allow participants to think about IST priorities for their own countries and for the EU as a whole. There were two type of prioritisations:

    o The most commonly used exercise required that participants allocate a given set of votes (normally 3 or 5) on a given set of options (normally 7 of 12).

    o A second type of exercise (used once – in section 2.5) required that participants indicate in order of importance, the top five ranking positions from a list of 12 options.

❖ Also related to the previous comment, we have found an interesting result when comparing the participants' views for their own countries with their views for the EU25 region. Although this is something which relates to one of the questions of the survey (Actions for more effective and socially beneficial IST) we think it is important we mention it here:

    o We first asked EU25 participants to think about what the EU should do for more effective and socially beneficial IST and '*reducing the digital divide'* came as the second most-voted option (see Table 1.3.1). But when we asked them the same question but in terms of their own country, their aggregated views show different results: '*Development of new & improved IST applications*' is the second most-voted while '*reducing the digital divide*' goes down to FIFTH position! (see Table 1.3.2)

❖ The representation of results by occupational sectors (Policy, Business and Science-base) is quite useful for understanding views of the different groups and perhaps rationalizing possible differences in their future R&D agendas.

Finally, we would like to make a few comments on **main commonalties and differences**:

❖ The report shows many areas where EU and non-EU results are rather similar and we believe that this information could be potentially used to promote future R&D cooperation programmes or projects in those areas (e.g. *Social and institutional innovations*)

❖ Results show that women and Under40s views tend to reach higher levels of consensus.

❖ Comparisons by regions and sectors proved to be useful to identify biases and priorities.

AN OVERVIEWS OF MAIN RESULTS

The survey is in several parts, which we discuss in turn below. First, let us pick out a number of highlights of the results:

❖ We asked how far EU organisations associated with IST and applications areas were capable of developing and exploiting IST in the various areas. The typical picture was that most EU organisations were felt to be average, while a few were felt to be cutting-edge.

❖ A very similar picture emerged when we asked about the preparedness of research communities to seize new IST opportunities in the various application areas. Again, it was common for most researchers to be felt to be "moderately" well-prepared, with only a couple of areas (e.g. transport) being seen as ones where researchers are generally well-prepared. There may be a slight tendency for the situation to be somewhat better for private sector.

❖ The outstanding result of the survey is the strong endorsement given to one particular application area - "Education and Learning". This repeatedly emerges as an application area for IST that contributes to numerous EU social and economic goals and is central to the construction of a European knowledge society. It is, however, a typical application area in terms of European capabilities and preparedness being average and moderate, respectively.

❖ Education emerges as an area that is important across a range of six EU goals. More generally, however, there is some divide between applications which are seen as contributing to more "social" goals (social cohesion, social inclusion), and those which contribute more to "economic" goals (competitiveness, job creation, wealth creation). (Environmental goals are rather more closely associated with the economic than the social goals, in terms of the application areas that contribute most to them.)

❖ IST applications in government, social welfare and public services, and cultural diversity contribute to many EU goals. However, applications in work organisation and in management are seen as contributing particularly strongly to the economic goals.

❖ It will be interesting to explore further in the IST Futures Forum why application areas like leisure and recreation, ageing and security were seen as contributing to EU goals to a limited extent only. This is rather surprising given the huge markets that exist around these areas, and the implications for job and wealth creation that follow.

❖ There was not a strong consensus on the major problems impeding development of IST applications, with none of the problems standing out as compared to others. The main problems were seen as those concerning social inequalities in access to IST, and lack of adequate finance for innovations

❖ The challenges seen as confronting Research and Development in EU IST were more differentiated in terms of the numbers of respondents identifying them as important. The two issues which received most endorsement were establishing more user-friendly systems, and enhancing the security of transactions and personal information. (Note: a possibility that we shall explore with the IST Futures Forum is that here "security" is taken to refer to the development of IST systems that are less vulnerable to hackers,

viruses, etc. while the application area of "security" is seen more as involving counterterrorism and similar issues around physical wellbeing.) Interestingly, improving IPR protection came last among the challenges we proposed.

❖ There was similarly a fairly strong pattern of emphasis where it came to actions that the EU would need to undertake, with the two topics *Social and institutional innovations*, and *Reducing the "digital divide"* coming ahead of many other actions – including such familiar ones as *Improving the communications infrastructure*; *Developing new & improved IST applications*, and achieving *Better IST training and awareness programmes*

❖ There are many intriguing variations across regions and occupational groups, though most of the outstanding results are replicated across these different disaggregations more often than not. We shall be using the IST Futures Forum to examine explanations of these variations in more detail. Through the report we have also tried to highlight those results where regional or occupational views differed.

❖ Results also showed that the majority of respondents see *National governments*, *Large firms in IST* and Small *and medium sized firms in IST* as the 'key players' improving IST applications in nearly all areas. In this respect the EU is believed to significantly contribute to the improvement of applications in four main areas: Social welfare and public services; Cultural diversity; Transport & Work organisation.

Section 1: RTD and Social needs

An overview of Information Society Technologies RTD in the EU

The European Union's research activities - organised into Framework Programmes for Research and Technological Development (RTD) - complement national and regional research programmes, helping Europe pool its resources and build a critical mass, thus improving competitiveness and quality of life.

In the EU's Sixth Framework programme Information Society Technologies (IST) is the largest priority (with 3.6 billion euros of funding) since it is believed that IST developments are critical to make the EU the most competitive and dynamic knowledge-driven economy in the future (**Lisbon Agenda**).

With this in mind, Europe has supported the vision of an **Ambient Intelligence** (people surrounded by easy-to-use interfaces embedded into all kinds of objects and capable of recognising and responding to individuals in a seamless, unobtrusive and invisible way) which places the user - the individual - at the centre of future developments for an inclusive knowledge-based society for all. However, realising this vision requires integrated R&D efforts in order to address the major societal and economical challenges and ensure the co-evolution of technologies and their applications. The main challenges and enabling technological building blocks are:

❖ **Establishing trust –** Improving security and public confidence in online infrastructures

❖ **Social cohesion –** Creating and promoting efficient, easy-to-use IST systems for public services

❖ **Sustainable growth and competitiveness –** Assisting large and small businesses in the adoption of IST to create a more dynamic marketplace with better employment opportunities

❖ **Problem solving –** Supporting science, society, industry and businesses by harnessing computing and knowledge management resources across Europe and bringing them to the desktop of any researcher, engineer or other end-user

❖ **Lowering costs –** Creating more efficient components and minimising cost and power consumption, making IST more accessible

❖ **New infrastructures –** Developing mobile, wireless, optical and broadband communication infrastructures as well as software and computing technologies that are reliable, pervasive, interoperable and can be adapted to accommodate new applications and services

❖ **User-friendly interfaces –** Developing user-friendly interfaces, coupled with more powerful and flexible knowledge technologies, including cognitive systems, will encourage greater uptake of IST and prepare for the next generation of services"

For further information on IST research in the EU, visit: http://europa.eu.int/information_society/research/

As we approach the year 2010, new tasks will test our abilities and skills to realise the Ambient Intelligence vision – and, of course, the Lisbon Agenda (which EU members launched in year 2000 as a normative vision of where Europe should be in the decade to come). On the whole the main objective of the latter is to make the European Union the most competitive and dynamic knowledge-based economy in the world. More pragmatically, the agenda focuses on specific targets, such as driving up productivity and creating more and better jobs (the employment rate is expected to go from the current 63% to 70% if Lisbon Action Plan succeeds in its implementation). Another explicit target is to extend and deepen the single market by means of a series of economic reforms and investments in research and development since it is believed that a regional R&D spending of 3% would increase EU GDP by nearly 2% in 2010.

It is in this context that FISTERA project undertook its Delphi study. We dedicated a full section of the survey (**RTD and Social needs**) to gather the views of 515 policy experts, business people and science-base researchers to prioritise key technological challenges and areas for concentration of R&D efforts in Information Society Technologies.

The section draws attention to 'big' issues connected with the development and use of IST in Europe in the period up to 2010 and beyond. This was done through the following questions:

- ❖ What are the key challenges that R&D needs to address in IST?

- ❖ What are the main impediments to the development of IST applications?

- ❖ What are the major actions needed for effective and socially beneficial IST?

As for the possible answers to the above questions, participants were given three (3) votes to indicate their top choices from a list of challenges, impediments and actions which was produced by PREST FISTERA Team in earlier activities already mentioned in the introduction.

Section 1.1 presents results on challenges; section 1.2 focuses on problems or impediments while section 1.3 centres the attention on important actions for effective and socially beneficial IST.

1.1   CHALLENGES

… THAT RTD NEEDS TO ADDRESS IN IST

In this section we present the results of the prioritisation on challenges where participants were given three votes to be allocated across eight options resulting from a process which involved literature review, brainstorming, workshops and desk research. Respondents were also allowed to input new challenges and issues (at least 46 experts from the EU25 provided interesting feedback on additional challenges).

IST challenges confronting the EU25

The FISTERA Delphi identified the perceived order of importance for a set of eight challenges that research and development needs to address in Information Society Technologies. This following list presents them in order of priorities for the EU25:

1. Establishing more user-friendly systems
2. Enhancing security of transactions and personal information
3. Reducing threats to privacy and civil liberties
4. Freedom from intrusion (advertising, spam, etc)
5. Enabling trust/ authentication of parties in IST-mediated activity
6. Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests
7. Improving measurement of effectiveness of interventions
8. Enhancing protection of Intellectual Property Rights

The following chart (Figure 1.1) indicates the level of consensus[2] on the importance of each challenge. As expected, Round 2 shows an increased consensus on top issues. However, even the results of Both Rounds Combined[3] (BRC) indicate that far more than 50% of respondents agree on the significance of the top 2 challenges. In contrast, fewer than 25% selected the bottom two areas as being among the most important.

We should stress that the task here did NOT involve people expressing the view that specific topics were NOT relevant challenges for EU R&D. No doubt, almost all of the respondents would agree that all or almost all of the challenges do need to be addressed through R&D (though they may also feel that efforts of other types are also important – e.g. regulatory and institutional innovations). What we have here is an assessment of the CRITICAL challenges, and the results tell us about how many experts believe that one or other challenge is key. We could interpret this as a snapshot of views about which challenges need most urgently to be addressed.

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[2] Consensus in this case involves a large share of participants agreeing that a topic is important. It is calculated using the total number of respondents as the base for determining the percentage of people allocating votes to the option.

[3] BRC results are the combination of final questionnaires from second round plus questionnaires from first round of those participants who did not take part on the second round or who just sent an email confirming their first round's views.

Figure 1.1.1 R&D challenges

CHALLENGES that R&D needs to address in IST (Results by rounds) — Round1, Round 2, BRC

higher importance
medium importance
lower importance

- Establishing more user-friendly systems
- Enhancing security of transactions and personal information
- Reducing threats to privacy and civil liberties
- Freedom from intrusion (advertising, spam, etc)
- Enabling trust/ authentication of parties in IST-mediated activity
- Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests
- Improving measurement of effectiveness of interventions
- Enhancing protection of Intellectual Property Rights

FISTERA Delphi 2004-5   *% of respondents*   *Round 1 Base: 363 Resp.*   *Round 2 Base: 242 Resp.*   *BRC Base: 515 Resp.*

The following sections focus on results grouped by regional and occupational sectors. Adjust

Analysis of IST challenges by regions

Here we summarise the results concerning challenges by region. Differences across the regions will naturally be interesting, but the identification of commonalities is also important. This is so not least because commonalities could indicate potential areas for designing joint R&D programmes (.e.g. IST cooperation with non-EU countries such as Canada, USA, Switzerland, Venezuela, Israel, Turkey, Norway and many others). Table 1.1 shows the challenges (the label is at the beginning of the row), and presents for each region two columns of information: the first indicates the ranking position of the challenge and the second shows the proportion of respondents who select this challenge as important. To facilitate comparisons, we have coloured the Top 3 challenges for each region - and a dark background is used to mark where relatively high consensus (more than 50% of respondents) was reached. Challenges are listed in terms of the EU25 rankings.

Table 1.1.1 Challenges by regions

Key challenges that R&D needs to address in IST	EU25		EU15		NMS		CCs		Non-EU	
Establishing more user-friendly systems	1	62.7%	1	63.6%	2	57.8%	4	38.9%	2	53.9%
Enhancing security of transactions and personal information	2	56.9%	2	55.9%	1	62.5%	1	83.3%	1	63.7%
Reducing threats to privacy and civil liberties	3	32.7%	3	33.5%	4	28.1%	5	27.8%	4	33.3%
Freedom from intrusion (advertising, spam, etc)	4	32.2%	4	33.5%	7	25.0%	7	16.7%	5	25.5%
Enabling trust/ authentication of parties in IST-mediated activity	5	30.0%	6	29.2%	3	34.4%	2	44.4%	3	36.3%
Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests	6	29.8%	5	30.1%	5	28.1%	6	22.2%	6	23.5%
Improving measurement of effectiveness of interventions	7	18.4%	7	17.5%	8	23.4%	8	16.7%	8	19.6%
Enhancing protection of Intellectual Property Rights	8	16.5%	8	14.6%	6	26.6%	3	44.4%	7	20.6%
Other	9	9.7%	9	10.9%	9	3.1%	9	0.0%	9	9.8%
Total number of votes	1193		1008		185		53		292	
Total number of experts	413		349		64		18		102	
EU25: 25 EU members / EU15: 15 EU members (before May 1, 2004) / NMS: New EU Member States CCs: Candidate Countries (Bulgaria, Romania and Turkey) / Non-EU: The rest of the World										

There is much similarity across regions. *Establishing more user-friendly systems* and *enhancing security of transactions and personal information* are among the Top 3 challenges for all regions except CCs. Likewise, except for CCs, these two challenges receive fairly similar shares of votes. Participants from CCs see *enabling trust and authentication of parties in IST-mediated activities* as a key challenge – an opinion shared by NMS and Non-EU. In relation to the importance that candidate countries give to *enhancing protection on intellectual property rights*, we should say that this result perhaps is in line with other studies[4] where CCs, in particular, demonstrate their concerns on the lack of legislation (or enforcement of legislation) on IPR and counterfeit products. (In contrast countries like the US, Canada and Australia probably experience less difficulty here.) Exactly how R&D might address these problems is of course a big question. Participants might be thinking

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[4] See results of the International Chamber of Commerce survey on counterfeiting and Intellectual Property Rights, available at http://www.iccwbo.org/home/news_archives/2005/Images/Ifo/BASCAP_graphics.asp

about IP agreements in the course of R&D collaboration, protection of the IP around innovative products that emerge from R&D (in each of these cases this might mean open source approaches as well as more proprietorial ones)[5], or innovations designed to protect IP (e.g. copy protection).

The following chart (Figure 1.2) indicates the level of consensus on the importance of the challenges by region.

Figure 1.1.2 Challenges by regions

CHALLENGES that R&D needs to address in IST (Results by regions) — Non-EU, CCs, NMS, EU15, EU25

FISTERA Delphi 2004-5   % of respondents   Bases (EU25: 413   EU15: 349   NMS: 64   CCs: 18   Non-EU: 102 Resp.)

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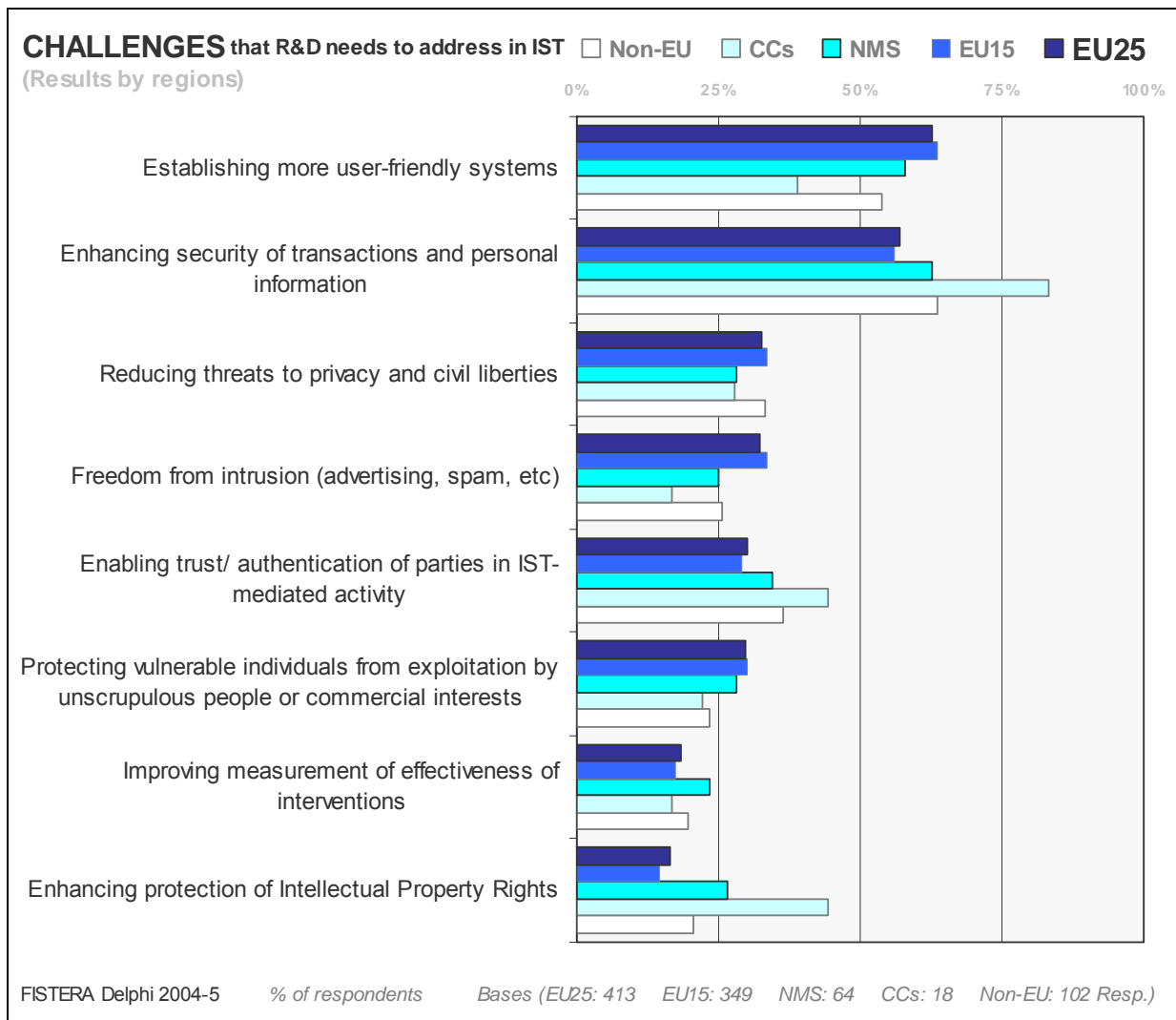
[5] Here, we should comment that many participants who responded to the request to add an extra challenge to our list, mentioned the EU fostering innovation by support for open source and copylefting approaches rather than conventional IPR.

Analysis of IST challenges by occupations

Participation in the Delphi was predominantly from researchers in the science-base (47%) followed by business people (26%) and policy makers (16%). This still gives us quite high numbers of people from the latter two groups. Participants who did not fit into these categories (11%) were not included in the following analysis. Of course, we should also look at the geographical composition of the sectors (see Table 1.1.2) in other to understand apparent EU biases. In this respect we make the following remarks: First, all sectors show 80% participation from Europe with a component of World opinion which ranges from 13% to 20%. Second, EU15 perceptions dominate most sectors (around 70%). Third, NMS perceptions reach a substantial 17.5% in the Policy sector, and Non-EU views tend to be more noticeable in both Business and Science-base sectors. Thus, in spite of a strong presence of EU15 in all sectors, comparison of occupational views still remains interesting.

Table 1.1.2 Regional Composition of Sectors

Sectors	Regions					Total
	EU25	EU15	NMS	CCS	Non-EU	
Policy	87.4%	69.9%	17.5%	2.9%	12.6%	78
Business	82.5%	72.5%	10.0%	6.3%	17.5%	126
Science	80.4%	71.3%	9.1%	5.1%	19.6%	221

Having said that, let's have a look at the R&D challenges for each sector!

Figure 1.1.3 Challenges by occupations

CHALLENGES that R&D needs to address in IST (Results by sectors) — Policy / Business / Science

Challenge	Science	Business	Policy
Establishing more user-friendly systems	56%	63%	77%
Enhancing security of transactions and personal information	54%	56%	63%
Reducing threats to privacy and civil liberties	35%	35%	27%
Freedom from intrusion (advertising, spam, etc)	35%	29%	26%
Enabling trust/ authentication of parties in IST-mediated activity	35%	29%	28%
Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests	33%	28%	15%
Improving measurement of effectiveness of interventions	18%	18%	17%
Enhancing protection of Intellectual Property Rights	16%	19%	22%

FISTERA Delphi 2004-5   *% of respondents   Policy Base: 78 Resp.   Business Base: 126 Resp.   Science Base: 221 Resp.*

Perhaps the major visible result is the greater emphasis of the policy respondents on the two top topics, and the lower emphasis they place on others – surprisingly, including protection of the vulnerable, which drops from the middle to the lowest of the bottom category for them.

Other suggested challenges:

Respondents were invited to add in free text concerning other important challenges. The ones that were entered by our pool were:

- ❖ **Socio-economic**
    - o developing "appropriate" technological systems for new uses and new online business models
    - o anticipating the consequences of a dependency on IST
    - o reducing health threats of wireless networks
- ❖ **Socio-political**
    - o promoting EU government/industry cooperation with open source[6] movements
    - o opening up areas of basic research that are over-protected by IPR
    - o strengthening business-research interactions
    - o providing open source intelligent systems
    - o developing effective e-Government
- ❖ **Technical**
    - o promoting interoperability
    - o human language processing
    - o promoting common standards
    - o automating complex decision-making

Reducing the digital divide was also suggested by many participants. The FISTERA Delphi addressed this topic as a possible aspect of innovation in order to ensure that applications of IST will be effective and socially beneficial, in a later question about at possible R&D actions in IST (see Actions section).

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[6] For further information about the EU position towards Free and Open Source Software, please visit the following URL: http://europa.eu.int/information_society/activities/opensource

1.2   IMPEDIMENTS

… TO THE DEVELOPMENT OF IST APPLICATIONS

While the analysis of challenges focuses on directions for future EU efforts in IST R&D, it was felt necessary also to address problems confronting the development of IST applications in the EU..

IST impediments confronting the EU25

The following list presents the topics employed in this question, in order of their final ranking positions that EU25 members gave to the eight impediments considered in the study.

1. Problems of social inequalities (different levels of access to IST)
2. Lack of adequate finance (or links to financial community) for innovations
3. Creating new professional skills and expertise
4. Bureaucratic rigidity on part of service organisations
5. Upgrading general workforce skills
6. Averseness of small firms to innovation
7. Regional inequalities (especially in IST R&D and production)
8. Limiting regulatory burdens on innovators

The rank ordering probably overstates the importance of differences between the various topics. The outstanding result is really that there is no striking consensus about one or other topic being most significant. In practically no cases does a topic get specified by more than 50% of respondents (and even then not by much). This was a situation already shown in first round results and one of the main reasons for asking participants to revise or confirm their opinions (in a second round) is precisely to try to reduce this type of flat distribution. But Figure 1.2.1 shows a similar pattern in for Round 2 results.

We can perhaps notice that the *problems of social inequalities (different levels of access to IST)* – which consistently receives most votes – and *lack of adequate finance (or links to financial community) for innovations* are the options attracting some of the very few people who changed their mind in Round 2.

Other visually striking tendencies are:

❖ four other topics receiving moderate levels of endorsement,

❖ and three topics receiving few choices – in particular *regulatory burdens!* In this respect, could assume that the main findings here are on the less voted options since second round participants assign even less votes to the bottom three.

Figure 1.2.1 IST Impediments

IMPEDIMENTS for developing IST applications — Round1, Round 2, BRC (Results by rounds)

- Problems of social inequalities (different levels of access to IST) — higher importance
- Lack of adequate finance (or links to financial community) for innovations
- Creating new professional skills and expertise — medium importance
- Bureaucratic rigidity on part of service organisations
- Upgrading general workforce skills
- Averseness of small firms to innovation — lower importance
- Regional inequalities (especially in IST R&D and production)
- Limiting regulatory burdens on innovators

FISTERA Delphi 2004-5   % of respondents   Round 1 Base: 363 Resp.   Round 2 Base: 242 Resp.   BRC Base: 515 Respt.

Analysis of impediments by regions

Key impediments to the development of IST applications	EU25		EU15		NMS		CCs		Non-EU	
Problems of social inequalities (different levels of access to IST)	1	45.5%	1	47.3%	3	35.9%	5	38.9%	1	52.9%
Lack of adequate finance (or links to financial community) for innovations	2	42.4%	3	38.7%	1	62.5%	2	50.0%	3	38.2%
Creating new professional skills and expertise	3	42.1%	2	43.6%	4	34.4%	6	22.2%	6	31.4%
Bureaucratic rigidity on part of service organisations	4	39.2%	5	35.0%	2	62.5%	3	50.0%	2	39.2%
Upgrading general workforce skills	5	36.3%	4	38.4%	6	25.0%	1	55.6%	4	38.2%
Averseness of small firms to innovation	6	28.8%	6	30.4%	8	20.3%	4	44.4%	7	30.4%
Regional inequalities (especially in IST R&D and production)	7	25.4%	7	24.4%	5	31.3%	7	22.2%	5	34.3%
Limiting regulatory burdens on innovators	8	22.5%	8	22.1%	7	25.0%	8	16.7%	8	16.7%
Other	9	6.8%	9	8.0%	9	0.0%	9	0.0%	9	6.9%
Total number of votes	1194		1004		190		54		294	
Total number of experts	413		349		64		18		102	

Regional variations are more striking in terms of this question, even though there are considerable regional similarities. *Problems of social inequalities (different levels of access to IST)* remain among the top for nearly all regions – but surprisingly, perhaps, they are given less weight by respondents from candidate countries. The *lack of adequate finance for innovation* is the second important problem for the EU25 - this is mainly because of the number of votes that NMS gave to this issue, though this is the third most important impediment for EU15 respondents. Also interesting is the emphasis of EU15 on *creating new professionals skills and expertise*, which does not appear as so important in the other regions. *Bureaucratic rigidity* is a major issue in NMS and CCs.

Figure 1.2.2 IST Impediments by regions
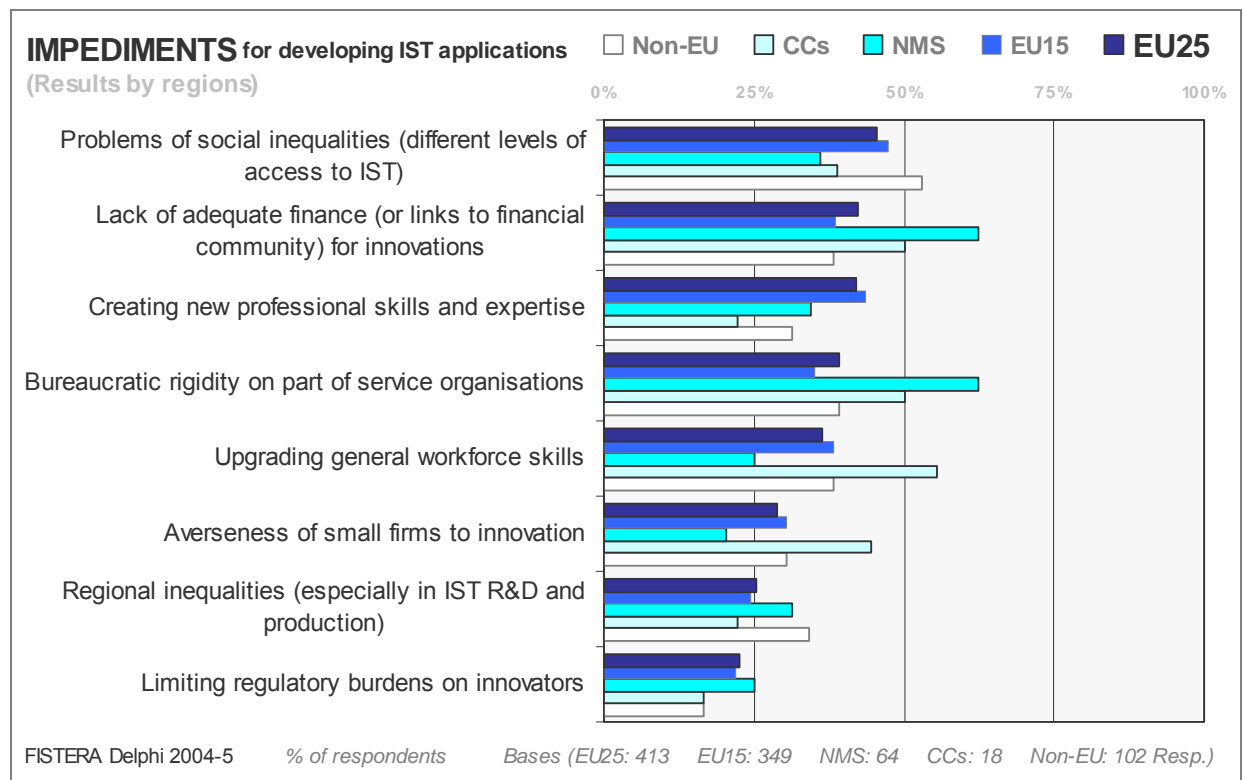
Analysis of IST impediments by occupations

Science-base sector is the only one showing a clear consensus of 51% on the importance of problems of social inequalities. This was closely shared by the business sectors but what strikes here is the considerable low number of votes that the Policy sector gave to this problem, putting it in their 7th place with only 28% consensus!

With regards to the second most voted problem (lack of adequate finance for innovations) there is a kind of common understating between Science base and Policy sectors. Overall, we can say that the business sector found it hard to focus on a specific problem. Votes were distributed evenly across the problems-set.

Figure 1.2.3 Impediments by occupations

IMPEDIMENTS for developing IST applications (Results by sectors) — Policy, Business, Science

Impediment	Policy	Business	Science
Problems of social inequalities (different levels of access to IST)	28%	47%	51%
Lack of adequate finance (or links to financial community) for innovations	46%	38%	42%
Creating new professional skills and expertise	44%	34%	43%
Bureaucratic rigidity on part of service organisations	36%	36%	39%
Upgrading general workforce skills	38%	39%	39%
Averseness of small firms to innovation	32%	35%	23%
Regional inequalities (especially in IST R&D and production)	22%	18%	31%
Limiting regulatory burdens on innovators	32%	31%	14%

FISTERA Delphi 2004-5   *% of respondents*   *Policy Base: 78 Resp.*   *Business Base: 126 Resp.*   *Science Base: 221 Resp.*

Other suggested impediments:

Respondents were invited to add in free text concerning other important impediments. The ones that were entered by our pool were:

- ❖ **Socio-economic**
    - o limited use of new technologies for business redesign in EU
    - o lack of adequate knowledge transfer
    - o lack of broadband infrastructure
    - o lack of integrated markets
    - o lack of profitability

- ❖ **Socio-political**
    - o software patents and excessive power of copyright holders
    - o lack of focus on real needs and social adaptation
    - o failure to support indigenous software development
    - o problems in setting and implementing standards
    - o PR-based monopoly of large software houses
    - o insufficient emphasis on more basic research
    - o cultural diversity and language barriers
    - o assessing and reducing health threats
    - o organisational culture and problems
    - o lack of work-life balance

- ❖ **Technical**
    - o Complexity of developing robust, modular, flexible, transparent software systems
    - o Lack of human-like behaviour of the user interfaces.

1.3   ACTIONS

… FOR EFFECTIVE & SOCIALLY BENEFICIAL IST

The FISTERA Delphi contained two questions that asked respondents to prioritise among actions which may lead to effective and socially beneficial IST. The first focused on actions for the EU25, and the second the participants' own country.

Key actions for the EU25

The following list shows the results for Europe, with the actions rank ordered in terms of the votes each received; fuller details are depicted in Figure 1.3.1:

1. Social and institutional innovations
2. Reducing the "digital divide"
3. Improved communications infrastructure
4. Development of new & improved IST applications
5. Better IST training and awareness programmes
6. More diffusion & deployment of current applications
7. Application of other technologies (e.g. biotechnology)

These actions do not fall into any obvious groups, with a fairly steady "descent" in the number of votes from the most frequently chosen ones to those that were less popular. What is striking is that the top items are more "social" ones – social innovations and reducing digital divides – followed by matters of infrastructure and applications.

Figure 1.3.1 Key actions for the EU25
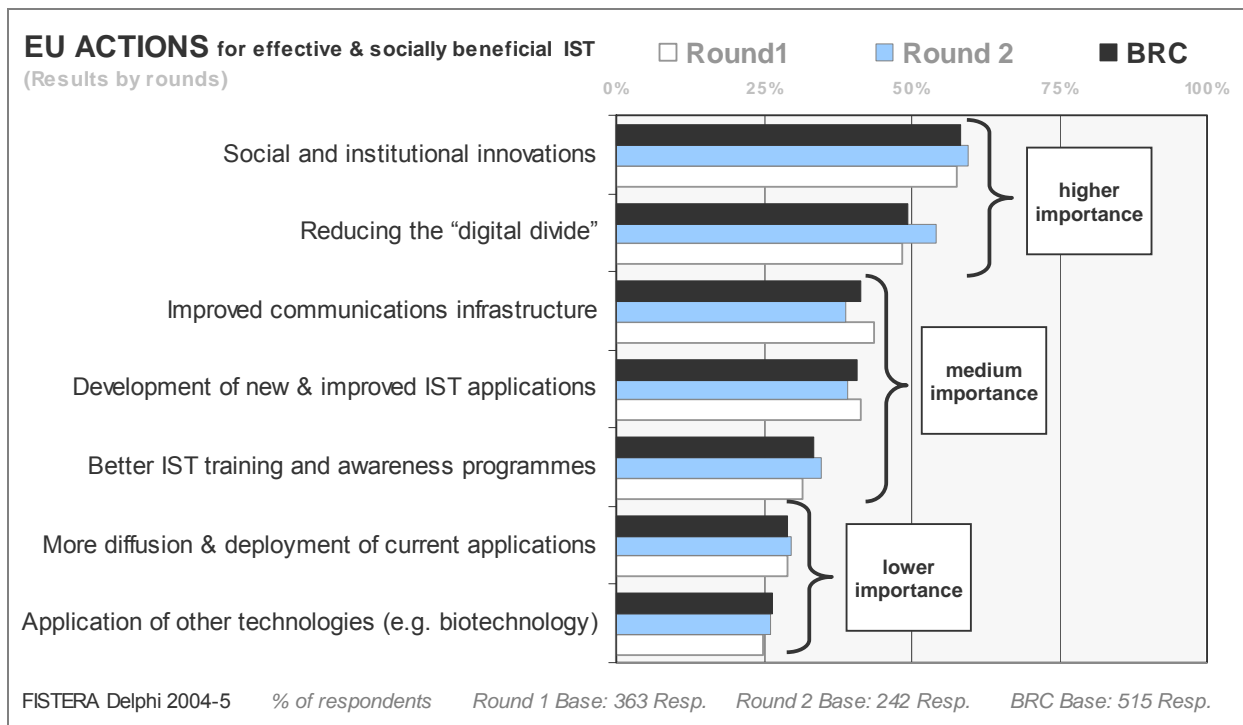
Analysis of actions for the EU25 by regions

The pattern of choices across regions is interesting. It is notable that *social and institutional innovations* received most votes in all regions. The *digital divide* emerges as much more of an EU concern than otherwise (even for CCs), and *improved communications infrastructure* is a frequently-cited action for the EU5 countries. *Training and awareness* and *new and improved applications*, are major areas for the CCs. Perhaps reflecting their diversity, the non-EU countries showed little consensus on important areas.

Table 1.3.1 Actions for the EU25 by regions

Key actions for effective and socially beneficial IST for the EU25	EU25 views		EU15 views		NMS views		CCs views		Non-EU views	
Social and institutional innovations	1	58.4%	1	59.3%	1	53.1%	2	50.0%	1	57.8%
Reducing the "digital divide"	2	52.1%	2	52.1%	2	51.6%	5	33.3%	3	38.2%
Improved communications infrastructure	3	44.3%	3	47.0%	7	29.7%	6	33.3%	5	30.4%
Development of new & improved IST applications	4	40.2%	4	39.3%	3	45.3%	1	55.6%	2	43.1%
Better IST training and awareness programmes	5	33.7%	5	32.1%	4	42.2%	3	50.0%	4	33.3%
More diffusion & deployment of current applications	6	29.3%	6	28.9%	6	31.3%	7	33.3%	7	28.4%
Application of other technologies (e.g. biotechnology)	7	25.4%	7	22.9%	5	39.1%	4	44.4%	6	30.4%
Other	8	5.6%	8	6.3%	8	1.6%	8	0.0%	8	3.9%
Total number of votes	1193		1005		188		54		271	
Total number of experts	413		349		64		18		102	

Figure 1.3.2 Impediments by occupations

FISTERA Delphi 2004-5   *% of respondents*   *Bases (EU25: 413   EU15: 349   NMS: 64   CCs: 18   Non-EU: 102 Resp.)*
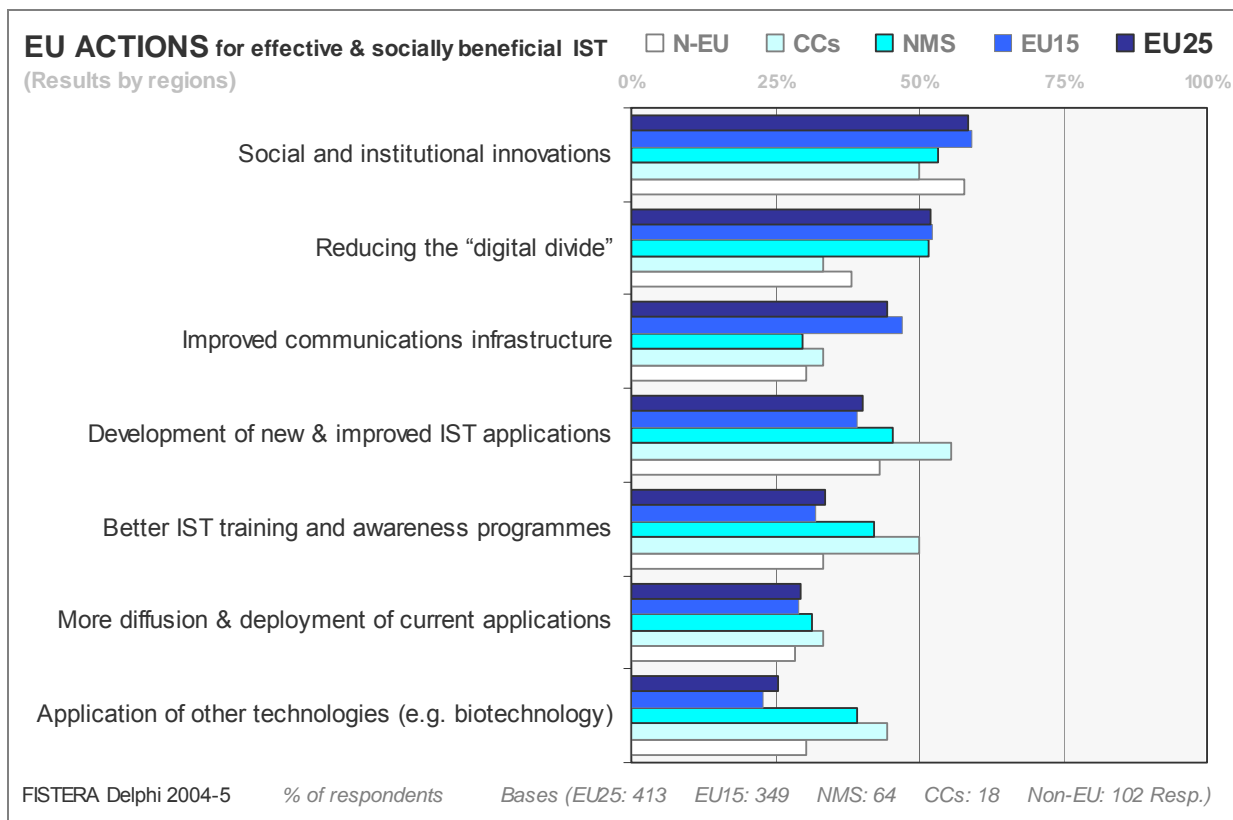
Analysis of actions for the individual regions

The second question about actions concerned what participants thought the actions should be for their own country. The following table (Table 1.3.2) shows the results obtained for this question, which can fruitfully be compared with the results in Table 1.3.1 aggregated by region:

(1) **Comparison of this result with the previous question about the EU25**

❖ *Social and institutional innovations* retains top place (except for CCs, where the *communications infrastructure* takes priority, and *diffusion* is also seen as very important.).

❖ *Reducing the digital divide* falls in importance, taking position 5 for nearly all regions except for Non-EU countries where it takes the third place. This could be interpreted in several ways. For instance, respondents might be thinking mainly of the divide between countries, or considering that the divide is worse elsewhere than in their own country.

(2) **Comparison of the top actions of EU25 with those of the non-EU regions**

❖ EU15 participants put a lot of weight on their countries focusing on the *development of new & improved IST applications.* This gets relatively few votes elsewhere.

❖ For the NMS region it appears that *better IST training and awareness programmes* should be on top of the agenda

❖ If we compare the results of what non-EU respondents thought about actions for their countries and the results from the previous question on actions for the EU25 we will see that the top 3 remain exactly the same.

Table 1.3.2 Actions for the EU25 by regions

Key actions for effective and socially beneficial IST for the REGIONS	EU25 region		EU15 region		NMS region		CCs region		Non-EU region	
Social and institutional innovations	1	61.0%	1	62.5%	1	53.1%	2	55.6%	1	55.9%
Development of new & improved IST applications	2	45.5%	2	48.7%	6	28.1%	6	22.2%	6	36.3%
Improved communications infrastructure	3	41.2%	3	39.5%	2	50.0%	1	66.7%	2	47.1%
More diffusion & deployment of current applications	4	39.5%	4	39.0%	4	42.2%	3	55.6%	5	39.2%
Reducing the "digital divide"	5	36.6%	5	35.5%	5	42.2%	5	33.3%	3	41.2%
Better IST training and awareness programmes	6	34.4%	6	32.4%	3	45.3%	4	55.6%	4	41.2%
Application of other technologies (e.g. biotechnology)	7	24.0%	7	24.9%	7	18.8%	7	11.1%	7	18.6%
Other	8	4.1%	8	4.6%	8	1.6%	8	0.0%	8	4.9%
Total number of votes	1182		1002		180		54		290	
Total number of experts	413		349		64		18		102	

Analysis of EU actions by occupational sector

The pattern of choices across occupations is also interesting. It is notable that the promotion of *social and institutional innovations* remains prominent in all groups. Another remarkable result is the importance that policy-makers assign to the *development of new and improved IST applications* (55% which makes an interesting contrast with a shared 39% in the Business and Science sectors). We are also surprised that the less voted action by the Science-sector was *applications of other technologies* since this and the previous topic suggest more of a long-term, technological innovation-oriented perspective (a quality which is commonly expected from researchers and entrepreneurs).

Figure 1.3.3 Impediments by occupations
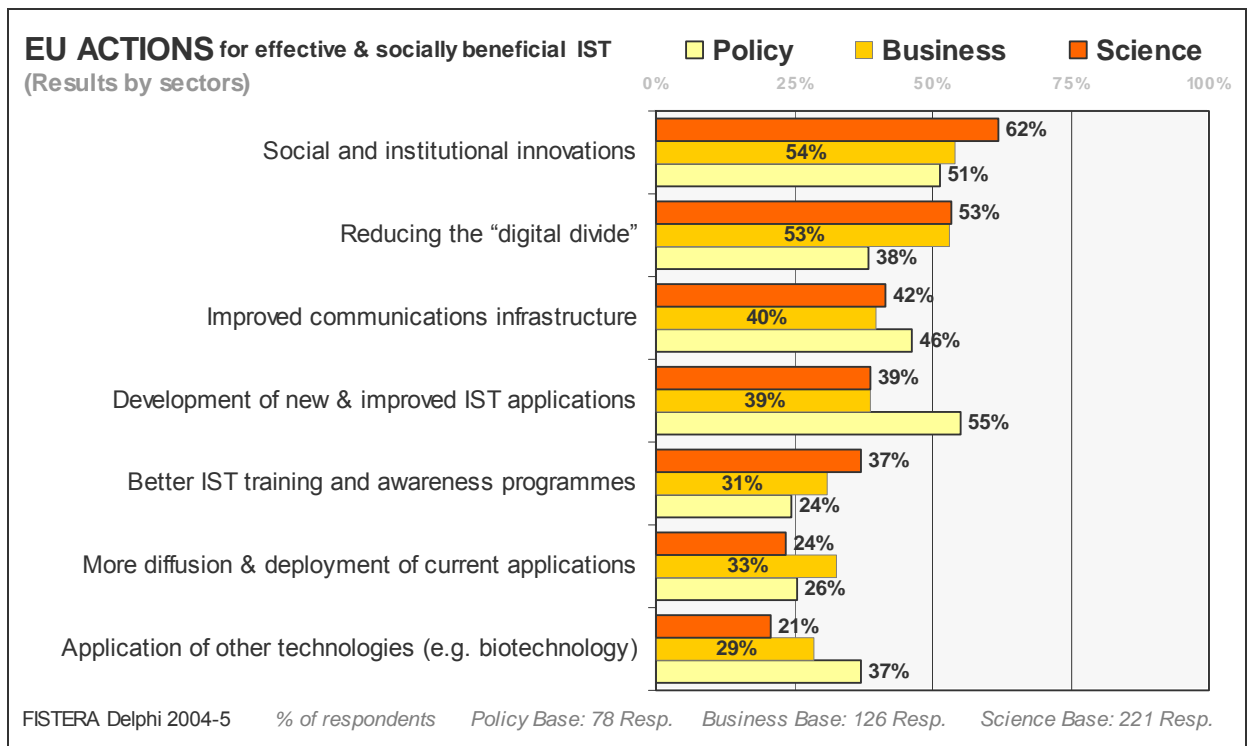
Other suggested actions:

Respondents were invited to add in free text concerning other important actions. The ones that were entered by our pool were:

❖ **Socio-economic**
- o deeper sense of social purpose
- o life-long learning & employment
- o more support to start up companies
- o applications easing intercultural exchange
- o greater participation by the public in setting research agendas
- o more understanding of need rather than technology led solutions
- o more open and fairer market for all IST-telecommunications services
- o re-introducing the human added-value rather than trying to by-pass it
- o transparency for human capital so trust in virtual labour market occurs
- o education in general (not only IST training) to avoid the emergence of a new class of functional illiterates – more access to IST (quantitative) does not translate into more understanding and profit (qualitative)

❖ **Socio-political**
- o Less bureaucracy
- o limiting "intellectual property"
- o how to handle legacy software/databases
- o relax IPR rights over software and media contents
- o technology transfer and development in developing nations
- o better antitrust and IPR policies – especially at EC level
- o clearer and more comprehensive 'light touch' regulatory framework
- o the structure (tasks etc.) of public authorities should be identical in EU countries

❖ **Technical**
- o cross lingual systems
- o Integration of novel technologies
- o user-friendliness (services and equipment)
- o more security and without reducing privacy
- o standardization and interoperability of systems

Section 2: EU goals and IST areas

A core question of the Delphi study is how much IST applications can help Europe achieve the sorts of Information Society it wants. The vision of a future Europe has been spelled out in the Lisbon Objectives, and this vision provides us with a framework against which to assess IST development and applications. In this section we focus on each of the following six EU goals:

I. job creation	III. competitiveness	V. social inclusion
II. wealth creation	IV. social cohesion	VI. environmental quality

Based on a literature review of recent IST-related scenario reports, we identified twelve areas of IST application:

1) Social / family relationships	5) Health	9) Security
2) Cultural diversity	6) Education and learning	10) Government
3) Transport	7) Social welfare / public services	11) Management
4) Ageing	8) Leisure and recreation	12) Work organisation

The term 'application area' refers to functions to which IST can be applied, rather than to industrial sectors. (Some areas are the province of specific industries or organisations – most visibly "government" and "health" – though often these will have important activities that are not predominantly channelled through these sectors or bodies. For instance, "health" includes not only medical and health services, but many everyday practices that make for healthy living.). Likewise, 'application area' does not refer to specific technologies. IST can have many different sorts of application in each area. (Taking the "health" case again, we could see IST applications spanning areas such as medical informatics, new diagnostic systems – including some of the IST/biotechnology combinations such as gene screening chips - new surgical techniques, wearable health monitoring devices, and so on.) In this section of the Delphi survey, participants were asked to select those areas that will have the greatest positive contribution to the achievement of each of the EU goals in the period up to 2010 and beyond. Each expert was given 5 votes and asked to allocate these to the areas that s/he thought would contribute most to each of the EU goals. There were thus six sets of voting, one for each goal.

2.1   A VIEW ACROSS APPLICATION AREAS

Before we discuss the results in detail, there are some very striking patterns of results across the various application areas. The numbers of votes is only a crude measure of just how important the area is felt to be – it is merely an indication that it is among the most important topics contributing to the specific Lisbon Objective.[7] (As for the overall importance of the selected areas, participants were asked in a separate question to rank the top 5 innovative applications of IST that would contribute to the success of European knowledge economies in the decade after 2010. The outcome of that exercise is presented in section 2.5.)

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[7] But we also need to make a basic point about interpretation of the results. Bearing in mind that the "votes" that are allocated here are for the five areas seen as being most important for each of the EU goals, a simple thought experiment can suffice to show that an application area that ranks fifth in importance in all areas for all people will receive more votes than would an area that was considered absolutely most important by all but one of the respondents, if that one respondent did not put it among the top five.

Given this proviso, a number of striking results emerge, as most obviously evidenced from Figure 2.1 which outlines cross-application results from the EU25 set of respondents:

❖ **Education and learning** (E&L) receive a huge proportion of the votes – almost twice as many as any other application area. We should stress that this is not a result of the large number of experts who were based in educational institutions giving priority to their own field! When we examined results by different categories of actor, we see that experts from business and policy communities concur in giving this application area a large number of votes.

❖ **E&L** actually receives the most votes in terms of five of the six goals, sometimes by a large margin over the next area, sometimes to a lesser degree. It always appears within the top three areas for each goal.

❖ Besides E&L only "**Work organisation**" achieves a moderate consensus in terms of *job* and *wealth creation* goals, (47% and 45% respectively).

❖ "**Social welfare/public services**" (SWP) and "**Cultural diversity**" (CUD) are the only areas other than E&L to achieve the top number of votes in terms of a goal (*social cohesion*). Both would also remain among the top on one other occasion (for *social inclusion*).

❖ In terms of numbers of votes accumulated, the next two areas to feature are "**Government**" (GOV) and "**Social welfare/public services**" (SWP) – both evidently areas with considerable scope for governmental action. However, it would be too hasty to assume that this simply gives us the top three areas as E&L, GOV and SWP. There can be some divergence between the rank order of application areas given by examining individual goals (in the next section), and that derived from simply counting up the number of votes received across all six goals (size of the bar in Figure 2.1). If we adopt the latter approach, GOV emerges as the third most voted-for area, after E&L and just behind SWP and before WOR.

❖ These apparently divergent results are in large part down to the different patterns of voting for different classes of goals:

  o Correlation analysis across the EU goals reveals that there are clearly two broad clusters of goals in terms of the correlation between voting at the level of application areas. "*Social inclusion*" and "*Social cohesion*" are extremely highly correlated (.99)[8] in terms of numbers of votes received. In other words, if one of these application areas receives many or few votes on one of these goals, it will also do so on the other goal. The second cluster involves "*Job Creation*" (JC) and "*Wealth Creation*" (WC) which are also very highly correlated (.95); each is also strongly related to "*Competitiveness*" (COM, which correlates .84 with WC, .80 with JC). COM is, interestingly, fairly closely related to "*Environmental Quality*" (EQ) at .74 (EQ has somewhat lower relations with WC at .64, JC at .55). There are no correlations across these two clusters of goals of greater than .25.   (In other words, high scores for an application area on a goal from one cluster have limited implications for the scores that will be achieved for a

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[8] All correlations reported here are Pearson r's.

goal from the other cluster.) These really do seem to be quite distinctive sets of outcomes: the more "social" and the more "economic" goals (with environmental quality tending to be associated with the latter)..

o   Different application areas are seen to offer more potential for the more economic and the more social goals. The overall aggregation of votes (given by the size of the bar in Figure 2.1) tends to hide the different patterns of priorities from each of the sets of goals. This could mean that an area that achieves moderate importance across most goals (e.g. GOV) can achieve a higher overall score than one which would be of fundamental importance to one cluster of goals, but is seen as less relevant to the other (e.g. Social and family relationships).

o   We excluded "*Environmental Quality*" (EQ) from the comments in the two preceding bullet points. Taking this goal into account would give us yet more reason caution in deriving priorities from aggregated votes. Transport appears as an important area in terms of EQ – which seems logical enough. (Though given oft-rehearsed problems with much of our transport infrastructure, it might have been expected to feature more highly in terms of its contribution to other, more economic, goals. Perhaps the logic of this is simply that the solutions to transport problems are not seen as largely lying in the realm of IST applications.)

o   These considerations about the role of different goals suggests that we should be cautious in deriving priorities from the aggregated votes, in simply assuming, for example, that funds should be allocated to R&D in line with the overall ranking of application areas as given by adding all the goals together.

Figure 2.1 Summary Statistics of Voting across Application Areas
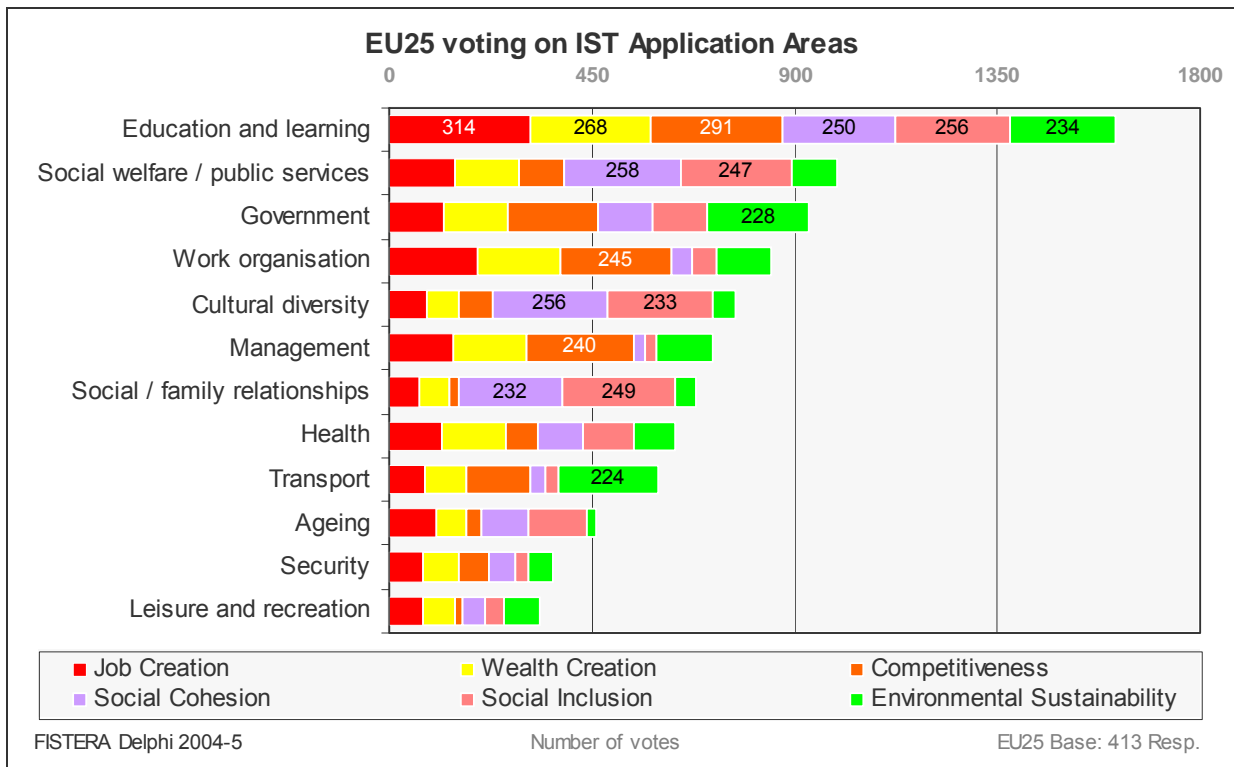
2.2   APPLICATION AND GOALS AS VIEWED IN DIFFERENT REGIONS

The following tables display the results of the analysis by each application area in turn. They disaggregate the data in terms of the geographical origin of respondents. The application areas are ordered in terms of the number of votes received from the EU25 participants for the application area in question, in relation to the goal. The top five (or more if there are ties) are highlighted for each set of respondents.

Job Creation

Table 2.2.1 presents results for this EU goal. While there are differences in detailed ranking, the top 5 topics are very similar across the geographical regions.

For all regions E&L have outstandingly the highest consensus. Presumably this reflects the high emphasis on skills and life-long learning in the knowledge-based economy (and this also applies to many of the other cases where E&L receive high consensus, so we will not repeat this point). For all EU countries, WOR is a second consensus-winner – which is significant given the fears that are somewhat expressed that work organisation is large part about reducing labour costs and increasing flexibility, often resulting in job loss. This is clearly not the view of many of the experts in this sample. (WOR is still in the top three topics for the non-EU experts.) There is not a great deal of difference in the level of consensus attained by the next application areas. SWP is in the top three for EU experts and the top five for others: we could see the contribution to job creation here as twofold (jobs created in social services, and clients moved into the labour market by effective application of the services). MAN is also important, especially for the non-EU experts and much the same comment could be made about this area as about WOR). Government (29.3%) and Health (28.6) tie for fifth place for EU experts (but we should point that Government prevailed in order largely due to the number of votes that respondents from New Members States gave to this area).

Wealth Creation

Table 2.2.2 presents results for this EU goal. The results are very similar to those for Job Creation, which is to be expected given the high correlation between these two goals.

E&L receives the highest consensus by far in all regions (though the extent to which it surpasses others is quite significant in the New Member States and Candidate Countries). WOR and MAN follow, with fairly similar moderate consensus. Again, Health, GOV and SWP go after, with Health falling just outside the top five for the non-EU experts and NMS. The importance that NMS and CCs give to SWP and GOV for wealth creation is interesting (and perhaps a little surprising – as is the lower rating for Health in non-EU responses).

Table 2.2.1 Views (by regions) on Job Creation

FOR JOB CREATION	EU25		EU15		NMS		CCs		Non-EU	
Education and learning	1	76%	1	73%	1	92%	1	89%	1	71%
Work organisation	2	47%	2	46%	2	55%	3	56%	3	36%
Social welfare / public services	3	35%	3	34%	5	42%	4	39%	7	29%
Management	4	34%	4	31%	3	53%	2	56%	2	38%
Government	5	29%	6	26%	4	48%	6	33%	4	32%
Health	6	29%	5	28%	6	30%	5	39%	5	31%
Ageing	7	25%	7	26%	9	20%	10	11%	9	25%
Cultural diversity	8	20%	9	21%	10	19%	8	22%	8	26%
Transport	9	20%	8	19%	8	22%	11	6%	12	19%
Security	10	19%	10	18%	7	23%	9	22%	11	21%
Leisure and recreation	11	18%	11	19%	12	13%	12	6%	10	24%
Social / family relationships	12	16%	12	16%	11	16%	7	33%	6	30%
Total number of votes	1521		1244		277		74		391	
Total number of experts	413		349		64		18		102	
Consensus higher than 50% is highlighted with dark background										

Table 2.2.2 Views (by regions) on Wealth Creation

FOR WEALTH CREATION	EU25		EU15		NMS		CCs		Non-EU	
Education and learning	1	65%	1	63%	1	73%	1	89%	1	66%
Work organisation	2	45%	2	43%	2	56%	4	39%	3	33%
Management	3	39%	3	37%	3	55%	3	44%	2	38%
Health	4	35%	4	33%	6	42%	5	39%	6	31%
Government	5	35%	5	33%	5	44%	6	33%	5	32%
Social welfare / public services	6	34%	6	32%	4	44%	2	50%	4	33%
Transport	7	22%	7	23%	10	16%	12	6%	10	20%
Security	8	19%	8	18%	8	23%	7	33%	7	25%
Leisure and recreation	9	18%	9	18%	9	16%	8	22%	8	26%
Cultural diversity	10	17%	12	18%	7	14%	9	11%	9	17%
Ageing	11	17%	11	17%	11	16%	10	6%	12	10%
Social / family relationships	12	16%	10	15%	12	22%	11	22%	11	22%
Total number of votes	1495		1226		269		71		361	
Total number of experts	413		349		64		18		102	
Consensus higher than 50% is highlighted with dark background										

Competitiveness

Table 2.2.3 presents results for this EU goal. Though highly correlated with Job and Wealth Creation, the results display some interesting differences.

Again, E&L is outstanding. WOR and MAN are in the top three in all regions. GOV is consistently at fourth ranking, suggesting that IST applications in government are seen as contributing in an important way to competitiveness (perhaps by increased efficiency, reduction of bureaucracy, more rapid processing of forms, etc.) At some distance behind these, but generally ahead of the next area (SWP), Transport is clearly recognised as an important contributor in its own right. Presumably the logic is that IST applications could render logistics and other systems more efficient and contribute to competitiveness.

Social Cohesion

Table 2.2.4 presents results for this EU goal which is exceptional in that E&L for once does not achieve the highest consensus. While it is in third place in the EU15 and Non-EU countries, E&L comes in at fourth in NMS and CCs.

Consistently in first place – quite plausibly for this goal – is the application of IST to supporting culturally diverse societies. It is rare for this application area to achieve many votes – the other occasion where it enters the top five is for social inclusion. However, it does not remain in first place for the EU25 due the number of votes that New Member States give to SWP – which consistently enter the top five, but with slightly different rankings in different geographical areas (emphasised more in the EU than elsewhere).

E&L and Social/family relationships (another area that does not often achieve high consensus) follow with considerable high consensus in all regions. Government applications remain in position 5 but with relatively low consensus.

Table 2.2.3 Views (by regions) on Competitiveness

FOR COMPETITIVENESS	EU25		EU15		NMS		CCs		Non-EU	
Education and learning	1	70%	1	67%	1	88%	2	78%	1	66%
Work organisation	2	59%	2	57%	3	73%	3	72%	3	48%
Management	3	58%	3	54%	2	78%	1	89%	2	61%
Government	4	48%	4	48%	4	48%	4	56%	4	44%
Transport	5	34%	5	34%	5	36%	5	39%	5	32%
Social welfare / public services	6	25%	6	24%	6	31%	7	17%	6	22%
Cultural diversity	7	17%	7	17%	7	22%	8	17%	9	13%
Health	8	17%	9	16%	8	22%	9	6%	8	19%
Security	9	16%	8	17%	9	11%	6	28%	7	22%
Ageing	10	8%	10	8%	10	3%	9	11%	10	12%
Social / family relationships	11	5%	11	5%	11	3%	12	6%	11	10%
Leisure and recreation	12	4%	12	5%	12	2%	10	6%	12	8%
Total number of votes	1493		1226		267		326		418	
Total number of experts	413		349		64		18		102	
Consensus higher than 45% is highlighted with dark background										

Table 2.2.4 Views (by regions) on Social Cohesion

FOR SOCIAL COHESION	EU25		EU15		NMS		CCs		Non-EU	
Social welfare / public services	1	62%	2	60%	1	77%	3	56%	4	49%
Cultural diversity	2	62%	1	62%	3	64%	1	78%	1	62%
Education and learning	3	61%	3	60%	4	61%	4	56%	3	54%
Social / family relationships	4	56%	4	53%	2	73%	2	67%	2	60%
Government	5	29%	5	28%	5	39%	7	28%	5	29%
Ageing	6	26%	6	26%	7	27%	9	11%	7	20%
Health	7	25%	7	23%	6	31%	5	39%	6	25%
Security	8	15%	8	14%	9	19%	10	11%	10	9%
Leisure and recreation	9	12%	10	10%	8	22%	6	33%	8	19%
Work organisation	10	11%	9	11%	10	11%	11	0%	12	7%
Transport	11	8%	11	9%	12	3%	8	17%	9	15%
Management	12	6%	12	5%	11	11%	12	0%	11	8%
Total number of votes	1535		1255		280		71		362	
Total number of experts	413		349		64		18		102	
Consensus higher than 45% is highlighted with dark background										

Social Inclusion

Table 2.2.5 presents results for this EU goal. E&L is the area that receives the highest consensus in the EU, though its lead is not immense, and in non-EU countries it is overtaken by Social/family relationships and Cultural Diversity, and by SWP in the Candidate Countries. These four areas are always the ones to receive the lion's share of votes, thus reaching higher levels of consensus. Ageing also generally enters the top five, which corresponds to the possibly that IST applications could help reduce the social exclusion of elderly people.

Environmental Quality

This EU goal was relatively less correlated to the other goals, so we can anticipate a distinctive pattern of voting. Table 2.2.6 presents results for this goal.

E&L retains its first place in the EU25, but it is very closely followed by two other areas. This top three is replicated for all regions, with differences in internal ordering. But the consensus that each of these receives are typically far above those received by other areas. E&L is joined by GOV – and Transport. Transport is seen as the most important item (in terms of consensus) in the EU 15 – possibly suggesting that we have here experts who are aware of the high environmental costs imposed by the sophisticated but often congested and energy-intensive systems in their countries (especially aviation and private cars). GOV is of course an important player in environmental regulations, and the view must be that IST applications in government will allow for more advanced and enforceable regulations and other types of measure to be put in place.

MAN and WOR enter the top five in the EU, and MAN is also seen as important by non-EU countries in general. Just outside the EU top five, and entering it for Candidate Countries, is SWP; Health emerges as an important area for non-EU countries (Why this should be so is rather difficult to determine.)

Table 2.2.5 Views (by regions) on Social Inclusion

FOR SOCIAL INCLUSION	EU25		EU15		NMS		CCs		Non-EU	
Education and learning	1	62%	1	61%	2	67%	4	50%	3	56%
Social / family relationships	2	60%	2	58%	1	70%	2	61%	1	57%
Social welfare / public services	3	60%	3	58%	3	67%	1	72%	4	52%
Cultural diversity	4	56%	4	56%	4	61%	3	61%	2	57%
Ageing	5	31%	5	31%	5	36%	5	50%	5	33%
Government	6	29%	6	28%	6	36%	7	17%	7	25%
Health	7	26%	7	26%	7	27%	6	44%	6	28%
Work organisation	8	13%	8	13%	10	11%	11	0%	10	7%
Leisure and recreation	9	10%	9	9%	9	14%	8	11%	8	10%
Transport	10	8%	10	8%	11	5%	9	11%	9	8%
Security	11	7%	11	7%	12	5%	10	11%	12	5%
Management	12	7%	12	4%	8	19%	12	0%	11	7%
Total number of votes	1525		1258		326		70		352	
Total number of experts	413		349		64		18		102	
Consensus higher than 45% is highlighted with dark background										

Table 2.2.6 Views (by regions) on Environmental Quality

FOR ENVIRONMENTAL QUALITY	EU25		EU15		NMS		CCs		Non-EU	
Education and learning	1	57%	3	53%	1	75%	1	67%	1	52%
Transport	2	55%	1	54%	2	61%	3	39%	3	45%
Government	3	54%	2	54%	3	56%	2	56%	2	50%
Management	4	30%	5	27%	4	42%	4	33%	5	31%
Work organisation	5	30%	4	29%	5	33%	5	33%	8	18%
Social welfare / public services	6	24%	6	24%	7	22%	6	33%	6	30%
Health	7	22%	7	20%	6	33%	7	33%	4	34%
Leisure and recreation	8	20%	8	20%	8	19%	9	17%	7	21%
Security	9	13%	9	12%	11	20%	10	22%	11	17%
Cultural diversity	10	12%	10	11%	9	17%	8	22%	9	14%
Social / family relationships	11	12%	11	10%	10	19%	11	11%	10	15%
Ageing	12	5%	12	5%	12	3%	12	6%	12	6%
Total number of votes	1374		1118		256		67		339	
Total number of experts	413		349		64		18		102	
Consensus higher than 45% is highlighted with dark background										

2.3   APPLICATION AREAS AND GOALS AS VIEWED BY DIFFERENT OCCUPATIONAL GROUPS

The following charts display the results of the analysis by each application area in turn. They disaggregate the data in terms of the occupational sector of respondents. The application areas are ordered in terms of the level of consensus received from the EU25 participants for the application area in question.

Job Creation

In terms of Job Creation the results show that there is not a distinctive set of application areas which may have a leading role in boosting employment. When we look at the results per region (see below) we can clearly see that education and learning is the only area where all regions reach a high consensus (> than 50%). Work organisation is the area that follows in terms of boosting jobs, but it does not really reach a 50% of the votes of any of the occupational sectors considered in the study. For this reason it remains together with "Social welfare and public services", "Management", "Government" and "Health" as areas with moderate consensus.

Figure 2.3.1 Views (by occupational groups) on Job Creation
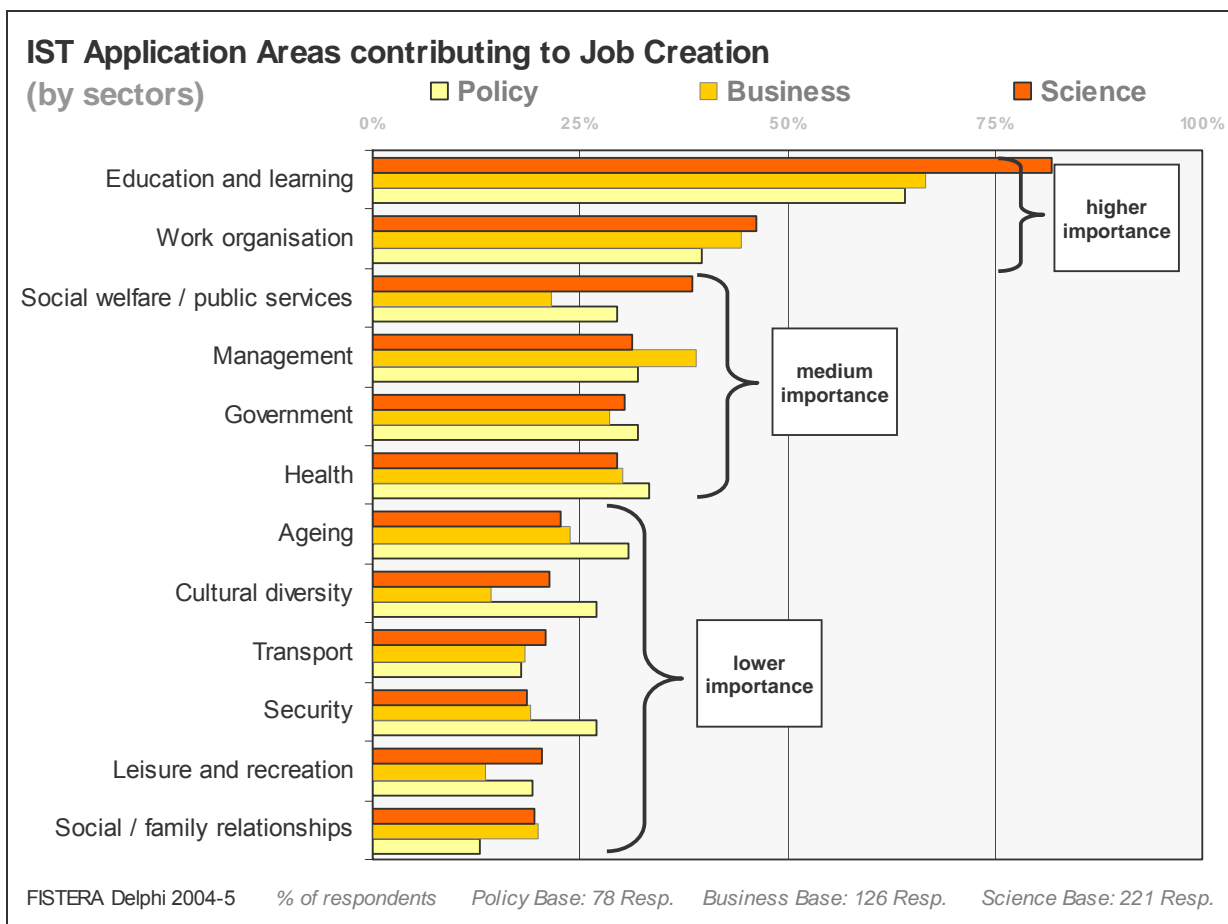
Wealth Creation

Wealth Creation shows a very similar pattern to the one of Job Creation. There some differences though, for example "Social welfare and public services" goes down to position 6. "Management" and "Government" are one step higher and "Health" takes position 5.

Figure 2.3.2 Views (by occupational groups) on Wealth Creation
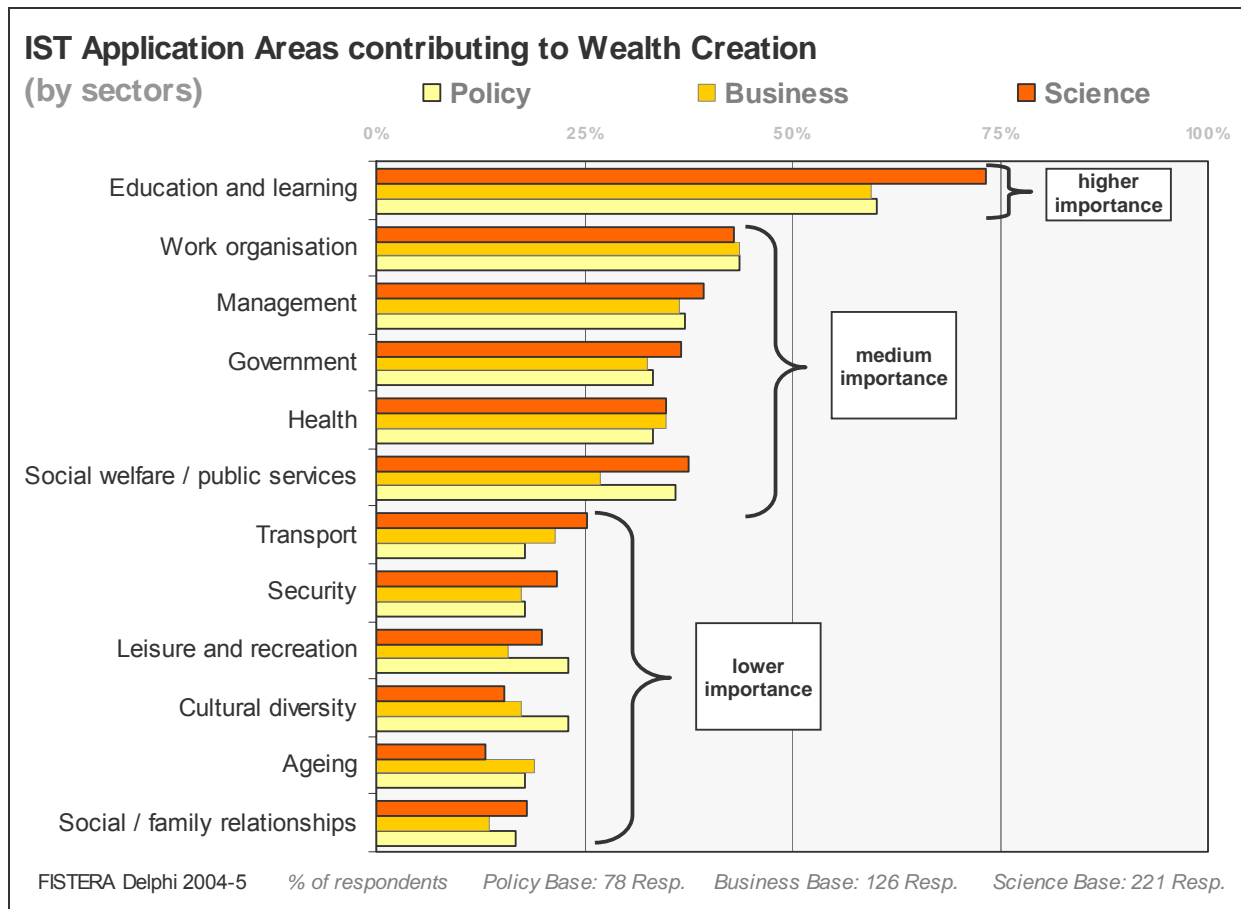
Competitiveness

The results for the goal competitiveness are instantly recognizable. There is high consensus among respondents from all three sectors that "Education and learning", "Work organisation" and "Management" are application areas contributing to the goal. A fourth area, "Government", also shows high consensus in the Policy sector and close to 50% among Science-base and Business sectors. "Transport" would be the only application reaching a sort of medium consensus on its contribution to competitiveness but this would be the perception of Science-base and Business sectors only.

Figure 2.3.3 Views (by occupational groups) on Competitiveness

IST Application Areas contributing to Competitiveness (by sectors) — Policy, Business, Science

FISTERA Delphi 2004-5   % of respondents   Policy Base: 78 Resp.   Business Base: 126 Resp.   Science Base: 221 Resp.
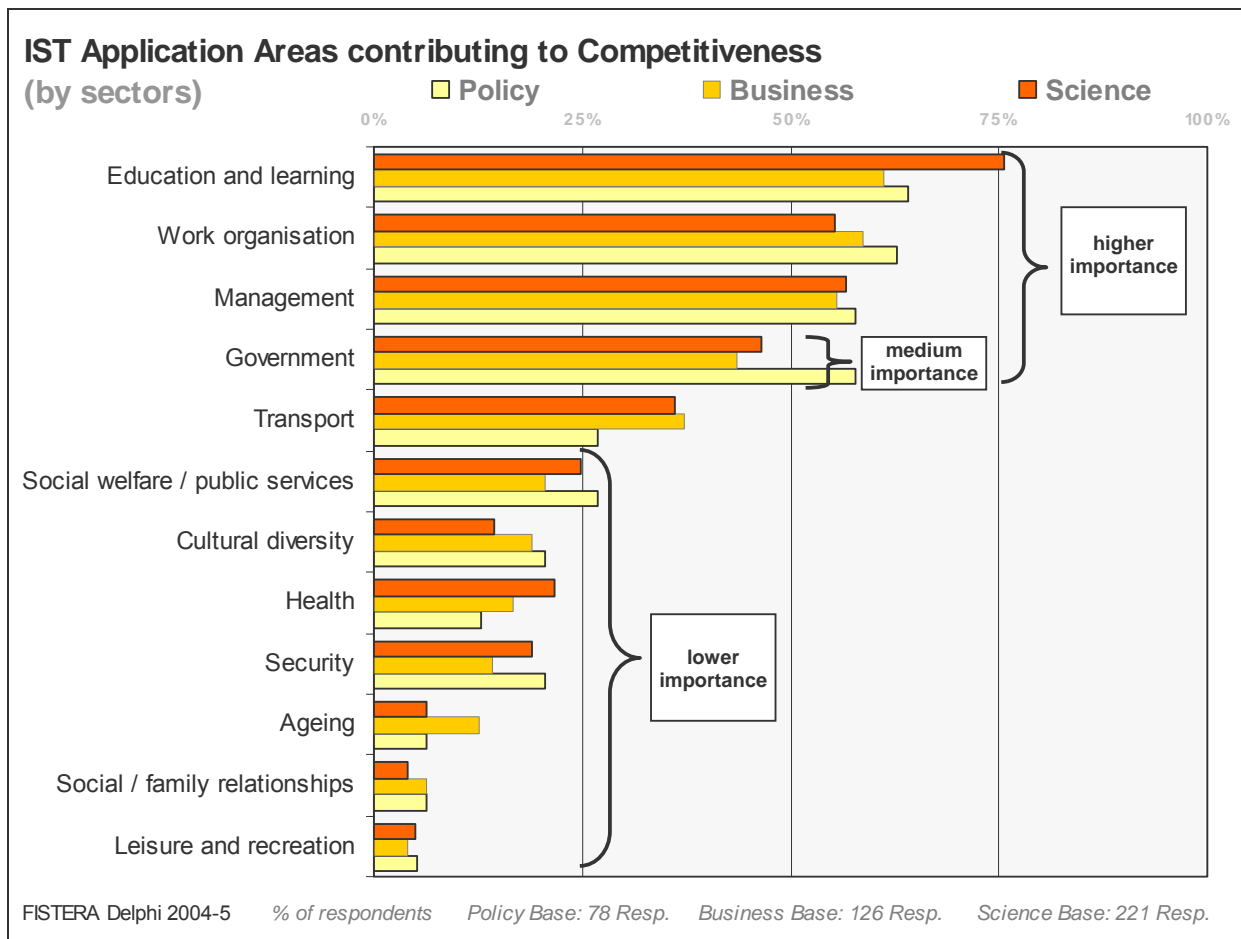
Social Cohesion

Results on application areas contributing to the social cohesion goal are also apparent. There is high consensus on four areas: "Social welfare and public services", "Cultural Diversity", "Education and learning" and "Social and family relationships".

Figure 2.3.4 Views (by occupational groups) on Social Cohesion
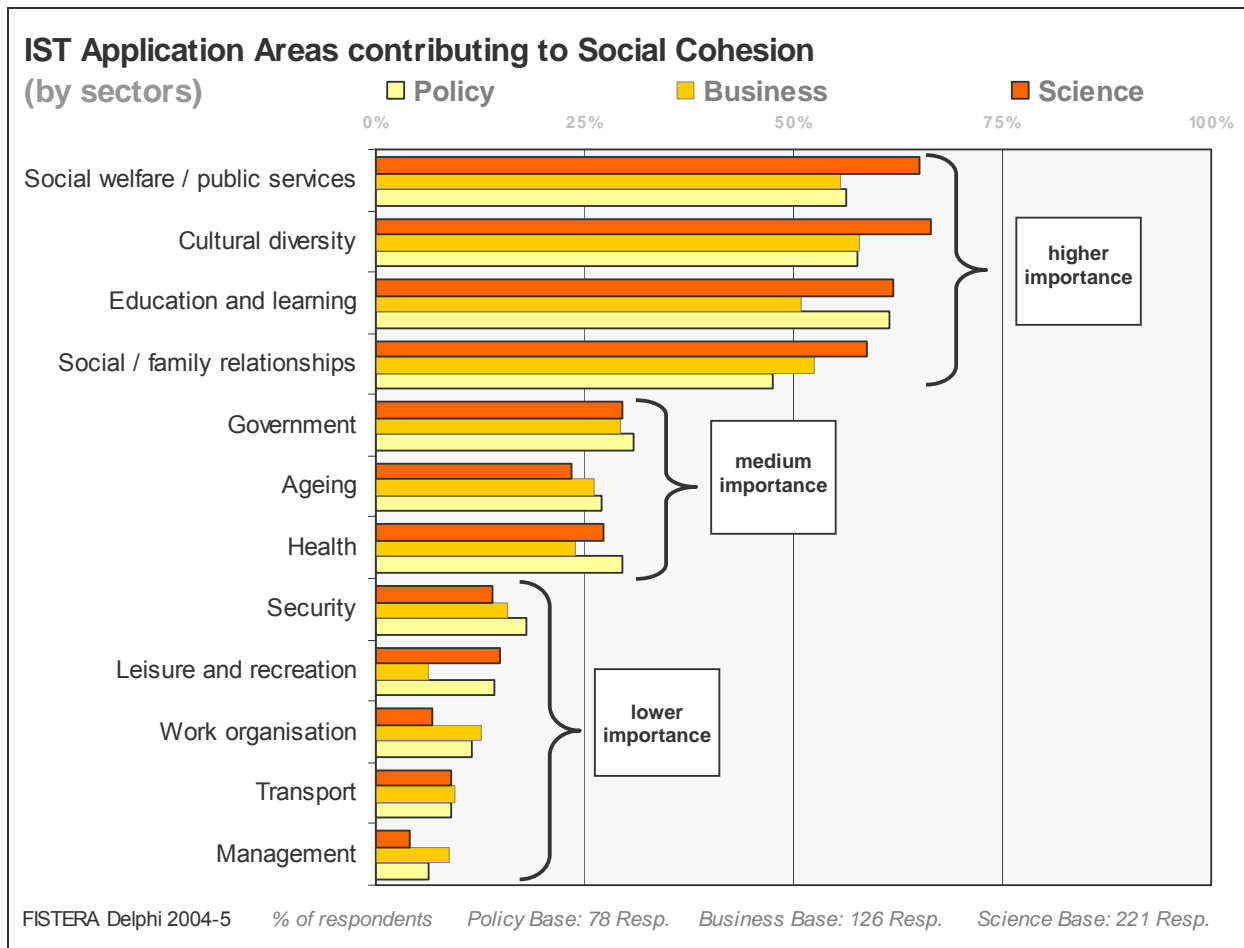
Social Inclusion

Again it seems that respondents find it easier to agree on more socially-oriented goals. Results for social inclusion show four areas with high consensus: "Social and family relationships", "Transport", "Cultural diversity" and "Health".

Figure 2.3.5 Views (by occupational groups) on Social Inclusion
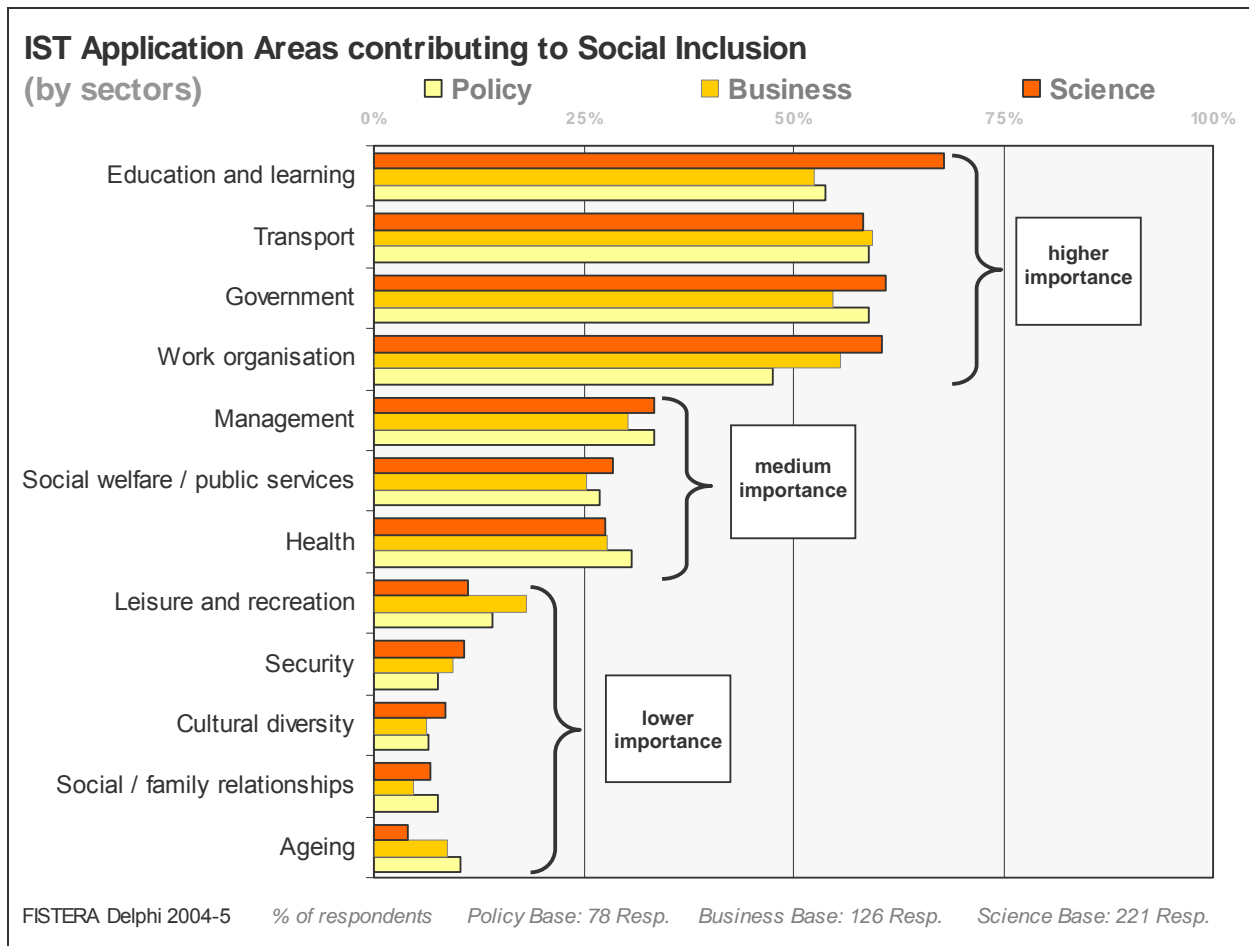
Environmental Quality

As expected "Transport" is an area where all sectors agree about its positive contribution to this goal. There are two other areas though showing high consensus: "Education and learning" is an area that Science-base researchers and Policy-makers perceived as possible contributor to environmental quality, but here the Business sector is not fully convinced. On the other hand, "Government" is given a high share of votes among Science-base and Business sectors while the Policy sector achieves a moderate 46% consensus here.

Figure 2.3.6 Views (by occupational groups) on Environmental Quality
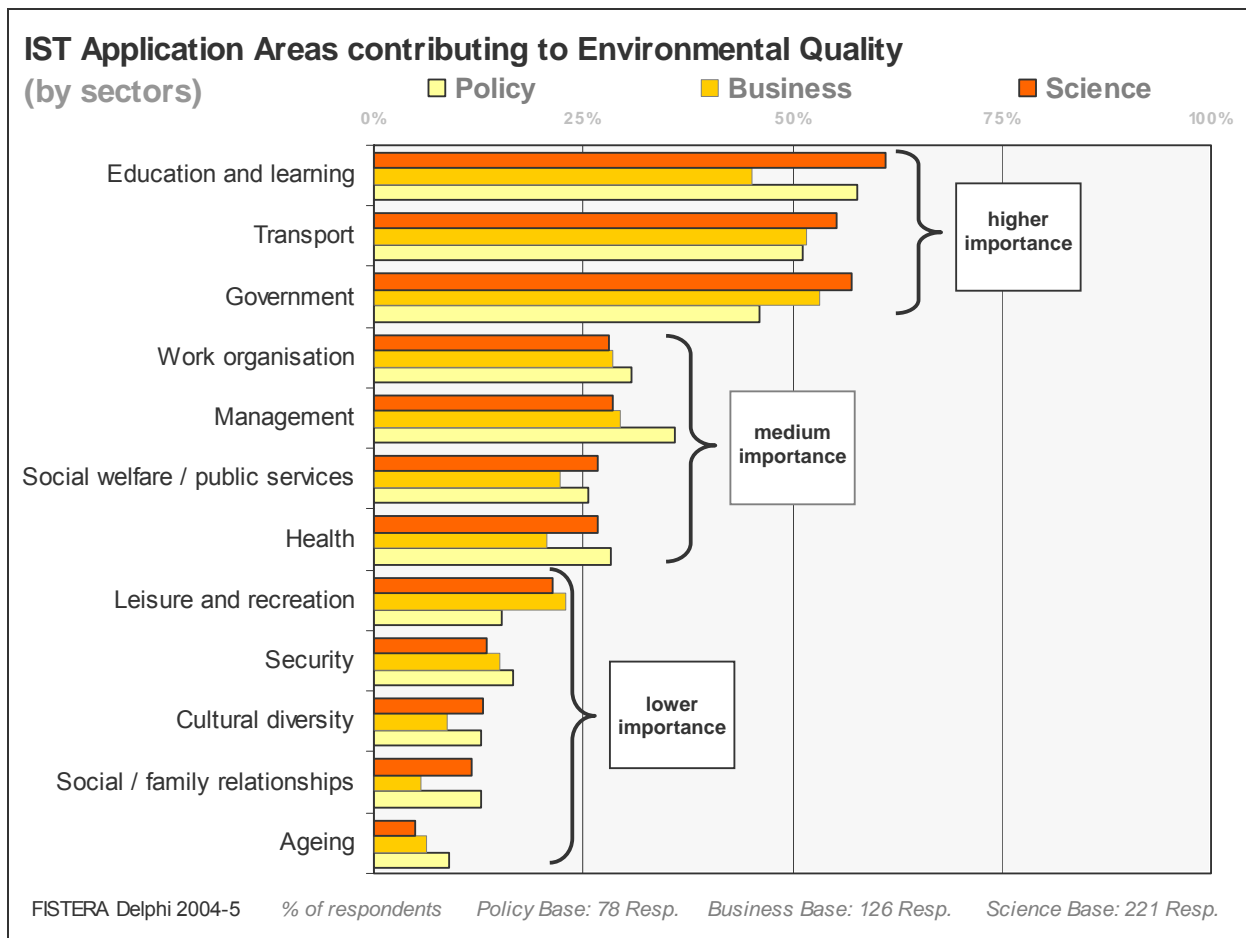
2.4   "REGIONAL RECIPES" FOR ACHIEVING LISBON 2010

The above sections were looking at each of the six Lisbon Objectives (LO) separately. Here we present an aggregated analysis of the results in an effort to provide each of the considered regions with a hopefully useful 'Recipe for targeting EU goals'.

Here we highlight in a single chart the key IST application areas which would best contribute to the achievement of the EU goals in each region. Recognising that the aggregation of votes across different EU goals can be problematic, we have included in this chart the level of consensus (where high) on the individual objectives.

We present these results in terms of the different regions which the Delphi survey covers. These are:

- ❖ The EU 25 (which includes E15 and NMS)
- ❖ The original EU15
- ❖ New Member States
- ❖ Candidate Countries for EU membership
- ❖ Non EU Countries (which includes CCs)

Among the key results are:

- ❖ Regional differences do not appear to be great, though there are certainly variations in detail.

- ❖ E&L, scoring at or near top in most goals for most regions, is outstandingly the application area which is seen as contributing most highly to the total set of goals. Other application areas typically have a more mixed pattern across different goals, and this is associated with variations across regions.

- ❖ SWP and GOV also receive many votes, in all regions

- ❖ MAN and WOR show a more mixed pattern, though at least one of these two is always in the top five (by consensus) for the regions considered.

- ❖ Ageing, Security and Leisure and Recreation are always the three areas receiving fewest votes. Of course, this is in terms of the goals considered here. (Other goals – such as personal autonomy, quality of life, or freedom from danger might have seen these getting larger votes!)

IST Recipe for the EU25

In order to facilitate reading of the results, in this chart we highlight those areas where EU25 participants put a lot of weight (more than 45 Regional differences do not appear to be great, though there are certainly variations in detail. E&L, scoring at or near top in most goals for most regions, is outstandingly the application area which is seen as contributing most highly to the total set of goals. Other application areas typically have a more mixed pattern across different goals, and this is associated with variations across regions.

- ❖ SWP and GOV also receive many votes, in all regions

- ❖ MAN and WOR show a more mixed pattern, though at least one of these two is always in the top five (by consensus) for the regions considered.

- ❖ Ageing, Security and Leisure and Recreation are always the three areas receiving fewest votes. Of course, this is in terms of the goals considered here. (Other goals – such as personal autonomy, quality of life, or freedom from danger might have seen these getting larger votes!)

Figure 2.4.1 Summary of EU25 votes across Application Areas [9]

IST Application Areas contributing to the 6 Lisbon Objectives in the EU25

- ■ Job Creation   ■ Wealth Creation   ■ Competitiveness
- ■ Social Cohesion   ■ Social Inclusion   ■ Environmental Quality

FISTERA Delphi 2004-5   *% of respondents*   *EU25 Base: 413 Resp.*

IST Recipe for the EU15

Figure 2.4.2 presents results for EU15 respondents. The Top 5 application areas remain the same as for EU25. There is a less significant consensus for the contribution of WOR on Wealth Creation. We can also appreciate Social and family relationships area moving up one position.

Figure 2.4.2 Summary of EU15 Consensus across Application Areas

IST Application Areas contributing to the 6 Lisbon Objectives in the EU15

Legend:
- Job Creation
- Wealth Creation
- Competitiveness
- Social Cohesion
- Social Inclusion
- Environmental Quality

Application Area	Values shown
Education and learning	73% / 63% / 67% / 60% / 61% / 53%
Social welfare / public services	60% / 58%
Government	48% / 54%
Work organisation	46% / 57%
Cultural diversity	62% / 56%
Social / family relationships	53% / 58%
Management	54%
Health	
Transport	54%
Ageing	
Security	
Leisure and recreation	

With less consensus on WC

TOP 5 (Same as EU25)

SFR from 7th to 6th

FISTERA Delphi 2004-5   *% of respondents*   *EU15 Base: 349 Resp.*

IST Recipe for New Member States

Figure 2.4.3 presents results for NMS participants. Here we can see the same top 3 application areas as EU25 but "Management" moves up to the 4th position leaving WOR in 5th place.

Figure 2.4.3 Summary of NMS Consensus across Application Areas
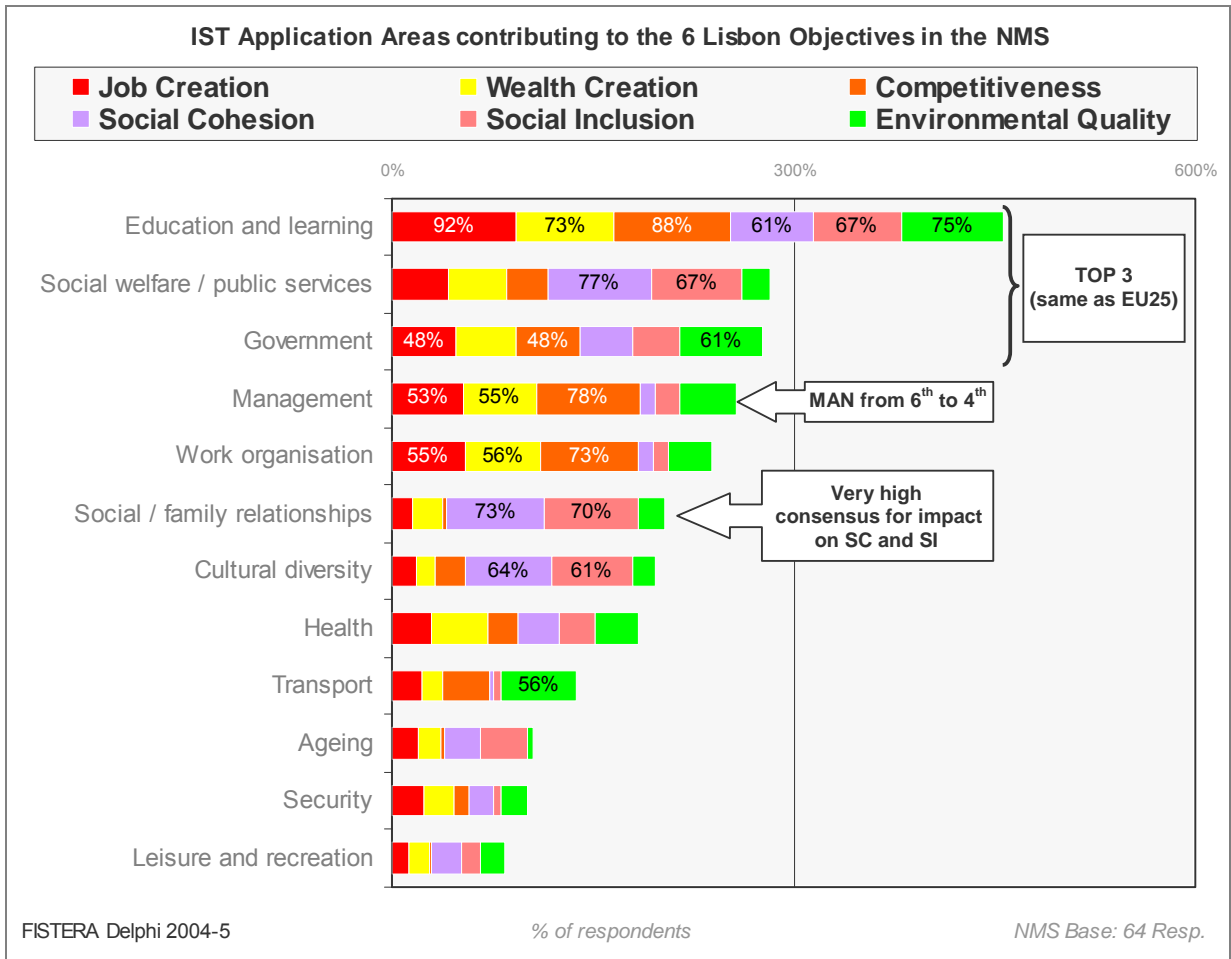
IST Recipe for Candidate Countries

Figure 2.4.4 presents results for CCs. Despite the low number of respondents from CCs (18) we can still find some interesting findings here. First we see that results the top 2 areas are consistent with other regions. "Management" moves up to the 3rd position, "Cultural diversity" takes fourth place and "Government" is left in fifth position. But perhaps one interesting results here is the 50% consensus for the contribution that IST applications targeting Ageing could have on Social Inclusion. This is a results that we would have expect in other regions too, but we have noticed that when it comes to the EU goal of social inclusion most participants (in other regions) distributed their fifth vote more or less evenly between Government, Health an Ageing.

Figure 2.4.4 Summary of CCs Consensus across Application Areas
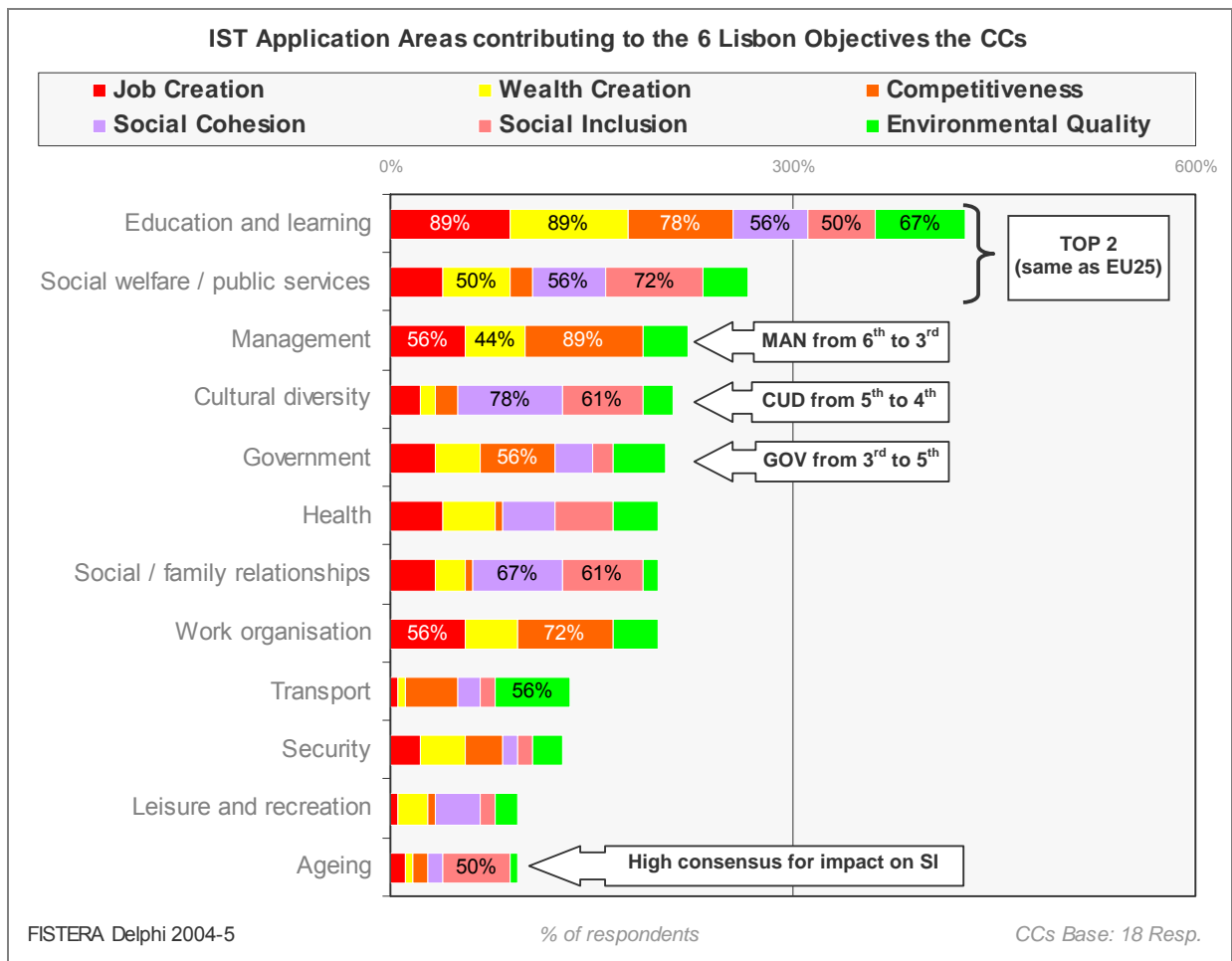
IST Recipe for Non-EU Countries

Figure 2.4.5 presents results for Non-EU respondents. Surprisingly, the results for participants from 27 countries outside Europe show similar results to the EU25 on the Top 5 application areas. Practically the major difference with EU25 perceptions is that social and family relationship area takes the place of work organisation.

Figure 2.4.5 Summary of Non-EU Consensus across Application Areas
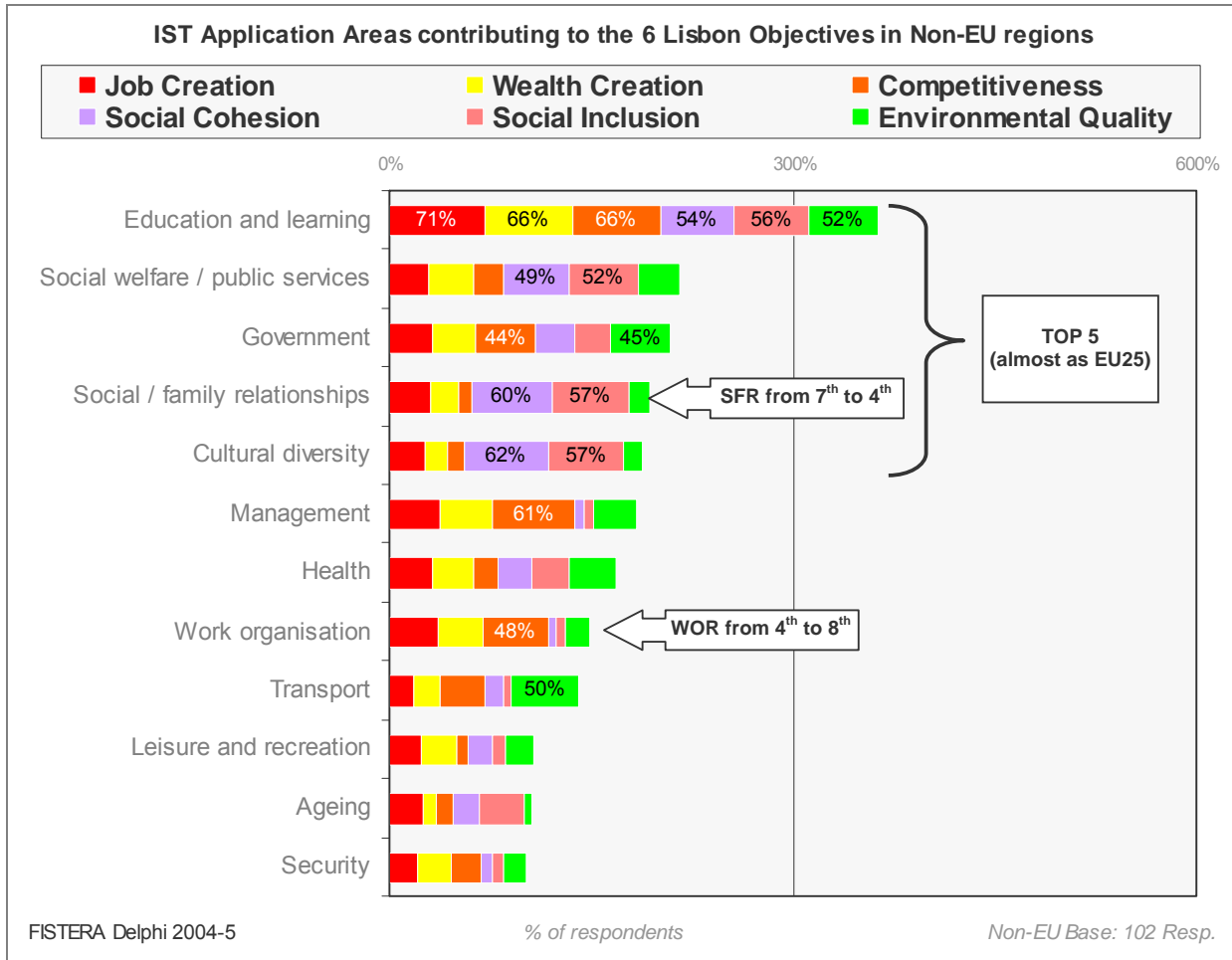
2.5   APPLICATION AREAS AND EUROPEAN KNOWLEDGE ECONOMIES

Section 2.1 offered a general overview of the contribution of 12 selected application areas to the six Lisbon Goals. Section 2.2 showed results by geographical regions while section 2.3 focused on the perceptions of the Policy, Business and Science-base sectors. In section 2.4 we provide useful pictures or 'recipes' which each region can use to identify those areas contributing to the achievement of the Lisbon Agenda.

As we mentioned in the beginning of section 2.1, the voting process in which participants were given 5 votes to allocate among 12 applications contributing to each of the six EU goals could provide distorted views about the perceived importance of the area.

> *"…a simple thought experiment can suffice to show that an application area that ranks fifth in importance in all areas for all people will receive more votes than would an area that was considered absolutely most important by all but one of the respondents, if that one respondent did not put it among the top five."*

As a result the previous exercise focused only on areas contributing to the "**six EU goals targeted at Lisbon**". But we must agree that there are other goals in addition to the six considered in Lisbon which may as well contribute the success of knowledge-based economies in Europe.

This section shows the results of a prioritisation exercise which asked participants to rank from 1 to 5 those innovative IST applications areas that would contribute to the "**success of European knowledge economies**" in the decade after 2010. Table 2.5.1 presents the results for the EU25.

Table 2.5.1 lists the application areas in terms of their ranking. Here we highlight the main results:

❖ *Education and learning* doubles in score its closest area but it surpasses it by 6 times in terms of number of times listed in first place

❖ *Government* achieve the second place in score due to number of times it appears on positions 3, 4 and 5. In fact Government is most cited area in position 4 (62 times)

❖ *Health* achieves the third position with a score of 593. However, when looking at the votes we can clearly see that it is the area most voted for position 2 (40 times). This is a result that we were expecting from the previous exercise and we had several discussions about the low number of votes given to health. This makes us conclude that health is an area which is perceived as extremely important in terms of its contribution to the success of European knowledge economies but not necessary to the Lisbon 'package' as a whole.

❖ *Work organisation*, *management* and *cultural diversity* follow in positions 4, 5 and 6, respectively. This result which is consistent with the voting in terms of Lisbon Objectives.

❖ In position 7 we find here another contrasting result, SWP was the second most voted application area in terms of Lisbon Objectives. Here we should notice it is the second most-voted area for position 4 (50 votes) and the second less-voted areas for position 1 (10 times).

❖ Positions for *transport*, *security* and *ageing* are relatively consistent with the previous exercises.

❖ *Social and family relations* and *leisure and recreation* are areas which surprisingly appear to be insignificant in terms of contributing to the Lisbon Objectives (previous exercise) and the European knowledge economies. This is a pattern for careful consideration since we could be undermining the impacts that, for example, entertainment and travel-related applications (such as gaming, music and video playing) have on wealth creation, innovation and competitiveness, among other key goals.

❖ Table 2.5.1 also presents the number of participants who voted on each position. In the exercise we did not required voting on each option since we thought that some participants would prefer to rank only their top 1, 2, 3 or 4. But results show that 89% of participants (373) completed the full task.

Table 2.5.1 Applications Areas contributing to the success of European knowledge economies

Application Areas	Rank	Total score	Votes	No of times:				
				1st	2nd	3rd	4th	5th
Education and learning	1	1489	363	193	75	52	25	18
Government	2	623	221	31	42	45	62	41
Health	3	593	188	40	49	34	30	35
Work organisation	4	590	205	29	46	43	45	42
Management	5	492	167	24	35	47	30	31
Cultural diversity	6	463	161	35	30	21	30	45
Social welfare / public services	7	441	165	10	36	39	50	30
Transport	8	379	136	14	26	37	35	24
Security	9	361	144	11	24	35	31	43
Ageing	10	258	96	12	20	15	24	25
Social / family relationships	11	198	63	18	11	11	8	15
Leisure and recreation	12	157	66	3	13	14	12	24
Total score = (1st position votes * 5) + (2nd position votes * 4) + (3rd position votes * 3) + (4th position votes * 2) + (5th position votes * 1)								
Number of participants who voted on each position				420	407	393	382	373

Section 3: Panoramic Delphis on 12 IST Areas

The previous two sections focused on big issues related to R&D needs (i.e. challenges, impediments and actions) as well as the role of application areas in contributing to Lisbon Goals. We have also identified areas where innovative applications of IST are more likely to contribute to the success of European knowledge economies in the decade after 2010 (table 2.5.1).

This section centres the attention on EU capabilities in IST in comparison to the World and the preparedness of the key EU research communities in the **public** and **private** sectors. We should bear in mind that for this section the survey had 12 independent sub-sections ('Panoramic Delphis') and that participants were asked to focus on one or two areas that relate most closely to their own field of expertise or experience.

The concept of 'panorama' was specially developed for the FISTERA Delphi. The aim was to provide a view on wide areas of applications of IST and to study several aspects of particular interest:

- ❖ How important participants think their area of expertise was to achieving the vision of a successful Knowledge Economy?

- ❖ How well developed are the EU R&D capabilities that are needed to contribute to the generation of IST applications for each area?

- ❖ How well developed are the EU capabilities for industrial exploitation of new IST applications?

- ❖ How well prepared are the key research communities in the public sector (including universities, government laboratories, etc.) to seize the research opportunities?

- ❖ How well prepared are the key research communities in the private sector to seize the research opportunities?

- ❖ Given a selection of six IST applications, participants were asked to indicate: Which are the most important applications in terms of contributing to quality of life and wealth creation, in the EU, in the post-2010 decade?

- ❖ Given a selection of eleven (11) stakeholders, participants were asked to indicate: Which are the most important stakeholders improving applications of IST to the area in the EU-25, in the post-2010 decade?

The ultimate aim of the panoramic approach is to provide information which hopefully will help decision-makers at the EU level (and elsewhere) to set R&D agendas and in particular identify issues requiring attention in the ongoing discussion about the role of IST in the Seventh Framework Programme (FP7).

3.1   A PANORAMIC VIEW OF EU R&D CAPABILITIES / PREPAREDNESS

Table 3.1.1 presents the results of the 12 Panoramic Delphi sections, altogether. Each raw indicate the results for the particular study area. A first look at the number of responses by area shows that "Education and learning" surpasses in more a double the number of responses of the next most-selected "Management". However, this information only tells us the interest of participants in the particular areas. Here again, "Leisure and recreation", "Ageing" and "Social and family relationships" seem to be less popular among respondents.

Table 3.1.1 Panoramic View of EU R&D capabilities and preparedness of Public & Private sectors

Panoramic View of EU R&D Capabilities & Preparedness (Areas)	Number of Resps.	Importance for the European Knowledge Economy	EU R&D capabilities compared to the World — For generation of IST applications (Most are)	(But few)	For industrial exploitation of IST (Most are)	(But few)	Preparedness in the Public Sector — poor	moderate	well	Preparedness in the Private Sector — poor	moderate	well
Social / family relationships	34						F	M	F	F	M	F
Cultural diversity	23						M	F	F	F	F	F
Transport	33						F	M	M	F	F	M
Ageing	22						F	F	F	F	F	F
Health	46						F	M	F	F	F	F
Education and learning	165						F	M	F	F	M	F
Social welfare / public services	25						M	M	F	F	M	F
Leisure and recreation	19						F	M	F	F	M	F
Security	24						M	F	F	F	M	F
Government	58						F	M	F	F	M	F
Management	71						F	M	F	F	M	M
Work organisation	54						F	M	F	F	M	F

Legend (Importance): irrelevant, unimportant, moderately imp., very important, essential. (EU R&D capabilities): cutting-edge, average, lagging-behind. (Preparedness) None = N, Few = F, Many = M, All = A.

Main results on importance

❖ No topics are ever found to be irrelevant. Only rarely are any considered to be unimportant by respondents.

❖ Looking at which applications are "essential", Education & Learning is often considered to be. Work organisation, Management, and Security are other application areas where the "essential" votes outweigh the "very important" ones. (The case of Security is interesting, since this area of application did not emerge prominently in terms of the EU goals considered earlier. The implication is that this reflects an essential feature of the knowledge society that was not pinpointed in the set of six goals discussed earlier.)

❖ The more "everyday" application areas (leisure, social relationships) are the ones most often considered only "moderately" important. This is rather puzzling given the large consumer markets that are available. The question arises: is there an assumption that Europe needs to pay especial attention to business and work applications of IST – that we are good consumers, but not economically effective users of IST? Or is the assumption more that we are unlikely to be competitive in the consumer applications?

❖ "Cultural diversity" does get a fairly high rating as "very important", in contrast to the other more "social" application areas. Is this because this is seen as the major European economic problem (e.g. heterogeneity in languages and practices as a major barrier to economies of scale, etc.) or even as a political/cultural impediment (e.g. social and political frictions impeding development of consensus vision of where we want Europe to be in the future)?

Main results on capabilities

❖ In practically all application areas, the majority view is that **most** European IST originators (the question concerned "generation of IST applications") are seen to be average. Typically, more respondents consider that a few are at the leading edge, than that they are typically lagging.

❖ Cultural diversity, Leisure, and Security, are exceptions. Here majorities think as usual that most of those in Europe generating IST applications are average; but this is also a more prevalent way of describing "few" actors than is "cutting edge" or "lagging". While these three areas' profiles differ in detail, the most obvious implication is that most respondents consider these to be relatively weak areas for the EU.

❖ Concerning industrial exploitation of IST applications (the question concerned "industrial exploitation of IST"), the picture is much the same.

❖ But in this case "Ageing" replaces "Security" as an application area where the most prevalent views concerning both most and few firms are that these are average

On Preparedness:

❖ We asked as to the state of preparedness of the public and private sectors, using four categories from "none" and "few" to "most" and "all" being poorly, moderately or well-prepared. Let us just consider

which judgements are employed most frequently. There are in principle 64 possible combinations of judgements that could be obtained here, since each of the characteristics poorly, moderately or well-prepared can receive any of four categorical judgements. But in practice the categories "none" or "all" never get a majority, so we are left with only six combinations of the two characterising terms that are liable to be used.   Two of these (FFF and MMM) would appear to be very unlikely – but statistical vagaries mean that it is possible for majorities to consider that "few" or even "most" organisations fall into each state of preparedness. In practice, the "unlikely" FFF combination appeared four times – for the public and private sectors in the case of ageing, and for the private sector only in the cases of cultural diversity and health. (MMM never occurred in contrast.)

❖ There were 12 assessments made for each of the public and private sectors.   The most common combination – in 7 of these 12 assessments in each case– is the combination FMF – i.e. "few" are doing either poorly or well, "most" are "moderate".

❖ The public sector also features two cases where the pattern is MFF (for cultural diversity and security) – most organisations are poorly prepared.

❖ The public sector only has one area where most players are seen as doing well (FMM for transport) while the private sector features two (FFM, also for transport, and FMM for management). Note, then, that transport is the unique case of an application area where both private and public sectors are seen as well-prepared. Private sector management is believed to be well-prepared. There are no cases where a preponderant view is that most public sector players are well-prepared but that few in the private sector are.

3.2   ANALYSIS OF STAKEHOLDERS' ROLE IN IST

Which stakeholders are more likely to play a key role in improving applications of IST in each area? The aggregation of votes again provides us with an overview of this, in terms of a list of major contributors: **national** and **regional governments**, **large firms in IST (and others)**, **health and insurance companies and schemes**, **SMEs in IST (and others)**, **the EU**, **communities and citizens**, and **NGOs.**

The aggregated results immediately tell an interesting story – national government and large IST firms, and then small and medium sized IST enterprises, receive many more votes than other stakeholders. A number of non-IST private sector actors are in receipt of fewest votes. There is marked variation in terms of the application areas where particular stakeholders are felt to be important. The most interesting information here concerns the significance that participants assign various stakeholders where the individual areas are concerned. Results for the individual areas are further discussed in the next section.

Figure 3.2.1 Stakeholders' contributions to IST applications

Stakeholders' role in improving Applications of IST

FISTERA Delphi 2004-5
Bases (SF=22, CU=27, TR=37, AG=24, HE=47, ED=177, SW=25, LE=21, SE=27, GO=62, MA=75, WO=57)
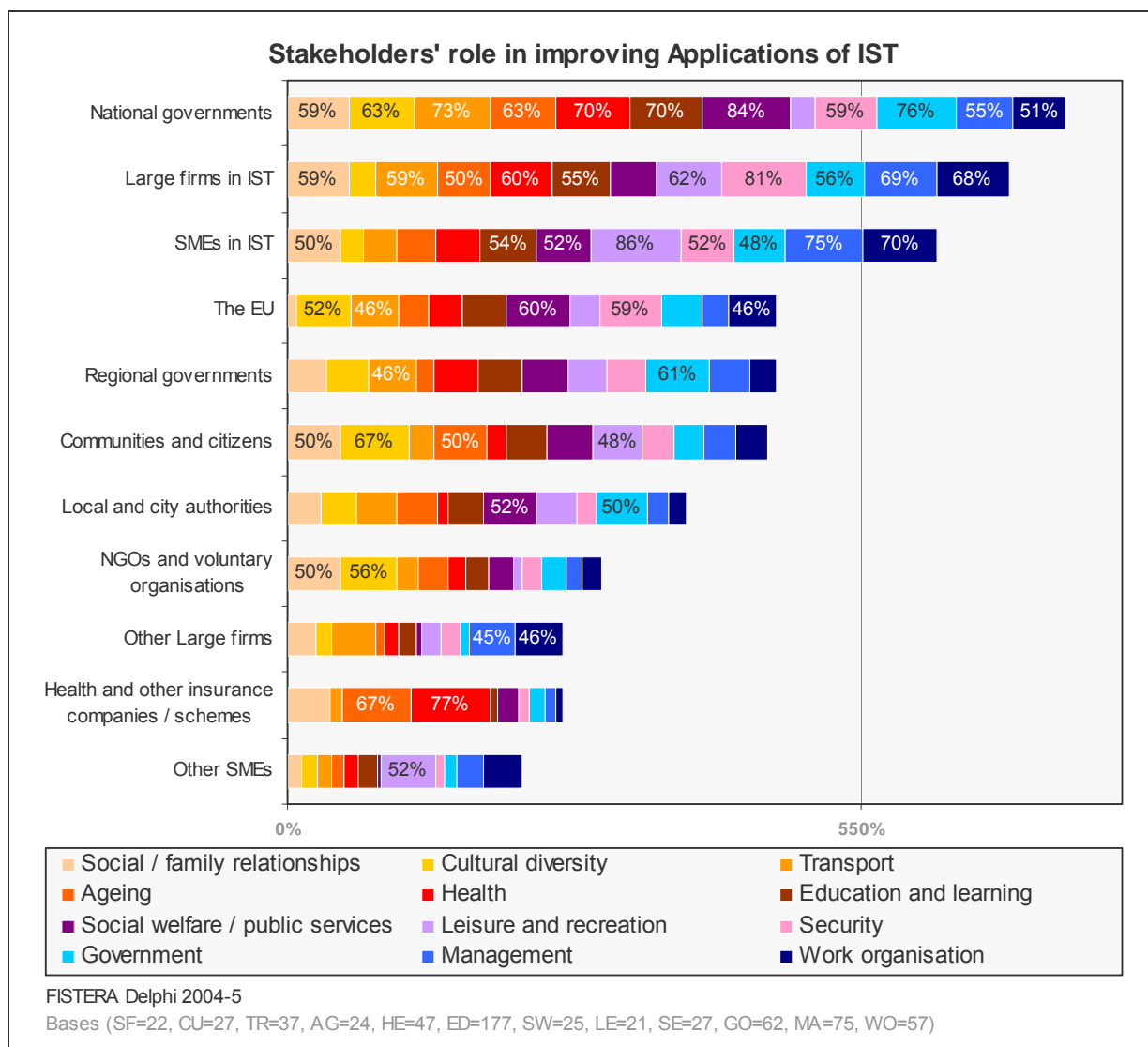
3.3   PRIORITY IST APPLICATIONS

IST Applications to Social and Family Relationships

The five major stakeholders expected to improve applications in the social and family relationships area are: National governments, large firms in IST, SMEs in IST, Communities and citizens and NGOs and voluntary organisations (see Figure 3.2.1 above).

Stakeholders improving IST applications to 'Social and Family Relationships'
1) National governments
2) Large firms in IST
3) SMEs in IST
4) Communities and citizens
5) NGOs and voluntary organisations

The question that follows is: what are the specific types of applications which are expected to improve quality of life ad wealth creation? Figure 3.3.1 offers the views of 34 experts in the area. (Note that only fourteen of those were actually from the EU25: but the pattern of results is fairly similar across EU and non-EU respondents.) The top two applications: '*More flexible work with less strain on family time or living space*' and '*Improved daily care of dependents such as children and disable family members*' achieve particularly high votes from within the EU, and together with enabling *better planning and coordination of everyday activities* around 50% of respondents vote for these applications. Other applications, achieving fewer votes (around or less than 25% of respondents) are those which somehow make people more reachable by family members and partners.

Figure 3.3.1 Social and Family Relationships applications contributing to QL & WC
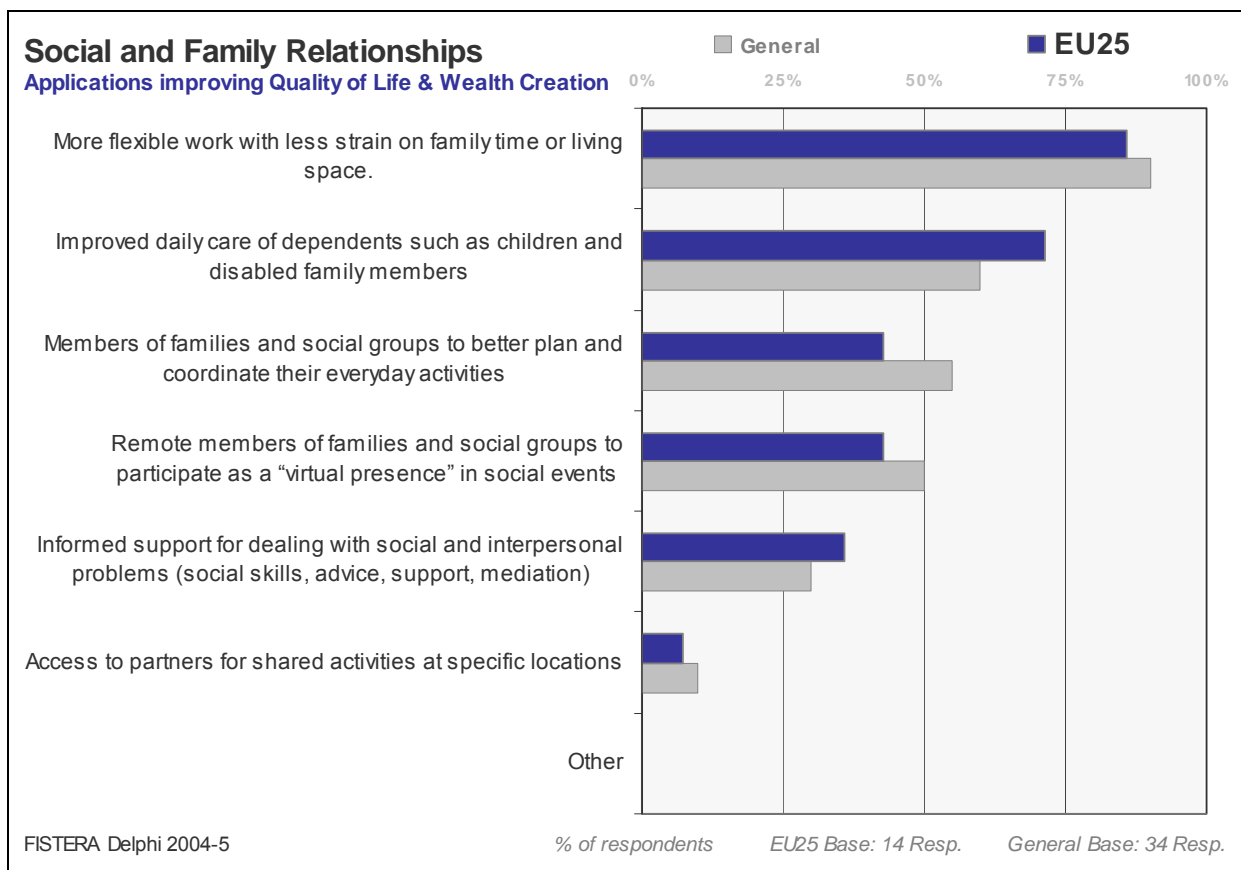
IST Applications to Cultural Diversity

This application attracted 23 experts (19 from the EU25 and 4 from the rest of the world).

The main stakeholders improving IST applications to cultural diversity were seen as: Communities and citizens, National governments, NGOs and voluntary organisations, and the European Union.

Stakeholders improving IST applications to 'Cultural diversity'
1) Communities and citizens   2) National governments   3) NGOs and voluntary organisations   4) The European Union

Figure 3.3.2 suggests that there is a less highly demarcated view of these applications than was the case in the previous application area (in which the top applications received distinctively high votes, over 75%). Three applications managed to attract 50% of the total set of experts. According to EU25 experts applications such as '*Individuals experiences that allow to better understand the ways of life and values of different cultural groups*'; '*Reduction of social exclusion by allowing individuals to locate "buddies" and people who will introduce them into welcoming (social and economic) networks*'; and '*Portable systems that permit rapid and accurate translation of speech from practically any significant language used in Europe to any other*' may improve QL and WC. A fourth application, mostly voted by non-EU experts is '*Access for migrant communities to resources and networks providing contact with their culture of origin*'.

Figure 3.3.2 Cultural Diversity applications contributing to QL & WC
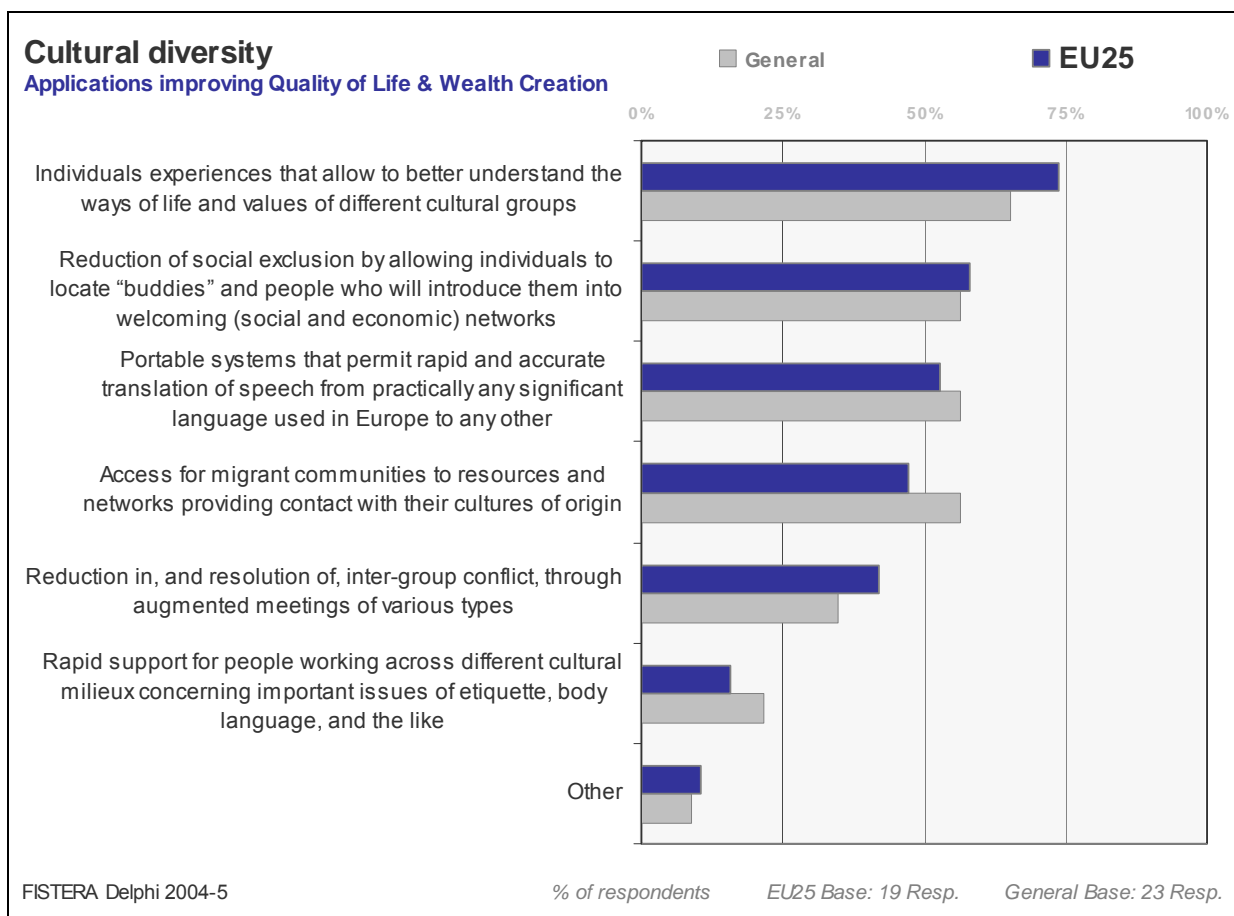
IST Applications to Transport

Transport received relatively higher numbers of respondents than did the previous application areas (33 experts of which 25 are from the EU25). National governments, large firms in IST, the EU and Regional governments were seen as the main stakeholders improving IST applications to this area.

Stakeholders improving IST applications to 'Transport'
1) National governments 2) Large firms in IST 3) The European Union 4) Regional governments

Figure 3.3.3 shows a rather clear picture of the top three applications that the above mentioned stakeholders should focus their efforts on in order to improve quality of life and wealth creation. These are:

  ❖ Major improvement of public transport service ability and quality

  ❖ Reduction of congestion and pollution by management of road traffic.

  ❖ Improved intermodal systems allowing transport to involve several different modes without serious delays or transfer costs

Figure 3.3.3 Transport applications contributing to QL & WC
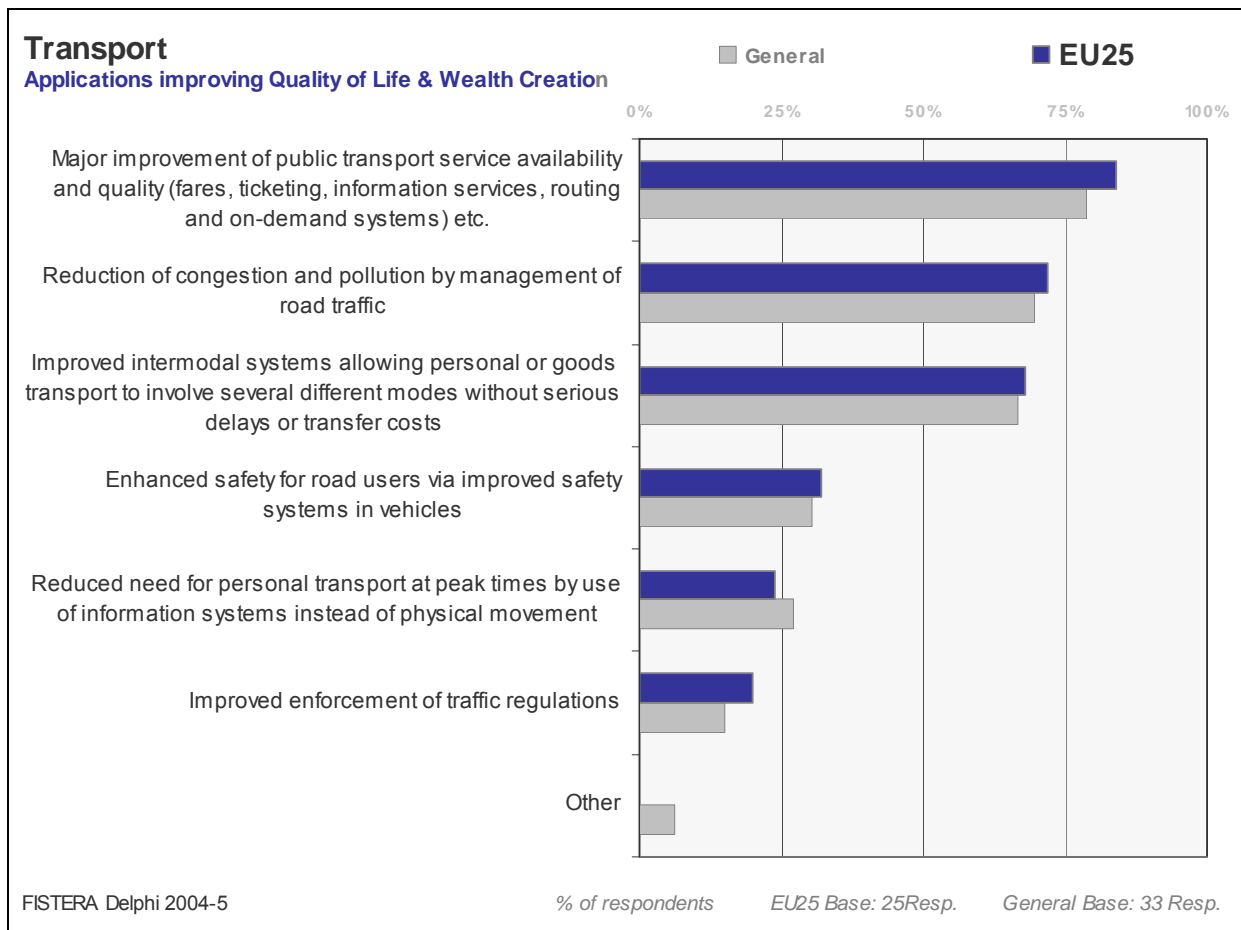
IST Applications to Ageing

Ageing is another area which attracted only a few experts (22 in total, but mostly from the EU25). Here we also find four major stakeholders improving IST applications to Ageing: National governments, large firms in IST, Communities and citizens, and Health and insurance companies / schemes.

Stakeholders improving IST applications to 'Ageing'
1) Health & insurance companies/schemes 2) National governments 3) Large firms in IST 4) Communities and citizens

Health and insurance companies / schemes – which have not appeared as important stakeholders in the earlier application areas - were seen as the main stakeholders to improve IST applications in this area. Figure 3.3.4 shows one application where most (more than 50% of) experts agree on its positive effect for improving quality of life and wealth creation. This is: Increased and more active participation of elderly in work environments through job redesign, training aids, etc. The second most-voted application related to *tools providing elderly people with rapid and appropriate information to help them navigate obstacles and carry out daily tasks effectively*. These two applications received more votes than others. Of the remaining topics, it appears that devices to enhance the autonomy of elderly people are seen as more important than applications helping emergency services.

Figure 3.3.4 Ageing applications contributing to QL & WC

Ageing
Applications improving Quality of Life & Wealth Creation

FISTERA Delphi 2004-5   % of respondents   EU25 Base: 20 Resp.   General Base: 22 Resp.
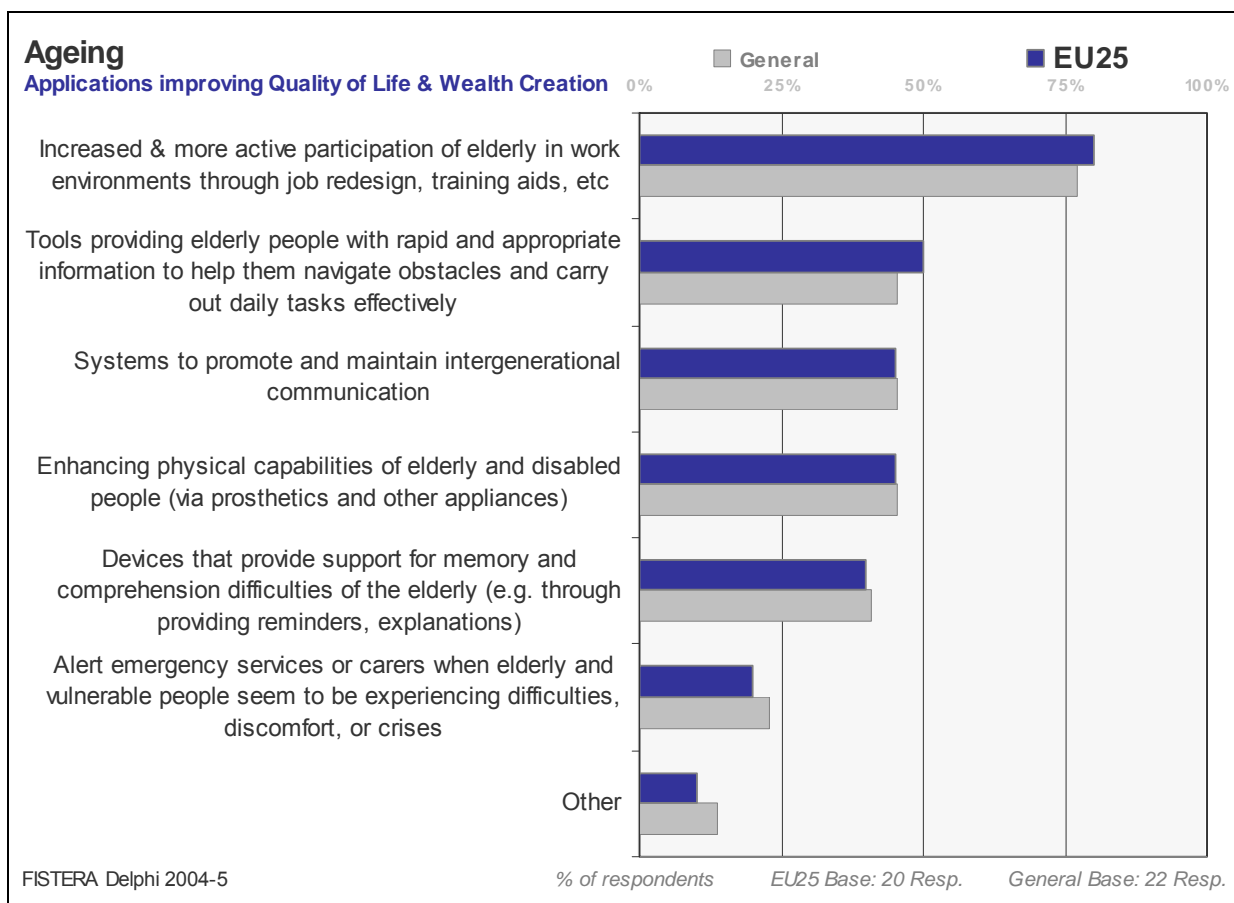
IST Applications to Health

Health was an area with a relatively high number of experts (46, of which 41 are EU25 respondents). Here we should also highlight that three stakeholders were believed to make particularly substantial improvements to this area: Health and insurance companies / schemes, National governments and large firms in IST.

Stakeholders improving IST applications to 'Health'
1) Health & insurance companies/schemes 2) National governments 3) Large firms in IST

Figure 3.3.5 indicates that four applications in the Health area received more than 50% of votes:

   ❖ Online systems that allow medical experts in different locations to pool resources in providing treatment

   ❖ Rapid retrieval of information on health history and needs

   ❖ Much speedier diagnosis of health problems

   ❖ Systems for adequately informed self-diagnosis, monitoring and treatment at home

Figure 3.3.5 Health applications contributing to QL & WC

Health
Applications improving Quality of Life & Wealth Creation

FISTERA Delphi 2004-5   % of respondents   EU25 Base: 41 Resp.   General Base: 46 Resp.
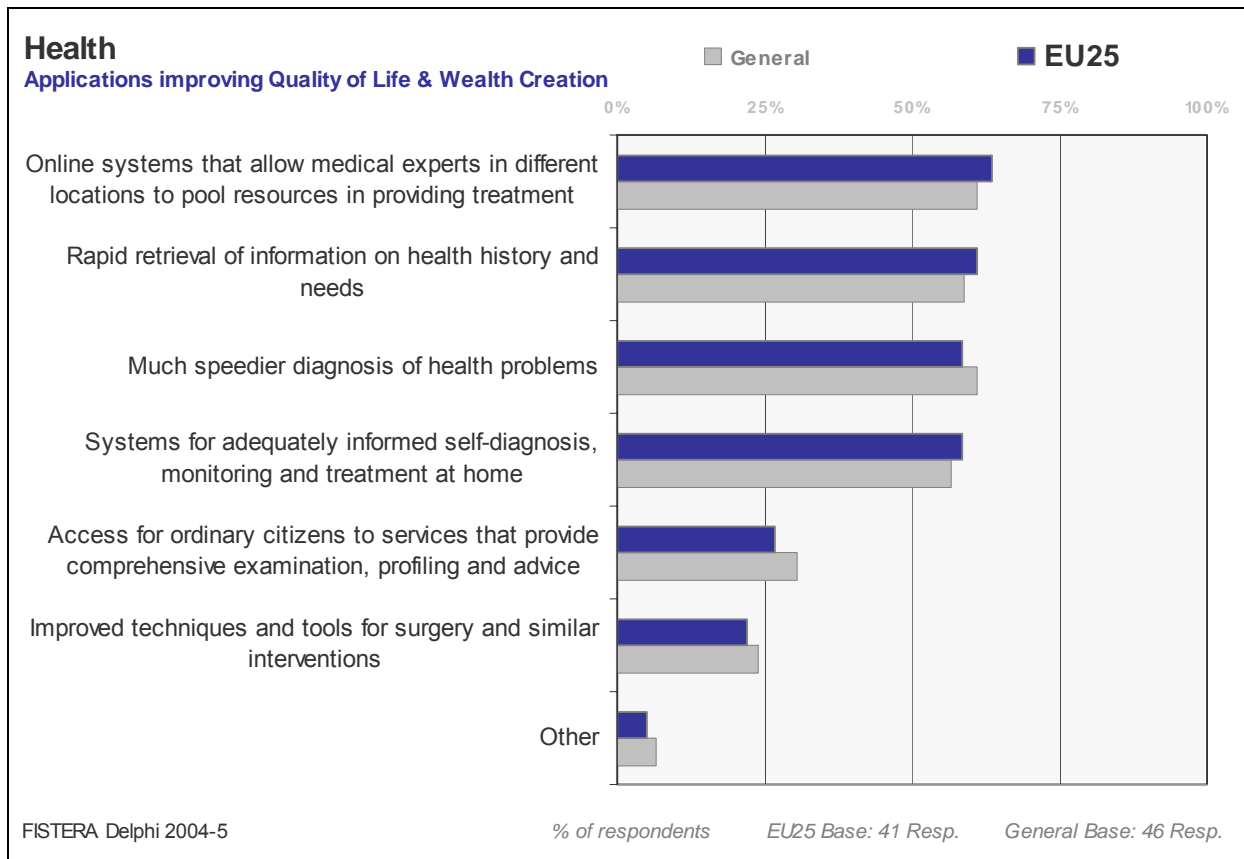
IST Applications to Education and Learning

Education and learning is the application area with the highest number of experts (in total of 165 of whom 130 came from the EU25). This is interesting, in view of the importance attached to this application area in terms of fulfilling EU goals.

Stakeholders improving IST applications to 'Education and learning'
1) National governments 2) Large firms in IST 3) SMEs in IST

The stakeholders' analysis (section 3.2.) shows that the main contributors to the improvement of IST applications to Education and learning are: National governments, large firms in IST and (interestingly) SMEs in IST. Figure 3.3.6 shows that most experts agree on the importance of two applications for the improvement of quality of life and wealth creation:

❖ Teachers and educationalists to create and deliver more effective learning content and teaching methods

❖ Employees to update and improve there skills while at work

It is noteworthy that these two applications seem to be focused more on improving teaching (quite possibly in conventional settings), while arguably more forward-thinking applications (e.g. "personalised" learning, virtual communities) receive markedly fewer votes.

Figure 3.3.6 Education and Learning applications contributing to QL & WC
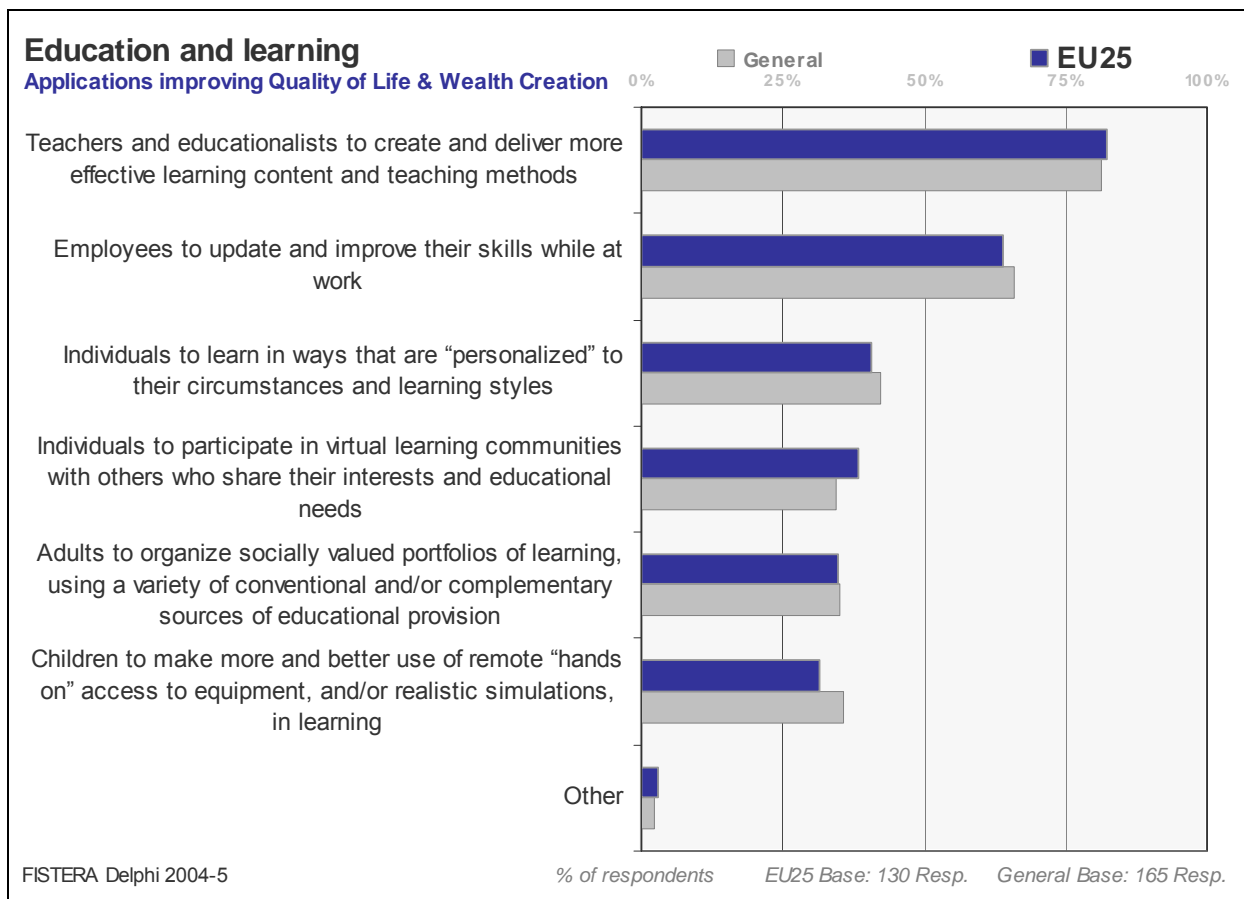
IST Applications to Social welfare / public services

Social welfare and public services was one of the few areas where the experts involved showed very little sign of any consensus on what the key applications contributing to quality of life and wealth creation might be. The area attracted a relatively low number of respondents (25 experts, mostly from the EU25).

Stakeholders improving IST applications to 'Social welfare and public services'
1) National governments
2) The European Union
3) SMEs in IST
4) Local and city authorities

Figure 3.3.7 shows a flat distribution of votes which indicates that there was little agreement among experts as to which of the considered applications might most significantly contribute to the improvement if quality of life and wealth creation. Whether this is because there are strong disagreements among the respondents, or simply that few respondents actually felt particularly strongly in favour of one or other application, we cannot tell from the results. The implications of these results will need to be explored in the discussions taking place in next phase of the project: the FISTERA Futures Forum.

Figure 3.3.7 Social welfare / public services applications contributing to QL & WC

Social welfare / public services
Applications improving Quality of Life & Wealth Creation

FISTERA Delphi 2004-5   *% of respondents   EU25 Base: 23 Resp.   General Base: 25 Resp.*
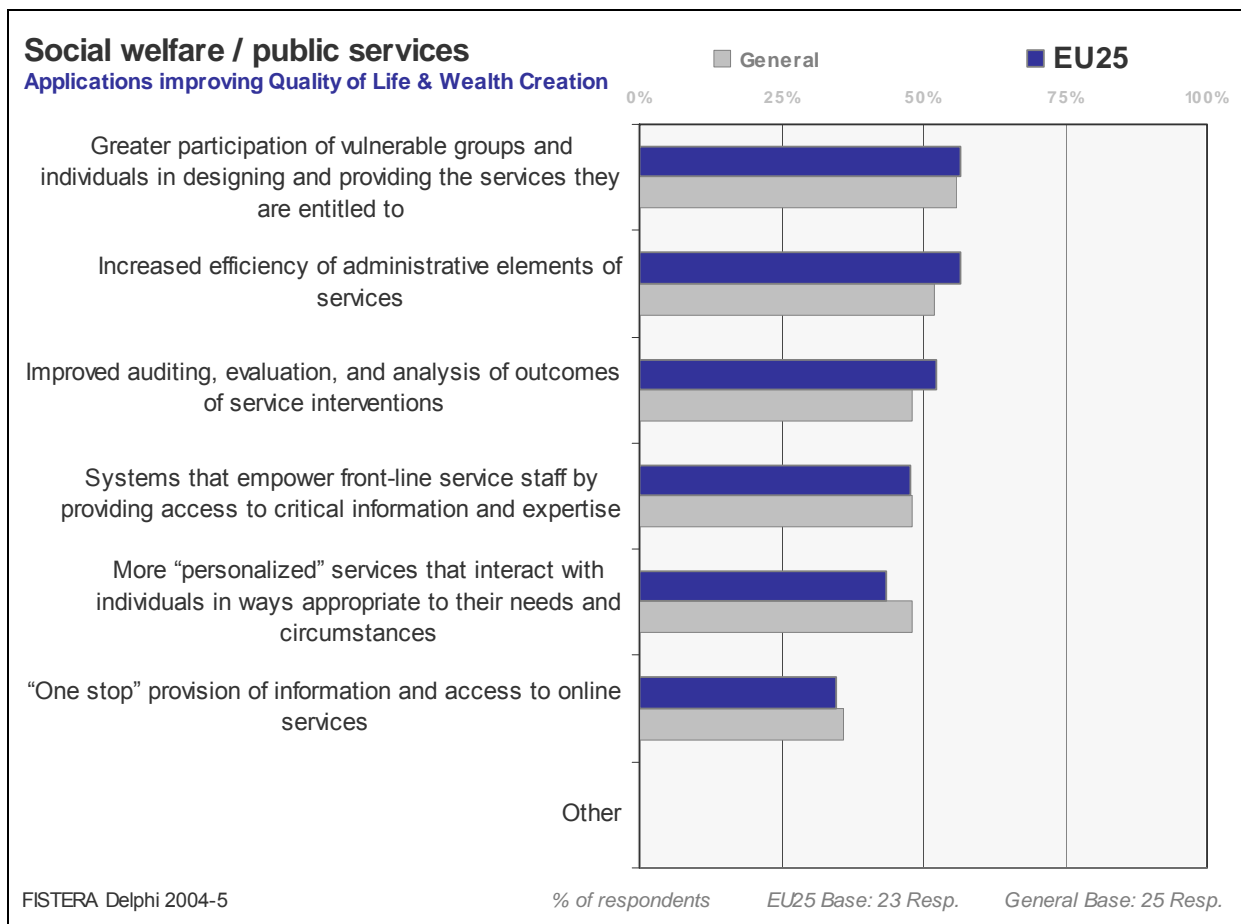
IST Applications to Leisure and recreation

Leisure and recreation was the area with fewest numbers of experts (19 from the EU25, 1 from Switzerland and 1 from Australia). This was also an area that we noted as scoring low in terms of EU goals, though arguably there are massive markets and implications for ways of life associated with such applications.

Stakeholders improving IST applications to 'Leisure and recreation'
1) SMEs in IST
2) Large firms in IST
3) Other SMEs
4) Communities and citizens

Perhaps the message for future work building on FISTERA is that a Delphi promotion strategy should make particular effort to target those stakeholders who are believed to improve applications to this area. (For instance, it might have been that IST "insiders" will often not consider the consumer electronics and computer games industries, for instance, as particularly important contributors to IST development.) As with the preceding application area, here we also received a low number of responses, but Figure 3.3.8 shows participants managed to agree on a few applications: '*Augmented environments for playing games, participation in art events, etc. in real physical locations*'; '*Rapid access to aesthetic, historical, or personal information related to particular places and spaces that individuals are in, or wish to know about*'; and '*Enhanced experiences in sport and other leisure facilities*'. (Again, we might suspect that this area will need to be further studied in our future activities).

Figure 3.3.8 Leisure and recreation applications contributing to QL & WC
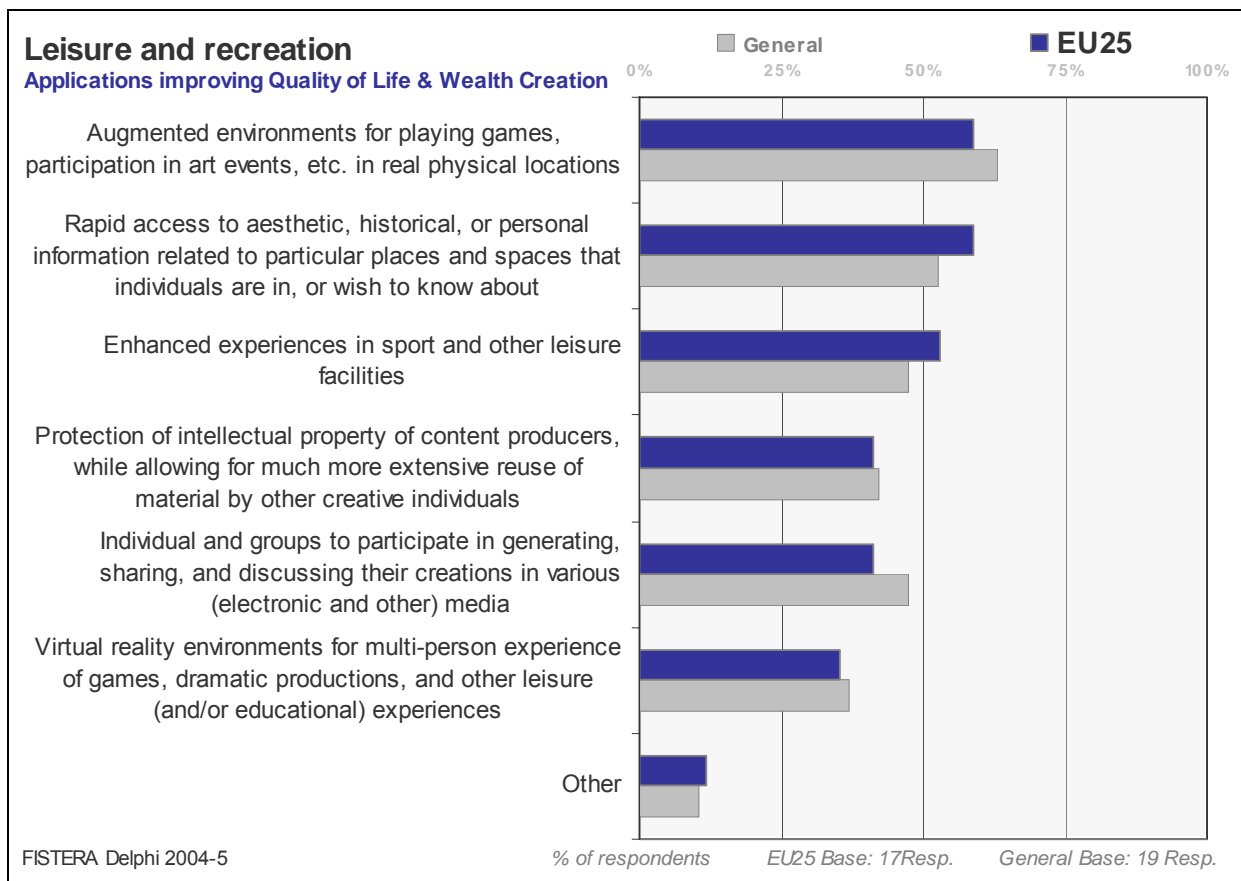
IST Applications to Security

The Security area attracted 24 experts; mostly from the EU25 region. The stakeholders' analysis (Figure 3.2.1) shows that the main contributors to the improvement of IST applications to this area are: Large firms in IST, National governments, the EU and SMEs in IST.

Stakeholders improving IST applications to 'Security'
1) Large firms in IST 2) National governments 3) The European Union 4) SMEs in IST

Figure 3.3.9 (below) shows unique and surprising results. Security was the only area where two the applications considered did not receive a single vote from the EU experts. Those applications are: *Individuals to limit calls on their time and attention from unscrupulous people, political and commercial organisations* and for *individuals to call for, and rapidly be provided with, assistance in seriously threatening situations*. For EU25 experts, applications to Security with the highest potential to improve QL and WC: *Reliable assessment of the authenticity and trustworthiness of others, and of the security of communications*, and *Critical infrastructures and systems to be designed so that they are less vulnerable to attacks and accidental damage*. It seems that "security" is here being seen very much in terms of the security of IST systems and the transactions they support, while personal security is not prioritised. Perhaps the term "security" is being predominantly interpreted in a specific (and rather narrow) way, and a better description of the application area should have been developed. However, the results bear more examination – for instance, is it just coincidence that emergency alarms are given low priority both here and in the ageing application area?

Figure 3.3.9 Security applications contributing to QL & WC
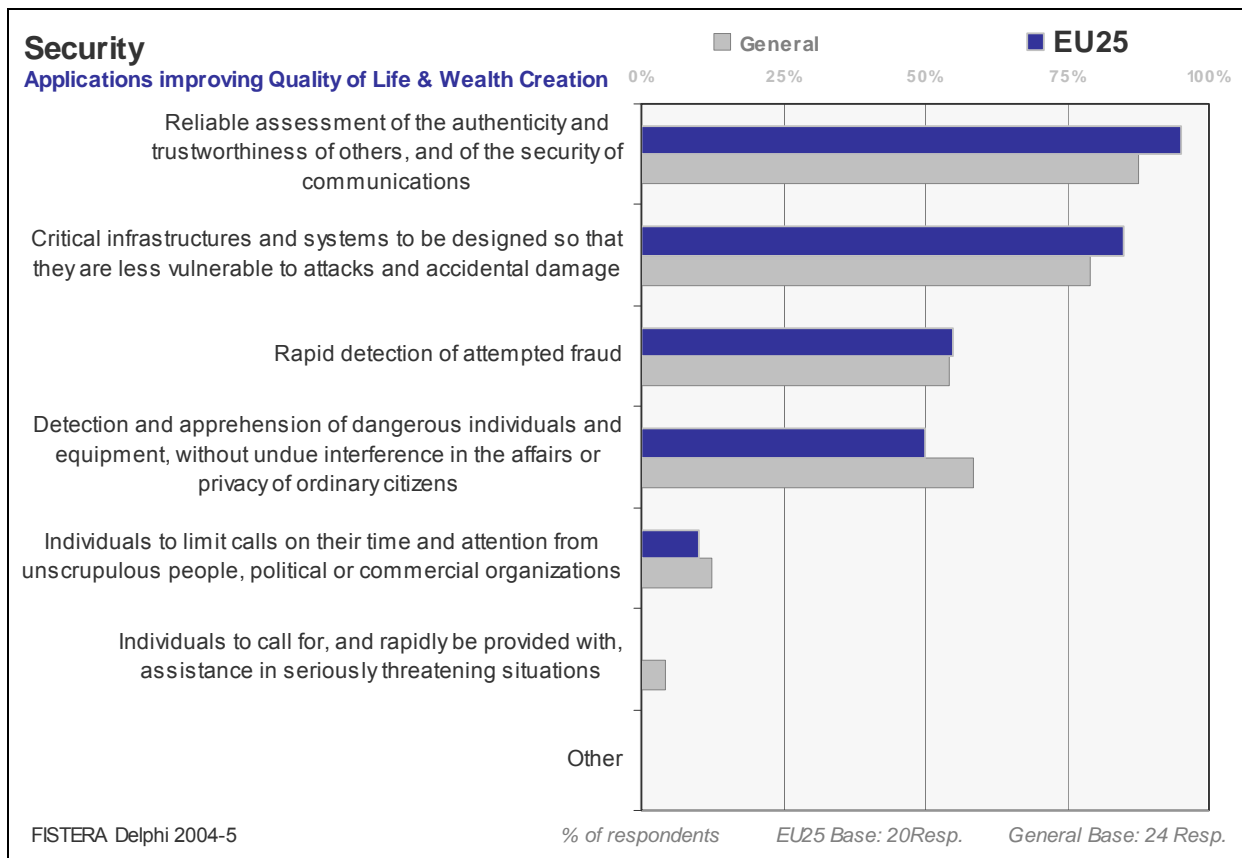
IST Applications to Government

The Government area, as might be expected, gathered the views of many experts (58 in total with 44 experts from the EU25). National governments, Regional governments, large firms in IST, local and city authorities, and SMEs in IST are major stakeholders improving IST applications to this area.

Stakeholders improving IST applications to 'Government'
1) National governments
2) Regional governments
3) Large firms in IST
4) Local and city authorities
5) SMEs in IST

Figure 3.3.10 shows a clear emergence of three top applications in terms of improving quality of life and wealth creation. Those are: (1) Providing efficient systems and services; (2) Enabling better coordination of activities across different levels of government (e.g. regional, national, supranational); and (3) Enabling different ministries and departments of the government to better coordinate and "join up" their policies and programme. Each receives the votes of more than 50% of participants.

There is, we can speculate, a similar dynamic at work here as we noted in the Education and learning area. There, we noted that applications supporting conventional education practices seemed to receive most endorsement. Here, it appears that administrative-type applications (e.g. enabling coordination of activities or institutions) prevail over those which aim to renew democratic processes (e.g. establishing new systems to make decision-making more public)?

Figure 3.3.10 Government applications contributing to QL & WC
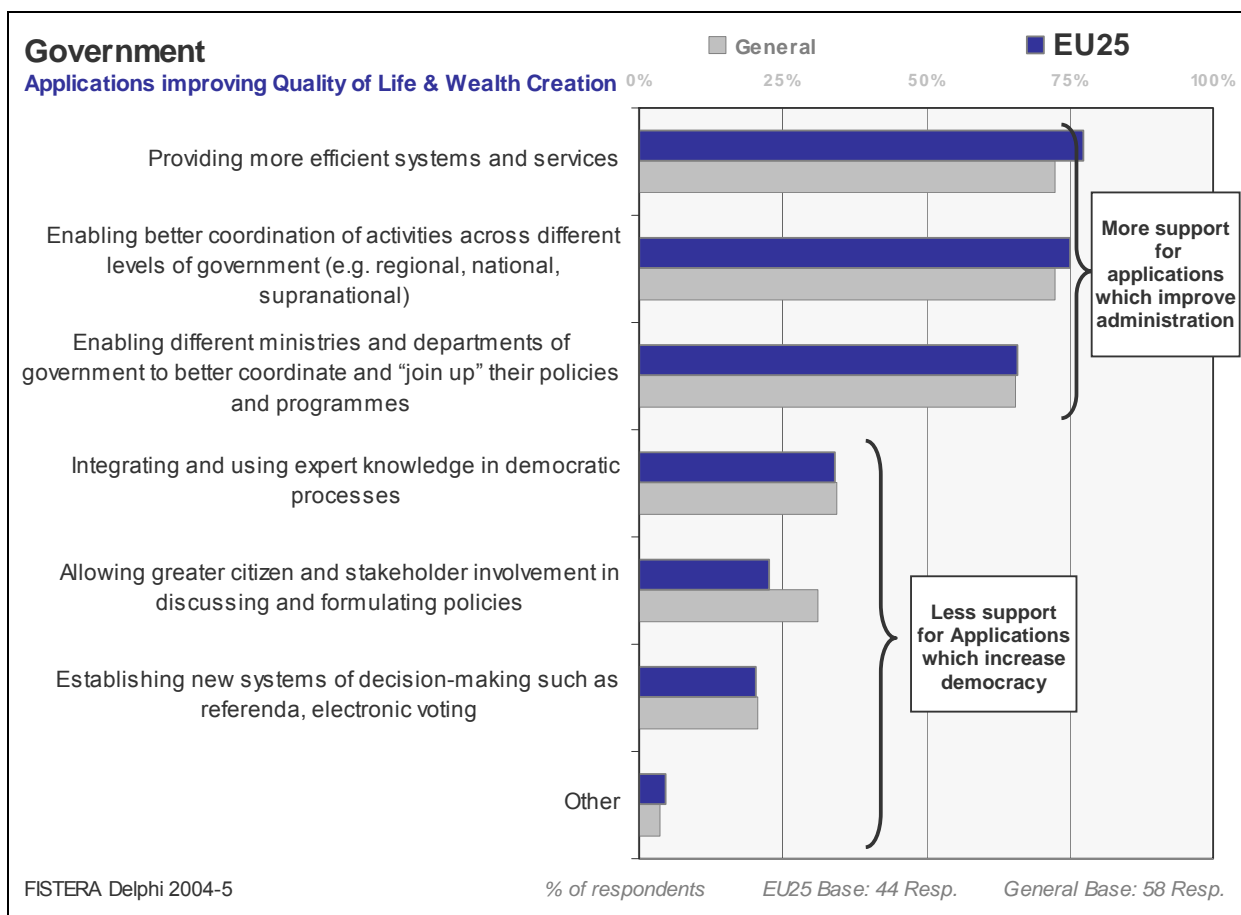
IST Applications to Management

The Management area was the second most popular one to be addressed by respondents.   It attracted 71 experts of which 57 came from the EU25. From the stakeholders' analysis we can see that the main actors seen as improving IST applications to Management are: SMEs in IST, large firms in IST, National governments and other large firms.

Stakeholders improving IST applications to 'Management'
1)   SMEs in IST 2)   Large firms in IST 3)   National governments 4)   Other large firms

Respondents saw three IST applications in this area as important to improving Quality Of Life and Wealth Creation (Figure 3.3.11):

❖   Knowledge Management to rapidly capture intelligence on business problems and solutions to them

❖   Decrease time to get innovation onto the market

❖   Improved customer relationships

Figure 3.3.11 Management applications contributing to QL & WC

Management
Applications improving Quality of Life & Wealth Creation

FISTERA Delphi 2004-5   % of respondents   EU25 Base: 57 Resp.   General Base: 71 Resp.
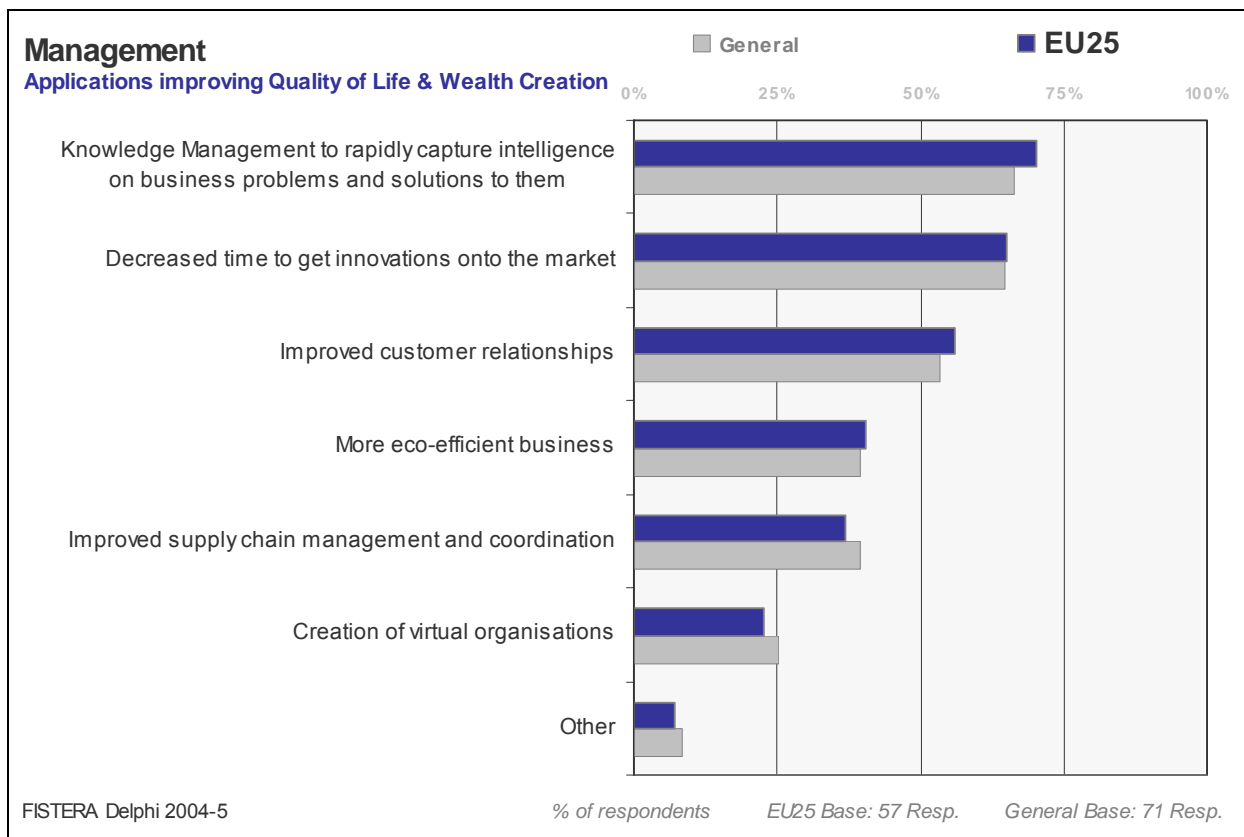
IST Applications to Work Organisation

Work organisation, like Management, was another popular area. It collected the views of 54 experts, of which 46 were from the EU25 region. The stakeholders' analysis shows five main players improving IST applications to Work organisation: SMEs in IST, large firms in IST, National governments, the European and other large firms.

Stakeholders improving IST applications to 'Work organisation'
1) SMEs in IST
2) Large firms in IST
3) National governments
4) The European Union
5) Other large firms

Figure 3.3.12 shows four main applications improving quality of life and wealth creation to this area:

- ❖ More effective and intensive collaborative working
- ❖ More empowerment and autonomy for the workforce
- ❖ Effective use of distance working (telework, telecottages, mobile work, etc)
- ❖ Improved systems for Lifelong learning on the job

It is interesting to see that these latter topics are very much in tune with notions of lifelong learning and the knowledge economy. In contrast, two applications with more of a traditional health and safety focus receive fairly few votes.

Figure 3.3.12 Work Organisation applications contributing to QL & WC

Work organisation
Applications improving Quality of Life & Wealth Creation

☐ General   ■ EU25

0%   25%   50%   75%   100%

- More effective and intensive collaborative working
- More empowerment and autonomy for the workforce
- Effective use of distance working (telework, telecottages, mobile work, etc)
- Improved systems for Lifelong learning on the job
- Reduction of stress at the workplace (e.g. systems that can assess and dynamically adjust workloads)
- Reduction of exposure of employees to physical hazards at work
- Other

FISTERA Delphi 2004-5   *% of respondents*   *EU25 Base: 46 Resp.*   *General Base: 54Resp.*

Main remarks

In this section we outline a selection of the main remarks and comments of the experts involved in The FISTERA Delphi.

REMARKS ON STAKEHOLDERS

We saw earlier that the stakeholders whose importance was most often affirmed were national government and large IST firms, and then small and medium sized IST enterprises. As we have noted on examining specific application areas, other stakeholder groups are important in specific fields. We gave respondents the opportunity to suggest other stakeholders relevant to specific areas, and the following table summarises the most recurrent suggestions:

Area	Additional stakeholders improving applications in the area
Social / family relationships	Software developer clusters
Cultural diversity	
Transport	Large automotive firm
Ageing	Higher education institutions (HEI), universities and research institutes
Health	Large pharmaceuticals, Medical groups
Education and learning	Higher education institutions (HEI), universities and research institutes
Social welfare / public services	
Leisure and recreation	Tourist industry
Security	Higher education institutions (HEI), universities and research institutes
Government	Open Source Communities
Management	Higher education institutions (HEI), universities and research institutes
Work organisation	Higher education institutions (HEI), universities and research institutes

In retrospect, this suggests that the decision not to include the HEI research sector among stakeholders was a mistake.

REMARKS ON APPLICATION AREAS

The FISTERA Delphi collected hundreds of comments from many participants. Here we present a selection, by application area. These have been chosen to reflect the range of opinions expressed, as well as the geographical spread of the experts involved. (We have attempted to correct obvious spelling mistakes and – when long comments were posted we present major points only.) It will be evident that a very rich and diverse set of comments has been made, which encourages to think that the Futures Forum will be a stimulating medium of exchange.

Participants' remarks on Social / family relationships

Some of the development is likely to be about the integration and utilisation of generic technologies to fit a variety of market needs which in turn make use of more affordable broadband access across all regions. The innovative stuff will come as virtual environments are increasingly 3D enabled, storage capacity and processor power increase dramatically and the use of geographically specific aspects of mobile technologies is deregulated.

Aidan Roe, UK

Almost all of the work in this and every other Area is still going on, albeit unconsciously, within an Industrial frame of reference, i.e. we are "fixing problems" and easing points of stress/congestion of the world as we know it. We tell ourselves we are creating a new future, but we are not. If you scratch under the paint of virtually all of the talk of "change, new and transformation" in both the EU and Canada we find fresh efforts to create a new version of yesterday.

We need a new and truly post-Industrial frame – one within which we learn to take responsibility for the ongoing co-creation of well-formed persons, communities, economies and societies. We need to become communities that can create wealth, health and community with out creating fear. Then, in this

> **" The hard part is not the technology, but the human parts... allowing ourselves to explore and understand just how profound is the societal transformation within which we now find ourselves. "**
>
> Ruben Nelson, Canada

new frame, we need to ask what IST infrastructure and applications would truly be helpful to nurture and manage the transition. The sooner we stop trying to improve our Industrial societies/economies and openly commit to co-creating truly post-Industrial societies/economies the easier will be out transitions to such a world. The fact is: most folks think a "knowledge-economy" is an updated version of our Industrial economies. It is not. The hard part is not the technology, but the human parts... allowing ourselves to explore and understand just how profound is the societal transformation within which we now find ourselves. The USA has a lock on the Industrial version of the emerging "knowledge economy." Let them have it. The world needs an EU that is cutting a new cultural swath.

Ruben Nelson, Canada

Participants' remarks on Cultural diversity

Exchange is the basic drive to create wealth, jobs, cultural transformation, etc.... More and more exchange is addressing goods (traditional economy) but the exchange of KNOWLEDGE is becoming more and more the foundation to wealth pits. If the cultural diversity is to be kept as a really applied concept inside the EU (I have to fill in the Delphi in English not in my mother-tongue as a proof of non-cultural diversity), then the CENTRAL ISSUE is Human language technology on which is based the exchange of knowledge. Without performing multilingual multimedia semantic Question/Answer systems effectively allowing the creation of knowledge regardless of the source language, the EU IST objective will never be reached. Human language technology is of NO interest for big firms because it takes too long time to pay off. Only small passionate firms can painfully accumulate the knowledge necessary to progress and DELIVER on the market the tools. The European Union Framework Programme (FP) IST budget should allocate more money on very small innovative firms.

Christian Gronoff, France

> " **Human language technology is of NO interest for big firms because it takes too long time to pay off. Only small passionate firms can painfully accumulate the knowledge necessary to progress and DELIVER on the market the tools.** "
>
> Christian Gronoff, France

Participants' remarks on Transport

The main problem is that transport systems are piecemeal. Integrated consistent solutions are necessary (e.g. if we want more goods to be transported by trains, the infrastructure for loading, unloading, and for the last miles are to be taken into account).

Peter Stollenmayer, Germany

There are important complementary areas of policy to consider for making many IST applications in transport work: environmental taxation, competition/liberalisation policy, standardisation policy.

Matthias Weber, Austria

As Europe grinds to an inevitable halt, it will eventually dawn on people that they cannot always travel where they want when the want. IST can support the transition to a non travelling society and perhaps the most important transport related applications are those that support flexible working.

Norman Butlin, UK

> " **IST can support the transition to a non travelling society and perhaps the most important transport related applications are those that support flexible working.** "
>
> Norman Butlin, UK

Participants' remarks on Ageing

Ageing does not equal elderly or difficulties - it is a much broader concept and carries with it much wider consequences of the kinds of things that need to be discussed in an information society policy. How does the economic, social, knowledge society shift its attitudes in the way in which it views the very different and fluid segments of people who are often financially loaded, have done their economic duties but have much more to contribute in the knowledge sense "wisdom", is often overlooked in the Western societies.

Dominique Purcell, Australia

> **" How does the economic, social, knowledge society shift its attitudes in the way in which it views the very different and fluid segments of people who are often financially loaded, have done their economic duties but have much more to contribute in the knowledge sense "wisdom", is often overlooked in the Western societies. "**
>
> Dominique Purcell, Australia

Participants' remarks on Health

The key challenge is to link the huge resources of the health service providers more effectively to IST development. This is less a question of doing cutting edge R&D than developing effective social and technical solutions - for example regarding information sharing. Public procurement could be a key force in overcoming the 'commercialisation gap' for RTD, and promoting job creation in IST Health applications.

Robin Williams, UK

> **" Public procurement could be a key force in overcoming the 'commercialisation gap' for RTD, and promoting job creation in IST Health applications. "**
>
> Robin Williams, UK

In my country (USA), legal authority over medical licensing and splintered service and insurance provision means that FEW stakeholders are large enough to move forward in this area. Concerns over litigation, medical malpractice, and legal liability restrict innovation in this area. The EU has developed more innovative ideas regarding IST in health, and has moved forward more aggressively to promote health for its citizens.

Claire Pavlik, USA

> **" The EU has developed more innovative ideas regarding IST in health, and has moved forward more aggressively to promote health for its citizens. "**
>
> Claire Pavlik, USA

Participants' remarks on Education and learning

The lack of really usable online learning materials on different languages makes difficult to improve applications of IST on the area of education and learning. Teachers don't know how to create materials for online learning and IT experts don't have knowledge of teachers. The two communities should find and understand each other.

> " **Teachers don't know how to create materials for online learning and IT experts don't have the knowledge of teachers. The two communities should find and understand each other.** "
>
> Julia Beres, Hungary

Julia Beres, Hungary

The EU needs to reduce "intellectual property" rights to protect the public interest and promote the advancement of scientific research.

Adam Funk, UK

The value added by ICT is driven by availability (ubiquity), cost/performance and suitable content (with safeguards). There are many stakeholders in the process of becoming an information society, and they are not yet well aligned, so it is necessary to make progress over several fronts simultaneously. The EU has a key role to play coordinating and facilitating this process.

John Gerard McInerney, Ireland

Learning best takes place in social situations marked by interaction and dialogue. There are tremendous benefits to be obtained through face-to-face interactions. This can be in the form of video-conferencing or in vivo but these benefits are not obtained through non-visual exchanges over the long term. One-way information flows are different in this respect and search mechanisms, open access data bases, teaching videos can all be helpful here.

> " **Learning best takes place in social situations marked by interaction and dialogue.** "
>
> Lynn K. Mytelka, The Netherlands

Lynn K. Mytelka, The Netherlands

The key technologies seem to be in most of the cases improved real-time and high data rate communication technologies, in particular to get fast information from databases, but also any kind of real-world information on-line. The failure of the tricky economy concepts of the new market (Toll collect flop, etc.) shows that we need a better equilibrium between technological skill and high cost management à la Havard B.S. Information technology will be accepted, if it works and if one can afford it. Skill concerning systems, hardware (design tools), OS's, compilers, code generators are under developed in EU, thus the cost for this products will increase more and more. The EU future in the information industry can not be mainly restricted to "plug and play" and to programming in C++ or JAVA..

Gerald Sobotta, Germany

Education and learning is a strategic IST application area to build democratic knowledge-based societies.

Domingo Aliaga-Guerra, France

IST is simply a tool. The challenge is to change the learning behaviour, learning culture, the mindset of the citizen and the general information culture as perfectly done in the Scandinavian countries. But there are cultural differences in place, dating back hundreds of centuries (catholic versus protestant information cultures).

Gerhard K. Wagner, Austria

> **" The challenge is to change the learning behaviour, learning culture, the mindset of the citizen and the general information culture as perfectly done in the Scandinavian countries. "**
>
> Gerhard K. Wagner, Austria

Participants' remarks on Social welfare and public services

The question (in this Area) do not touch upon the need to build register data, to use unique, standardised person and firm IDs, to have Public Key Infrastructure (PKI) systems etc. This means building the basic infrastructures for eGovernment, for building of efficient private service systems, etc.

Anders Ekeland, Norway

It would also have been nice to see a question on the adequacy of customer-supplier relationship models built in to many private sector COTS applications used for public service delivery, and of the impact of contracting out and privatisation.

Jonathan Cave, UK

Participants' remarks on Leisure and recreation

In many ways building leisure and recreation into any future plans is like building with sand as situations change. I don't see a sustainable future for tourism and I would give this area of work a low priority for system building.

Norman Butlin, UK

Participants' remarks on Security

The development of IST technology and its widespread use to attempt the analysis of security problems is sterile without the concurrence of two key things:

1. A proactive attitude to approach the problem and its solution (this implies the need of strategic thinking on working routines)

2. Educational skills, taken under a holistic point of view.

In most cases we (the politicians or the analysts) tend to identify the existence of software or a complicated system with the existence of a solution to a problem; generally, a very good software or system is not well used to solve a problem because of the users' lack of skills and perspective.

> **❝ IST hardly can contribute to deal with security problems without -first- training the analysts to think future oriented and holistic. ❞**
>
> Enric Bas, Spain

What I mean is: IST hardly can contribute to deal with security problems without -first- training the analysts to think future oriented and holistic.

Enric Bas, Spain

Products in the field of security strongly depend on non-EU technologies. The EU25 is not independent and autonomous particularly in designing, developing and producing data processing systems. Key components in SW and HW are not provided by the EU25 companies and there is a lack of basic skills in producing these products.

Non-EU SW and HW modules are becoming very expensive, in particular design tool licenses for ASIC's/FPGA's development, arriving now at the level of net man-power costs and will increase in the future. The EU25 moves towards pure bachelor level engineering (plus managing) by loosing high

> **❝ EU25 mainly ignores the value of intellectual skill – something that the open-source culture underlines. ❞**
>
> Gerald Sobotta, Germany

level engineering skills. Technological breakthroughs as a result of medium or long term research activities are becoming out of scope in the EU25. As the seven-year Huygens mission drastically underlines, the EU25 exhibits some talent in the first technological step, but has no organisation structures to ensure now the evaluation of the incoming data from Saturn moon Titan.

The EU25 mainly ignores the value of intellectual skill, – something that the open source culture underlines. The strategic application of logic patents outside of Europe weakens the EU25 considerably.

Gerald Sobotta, Germany

Participants' remarks on Management

Research and higher education institutes have a much role to play (in this Area), but unfortunately: (1) universities are more and more difficult to keep most talented researchers due to very poor pay and these talented people are doing some trivial development works due to the lack of innovation culture in EU IST industries; (2) the current poor funding situation in EU higher education makes it impossible to develop any serious new technology; and (3) researchers in universities do not know what the market needs and produce 90% useless publications for the research assessment exercise.

> " ...the current poor funding situation in EU higher education makes it impossible to develop any serious new technology. "
>
> Xiao-Jun Zeng, UK

Xiao-Jun Zeng, UK

The quick evolution of Information and Communication Technologies (ICT) offers a technological readiness that overcomes the own capacity of companies (mainly SMEs), and questions the capability of many organizations to collaborate. For this reason, it is quite difficult to analyze the possible evolutions of this topic since the own nature of ICT will, probably, continue to offer multiple and important opportunities. However, the depth of the impact of ICT will depend on the capacity of diffusion from the supply-side and the degree of absorption of main users. Therefore, Governments

> " The quick evolution of Information and Communication Technologies (ICT) offers a technological readiness that overcomes the own capacity of companies (mainly SMEs) and questions the capability of many organizations to collaborate. "
>
> Jose Miguel Echarri, Spain

should: (1) play an important role stimulating both diffusion and absorption of ICT; (2) build a regulatory framework that facilitates the real competition between operators and technologies; (3) guarantee the sustained development of the infrastructures and networks; (4) build trust among the potential users; (5) focus on the products, services and applications which offer the most for the users and the government itself; and (6) make more internal (among administrative offices) and external (with citizens) use of ICT

Jose Miguel Echarri, Spain

I believe there is a lack of changing expertise between universities and private companies. At the moment and in the near future SMEs do not have access to the knowledge at a fair price.

Georg Dutschke, Portugal

Participants' remarks on Work organisation

Due to the fast developments in the field of IST (accompanied by the impacts of globalisation) we are faced with huge transformation concerning our working conditions. Society can deal with these challenges if the individual risks (which are the counter side of individual flexibility) could be spread and could be carried by the howl community.

Ulrich Fiedeler, Germany

Europe needs to develop new systems reflecting the specific aspects of its most innovative companies (regional grounds, continuous innovation, non-functional management, high knowledge sharing, etc.). In order to do so Europe needs to invest IST at all levels: basic research, development of new systems, and diffusion of new systems).

> **"Europe needs to develop new systems reflecting the specific aspects of its most innovative companies."**
>
> Giorgio de Michelis, Italy

Giorgio de Michelis, Italy

Conclusions

The FISTERA Delphi offers interesting insights into expert views about the social dimensions of Information Society Technologies. This report has set out to highlight areas of common understanding among participants and those where opinions diverge. For example, participants showed considerable agreement on the main challenges that R&D needs to address in IST. But when it comes to impediments to the successful development of IST, applications views are much more dispersed.

In terms of the process, The FISTERA Delphi proved to be highly successful in gathering views from a large number of individuals concerned about IST. These results should provide powerful inputs for the next phase of the project: "The IST Futures Forum". The Forum will be a medium in which we can experts to explicate, comment on, and elaborate the Delphi results, and dialogue with each other as to their significance.

The FISTERA Delphi raises interesting questions concerning exactly what message is being given by the experts' responses. For example:

❖ Why, in the *Government* area, do administrative-type applications (e.g. enabling coordination of activities or institutions) prevail from those which could increase democracy (e.g. establishing new systems to make decision-making more public)?

❖ Why, in the *Education* area, do conventional-type applications (e.g. improving teaching) prevail from the more forward-thinking ones (e.g. "personalised" learning)?

❖ Why do respondents seem to have less interest/knowledge/experience on every-day-life areas like: *Leisure and recreation*, *Social and family relationships*, and *Ageing*?

❖ Why does personal security seem to receive little endorsement in terms of applications enhancing Quality of Life and Wealth Creation, and why does Leisure and Recreation appear to be seen as contributing so little to EU goals?

To conclude, we hope that the material of this report will contribute to a better understanding of the perceived potential that different IST Applications Areas have for achieving specific EU objectives (e.g. more jobs, environmental sustainability) and more general ones (e.g. successful Knowledge Economy). The Futures Forum should be an opportunity to discuss the implications of these results for formulating strategies of IST Research and development, and other innovation-oriented efforts.

Annexes

ANNEXE A – METHODOLOGY OF THE FISTERA DELPHI

About Delphi

A Delphi survey is a process which consists of collecting and distilling knowledge from a group of experts by means of a series of questionnaires, generally involving two consultation rounds. In this sense, it is conceived as a communication structure methodology with the purpose of producing detailed critical examination and discussion upon several topics.

Objectives

The Delphi study was carried out as part of the European Commission-funded FISTERA project which constitutes an ambitious effort to gather and share knowledge and views in relation to the future of Information Society Technologies (IST) in Europe in the period up to 2010 and beyond. A key aim of the project is to generate scenarios with respect to this future, and the Delphi survey represents an important vehicle for moving towards the creation of evidence-based and well-founded visions.

The Delphi is designed specifically to address the Lisbon Objectives and to consider the extent to which - and in what ways - ISTs and associated applications can assist European nations in advancing towards the improvements of key EU objectives: job creation, wealth creation, competitiveness, social cohesion, environmental sustainability and social inclusion. More pragmatically the Delphi expect to:

- ❖ provide European policy-makers with a sound basis for planning in relation to IST RTD effort;
- ❖ inform discussions relating to the design of the EC's forthcoming Seventh Framework Programme (FP7); and,
- ❖ provide policy-makers and researchers at national level with detailed information relating to their region's relative strengths, weaknesses and opportunities with respect to selected application areas.

In addition, the Delphi provided its participants with an opportunity to (a) air their views with respect to national and European priorities for IST development, (b) express opinions in relation to Europe's readiness and potential to compete in global IST markets, and (c) assess the role of different stakeholders in improving IST application areas.

Approach

Given that the study is mainly aimed at informing policy makers at the EU level, the structure of the questionnaire has been designed using a *normative* approach, that is, based on prioritisation exercises and using a comparative (benchmark-type) questions for each of the 12 selected areas (Social and family relationships; Cultural diversity; Transport; Ageing; Health; Education and learning; Social welfare and public services; Leisure and recreation; Security; Government; Management; and Work organisation).

Delphi System

FISTERA has used Calibrum Corporation's Delphi system (Surveylet – http://www.calibrum.com) for designing, gathering, managing and processing the Delphi questionnaires. The system also allowed us to build databases of experts for each round which have been used for email communications and to feedback results.

In 1999 Calibrum Corporation developed its Online Foresight Package (Surveylet, Strategylet, Tracklet) to help organizations undertake systematic prospective and foresight activities.

Calibrum's system addresses the four fundamental problems that had existed in earlier methodologies:

❖ Time (designing & carrying out exercises and processing results)

❖ Dynamism (adapting exercises to dynamic & changing environments)

❖ Information (ensuring data & information come from reliable sources)

❖ Participation (designing robust, generic and user-friendly tools)

Brief history of Calibrum's online Delphi

In 2001 the Calibrum's system was installed at ICS-UNIDO (International Centre for High Science and Technology - United Nations Industrial Development Organization) in Trieste, Italy as a tool for promoting and supporting Technology Foresight Programmes in Latin America and the Caribbean regions (TFLAC).

Through the UNIDO-ICS TFLAC Programme and other impendent governmental initiatives in Latin America, Calibrum tools helped the emergence of more dynamic foresight practices and strengthened the foresight culture in the region.

Since 2002 Calibrum tools became more popular in Europe, especially in projects coordinated by strong foresight research centres (i.e. the European Commission's Institute for Prospective Technological Studies, Finland Futures Research Centre, BUESPA's Futures Studies Centre and the Manchester University's PREST institute, among others).

In 2003 Calibrum's systems was used in The EUFORIA Delphi. EUFORIA was a project of the European Foundation for the Improvement of Living and Working Conditions dedicated to provide improved information about the implications of those contemporary changes that lead to commentators speaking of a "knowledge society", especially for working life and living conditions.

In 2004 Calibrum released a new and improved BETA version of its Surveylet software for online Delphi. The FISTERA Delphi's Round 1 used Surveylet BETA, but by the time we launched the second round the system was completed so the final data was processed using the new Delphi analysis features (E.g. question filters, expertise-based comparisons, etc.).

The success of The FISTERA Delphi design inspired a methodologically parallel Biotechnology Delphi carried out Colombian Technology Foresight Programme (2004-5).

Groups

To ensure that Delphi findings are representative and robust, opinions and perspectives were clustered into various groups based on the personal information provided by respondents. Of course, we should keep in mind that the survey had no required questions; therefore participants were not obliged to provide personal information or answer to all questions. This is part of the traditional features of Delphi which allows for anonymous inputs. Consequently, total numbers of questionnaires are sometimes higher than the total number of votes for some questions, in other words, few participants left questions answered.

The following groups were used to make the data analysis:

- ❖ **By rounds**
  - ○ Round 1 groups questionnaires before September 26th, 2004.
  - ○ Round 2 groups those received by February 1st, 2005.
  - ○ BRC both rounds combined.
- ❖ **By age**
  - ○ Under 40 groups participants from 20 to 40 years old
  - ○ Over 40 groups participants over 40 years old
- ❖ **By gender**
  - ○ Female
  - ○ Male
- ❖ **By region**
  - ○ EU25 groups the 25 member states.
  - ○ EU15 groups the 15 EU members before accession (before May 1st, 2004),
  - ○ CCs groups candidate countries (Bulgaria, Croatia, Romania and Turkey),
  - ○ NMS groups the 10 New Member States, and
  - ○ Non-EU groups questionnaires from the rest of the World.
- ❖ **By sector**
  - ○ Policy sector groups questionnaires from policymaker in IST areas and other areas
  - ○ Business sector groups questionnaires from researchers in private business in IST sectors, researchers in private business (IST user) and managers in private business
  - ○ Science sector groups questionnaires from IST researchers in higher educational institution, Non-IST researcher in higher educational institution and researchers in government laboratory

Occupational Sectors			Number of selections	Percentage
IST Researcher in higher educational institution			151	24.16%
Non-IST Researcher in higher educational institution			82	13.12%
Researcher in government laboratory			63	10.08%
Manager in private business			77	12.32%
Researcher in private business in IST sectors			50	8.00%
Researcher in private business (IST user)			33	5.28%
Policymaker in IST areas			59	9.44%
Policymaker in other areas			44	7.04%
Other			66	10.56%
Policy	**Business**	**Science**	625	100%
16%	26%	47%		

Population

The Delphi gathered views from key stakeholders and informed commentators across the 25 member states of the European Union and 27 countries from different parts of the World. From the 515 participants, 413 (80%) were from the EU25 region and 102 (20%) from non-EU countries. Most respondents provided additional personal information, such as gender, age an occupation; which made possible to cluster these views into groups. The charts below show the distribution of EU25 and non-EU responses per country.

EU25 participation

■ Self-identified ■ Anonymous □ Visitors

Base: 413 respondents and 41 visitors
(From respondents: 403 self-identified, 10 anonymous)

International participation

■ Self-identified ■ Anonymous □ Visitors

Base: 102 respondents and 12 visitors
(From respondents: 90 self-identified, 12 anonymous)
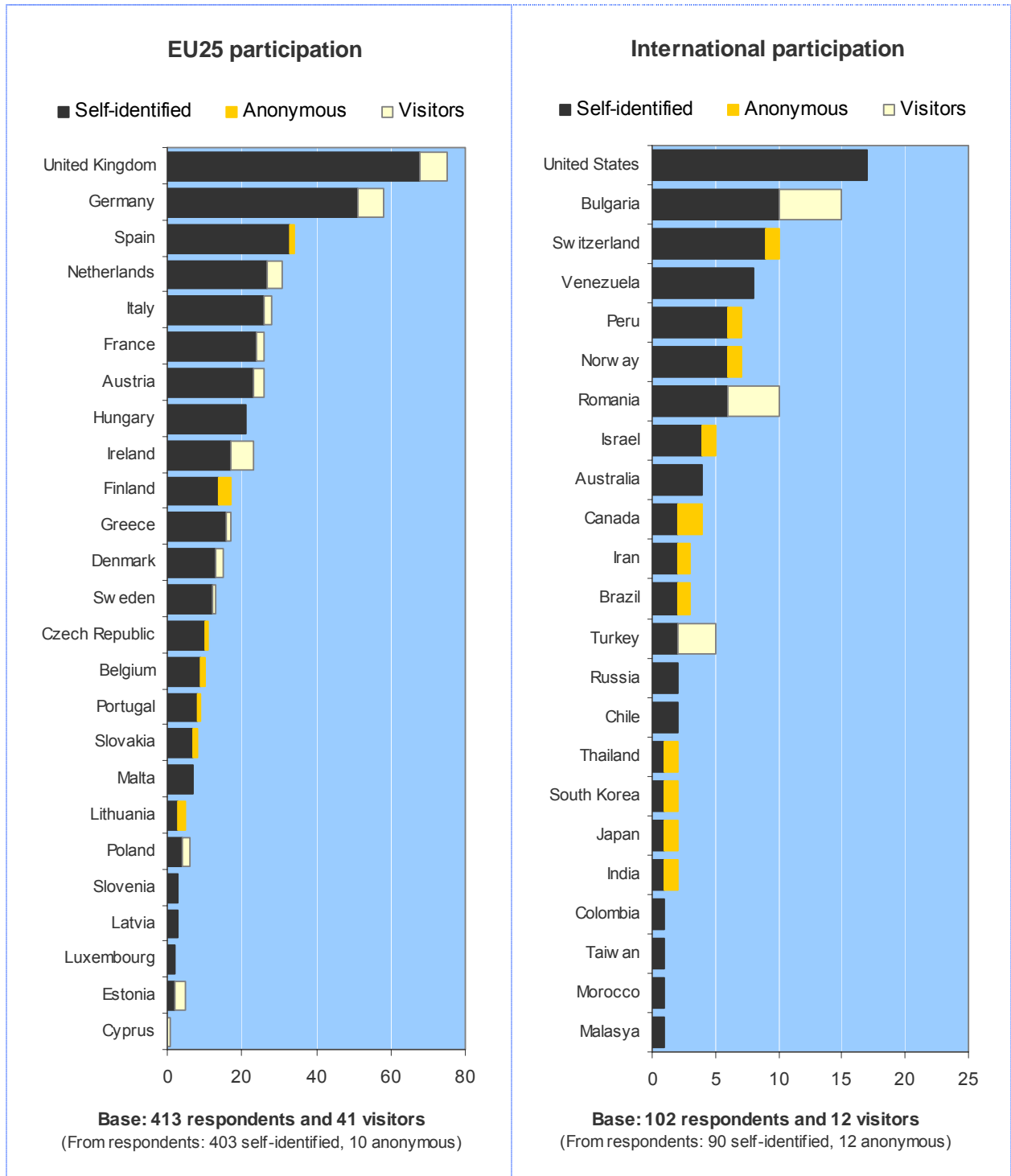
Experts

The FISTERA Delphi gathered 515 responses from different parts of the world:

❖   413 from the European Union

❖   102 international responses (of which 18 were from 3 Candidate Countries: Bulgaria, Romania & Turkey)

There were also 53 visitors of the system (people who entered their personal details but did not answer the questionnaire). The following lists show the name, country of origin and occupation of the involved experts and visitors, altogether. The table below includes 438 EU participants, of which 41 are visitors[10]. We also have some information about the origin and occupation of 10 anonymous respondents – mainly from France, Germany, Greece, Italy, Netherlands, Spain, and the United Kingdom (40% are from the business sector, 30% from the science-base sector, 25% from the policy sector and 5% unidentified).

International visitors (12) are mainly from candidate countries and anonymous questionnaire (12 again) arrived from 11 different countries (see chart above).

We would also like to mention that we have identified 9 anonymous questionnaires from Algeria, Angola, Afghanistan (3), American Samoa, Cameroon, Cape Verde, and Nicaragua. These nine surveys had no data on it different than the country of origin. We decided to delete them from our database but we have kept the IP addresses for security reasons.

Participation from EU25 Countries		
Name	**Country**	**Occupation**

Austria

	Name	Country	Occupation
1	Ana Jakil	Austria	IST Researcher in higher educational institution
2	Anton Scheibelmasser	Austria	IST Researcher in higher educational institution
3	Bernhard Dachs	Austria	Researcher in government laboratory
4	Erich Prem	Austria	Manager in private business
5	Ferdinand Aicher	Austria	Manager in private business
6	Gerhard K. Wagner	Austria	Policymaker in IST areas
7	Hannes Selhofer	Austria	
8	Hannes Werthner	Austria	IST Researcher in higher educational institution
9	Johann Cas	Austria	Non-IST Researcher in higher educational institution
10	Liana Giorgi	Austria	Non-IST Researcher in higher educational institution
11	Matthias Weber	Austria	Researcher in government laboratory
12	Michael Nentwich	Austria	IST Researcher in higher educational institution
13	Monika Bargmann	Austria	Non-IST Researcher in higher educational institution
14	Petra Wagner	Austria	Researcher in government laboratory
15	Reinhard Goebl	Austria	Policymaker in IST areas
16	Ronald Pohoryles	Austria	Other: Resercher in the field of Technology Assessment
17	Siegfried Putz	Austria	Other: II chamber
18	Stefan Trattner	Austria	Manager in private business
19	Thomas Strasser	Austria	IST Researcher in higher educational institution
20	Werner Merzeder	Austria	Policymaker in other areas

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[10] Visitors equal total number of self-identified people (438) plus total number of anonymous questionnaires (17) minus the total number of filled questionnaires (413). That is: 438 + 17 – 413 = 42

Belgium

21	Bror Salmelin	Belgium	Policymaker in IST areas
22	Claire Lobet-Maris	Belgium	IST Researcher in higher educational institution
23	Isidro Laso Ballesteros	Belgium	Policymaker in IST areas
24	Jo Pierson	Belgium	IST Researcher in higher educational institution
25	Kaat Exterbille	Belgium	Manager in private business
26	Monique Ramioul	Belgium	Non-IST Researcher in higher educational institution
27	Pascale Van Dinter	Belgium	
28	Peter De Smedt	Belgium	Researcher in government laboratory
29	Pol Descamps	Belgium	Researcher in private business in IST sectors

Cyprus

30	Kyriakos Maifoshis	Cyprus	

Czech Republic

31	Dusan Vincour	Czech Rep.	Researcher in private business (IST user)
32	Hejda Zdeněk	Czech Rep.	Other: Consultant
33	Helena Dvorakova	Czech Rep.	Policymaker in IST areas
34	Jaroslav Drobník	Czech Rep.	IST Researcher in higher educational institution
35	Jiri Peterka	Czech Rep.	Other: policy development
36	Karel Aim	Czech Rep.	Researcher in government laboratory
37	Kristina Kadlecikova	Czech Rep.	
38	Martin Hirsal	Czech Rep.	Policymaker in other areas
39	Miluse Fukalova	Czech Rep.	Researcher in private business (IST user)
40	Stanislav Cerný	Czech Rep.	Manager in private business

Denmark

41	Anders Henten	Denmark	IST Researcher in higher educational institution
42	Bjarke Fonnesbech	Denmark	Policymaker in other areas
43	Cynthia Selin	Denmark	Researcher in government laboratory
44	Janus Sandsgaard	Denmark	Other: lecturer with biological science background
45	Jonas Svava Iversen	Denmark	Researcher in private business in IST sectors
46	Lars Fuglsang	Denmark	IST Researcher in higher educational institution
47	Lars Schmidt	Denmark	Researcher in private business in IST sectors
48	Leif Arffmann	Denmark	Other: Resercher in the field of Technology Assessment
49	Mette Abrahamsen	Denmark	Researcher in government laboratory
50	Michael Thomsen	Denmark	Researcher in government laboratory
51	Oluf Nielsen	Denmark	Policymaker in IST areas
52	Peter Plougmann	Denmark	Manager in private business
53	Søren Aalykke	Denmark	
54	Stine Grenaa	Denmark	Researcher in government laboratory
55	Ulrik Jørgensen	Denmark	IST Researcher in higher educational institution

Estonia

56	Ivari Niinemae	Estonia	Policymaker in other areas
57	Liina Karo	Estonia	Other: Research Director in a NPO research centre
58	Marek Tiits	Estonia	
59	Mihkel Kraav	Estonia	Policymaker in IST areas
60	Tarmo Kalvet	Estonia	IST Researcher in higher educational institution

Finland

61	Aatto J. Repo	Finland	Policymaker in other areas
62	Annele Eerola	Finland	Researcher in government laboratory
63	Eija Ahola	Finland	Policymaker in other areas
64	Erja Ämmälahti	Finland	Policymaker in other areas
65	Juha Saukkonen	Finland	IST Researcher in higher educational institution
66	Kari Toivonen	Finland	Other: Consultant
67	Lars Tollet	Finland	Other: director of ngo

68	Markus Koskenlinna	Finland	Policymaker in other areas
69	Osmo Kuusi	Finland	Researcher in government laboratory
70	Petri Ahonen	Finland	Policymaker in IST areas
71	Seppo Kangaspunta	Finland	Policymaker in other areas
72	Sirkku Kivisaari	Finland	
73	Timo Kauppinen	Finland	IST Researcher in higher educational institution
74	Tuomas Parkkari	Finland	Policymaker in other areas

France

75	Alain Brenac	France	
76	Antoine Pery	France	Researcher in private business in IST sectors
77	Aymard De-touzalin	France	Policymaker in IST areas
78	Bastiaan de Laat	France	
79	Christian Gronoff	France	Other: researcher in non-profit org
80	Comyn Gerard	France	Policymaker in IST areas
81	Damien Broussolle	France	Non-IST Researcher in higher educational institution
82	Denise Pumain	France	Non-IST Researcher in higher educational institution
83	Domingo Aliaga-Guerra	France	IST Researcher in higher educational institution
84	François Farhi	France	Manager in private business
85	Frank Thomas	France	Researcher in private business in IST sectors
86	Gérard Pogorel	France	IST Researcher in higher educational institution
87	Gilles Parienté	France	Researcher in private business (IST user)
88	Jacques De Bandt	France	IST Researcher in higher educational institution
89	Jean-pierre Lacotte	France	
90	Marc Shapiro	France	Researcher in private business in IST sectors
91	Michel Elie	France	Other: University professor
92	Nicole Rousier	France	Non-IST Researcher in higher educational institution
93	Olivier Da Costa	France	Researcher in government laboratory
94	Patrick Schouller	France	Policymaker in IST areas
95	Paul Desruelle	France	Researcher in government laboratory
96	Peter Johnston	France	Policymaker in IST areas
97	Puissochet Alain	France	Other: IST Research Manager in public-privately funded institute
98	Remi Barré	France	Non-IST Researcher in higher educational institution
99	Stephane Amarger	France	Manager in private business
100	Véronique Cova	France	Researcher in government laboratory

Germany

101	Alexandra Wagner	Germany	Researcher in private business (IST user)
102	Anastasius Gavras	Germany	Manager in private business
103	Andrey Girenko	Germany	Manager in private business
104	Arnd Weber	Germany	Researcher in government laboratory
105	Axel Zweck	Germany	Other: Consultant
106	Barbara Baier	Germany	IST Researcher in higher educational institution
107	Britta Oertel	Germany	
108	Claudia Rainfurth	Germany	Non-IST Researcher in higher educational institution
109	Cornelia Daheim	Germany	Researcher in private business in IST sectors
110	Elin-Birgit Berndt	Germany	IST Researcher in higher educational institution
111	Elna Schirrmeister	Germany	Researcher in government laboratory
112	Frank Ruff	Germany	Researcher in private business (IST user)
113	Gerald Sobotta	Germany	Researcher in private business in IST sectors
114	Gerd Kortuem	Germany	
115	Gregory A. Kohring	Germany	
116	Grobian Gans	Germany	Researcher in private business in IST sectors
117	Guenter Clar	Germany	Policymaker in other areas
118	Hans Schedl	Germany	Researcher in private business in IST sectors
119	Heike Wiesner	Germany	IST Researcher in higher educational institution
120	Henning Banthien	Germany	Manager in private business

121	Horst Fiedler	Germany	Manager in private business
122	Ingo Rollwagen	Germany	Researcher in private business (IST user)
123	Joachim Breitner	Germany	Other: innovation & technology management academic researcher
124	Joachim Thiel	Germany	IST Researcher in higher educational institution
125	Jochen Koubek	Germany	
126	Jochen Zachgo	Germany	Policymaker in IST areas
127	K. Floegel	Germany	Manager in private business
128	Karlheinz Steinmueller	Germany	Researcher in private business (IST user)
129	Katrin Nikoleyczik	Germany	Non-IST Researcher in higher educational institution
130	Kerstin Cuhls	Germany	Researcher in private business (IST user)
131	Knud Boehle	Germany	
132	Kurt Kretzschmar	Germany	Manager in private business
133	Lorenz Erdmann	Germany	Researcher in private business in IST sectors
134	M. Breitner	Germany	Researcher in private business in IST sectors
135	Markus Scheuer	Germany	
136	Michael Friedewald	Germany	Researcher in government laboratory
137	Michael Jaspers	Germany	Policymaker in other areas
138	Michael Rader	Germany	Researcher in government laboratory
139	Michael Resch	Germany	IST Researcher in higher educational institution
140	Norbert Jastroch	Germany	Manager in private business
141	Peter Bittner	Germany	IST Researcher in higher educational institution
142	Peter Georgieff	Germany	Researcher in government laboratory
143	Peter H. Mettler	Germany	Policymaker in other areas
144	Peter Stollenmayer	Germany	Manager in private business
145	Peter Zoche	Germany	IST Researcher in higher educational institution
146	Philine Warnke	Germany	Researcher in private business (IST user)
147	Reinhard Stransfeld	Germany	Policymaker in IST areas
148	Stefan Kuhlmann	Germany	Researcher in government laboratory
149	Sabine Hafner	Germany	Non-IST Researcher in higher educational institution
150	Stephan Gauch	Germany	IST Researcher in higher educational institution
151	Swaran Sandhu	Germany	Policymaker in IST areas
152	Thomas Ziegert	Germany	Researcher in private business in IST sectors
153	Tobias Hüsing	Germany	Researcher in private business in IST sectors
154	Torsten Eymann	Germany	IST Researcher in higher educational institution
155	Torsten Fleischer	Germany	Researcher in government laboratory
156	Ulrich Fiedeler	Germany	Other: Policy analyst in NGO
157	Uwe Schmidt	Germany	Policymaker in IST areas
158	Yvonne Arnold	Germany	Researcher in government laboratory

Greece

159	Athanasios Pitsiorlas	Greece	IST Researcher in higher educational institution
160	Constantina Safiliou-Rothschild	Greece	IST Researcher in higher educational institution
161	Deniozos Dimitris	Greece	Policymaker in other areas
162	Eugenia Lagadianou	Greece	Consultant
163	John.N. Arnaoutis	Greece	Consultant
164	Katerina Papakonstantinou	Greece	Manager in private business
165	Konstantinos Kostopoulos	Greece	IST Researcher in higher educational institution
166	Lena Tsipouri	Greece	Non-IST Researcher in higher educational institution
167	Nickos Konstantopoulos	Greece	Policymaker in other areas
168	Nikos Katsiadakis	Greece	Researcher in private business in IST sectors
169	Nikos Maroulis	Greece	Manager in private business
170	Rozina Efstathiades	Greece	Manager in private business
171	Thanos Mytilinaios	Greece	IST Prize Winner or Candidate
172	Tonia Damvakeraki	Greece	Researcher in private business (IST user)
173	Virginia Alizioti	Greece	Other: Lecturer - Aged
174	Xenophon Tsilibaris	Greece	Policymaker in IST areas
175	Yannis Tolias	Greece	Manager in private business

Hungary

176	Bal Tazar	Hungary	IST Researcher in higher educational institution
177	Balint Domolki	Hungary	Policymaker in IST areas
178	Erika Nagy	Hungary	Researcher in government laboratory
179	Erika Nyary	Hungary	
180	Erzsébet Nováky	Hungary	Non-IST Researcher in higher educational institution
181	Ferenc Vajda	Hungary	Researcher in government laboratory
182	Gusztav Arz	Hungary	IST Researcher in higher educational institution
183	György Borbély	Hungary	Policymaker in other areas
184	Gyula Kenyeres	Hungary	Manager in private business
185	Janos Rekasi	Hungary	Policymaker in IST areas
186	Judit Gaspar	Hungary	Non-IST Researcher in higher educational institution
187	Julia Beres	Hungary	Researcher in private business in IST sectors
188	Katalin Nagy	Hungary	
189	Lajos Nyiri	Hungary	Consultant
190	Miklos Devecz	Hungary	
191	Peter Bakonyi	Hungary	Policymaker in IST areas
192	Réka Várnagy	Hungary	
193	Sandor Bottka	Hungary	Other: Resercher in the field of Technology Assessment
194	Tamas Balogh	Hungary	Policymaker in other areas
195	Tibor Dory	Hungary	Researcher in government laboratory
196	Zoltan Keszthelyi	Hungary	Other: Consultant

Ireland

197	Alun J. Carr	Ireland	Non-IST Researcher in higher educational institution
198	Anthony Staines	Ireland	
199	Claire McDonnell	Ireland	Non-IST Researcher in higher educational institution
200	Conor O'Reilly	Ireland	Non-IST Researcher in higher educational institution
201	Eamonn Cahill	Ireland	Researcher in private business (IST user)
202	Grainne Collins	Ireland	Non-IST Researcher in higher educational institution
203	James Lyng	Ireland	Non-IST Researcher in higher educational institution
204	Jerome Casey	Ireland	Researcher in private business in IST sectors
205	John Gerard McInerney	Ireland	IST Researcher in higher educational institution
206	John Harpur	Ireland	
207	K. Cullen	Ireland	Other: Economist, expert
208	Mairtin O'Droma	Ireland	IST Researcher in higher educational institution
209	Martin Stynes	Ireland	IST Researcher in higher educational institution
210	Meriel Huggard	Ireland	IST Researcher in higher educational institution
211	Michael Grufferty	Ireland	Non-IST Researcher in higher educational institution
212	Owen Doyle	Ireland	Non-IST Researcher in higher educational institution
213	Padraig Dunne	Ireland	Non-IST Researcher in higher educational institution
214	Pascal Landais	Ireland	IST Researcher in higher educational institution
215	Patrick Felle	Ireland	Non-IST Researcher in higher educational institution
216	Sean Mc grath	Ireland	IST Researcher in higher educational institution
217	Shane Ward	Ireland	Researcher in government laboratory
218	Stephen Brown	Ireland	IST Researcher in higher educational institution
219	Thomas casey	Ireland	

Italy

220	Alberto Di Minin	Italy	IST Researcher in higher educational institution
221	Alberto Sanna	Italy	
222	Alessandro Pastore	Italy	Manager in private business
223	Angelo Montani	Italy	Researcher in government laboratory
224	Annaflavia Bianchi	Italy	Researcher in government laboratory
225	Antonello Zanfei	Italy	Non-IST Researcher in higher educational institution
226	Claudio Roveda	Italy	Non-IST Researcher in higher educational institution
227	David Osimo	Italy	Researcher in government laboratory

228	Domenico Talia	Italy	IST Researcher in higher educational institution
229	Eleonora Barbieri Masini	Italy	Non-IST Researcher in higher educational institution
230	Emilio Rottoli	Italy	Manager in private business
231	Ettore Bolisani	Italy	Non-IST Researcher in higher educational institution
232	Fabiana Scapolo	Italy	Non-IST Researcher in higher educational institution
233	Felice Faraci	Italy	Researcher in private business in IST sectors
234	Francesco Lissoni	Italy	IST Researcher in higher educational institution
235	Francesco Vatalaro	Italy	IST Researcher in higher educational institution
236	Gian Franco Piacentini	Italy	IST Researcher in higher educational institution
237	Giannino C. Bernabei	Italy	Other: researcher in NGO
238	Giorgio de Michelis	Italy	IST Researcher in higher educational institution
239	Guido Frigo	Italy	Researcher in private business in IST sectors
240	Ivo Mentuccia	Italy	Manager in private business
241	Mario Coccia	Italy	Researcher in government laboratory
242	Patrizia Fariselli	Italy	Researcher in private business in IST sectors
243	Piera Magnatti	Italy	Researcher in private business in IST sectors
244	Roberta Capello	Italy	Non-IST Researcher in higher educational institution
245	Roberto Saracco	Italy	Researcher in private business in IST sectors
246	Stefano Berti	Italy	Non-IST Researcher in higher educational institution
247	Terry Peterson	Italy	Other: Consultant

Latvia

248	Arturs Puga	Latvia	
249	Atis Kapenieks	Latvia	IST Researcher in higher educational institution
250	Tamara Puga	Latvia	Researcher in private business (IST user)

Lithuania

251	Jonas Milerius	Lithuania	IST Researcher in higher educational institution
252	Justas Jaskonis	Lithuania	Non-IST Researcher in higher educational institution
253	Renata Bareikiene	Lithuania	Policymaker in IST areas

Luxembourg

| 254 | Carlo Duprel | Luxembourg | Policymaker in IST areas |
| 255 | Geoff Thompson | Luxembourg | Manager in private business |

Malta

256	Antonella Caruana Mansueto	Malta	Researcher in private business (IST user)
257	Christopher Farrugia	Malta	Manager in private business
258	Dorita Galea	Malta	Other: Consultant
259	Jennifer Harper	Malta	Policymaker in other areas
260	Kristy Spiteri	Malta	
261	Marisa Xuereb	Malta	Manager in private business
262	Wilfred Kenely	Malta	Policymaker in other areas

Netherlands

263	Andreas Ligtvoet	Netherlands	Researcher in private business in IST sectors
264	Annejet P. Meijler	Netherlands	Policymaker in IST areas
265	Appie Reuver	Netherlands	Policymaker in IST areas
266	Barend van der Meulen	Netherlands	Non-IST Researcher in higher educational institution
267	Gerard Bakker	Netherlands	Policymaker in other areas
268	Hans Schaffers	Netherlands	Other: Manager at university research centre
269	Hans van Vliet	Netherlands	Researcher in government laboratory
270	Henk Kox	Netherlands	Researcher in government laboratory
271	Hilke Brouwers	Netherlands	IST Researcher in higher educational institution
272	Jaap van der Heijden	Netherlands	Researcher in private business in IST sectors
273	James Kahan	Netherlands	Researcher in private business in IST sectors
274	Jan van Dijk	Netherlands	IST Researcher in higher educational institution
275	Joeri van den Steenhoven	Netherlands	Policymaker in IST areas

276	John Thackara	Netherlands	Other: Consultant
277	Jos de Haan	Netherlands	Researcher in government laboratory
278	Jos Leyten	Netherlands	Researcher in government laboratory
279	Lynn K. Mytelka	Netherlands	IST Researcher in higher educational institution
280	Marc van Lieshout	Netherlands	Researcher in government laboratory
281	Martin Rem	Netherlands	IST Researcher in higher educational institution
282	Patrick van der Duin	Netherlands	Researcher in government laboratory
283	Paul Drewe	Netherlands	Non-IST Researcher in higher educational institution
284	Paul 't Hoen	Netherlands	Policymaker in IST areas
285	Pim den Hertog	Netherlands	Researcher in private business (IST user)
286	René Hartman	Netherlands	IST Researcher in higher educational institution
287	Rob Bilderbeek	Netherlands	Manager in private business
288	Ruud Leyendekker	Netherlands	Policymaker in IST areas
289	Thea Weijers	Netherlands	IST Researcher in higher educational institution
290	V.C.M. Timmerhuis	Netherlands	Policymaker in other areas
291	Ver Loren van Themaat	Netherlands	Policymaker in other areas
292	Wil Thissen	Netherlands	Non-IST Researcher in higher educational institution
293	Wouter J. Den Ouden	Netherlands	

Poland

294	Andrzej Skulimowski	Poland	IST Researcher in higher educational institution
295	Krzysztof Borodako	Poland	
296	M. Czerni	Poland	IST Researcher in higher educational institution
297	Marek Gabrys	Poland	Manager in private business
298	Marek Kryda	Poland	Policymaker in other areas
299	Roman GALAR	Poland	Non-IST Researcher in higher educational institution

Portugal

300	António Moniz	Portugal	
301	Francisco Diniz	Portugal	Policymaker in other areas
302	Georg Dutschke	Portugal	Manager in private business
303	José Luís Campos de Almeida Mota	Portugal	Policymaker in IST areas
304	Luis Camarinha-Matos	Portugal	IST Researcher in higher educational institution
305	Roberto Carneiro	Portugal	IST Researcher in higher educational institution
306	Sofía Sergio	Portugal	Manager in private business
307	Tessaleno Campos Devezas	Portugal	IST Researcher in higher educational institution

Slovakia

308	Igor Gazdik	Slovakia	Manager in private business
309	Tomas Sabol	Slovakia	IST Researcher in higher educational institution
310	Viera Rosova	Slovakia	Researcher in government laboratory

Slovenia

311	Jaro Berce	Slovenia	
312	Marko Bonac	Slovenia	Researcher in government laboratory
313	Metka Stare	Slovenia	IST Researcher in higher educational institution
314	Peter Stanovnik	Slovenia	IST Researcher in higher educational institution
315	Tanja sterk	Slovenia	IST Researcher in higher educational institution
316	Vasja Vehovar	Slovenia	IST Researcher in higher educational institution
317	Violeta Bulc	Slovenia	Other: Consulting for the Government

Spain

318	Adrian Pascu	Spain	
319	Alexander Heichlinger	Spain	IST Researcher in higher educational institution
320	Antonio Herrera	Spain	Other: Resercher in the field of Technology Assessment
321	Claudio Feijóo	Spain	Policymaker in IST areas
322	Elena Requena	Spain	
323	Emilio Fontela	Spain	IST Researcher in higher educational institution

324	Enric Bas	Spain	IST Researcher in higher educational institution
325	Ion Arocena	Spain	Other: mediacoordinator/EU area
326	Jesus Perez	Spain	Non-IST Researcher in higher educational institution
327	Joe Cooper	Spain	Other: Resercher in the field of Technology Assessment
328	Jordi Marín Puigpelat	Spain	Manager in private business
329	José A. Camacho	Spain	IST Researcher in higher educational institution
330	José Luis Navarro	Spain	IST Researcher in higher educational institution
331	Jose Miguel Echarri	Spain	Other: Resercher in the field of Technology Assessment
332	Jose Molero	Spain	IST Researcher in higher educational institution
333	Juan Antonio Cabrera	Spain	Researcher in government laboratory
334	Juan Miguel González Aranda	Spain	IST Researcher in higher educational institution
335	Lluis M. Martinez	Spain	Manager in private business
336	Luis Sanz	Spain	Researcher in government laboratory
337	Manuel Fernandez Lopez	Spain	Non-IST Researcher in higher educational institution
338	Manuel Pereira	Spain	Policymaker in IST areas
339	Mar Isla i Pera	Spain	Non-IST Researcher in higher educational institution
340	Maria Dolores Genaro Moya	Spain	Non-IST Researcher in higher educational institution
341	María Paloma Sánchez Muñoz	Spain	Non-IST Researcher in higher educational institution
342	Maria Vicente	Spain	IST Researcher in higher educational institution
343	Marta Lopez	Spain	
344	Montserrat Escudero	Spain	
345	Paloma Mallorquin Esteban	Spain	Other: Project manager in governmental organization
346	Pedro Segura-artero	Spain	Researcher in government laboratory
347	Ramón Compañó	Spain	Policymaker in IST areas
348	Roberto Rodriguez	Spain	IST Researcher in higher educational institution
349	Verónica Pascual	Spain	Researcher in private business (IST user)
350	Vicente Gabaldon	Spain	Researcher in government laboratory

Sweden

351	Bengt A Mölleryd	Sweden	Other: director of ngo
352	Dimitris Lyris	Sweden	Other: Memeber of the technology transfer Office
353	Eric Hoas	Sweden	Researcher in private business (IST user)
354	Erik Herngren	Sweden	Researcher in private business (IST user)
355	Holger Ronquist	Sweden	Manager in private business
356	Jan Sjögren	Sweden	Researcher in government laboratory
357	Jerker Delsing	Sweden	IST Researcher in higher educational institution
358	Juan Hernandez	Sweden	Manager in private business
359	Lennart Elg	Sweden	Policymaker in other areas
360	Margareta Groth	Sweden	
361	Michael Nilsson	Sweden	Other: Researcher in private research & consultancy firm
362	Rune H. Persson	Sweden	Policymaker in IST areas
363	Sara Ferlander	Sweden	IST Researcher in higher educational institution

UK

364	Adam Funk	UK	IST Researcher in higher educational institution
365	Aidan Roe	UK	Manager in private business
366	Alan Wilson	UK	IST Researcher in higher educational institution
367	Allan Ramsay	UK	IST Researcher in higher educational institution
368	Andre Oboler	UK	IST Researcher in higher educational institution
369	Andrew Faulkner	UK	IST Researcher in higher educational institution
370	Andrew Slade	UK	IST Researcher in higher educational institution
371	Andrew Webster	UK	Manager in private business
372	Anthony Finkelstein	UK	IST Researcher in higher educational institution
373	Bernard Hunt	UK	Researcher in private business in IST sectors
374	Bob Thompson	UK	Researcher in private business (IST user)
375	Bruce Tether	UK	Non-IST Researcher in higher educational institution
376	Céline Loscos	UK	IST Researcher in higher educational institution

377	Colin Blackman	UK	Researcher in private business in IST sectors
378	Dai davies	UK	Researcher in private business in IST sectors
379	Dave Evans	UK	
380	David Dickinson	UK	Manager in private business
381	David G. Evans	UK	IST Researcher in higher educational institution
382	Denis Loveridge	UK	IST Researcher in higher educational institution
383	Despina Kanellou	UK	IST Researcher in higher educational institution
384	Dimosthenis Karatzas	UK	IST Researcher in higher educational institution
385	Duncan Thomas	UK	IST Researcher in higher educational institution
386	Fiona Harrison	UK	Policymaker in IST areas
387	Floriana Grasso	UK	IST Researcher in higher educational institution
388	Gareth Hughes	UK	
389	Gary Boswell	UK	Manager in private business
390	Gerd Kortuem	UK	IST Researcher in higher educational institution
391	Guy Dewsburu	UK	IST Researcher in higher educational institution
392	Howard Rush	UK	IST Researcher in higher educational institution
393	Iain Bitran	UK	Manager in private business
394	Ian Miles	UK	Non-IST Researcher in higher educational institution
395	James Stewart	UK	IST Researcher in higher educational institution
396	Jeff Browne	UK	Manager in private business
397	Jeff Butler	UK	
398	Jim Miles	UK	Non-IST Researcher in higher educational institution
399	Joanne Roberts	UK	IST Researcher in higher educational institution
400	John Desmond Ryan	UK	Other: Resercher in the field of Technology Assessment
401	John Kinghorn	UK	Manager in private business
402	John Rigby	UK	IST Researcher in higher educational institution
403	Jonathan Cave	UK	IST Researcher in higher educational institution
404	Ken Abraham	UK	Other: director of ngo
405	Khurshid Ahmad	UK	IST Researcher in higher educational institution
406	Kieron Flanagan	UK	
407	Lawrence Green	UK	IST Researcher in higher educational institution
408	Linda A Macaulay	UK	IST Researcher in higher educational institution
409	Ludmila Striukova	UK	Non-IST Researcher in higher educational institution
410	Marco Cavallari	UK	Researcher in private business in IST sectors
411	Marek Rejman-Green	UK	Manager in private business
412	Matthew White	UK	Policymaker in other areas
413	Meirion Thomas	UK	
414	Michael Fisher	UK	IST Researcher in higher educational institution
415	Michelle Selinger	UK	Researcher in private business in IST sectors
416	Nicolas Gold	UK	IST Researcher in higher educational institution
417	Norman Butlin	UK	Policymaker in IST areas
418	Peter Bagnall	UK	IST Researcher in higher educational institution
419	Peter Carter	UK	Policymaker in other areas
420	Peter McBurney	UK	IST Researcher in higher educational institution
421	Philomena de Lima	UK	Non-IST Researcher in higher educational institution
422	Reede Ren	UK	
423	Richard Deed	UK	Non-IST Researcher in higher educational institution
424	Robin Williams	UK	Non-IST Researcher in higher educational institution
425	Rohit Talwar	UK	Manager in private business
426	Ron Summers	UK	IST Researcher in higher educational institution
427	Rudolf Schreiner	UK	Manager in private business
428	Ruth Aylett	UK	IST Researcher in higher educational institution
429	Sarag Wilkinson	UK	
430	Sheena Bassett	UK	Researcher in private business in IST sectors
431	Simon French	UK	IST Researcher in higher educational institution
432	Sophia Drossopoulou	UK	IST Researcher in higher educational institution
433	Speros/Ross Velentzas	UK	Manager in private business

434	Steve Furber	UK	IST Researcher in higher educational institution
435	Ted Fuller	UK	Non-IST Researcher in higher educational institution
436	Tim R. Jordan	UK	IST Researcher in higher educational institution
437	Ursula Huws	UK	IST Researcher in higher educational institution
438	Xiao-Jun Zeng	UK	IST Researcher in higher educational institution

Participation from Candidate Countries

Bulgaria

439	Alexander Madzhirov	Bulgaria	Manager in private business
440	Daniela Tchonkova	Bulgaria	Manager in private business
441	Ivan Krumov Kurtev	Bulgaria	IST Researcher in higher educational institution
442	Katherine Ognyanova	Bulgaria	Researcher in private business (IST user)
443	Milanka Slavova	Bulgaria	Non-IST Researcher in higher educational institution
444	Nadejda Riachi	Bulgaria	Other: lecturer with biological science background
445	Nelly Ognyanova	Bulgaria	IST Researcher in higher educational institution
446	Nelly Stoyanova	Bulgaria	
447	Raya Staikova	Bulgaria	Researcher in government laboratory
448	Rumyana Tencheva	Bulgaria	Manager in private business
449	Ruslan Stefanov	Bulgaria	Researcher in private business (IST user)
450	Snezhana Kovacheva	Bulgaria	Policymaker in IST areas
451	Temenuga Hristova Hineva	Bulgaria	Non-IST Researcher in higher educational institution
452	Todor Yalamov	Bulgaria	IST Researcher in higher educational institution
453	Zornitza Anguelova	Bulgaria	Policymaker in IST areas

Romania

454	Carmen Marcus	Romania	
455	Donciulescu Alexandru Dan	Romania	IST Researcher in higher educational institution
456	Gabriela Flores	Romania	Researcher in government laboratory
457	Petru Filip	Romania	Researcher in government laboratory
458	Radu Gheorghiu	Romania	Researcher in government laboratory
459	Romeo Ilie	Romania	Policymaker in IST areas
460	Tasnadi Bogdan	Romania	Researcher in private business (IST user)
461	Virginia Campeanu	Romania	Researcher in government laboratory

Turkey

462	Ayhan Uysal	Turkey	Other: Resercher in the field of Technology Assessment
463	Haluk Zontul	Turkey	
464	Heyecan Giritli	Turkey	
465	Nihan Yildirim	Turkey	IST Researcher in higher educational institution
466	Turgut Tumer	Turkey	Non-IST Researcher in higher educational institution

International participation

Australia

467	Dominique Purcell	Australia	Manager in private business
468	Greg Tegart	Australia	
469	M Barber	Australia	Other: Resercher in the field of Technology Assessment
470	Wayne Pethrick	Australia	Researcher in private business in IST sectors

Brazil

| 471 | Dalci Maria dos Santos | Brazil | Policymaker in other areas |
| 472 | Mauro Zackiewicz | Brazil | IST Researcher in higher educational institution |

Canada

| 473 | Michael Wernerheim | Canada | Non-IST Researcher in higher educational institution |
| 474 | Ruben Nelson | Canada | Other: IST researcher in the danish church |

Chile

| 475 | Homero Latorre | Chile | Researcher in government laboratory |
| 476 | John Griffiths | Chile | Researcher in government laboratory |

Colombia

| 477 | Lucio Mauricio Henao | Colombia | |

India

| 478 | Pranav N. Desai | India | IST Researcher in higher educational institution |

Iran

| 479 | Armin Shams | Iran | IST Researcher in higher educational institution |
| 480 | Rouhallah Ghadiri | Iran | Researcher in government laboratory |

Israel

481	Aharon Hauptman	Israel	Non-IST Researcher in higher educational institution
482	Doron Faran	Israel	IST Researcher in higher educational institution
483	Dov Maor	Israel	Manager in private business
484	Ehud Gelb	Israel	
485	Yair Sharan	Israel	Policymaker in IST areas

Japan

| 486 | Teppo Turkki | Japan | IST Researcher in higher educational institution |

Malasya

| 487 | Kamarulzaman Ab. Aziz | Malaysia | Non-IST Researcher in higher educational institution |

Morocco

| 488 | Larbi JAIDI | Morocco | IST Researcher in higher educational institution |

Norway

489	Anders Ekeland	Norway	Researcher in government laboratory
490	Ellen Veie	Norway	Policymaker in other areas
491	Henri Roberts	Norway	Non-IST Researcher in higher educational institution
492	Knut Erik Solem	Norway	Non-IST Researcher in higher educational institution
493	Paul Gretland	Norway	Policymaker in IST areas
494	Tron Espeli	Norway	Policymaker in IST areas

Peru

495	Doris Adriana Zaldívar Peña	Peru	Non-IST Researcher in higher educational institution
496	Isaías Quevedo	Peru	Non-IST Researcher in higher educational institution
497	Luis Morales Robertti	Peru	IST Researcher in higher educational institution
498	Marcos Ruiz	Peru	Policymaker in other areas
499	Marta Tostes	Peru	IST Researcher in higher educational institution
500	Sandro Paz	Peru	Non-IST Researcher in higher educational institution
501	Victor Fupuy Chiong	Peru	

Russia

| 502 | Alexander Sokolov | Russia | IST Researcher in higher educational institution |
| 503 | Igor Kuprienko | Russia | Manager in private business |

South Korea

| 504 | Heung Deug Hong | South Korea | Non-IST Researcher in higher educational institution |

Switzerland

| 505 | G. Kotrotsios | Switzerland | IST Prize Winner or Candidate |
| 506 | Laurent Sciboz | Switzerland | IST Researcher in higher educational institution |

507	Luc Vodoz	Switzerland	IST Researcher in higher educational institution
508	Marco Malinverno	Switzerland	Manager in private business
509	Pierre Rossel	Switzerland	IST Researcher in higher educational institution
510	Theodore Modis	Switzerland	Researcher in private business (IST user)
511	Urs Hohl	Switzerland	Non-IST Researcher in higher educational institution
512	Vicente Carabias-Hütter	Switzerland	IST Researcher in higher educational institution
513	Walter R Stahel	Switzerland	Researcher in private business (IST user)

Taiwan

| 514 | Hunter | Taiwan | Manager in private business |

Thailand

| 515 | Palakorn Buppatanakor | Thailand | Policymaker in IST areas |

USA

516	Alan Porter	USA	Researcher in private business in IST sectors
517	Bill Anderson	USA	Non-IST Researcher in higher educational institution
518	Brandon Bruce	USA	Researcher in private business (IST user)
519	Christopher H. Lovelock	USA	Non-IST Researcher in higher educational institution
520	Cindy Frewen	USA	Non-IST Researcher in higher educational institution
521	Claire Pavlik	USA	IST Researcher in higher educational institution
522	Clem Bezold	USA	Other: UNIDO Industrial Development
523	Cody Clark	USA	Manager in private business
524	Craig Bettles	USA	Researcher in private business in IST sectors
525	Greg Kohring	USA	Researcher in private business in IST sectors
526	Jerry Sheehan	USA	Policymaker in IST areas
527	Jim Burke	USA	Manager in private business
528	Joseph Coates	USA	Other: programme management in IST sector
529	Kevin Boyack	USA	Researcher in government laboratory
530	Michael Teitz	USA	Non-IST Researcher in higher educational institution
531	Raffaele de Peppe	USA	Manager in private business
532	Thomas G. Johnson	USA	Non-IST Researcher in higher educational institution

Venezuela

533	Andrea Jannelle Brizuela Fernandez	Venezuela	
534	Gina Caraballo	Venezuela	IST Researcher in higher educational institution
535	Ibelis Blanco Rangel	Venezuela	Non-IST Researcher in higher educational institution
536	José Miguel Astete Del Carpio	Venezuela	Other: IST Research Manager in public-privately funded institute
537	Omar Valenti G	Venezuela	Manager in private business
538	Rafael Popper	Venezuela	IST Researcher in higher educational institution
539	Roberto Betancourt	Venezuela	Non-IST Researcher in higher educational institution
540	Yuli Villarroel	Venezuela	IST Researcher in higher educational institution

Design

The survey may look and feel different to traditional Delphi surveys. The FISTERA Delphi was baptised as a "Panoramic Delphi", that is, instead of asking participants' views about a large number of Delphi statements (as would be the standard task), participants were asked questions that are related to 'description boxes' (panoramas) in which the role of selected IST application areas is sketched.

Time

The first round of the online Delphi was open at the beginning of the summer season 2004 (end of June). The original date for closing the first round was the end of August 2004; however this was extended until September 26th. The second round was launched September 27th with general First Round Results embedded as PopUp charts next to each question (this allowed participants to see overall results and confirm or vote against them. There are certainly other goals different from the exploratory activities of future-oriented thinking which require a more normative approach.

Country promoters

❖ **PREST - POLICY RESEARCH IN ENGINEERING, SCIENCE AND TECHNOLOGY**
Overall promotion in the UK, other EU countries and the rest of the rest of the World

❖ **IPTS - INSTITUTE FOR PROSPECTIVE TECHNOLOGICAL STUDIES**
Overall promotion in Spain and EU institutions

❖ **FZK - ITAS - INSTITUT FÜR TECHNIKFOLGENABSCHÄTZUNG UND SYSTEMANALYSE**
Overall promotion in Germany

❖ **TILAB - TELECOM ITALIA LAB**
Overall promotion in Italy

❖ **ARC/SR - ARC SEIBERSDORF RESEARCH GMBH**
Overall promotion in Austria

❖ **Other institutes promoting The FISTERA Delphi:**
   o Institute of Strategy, Technology and Policy - TNO-STB (The Netherlands)
   o Applied Research and Communications Fund - ARC Fund (Bulgaria)
   o Danish Technological Institut - DTI (Denmark)
   o IQSOFT (Hungary)
   o Tecno Campus Mataró Foundation (Spain)
   o The Scientific and Technical Research Council of Turkey - TUBITAK (Turkey)
   o Observatório de Prospectiva da Engenharia e da Tecnologia-OPET (Portugal)
   o The Researchers' Association of Slovenia - ZRS-RAS (Slovenia)
   o NMRC University College Cork (Ireland)
   o PB&F (Poland)
   o Berkeley Roundtable on the International Economy BRIE/UCB (USA)
   o Univerity of Aveiro (Portugal)

Promotion instruments

❖ **Emails**

Emails proved to be one of the most useful and effective instruments to reach large number of experts at minimum cost (cost could be that of researchers time to contact experts, build email databases, answer questions and concerns and sometimes apologise for cross-posting messages)

❖ **Websites**

Website links were also useful for making the study more accessible at the country levels since brief descriptions of the survey were also written in the local language. This made the survey more 'popular' in the sense that it showed the support of recognised institutes such as those mentioned above.

❖ **Workshops**

A workshop organised with IPTS (June 17-18, 2004) which was partly designed to test, validate and launch the Delphi survey proved to be extremely constructive and valuable for the study. First, it allowed the research team to evaluate the reaction and include the suggestions of more than 22 IST experts from different parts of Europe. Second, it allowed us to test the user-friendliness of the instrument and the robustness of the system. Third, it also provided an informal space for marketing the activity among participants since after their suggestions were taken into account some left with a feeling of ownership over the study, which later on was translated into voluntary support through their networks. Another workshop, held in Romania, was dedicated to NMS and CCs. In the workshop "First Round" results from NMS were presented, thus helping Second Round marketing.

❖ **Targeted groups**

As part of the promotional activities of IPTS, a group of experts from the eEurope Team was contacted via email to participate in the Delphi. The access to the survey was open for 1 week and a total of 18 experts answered the questionnaire. As a result, a special 'draft' report was produced for the group over the following weekend in order to inform discussions of the eEurope Team taking place the following week. So, cooperation with targeted groups proved to be mutually beneficial.

❖ **Conferences**

A few conferences helped the promotion of The FISTERA Delphi during 2004, some of those are:

o   November 2004 – UNIDO Conference and training on Delphi (**Russia**)

o   November 2004 – IST Summit 2004 (**Netherlands**)

o   October 2004 – COLCIENCIAS training course on Delphi (**Colombia**)

o   October 2004 – CAF International Conference on Regional Andean Competitiveness (**Venezuela**)

❖ **Personal contacts**

Personal contacts are very helpful, especially in the field of foresight. FISTERA partners and associate members participate actively in many research projects, some of which are linked to other foresight initiatives in Europe. In this sense, each partner has lots of personal contacts who are potentially interested in promoting and/or learning from ongoing foresight experiences. Contacts with colleagues from the Malta Council for Science and Technology, eForesee project, ForeTech project and

ForSociety helped the dissemination of activities and played an important role in the regional promotion of the study; all this, on the basis of personal contacts.

❖ **Word of Mouth**

While this should not be consider as a strategy, it is worth noticing that the combination of the above mentioned instruments generated several opinions and rumours about the study. Sometimes the research team was contacted by other institutes who heard about the layout of the survey or the system used, and who wanted to have more concrete information about the project. These curiosity-driven contacts recruited more voluntary respondents.

Reminders

The following box shows one type of email sent to participants via email in order to remind her/him that the first round was about to closed in a few days. Reminders like this have proven to be effective; other emails with longer explanatory text about the project had relatively lower impact.

***** Apologies for cross-posting *****

Dear [TITLE] [FIRST NAME] [LAST NAME],

I would like to invite you to participate in a European Delphi on Information Society Technologies. The Delphi is part of the activities of FISTERA project.

Access link: http://www.calibrum.com/surveyletxp/takesurvey.asp?surveycode=4633QCLU8

FISTERA aims to gather and share knowledge and views in relation to the future of Information Society Technologies (IST) in Europe in the period up to 2010 and beyond. The Delphi is designed specifically to address the Lisbon Objectives and to consider the extent to which IST and associated applications can assist in advancing towards the realisation of major EU objectives.

The first round of the Delphi will be open until this Friday 24th of September. Overall results will be processed and sent to you in electronic format for your consideration and evaluation. If you have any questions about the Delphi system or preliminary results please contact Rafael.Popper@man.ac.uk

We would be grateful if you forward the Delphi Access link to other colleagues of yours who share similar interests on IST issues: [SURVEY URL]

Many thanks in advance for you collaboration,

Kind regards,

Ian Miles

PS: If you would like to see the Response Status per country, please go to the following web page: http://www.calibrum.com/surveylet/accounts/4633.268666F5D5A5F50/Country_Response_Status.html

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Professor **Ian Miles**

PREST, IoIR, University of Manchester

http://les.man.ac.uk/prest

IoIR, Harold Hankins Building, Booth Street West, Manchester, M13 9QH, UK

New publications, Online resources at: http://milesblogs.blogspot.com/

ANNEXE B – THE QUESTIONNAIRE

Introduction, email, age and gender

Welcome: Introduction & Personal information

Country, occupation and optional information

…the questionnaire
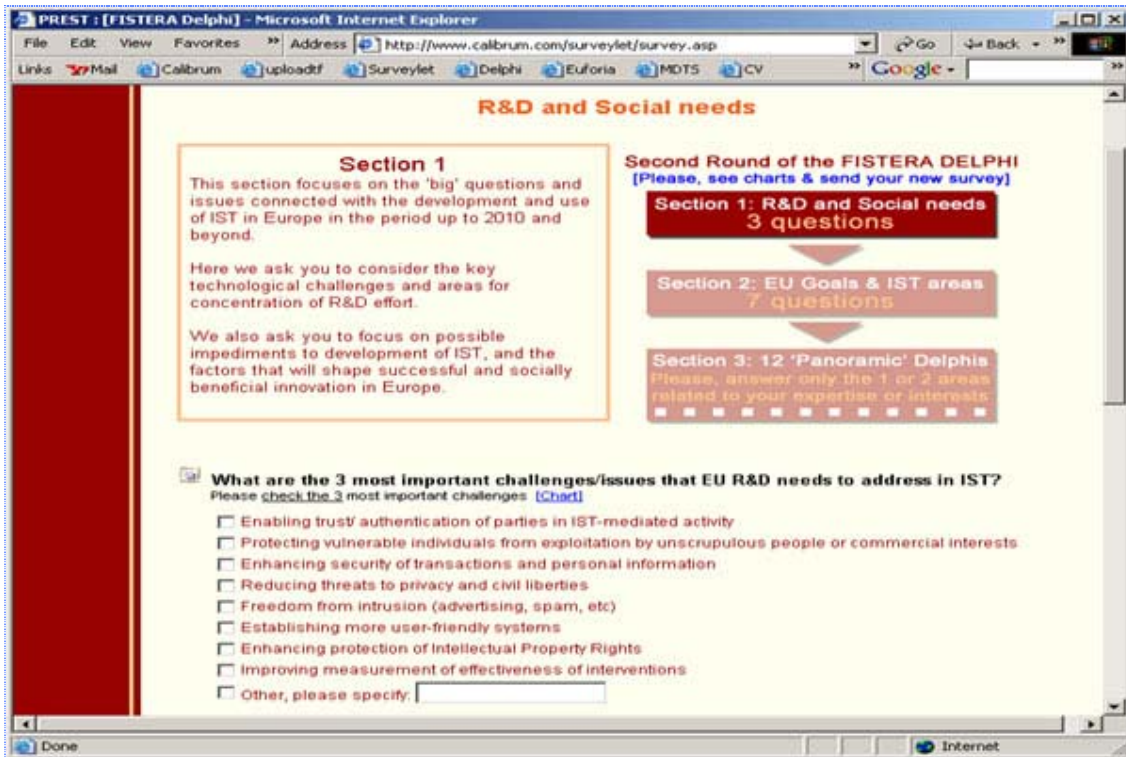
Section 1: R&D and Social Needs
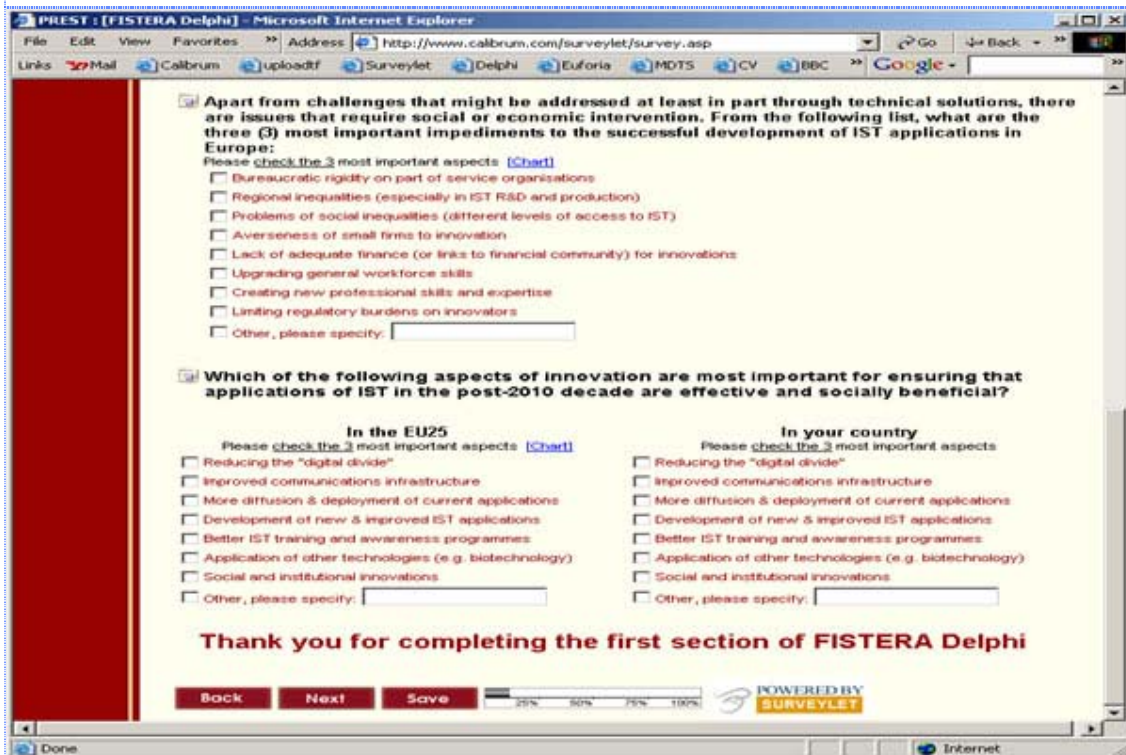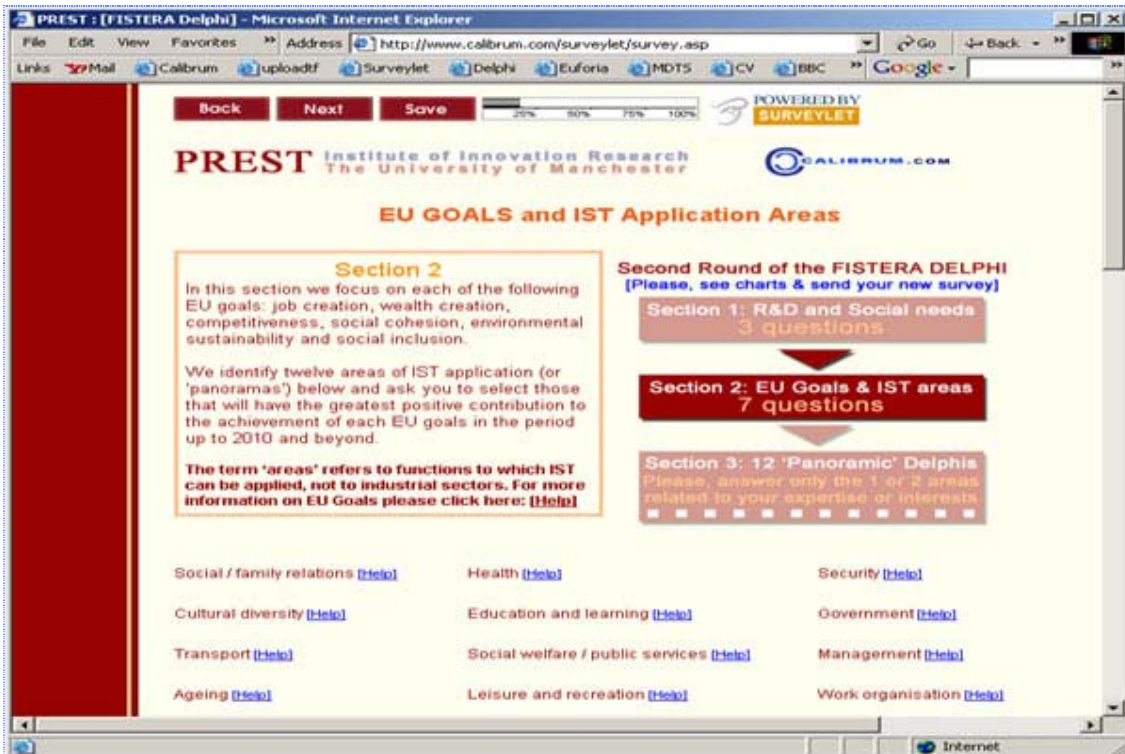
…the questionnaire

Section introduction & Application Areas

Section 2: EU Goals & IST Application Areas
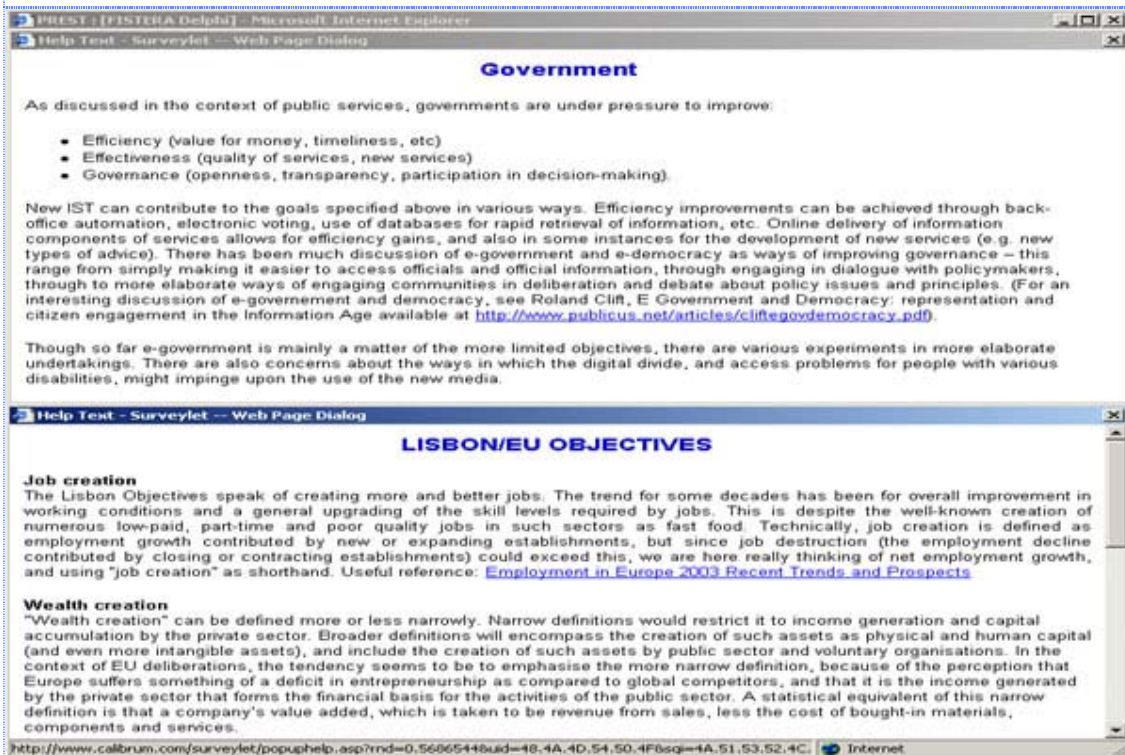
Panoramic area description & Lisbon Objectives

…the questionnaire

(vertical text, right margin) **Job Creation, Wealth Creation & Competitiveness**

…EU Goals and IST Application Areas

(vertical text, right margin) **Social Cohesion, Environmental Sustainability, Social Inclusion and Innovation**

…the questionnaire

Section 3: Panoramic Delphis
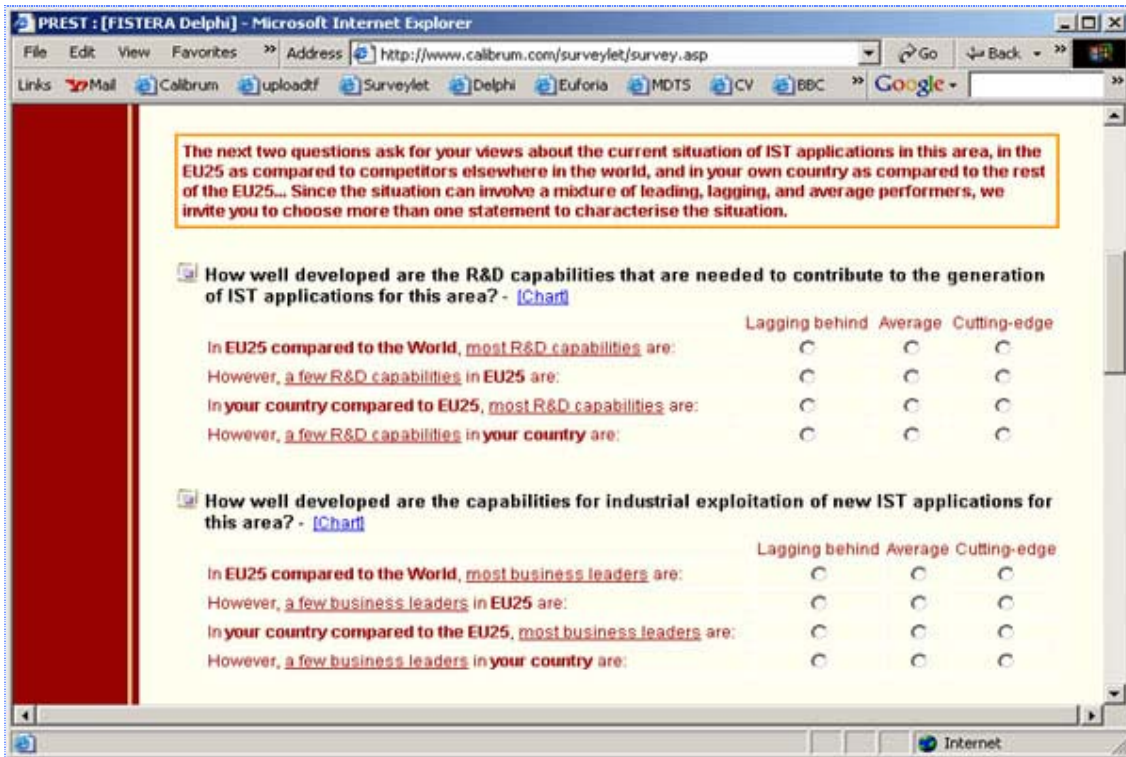
…the questionnaire

R&D capabilities and capabilities for industrial exploitation

…Panoramic Delphis
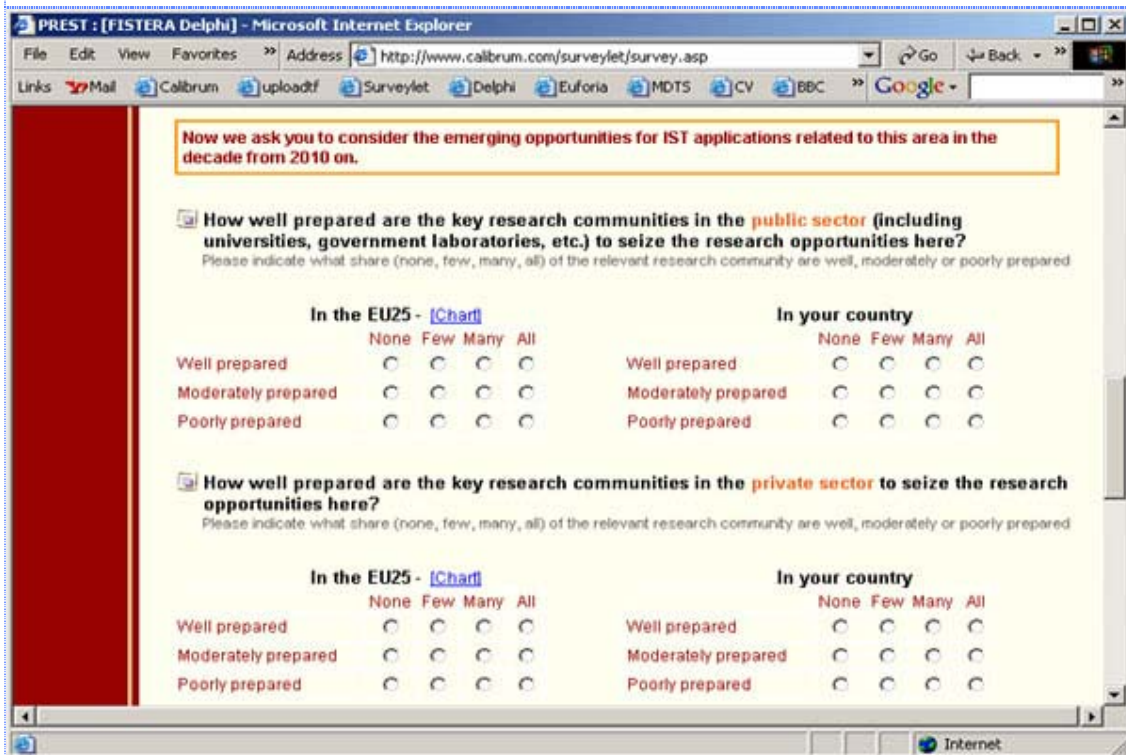
Preparedness of public and private sectors to seize research opportunnities

…the questionnaire

End of survey

ANNEXE C – ROUND 1 RESULTS

	Sectors (R1)			Regions (R1)					Age (R1)		Gender (R1)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
AGE													
Under 20	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
21-30	9%	13%	13%	25%	12%	13%	23%	13%	35%	0%	17%	12%	13%
31-40	19%	26%	24%	16%	23%	23%	31%	32%	64%	0%	30%	22%	24%
41-50	28%	39%	34%	23%	34%	32%	31%	37%	0%	53%	33%	33%	33%
51- 60	26%	18%	26%	25%	25%	25%	15%	16%	0%	38%	16%	26%	24%
61-70	18%	3%	2%	11%	5%	6%	0%	3%	0%	9%	3%	6%	5%
Over 70	0%	1%	1%	0%	1%	1%	0%	0%	0%	1%	0%	1%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
GENDER													
Female	21%	24%	25%	39%	20%	22%	77%	29%	30%	19%	100%	0%	23%
Male	79%	76%	75%	61%	80%	78%	23%	71%	70%	81%	0%	100%	77%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
COUNTRY													
Austria	4%	3%	6%	0%	5%	5%			9%	3%	6%	4%	5%
Belgium	2%	3%	2%	0%	2%	2%			2%	3%	5%	1%	2%
Cyprus	0%	0%	0%	2%	0%	0%			1%	0%	0%	0%	0%
Czech Republic	6%	3%	1%	15%	0%	2%			2%	2%	2%	2%	2%
Denmark	2%	3%	4%	0%	4%	4%			3%	4%	4%	3%	4%
Estonia	4%	0%	1%	9%	0%	1%			2%	0%	1%	1%	1%
Finland	8%	3%	2%	0%	4%	4%			3%	4%	6%	3%	4%
France	8%	7%	8%	0%	8%	7%			5%	9%	5%	8%	7%
Germany	10%	24%	9%	0%	15%	14%			17%	12%	11%	14%	14%
Greece	12%	5%	1%	0%	5%	5%			5%	4%	6%	4%	5%
Hungary	6%	5%	2%	37%	0%	4%			5%	5%	7%	4%	4%
Ireland	2%	0%	10%	0%	6%	5%			4%	6%	4%	6%	5%
Italy	0%	8%	7%	0%	7%	6%			6%	6%	6%	6%	6%
Latvia	0%	0%	0%	2%	0%	0%			0%	0%	0%	0%	0%
Lithuania	2%	0%	0%	4%	0%	1%			1%	0%	1%	0%	1%
Luxembourg	0%	1%	0%	0%	0%	0%			0%	0%	0%	0%	0%
Malta	6%	1%	0%	11%	0%	1%			2%	1%	5%	0%	1%
Netherlands	12%	5%	6%	0%	7%	6%			4%	8%	4%	7%	6%
Poland	0%	1%	1%	7%	0%	1%			1%	1%	0%	1%	1%
Portugal	2%	1%	2%	0%	1%	1%			0%	2%	0%	2%	1%
Slovenia	0%	0%	2%	11%	0%	1%			1%	1%	2%	1%	1%
Slovakia	2%	0%	1%	2%	0%	0%			0%	0%	1%	0%	0%
Spain	6%	1%	9%	0%	9%	8%			15%	4%	7%	8%	8%
Sweden	2%	4%	1%	0%	3%	2%			2%	3%	1%	3%	2%
United Kingdom	8%	22%	24%	0%	21%	18%			14%	20%	14%	19%	18%
Total	100%	100%	100%	100%	100%	100%			100%	100%	100%	100%	100%

…round 1 (main results)

	Sectors (R1)			Regions (R1)					Age (R1)		Gender (R1)		
OCCUPATION	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
IST Researcher in higher educational institution	2%	4%	50%	14%	31%	29%	7%	20%	26%	28%	25%	28%	26%
Non-IST Researcher in higher educational institution	2%	1%	27%	8%	13%	12%	29%	29%	16%	14%	21%	13%	14%
Researcher in government laboratory	3%	0%	17%	11%	9%	10%	0%	7%	10%	9%	9%	9%	9%
Researcher in private business in IST sectors	0%	30%	1%	3%	9%	9%	0%	2%	7%	8%	4%	8%	9%
Researcher in private business (IST user)	0%	20%	0%	5%	5%	5%	7%	7%	7%	4%	8%	4%	5%
Policymaker in IST areas	58%	0%	1%	16%	9%	10%	14%	8%	8%	11%	9%	10%	10%
Policymaker in other areas	33%	0%	1%	19%	5%	6%	0%	3%	4%	7%	4%	6%	6%
Manager in private business	0%	45%	0%	14%	10%	10%	29%	17%	13%	11%	12%	11%	12%
Other	3%	0%	2%	11%	9%	9%	14%	7%	10%	8%	7%	9%	10%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
CHALLENGES													
Enabling trust/ authentication of parties in IST-mediated activity	11%	10%	12%	11%	11%	11%	8%	15%	11%	12%	9%	12%	12%
Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests	4%	11%	13%	6%	11%	10%	13%	7%	10%	10%	10%	10%	10%
Enhancing security of transactions and personal information	18%	20%	18%	24%	17%	18%	33%	23%	19%	19%	21%	18%	19%
Reducing threats to privacy and civil liberties	10%	11%	12%	13%	12%	12%	4%	11%	12%	11%	13%	11%	12%
Freedom from intrusion (advertising, spam, etc)	10%	11%	13%	9%	13%	12%	4%	10%	12%	12%	10%	12%	12%
Establishing more user-friendly systems	24%	20%	18%	21%	20%	20%	21%	19%	17%	21%	20%	20%	20%
Enhancing protection of Intellectual Property Rights	9%	9%	5%	8%	6%	6%	17%	7%	9%	5%	7%	6%	6%
Improving measurement of effectiveness of interventions	8%	4%	5%	8%	6%	6%	0%	5%	6%	6%	6%	6%	6%
Other	6%	4%	5%	2%	5%	4%	0%	5%	4%	5%	3%	5%	4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
IMPEDIMENTS													
Bureaucratic rigidity on part of service organisations	14%	13%	12%	21%	12%	13%	21%	14%	14%	13%	15%	13%	13%
Regional inequalities (especially in IST R&D and production)	13%	7%	12%	12%	9%	9%	8%	13%	10%	10%	12%	9%	10%
Problems of social inequalities (different levels of access to IST)	10%	15%	17%	14%	15%	15%	17%	16%	16%	16%	18%	15%	15%
Averseness of small firms to innovation	11%	11%	9%	8%	10%	10%	17%	11%	9%	10%	8%	10%	10%
Lack of adequate finance (or links to financial community) for innovations	16%	13%	13%	17%	13%	13%	17%	14%	15%	12%	15%	13%	13%
Upgrading general workforce skills	7%	15%	14%	10%	13%	13%	13%	10%	12%	13%	13%	12%	12%
Creating new professional skills and expertise	13%	12%	15%	9%	16%	15%	4%	11%	12%	15%	15%	14%	14%
Limiting regulatory burdens on innovators	13%	10%	6%	10%	9%	9%	4%	6%	9%	8%	5%	9%	8%
Other	3%	2%	3%	0%	3%	3%	0%	4%	2%	3%	1%	4%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
ACTIONS													
Reducing the "digital divide"	12%	19%	18%	19%	18%	18%	13%	15%	15%	18%	22%	16%	17%
Improved communications infrastructure	16%	16%	16%	7%	17%	16%	21%	14%	15%	16%	15%	16%	15%
More diffusion & deployment of current applications	8%	11%	8%	10%	10%	10%	13%	11%	11%	9%	8%	10%	10%
Development of new & improved IST applications	20%	15%	13%	19%	13%	14%	21%	17%	13%	16%	12%	16%	15%
Better IST training and awareness programmes	8%	11%	13%	10%	11%	11%	17%	11%	13%	11%	14%	11%	11%
Application of other technologies (e.g. biotechnology)	13%	10%	8%	14%	8%	8%	8%	10%	9%	8%	8%	9%	9%
Social and institutional innovations	19%	19%	22%	20%	21%	21%	8%	19%	23%	19%	19%	21%	20%
Other, please specify:	3%	1%	2%	1%	2%	2%	0%	3%	2%	3%	2%	2%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

…round 1 (main results)

Job Creation within the EU	S (R1)			R (R1)					A (R1)		G (R1)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
Social / family relationships	4%	6%	4%	3%	5%	4%	7%	7%	6%	4%	3%	5%	5%
Cultural diversity	11%	4%	5%	5%	6%	5%	3%	6%	5%	6%	6%	6%	6%
Transport	5%	5%	6%	5%	6%	6%	0%	7%	5%	7%	4%	6%	6%
Ageing	9%	8%	5%	7%	7%	7%	3%	6%	6%	7%	8%	6%	7%
Health	7%	8%	8%	6%	8%	7%	7%	7%	6%	8%	6%	8%	7%
Education and learning	17%	19%	21%	21%	20%	20%	20%	17%	21%	20%	21%	20%	20%
Social welfare / public services	9%	7%	11%	10%	10%	10%	10%	7%	12%	8%	11%	9%	10%
Leisure and recreation	3%	5%	5%	2%	5%	5%	0%	8%	5%	5%	3%	6%	5%
Security	6%	6%	5%	10%	5%	6%	7%	5%	5%	6%	6%	6%	6%
Government	8%	8%	8%	13%	7%	8%	10%	8%	9%	8%	9%	8%	8%
Management	9%	11%	9%	10%	9%	9%	17%	11%	9%	9%	10%	9%	9%
Work organisation	12%	12%	12%	9%	13%	12%	17%	10%	12%	13%	14%	12%	12%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Wealth Creation within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
Social / family relationships	4%	2%	5%	6%	4%	4%	0%	5%	6%	4%	3%	5%	5%
Cultural diversity	8%	5%	3%	3%	5%	5%	0%	4%	5%	5%	5%	5%	5%
Transport	5%	7%	8%	4%	7%	7%	4%	6%	5%	8%	7%	7%	7%
Ageing	5%	6%	3%	3%	4%	4%	4%	4%	5%	4%	5%	4%	4%
Health	7%	11%	10%	9%	10%	10%	11%	9%	8%	10%	8%	10%	10%
Education and learning	16%	17%	19%	16%	17%	17%	25%	17%	16%	18%	18%	17%	17%
Social welfare / public services	10%	9%	9%	12%	9%	10%	14%	8%	11%	9%	10%	10%	9%
Leisure and recreation	5%	5%	4%	7%	4%	5%	4%	8%	6%	4%	5%	5%	5%
Security	4%	6%	7%	5%	6%	6%	7%	8%	6%	6%	7%	6%	6%
Government	10%	9%	10%	9%	9%	9%	11%	10%	9%	10%	10%	9%	9%
Management	12%	10%	10%	12%	10%	11%	7%	10%	10%	11%	9%	11%	11%
Work organisation	14%	13%	12%	14%	12%	13%	14%	11%	13%	13%	13%	12%	12%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Competitiveness within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
Social / family relationships	2%	2%	1%	0%	1%	1%	0%	2%	2%	1%	1%	2%	1%
Cultural diversity	6%	5%	4%	5%	5%	5%	3%	3%	6%	4%	6%	5%	5%
Transport	8%	11%	11%	8%	10%	10%	9%	9%	9%	10%	8%	10%	10%
Ageing	2%	3%	2%	1%	3%	2%	6%	4%	2%	3%	2%	2%	3%
Health	5%	5%	6%	6%	5%	5%	0%	4%	5%	5%	4%	5%	5%
Education and learning	16%	18%	21%	21%	19%	19%	16%	19%	19%	19%	19%	19%	19%
Social welfare / public services	5%	6%	6%	8%	6%	6%	6%	7%	8%	5%	7%	6%	6%
Leisure and recreation	2%	2%	1%	1%	1%	1%	3%	2%	2%	1%	3%	1%	1%
Security	7%	5%	6%	4%	6%	6%	9%	8%	7%	5%	6%	6%	6%
Government	15%	11%	12%	10%	13%	12%	13%	13%	12%	13%	13%	12%	13%
Management	15%	15%	15%	18%	15%	15%	19%	17%	14%	16%	15%	15%	16%
Work organisation	18%	17%	15%	18%	16%	16%	16%	12%	15%	17%	17%	16%	16%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

…round 1 (main results)

Social Cohesion within the EU

	S (R1)			R (R1)					A (R1)		G (R1)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
Social / family relationships	14%	16%	15%	18%	15%	15%	16%	17%	17%	15%	15%	16%	16%
Cultural diversity	15%	18%	16%	15%	17%	17%	19%	17%	17%	17%	20%	16%	17%
Transport	3%	4%	2%	1%	3%	2%	9%	5%	3%	2%	2%	3%	3%
Ageing	8%	6%	6%	7%	7%	7%	0%	6%	7%	7%	5%	7%	7%
Health	9%	6%	8%	6%	7%	7%	6%	6%	7%	6%	5%	7%	7%
Education and learning	17%	13%	17%	13%	17%	16%	16%	15%	15%	17%	19%	15%	16%
Social welfare / public services	15%	15%	17%	15%	16%	16%	13%	14%	16%	16%	17%	16%	16%
Leisure and recreation	3%	2%	3%	5%	3%	3%	3%	5%	4%	3%	1%	4%	4%
Security	5%	4%	4%	6%	3%	4%	3%	2%	4%	3%	4%	4%	4%
Government	7%	10%	8%	9%	8%	8%	16%	8%	6%	9%	9%	8%	8%
Management	1%	2%	1%	2%	1%	1%	0%	2%	1%	2%	1%	2%	2%
Work organisation	2%	4%	2%	2%	3%	2%	0%	2%	2%	2%	2%	3%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Environmental Sustainability and environmental quality within the EU

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
Social / family relationships	4%	2%	2%	2%	2%	2%	3%	5%	4%	3%	3%	3%	3%
Cultural diversity	5%	1%	3%	4%	4%	4%	3%	4%	4%	4%	3%	4%	4%
Transport	14%	19%	17%	13%	18%	17%	20%	17%	16%	17%	17%	16%	17%
Ageing	4%	2%	1%	1%	2%	2%	0%	2%	2%	2%	1%	2%	2%
Health	8%	6%	9%	9%	7%	7%	10%	10%	8%	7%	10%	7%	8%
Education and learning	17%	15%	17%	19%	16%	17%	20%	15%	17%	17%	17%	17%	16%
Social welfare / public services	6%	8%	8%	6%	8%	7%	0%	8%	8%	8%	8%	7%	7%
Leisure and recreation	5%	8%	7%	4%	7%	6%	7%	7%	8%	5%	6%	6%	7%
Security	5%	4%	5%	4%	4%	4%	7%	6%	6%	4%	5%	5%	4%
Government	14%	17%	16%	16%	17%	17%	10%	13%	15%	17%	15%	16%	16%
Management	12%	9%	8%	11%	9%	9%	7%	9%	6%	10%	6%	9%	9%
Work organisation	8%	8%	7%	11%	8%	8%	13%	5%	7%	8%	7%	8%	7%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Social Inclusion within the EU

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R1
Social / family relationships	17%	17%	14%	17%	15%	16%	16%	17%	16%	16%	15%	16%	16%
Cultural diversity	16%	16%	16%	15%	17%	16%	13%	16%	15%	17%	18%	16%	16%
Transport	2%	2%	2%	2%	2%	2%	10%	2%	3%	1%	3%	2%	2%
Ageing	10%	8%	10%	9%	9%	9%	16%	9%	8%	10%	10%	9%	9%
Health	10%	7%	8%	5%	7%	7%	13%	9%	7%	7%	8%	7%	7%
Education and learning	16%	17%	18%	16%	18%	18%	13%	16%	19%	17%	18%	18%	17%
Social welfare / public services	14%	14%	17%	16%	15%	15%	16%	16%	16%	15%	15%	15%	15%
Leisure and recreation	2%	4%	3%	5%	3%	3%	0%	2%	2%	3%	1%	3%	3%
Security	1%	1%	2%	1%	2%	2%	3%	2%	2%	1%	1%	2%	2%
Government	7%	8%	8%	9%	8%	8%	0%	7%	7%	8%	7%	8%	8%
Management	2%	2%	1%	3%	1%	1%	0%	2%	1%	1%	1%	1%	1%
Work organisation	3%	3%	3%	3%	3%	3%	0%	2%	3%	3%	3%	3%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

ANNEXE D – ROUND 2 RESULTS

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AGE	Sectors (R2)			Regions (R2)					Age (R2)		Gender (R2)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Under 20	0%	1%	0%	0%	1%	0%	0%	0%	1%	0%	0%	1%	0%
21-30	8%	14%	14%	25%	10%	13%	24%	23%	38%	0%	29%	10%	15%
31-40	20%	26%	23%	13%	27%	24%	18%	21%	61%	0%	21%	25%	23%
41-50	20%	18%	31%	23%	26%	25%	18%	17%	0%	38%	25%	23%	23%
51- 60	48%	30%	23%	28%	28%	28%	41%	30%	0%	46%	22%	31%	29%
61-70	3%	7%	6%	8%	7%	7%	0%	8%	0%	11%	3%	9%	7%
Over 70	3%	3%	3%	5%	2%	3%	0%	2%	0%	4%	1%	3%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

GENDER	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Female	20%	21%	27%	48%	22%	27%	47%	26%	34%	22%	100%	0%	27%
Male	80%	79%	73%	53%	78%	73%	53%	74%	66%	78%	0%	100%	73%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

COUNTRY	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Austria	6%	6%	7%	0%	9%	7%			9%	5%	2%	8%	7%
Belgium	6%	2%	1%	0%	2%	2%			4%	1%	2%	2%	2%
Cyprus	0%	0%	0%	2%	0%	0%			0%	0%	0%	0%	0%
Czech Republic	3%	2%	1%	11%	0%	2%			0%	3%	3%	1%	2%
Denmark	6%	2%	3%	0%	4%	3%			4%	3%	2%	4%	3%
Estonia	3%	0%	0%	5%	0%	1%			2%	0%	2%	1%	1%
Finland	17%	2%	1%	0%	4%	3%			4%	3%	3%	3%	3%
France	0%	6%	3%	0%	5%	4%			2%	6%	2%	6%	4%
Germany	14%	21%	8%	0%	13%	11%			13%	9%	7%	12%	11%
Greece	3%	11%	1%	0%	5%	4%			7%	3%	8%	3%	4%
Hungary	6%	3%	8%	34%	0%	6%			6%	7%	14%	4%	6%
Ireland	0%	3%	6%	0%	5%	4%			1%	6%	0%	6%	4%
Italy	3%	6%	8%	0%	9%	7%			7%	7%	8%	6%	7%
Latvia	0%	2%	1%	7%	0%	1%			0%	2%	2%	1%	1%
Lithuania	0%	0%	2%	7%	0%	1%			2%	1%	2%	1%	1%
Luxembourg	3%	0%	0%	0%	1%	0%			1%	0%	0%	1%	0%
Malta	3%	5%	1%	11%	0%	2%			4%	1%	5%	1%	2%
Netherlands	11%	8%	7%	0%	9%	7%			6%	8%	5%	8%	7%
Poland	3%	2%	1%	9%	0%	2%			1%	1%	0%	2%	2%
Portugal	8%	3%	1%	0%	3%	3%			2%	2%	2%	2%	3%
Slovenia	0%	0%	3%	9%	0%	2%			2%	1%	5%	1%	2%
Slovakia	0%	2%	1%	5%	0%	1%			0%	1%	0%	1%	1%
Spain	3%	3%	9%	0%	9%	7%			13%	4%	10%	7%	7%
Sweden	3%	3%	1%	0%	3%	3%			0%	4%	0%	4%	3%
United Kingdom	3%	12%	24%	0%	19%	16%			7%	21%	17%	16%	16%
Total	100%	100%	100%	100%	100%	100%			100%	100%	100%	100%	100%

…round 2 (main results)

OCCUPATION	Sectors (R2)			Regions (R2)					Age (R2)		Gender (R2)		R2
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
IST Researcher in higher educational institution	2%	1%	45%	30%	18%	20%	21%	21%	23%	19%	22%	20%	21%
Non-IST Researcher in higher educational institution	0%	0%	25%	8%	10%	10%	0%	18%	8%	14%	14%	11%	12%
Researcher in government laboratory	2%	1%	25%	8%	11%	10%	32%	14%	13%	11%	11%	12%	11%
Researcher in private business in IST sectors	2%	29%	1%	5%	10%	10%	5%	5%	6%	10%	9%	8%	9%
Researcher in private business (IST user)	0%	19%	0%	8%	4%	5%	16%	9%	8%	5%	11%	4%	6%
Policymaker in IST areas	40%	1%	1%	5%	9%	8%	5%	5%	6%	8%	3%	9%	8%
Policymaker in other areas	44%	2%	1%	11%	9%	9%	0%	5%	5%	11%	9%	8%	8%
Manager in private business	6%	45%	1%	11%	16%	15%	5%	9%	16%	12%	5%	17%	14%
Other	4%	1%	2%	14%	13%	13%	16%	13%	15%	11%	16%	12%	13%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

CHALLENGES	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Enabling trust/ authentication of parties in IST-mediated activity	9%	11%	12%	12%	10%	10%	19%	11%	9%	11%	9%	11%	11%
Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests	7%	8%	9%	11%	8%	9%	6%	9%	9%	8%	9%	8%	9%
Enhancing security of transactions and personal information	27%	18%	19%	21%	21%	21%	25%	22%	21%	22%	24%	21%	22%
Reducing threats to privacy and civil liberties	8%	14%	12%	8%	12%	11%	13%	12%	13%	11%	10%	12%	11%
Freedom from intrusion (advertising, spam, etc)	7%	8%	12%	9%	10%	10%	6%	8%	11%	9%	11%	10%	10%
Establishing more user-friendly systems	29%	26%	21%	20%	25%	24%	9%	18%	20%	25%	19%	24%	23%
Enhancing protection of Intellectual Property Rights	6%	4%	7%	10%	4%	5%	13%	8%	7%	5%	9%	4%	6%
Improving measurement of effectiveness of interventions	4%	9%	7%	9%	7%	7%	9%	10%	9%	7%	8%	8%	8%
Other	2%	3%	1%	0%	2%	2%	0%	2%	1%	2%	1%	2%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

IMPEDIMENTS	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Bureaucratic rigidity on part of service organisations	10%	12%	17%	19%	13%	14%	12%	12%	13%	14%	18%	12%	14%
Regional inequalities (especially in IST R&D and production)	2%	5%	9%	9%	7%	8%	9%	10%	8%	8%	9%	7%	8%
Problems of social inequalities (different levels of access to IST)	10%	18%	19%	13%	19%	18%	9%	21%	20%	17%	17%	19%	18%
Averseness of small firms to innovation	11%	12%	7%	6%	11%	10%	12%	8%	10%	10%	8%	10%	10%
Lack of adequate finance (or links to financial community) for innovations	17%	13%	16%	23%	14%	16%	18%	13%	17%	14%	16%	15%	15%
Upgrading general workforce skills	21%	12%	12%	9%	13%	12%	21%	16%	11%	15%	13%	13%	13%
Creating new professional skills and expertise	18%	12%	14%	13%	14%	13%	12%	13%	13%	14%	13%	13%	13%
Limiting regulatory burdens on innovators	10%	12%	4%	8%	7%	7%	6%	5%	7%	7%	5%	8%	7%
Other	1%	3%	1%	0%	3%	2%	0%	1%	1%	2%	1%	2%	2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

ACTIONS	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Reducing the "digital divide"	15%	19%	21%	17%	20%	19%	12%	17%	21%	18%	20%	19%	19%
Improved communications infrastructure	16%	12%	13%	11%	16%	15%	6%	9%	13%	14%	15%	13%	14%
More diffusion & deployment of current applications	10%	13%	8%	10%	11%	11%	9%	9%	10%	10%	12%	9%	10%
Development of new & improved IST applications	19%	13%	14%	15%	13%	14%	18%	14%	12%	15%	11%	15%	14%
Better IST training and awareness programmes	9%	11%	13%	16%	11%	12%	15%	13%	13%	12%	16%	11%	12%
Application of other technologies (e.g. biotechnology)	14%	11%	6%	13%	7%	8%	18%	13%	9%	9%	7%	10%	9%
Social and institutional innovations	17%	19%	22%	17%	21%	20%	21%	24%	20%	21%	19%	22%	21%
Other, please specify:	2%	2%	1%	0%	2%	2%	0%	1%	1%	1%	1%	2%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

…round 2 (main results)

	Sectors (R2)			Regions (R2)					Age (R2)		Gender (R2)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Job Creation within the EU													
Social / family relationships	2%	5%	6%	4%	5%	4%	8%	8%	5%	5%	4%	5%	5%
Cultural diversity	3%	3%	7%	4%	6%	5%	6%	8%	5%	6%	4%	6%	6%
Transport	5%	6%	4%	5%	5%	5%	2%	2%	5%	5%	6%	4%	5%
Ageing	8%	7%	6%	5%	8%	7%	2%	8%	7%	7%	7%	7%	7%
Health	12%	10%	8%	7%	9%	9%	10%	8%	6%	10%	4%	10%	9%
Education and learning	18%	20%	22%	22%	20%	21%	22%	21%	21%	21%	22%	20%	21%
Social welfare / public services	7%	6%	8%	9%	8%	8%	10%	8%	9%	8%	10%	8%	8%
Leisure and recreation	8%	3%	5%	4%	6%	5%	2%	2%	3%	5%	3%	5%	5%
Security	9%	5%	5%	2%	5%	4%	4%	6%	4%	5%	3%	5%	4%
Government	10%	9%	8%	11%	7%	8%	8%	10%	10%	8%	7%	9%	8%
Management	7%	12%	8%	13%	9%	10%	12%	10%	11%	9%	11%	9%	10%
Work organisation	9%	14%	13%	14%	13%	13%	12%	10%	15%	11%	17%	11%	13%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Wealth Creation within the EU													
Social / family relationships	5%	5%	6%	6%	5%	5%	8%	6%	4%	6%	4%	6%	5%
Cultural diversity	4%	5%	5%	3%	5%	4%	4%	5%	3%	5%	6%	4%	4%
Transport	6%	6%	5%	4%	6%	5%	0%	5%	6%	5%	4%	6%	5%
Ageing	6%	6%	5%	5%	6%	6%	0%	2%	5%	5%	5%	5%	5%
Health	12%	10%	9%	11%	10%	10%	10%	8%	9%	10%	9%	10%	10%
Education and learning	17%	18%	19%	18%	18%	18%	21%	19%	18%	18%	19%	18%	18%
Social welfare / public services	11%	6%	11%	9%	9%	9%	13%	10%	10%	9%	10%	9%	9%
Leisure and recreation	8%	4%	7%	3%	7%	6%	6%	6%	6%	6%	4%	7%	6%
Security	6%	5%	5%	6%	5%	5%	8%	7%	6%	5%	5%	6%	5%
Government	9%	9%	8%	11%	8%	9%	8%	10%	9%	9%	8%	10%	9%
Management	7%	12%	11%	13%	10%	11%	13%	12%	12%	10%	13%	10%	11%
Work organisation	9%	13%	11%	13%	12%	12%	8%	8%	12%	11%	14%	11%	12%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Competitiveness within the EU													
Social / family relationships	2%	1%	2%	1%	2%	2%	2%	3%	2%	2%	2%	2%	2%
Cultural diversity	5%	5%	5%	4%	5%	5%	4%	5%	5%	5%	4%	5%	5%
Transport	7%	10%	8%	8%	8%	8%	10%	9%	8%	9%	7%	9%	8%
Ageing	1%	4%	1%	1%	3%	2%	0%	1%	2%	2%	2%	2%	2%
Health	2%	5%	5%	5%	4%	4%	2%	5%	4%	5%	5%	5%	4%
Education and learning	20%	18%	21%	22%	19%	20%	20%	19%	18%	20%	20%	20%	20%
Social welfare / public services	10%	5%	7%	6%	8%	8%	4%	5%	9%	7%	8%	7%	7%
Leisure and recreation	2%	0%	2%	1%	2%	1%	0%	2%	1%	2%	1%	2%	2%
Security	4%	4%	4%	2%	4%	3%	4%	5%	5%	3%	2%	4%	4%
Government	17%	14%	13%	13%	14%	14%	14%	14%	14%	13%	14%	13%	14%
Management	15%	17%	16%	20%	16%	17%	20%	17%	17%	16%	18%	16%	17%
Work organisation	16%	16%	15%	18%	16%	16%	18%	15%	17%	15%	18%	15%	16%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

…round 2 (main results)

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Social Cohesion within the EU	Sectors (R2)			Regions (R2)					Age (R2)		Gender (R2)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Social / family relationships	11%	14%	16%	15%	15%	15%	16%	16%	18%	13%	15%	15%	15%
Cultural diversity	17%	16%	19%	15%	17%	17%	20%	18%	18%	17%	18%	17%	17%
Transport	2%	1%	2%	1%	2%	2%	2%	3%	2%	2%	2%	2%	2%
Ageing	7%	10%	6%	5%	7%	7%	5%	7%	6%	7%	6%	7%	7%
Health	7%	7%	6%	7%	6%	6%	11%	8%	5%	7%	5%	7%	6%
Education and learning	17%	17%	16%	16%	17%	16%	14%	15%	14%	18%	18%	16%	16%
Social welfare / public services	15%	16%	17%	18%	17%	17%	16%	14%	17%	16%	17%	16%	16%
Leisure and recreation	4%	1%	5%	5%	3%	3%	11%	6%	4%	4%	4%	4%	4%
Security	5%	5%	3%	3%	4%	4%	2%	2%	3%	4%	1%	5%	3%
Government	10%	7%	7%	9%	7%	8%	2%	8%	8%	7%	8%	8%	8%
Management	3%	3%	1%	4%	1%	2%	0%	1%	1%	2%	3%	2%	2%
Work organisation	4%	3%	2%	2%	4%	4%	0%	1%	4%	3%	5%	2%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Environmental Sustainability and environmental quality within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Social / family relationships	3%	1%	5%	6%	4%	5%	2%	4%	5%	4%	5%	4%	5%
Cultural diversity	3%	5%	5%	4%	4%	4%	7%	4%	3%	5%	4%	4%	4%
Transport	13%	15%	15%	14%	15%	15%	12%	13%	13%	15%	14%	15%	15%
Ageing	1%	2%	2%	0%	1%	1%	2%	2%	1%	1%	1%	1%	1%
Health	9%	8%	6%	8%	6%	6%	10%	13%	7%	7%	5%	8%	7%
Education and learning	17%	14%	18%	20%	17%	18%	17%	17%	18%	17%	19%	17%	18%
Social welfare / public services	9%	7%	9%	5%	9%	8%	14%	11%	8%	8%	8%	8%	8%
Leisure and recreation	3%	6%	5%	5%	5%	5%	2%	4%	5%	5%	7%	5%	5%
Security	6%	5%	2%	6%	3%	4%	5%	3%	3%	3%	5%	3%	3%
Government	17%	16%	15%	15%	17%	16%	12%	14%	17%	16%	17%	16%	16%
Management	9%	11%	9%	10%	9%	9%	10%	9%	10%	9%	8%	9%	9%
Work organisation	9%	10%	10%	7%	11%	10%	7%	5%	8%	10%	9%	9%	9%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Social Inclusion within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	R2
Social / family relationships	15%	17%	17%	17%	17%	17%	16%	17%	19%	16%	18%	17%	17%
Cultural diversity	9%	16%	16%	13%	15%	14%	18%	18%	15%	15%	17%	15%	15%
Transport	3%	1%	2%	1%	2%	2%	0%	1%	1%	3%	2%	2%	2%
Ageing	9%	8%	7%	8%	8%	8%	9%	8%	9%	7%	9%	7%	8%
Health	7%	8%	7%	6%	7%	7%	11%	9%	7%	7%	8%	7%	7%
Education and learning	15%	13%	17%	18%	15%	16%	14%	17%	16%	16%	17%	16%	16%
Social welfare / public services	19%	17%	16%	16%	17%	17%	18%	13%	18%	16%	15%	17%	16%
Leisure and recreation	3%	1%	3%	3%	2%	2%	5%	3%	2%	3%	2%	3%	2%
Security	3%	3%	3%	1%	3%	2%	2%	3%	2%	3%	2%	3%	3%
Government	9%	6%	9%	8%	8%	8%	7%	8%	8%	8%	7%	8%	8%
Management	4%	3%	1%	6%	2%	2%	0%	1%	1%	2%	2%	2%	2%
Work organisation	5%	6%	3%	1%	4%	4%	0%	1%	2%	4%	3%	4%	3%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

ANNEXE E – RESULTS FOR BOTH ROUNDS COMBINED

AGE	S (BRC)			R (BRC)					A (BRC)		G (BRC)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Under 20	0%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0.3%
21-30	7%	14%	13%	22%	12%	13%	24%	17%	37%	0%	21%	12%	13.8%
31-40	20%	27%	23%	16%	24%	23%	24%	24%	62%	0%	27%	22%	23.1%
41-50	25%	28%	33%	22%	30%	29%	21%	27%	0%	46%	29%	29%	28.8%
51- 60	35%	23%	26%	26%	26%	26%	31%	24%	0%	42%	19%	28%	26.1%
61-70	11%	5%	4%	11%	6%	6%	0%	6%	0%	10%	3%	7%	6.4%
Over 70	1%	2%	1%	3%	1%	2%	0%	1%	0%	2%	1%	2%	1.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

GENDER	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Female	20%	21%	26%	41%	21%	24%	59%	25%	31%	20%	100%	0%	24%
Male	80%	79%	74%	59%	79%	76%	41%	75%	69%	80%	0%	100%	76%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

COUNTRY	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Austria	5%	5%	6%	0%	7%	6%			9%	3%	5%	5%	5.6%
Belgium	3%	2%	2%	0%	2%	2%			2%	2%	4%	2%	2.0%
Cyprus	0%	0%	0%	1%	0%	0%			0%	0%	0%	0%	0.2%
Czech Republic	5%	2%	1%	14%	0%	2%			1%	2%	2%	2%	2.0%
Denmark	3%	2%	4%	0%	5%	4%			4%	4%	3%	4%	3.9%
Estonia	3%	0%	0%	8%	0%	1%			3%	0%	2%	1%	1.1%
Finland	11%	2%	2%	0%	4%	4%			3%	4%	4%	4%	3.7%
France	5%	7%	6%	0%	7%	6%			4%	8%	4%	7%	6.3%
Germany	11%	23%	9%	0%	14%	12%			16%	10%	11%	13%	12.1%
Greece	8%	7%	1%	0%	5%	5%			5%	4%	7%	4%	4.6%
Hungary	6%	4%	4%	33%	0%	5%			5%	5%	9%	4%	4.8%
Ireland	1%	2%	9%	0%	6%	5%			3%	6%	2%	6%	4.8%
Italy	1%	7%	6%	0%	7%	6%			6%	6%	6%	6%	5.9%
Latvia	0%	1%	0%	5%	0%	1%			0%	1%	1%	1%	0.7%
Lithuania	1%	0%	1%	6%	0%	1%			2%	1%	2%	1%	0.9%
Luxembourg	1%	1%	0%	0%	0%	0%			1%	0%	0%	1%	0.4%
Malta	3%	3%	0%	11%	0%	2%			3%	1%	5%	1%	1.7%
Netherlands	11%	5%	6%	0%	8%	7%			5%	8%	5%	8%	6.7%
Poland	1%	2%	1%	8%	0%	1%			1%	1%	0%	1%	1.1%
Portugal	5%	2%	1%	0%	2%	2%			1%	2%	1%	2%	1.9%
Slovenia	0%	0%	2%	10%	0%	1%			2%	1%	3%	1%	1.5%
Slovakia	1%	1%	1%	4%	0%	1%			0%	1%	1%	1%	0.6%
Spain	5%	2%	9%	0%	10%	8%			15%	4%	9%	8%	8.2%
Sweden	2%	3%	1%	0%	3%	2%			1%	3%	1%	3%	2.2%
United Kingdom	6%	18%	24%	0%	20%	17%			12%	20%	15%	18%	17.1%
Total	100%	100%	100%	100%	100%	100%			100%	100%	100%	100%	100%

…BRC (main results)

	S (BRC)			R (BRC)					A (BRC)		G (BRC)		
OCCUPATION	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
IST Researcher in higher educational institution	2%	3%	48%	20%	26%	25%	16%	19%	24%	24%	23%	24%	24.2%
Non-IST Researcher in higher educational institution	1%	1%	26%	9%	11%	11%	13%	23%	12%	14%	19%	11%	13.1%
Researcher in government laboratory	3%	1%	20%	10%	10%	10%	19%	11%	11%	10%	11%	10%	10.1%
Researcher in private business in IST sectors	1%	29%	1%	4%	10%	9%	3%	4%	7%	9%	6%	8%	8.0%
Researcher in private business (IST user)	0%	19%	0%	7%	4%	5%	13%	8%	7%	4%	9%	4%	5.3%
Policymaker in IST areas	50%	1%	1%	11%	10%	10%	9%	7%	8%	10%	7%	10%	9.4%
Policymaker in other areas	38%	1%	1%	14%	7%	8%	0%	5%	4%	9%	6%	7%	7.0%
Manager in private business	3%	45%	1%	11%	12%	12%	16%	14%	15%	11%	9%	14%	12.3%
Other	3%	1%	2%	13%	11%	11%	13%	9%	12%	10%	10%	11%	10.6%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
CHALLENGES													
Enabling trust/ authentication of parties in IST-mediated activity	10%	10%	12%	12%	10%	10%	15%	13%	10%	11%	8%	12%	10.8%
Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests	5%	10%	11%	10%	10%	10%	8%	8%	10%	10%	12%	9%	9.9%
Enhancing security of transactions and personal information	22%	19%	19%	22%	19%	20%	28%	22%	20%	20%	22%	19%	20.2%
Reducing threats to privacy and civil liberties	9%	12%	12%	10%	12%	11%	9%	12%	14%	10%	12%	11%	11.4%
Freedom from intrusion (advertising, spam, etc)	9%	10%	12%	9%	12%	11%	6%	9%	11%	11%	10%	11%	10.7%
Establishing more user-friendly systems	27%	22%	19%	20%	22%	22%	13%	19%	18%	23%	19%	22%	21.1%
Enhancing protection of Intellectual Property Rights	8%	7%	6%	9%	5%	6%	15%	7%	8%	5%	9%	5%	6.0%
Improving measurement of effectiveness of interventions	6%	6%	6%	8%	6%	6%	6%	7%	7%	6%	6%	6%	6.5%
Other	4%	3%	3%	1%	4%	3%	0%	3%	3%	4%	2%	4%	3.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
IMPEDIMENTS													
Bureaucratic rigidity on part of service organisations	13%	13%	14%	21%	12%	14%	17%	14%	14%	13%	17%	13%	13.6%
Regional inequalities (especially in IST R&D and production)	8%	6%	11%	11%	8%	9%	7%	12%	9%	9%	11%	9%	9.4%
Problems of social inequalities (different levels of access to IST)	10%	16%	18%	12%	16%	16%	13%	18%	17%	16%	17%	16%	16.3%
Averseness of small firms to innovation	11%	12%	8%	7%	11%	10%	15%	11%	10%	10%	8%	11%	10.1%
Lack of adequate finance (or links to financial community) for innovations	16%	13%	14%	21%	13%	15%	17%	13%	16%	13%	15%	14%	14.4%
Upgrading general workforce skills	14%	14%	14%	8%	13%	13%	19%	13%	12%	13%	12%	13%	12.7%
Creating new professional skills and expertise	15%	12%	15%	12%	15%	15%	7%	11%	13%	14%	14%	14%	13.8%
Limiting regulatory burdens on innovators	11%	11%	5%	8%	8%	8%	6%	6%	8%	8%	5%	9%	7.4%
Other	2%	3%	2%	0%	3%	2%	0%	2%	1%	3%	1%	3%	2.4%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
ACTIONS													
Reducing the "digital divide"	13%	19%	19%	18%	18%	18%	11%	14%	17%	18%	21%	16%	17.3%
Improved communications infrastructure	16%	14%	15%	10%	16%	15%	11%	11%	14%	15%	15%	15%	14.6%
More diffusion & deployment of current applications	9%	12%	8%	11%	10%	10%	11%	11%	12%	9%	10%	10%	10.2%
Development of new & improved IST applications	19%	14%	14%	15%	14%	14%	19%	16%	12%	16%	12%	15%	14.3%
Better IST training and awareness programmes	9%	11%	13%	14%	11%	12%	17%	13%	13%	12%	15%	11%	11.8%
Application of other technologies (e.g. biotechnology)	13%	10%	7%	13%	8%	9%	15%	11%	9%	9%	8%	10%	9.3%
Social and institutional innovations	18%	19%	22%	18%	21%	20%	17%	22%	21%	20%	19%	21%	20.5%
Other, please specify:	3%	2%	2%	1%	2%	2%	0%	1%	1%	2%	1%	2%	1.8%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

…BRC (main results)

Job Creation within the EU	S (BRC)			R (BRC)					A (BRC)		G (BRC)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Social / family relationships	4%	6%	5%	4%	5%	4%	8%	8%	6%	4%	4%	5%	5.1%
Cultural diversity	7%	4%	6%	4%	6%	6%	5%	7%	5%	6%	5%	6%	5.8%
Transport	5%	5%	5%	5%	5%	5%	1%	5%	5%	6%	5%	5%	5.2%
Ageing	8%	7%	6%	5%	7%	7%	3%	7%	6%	7%	7%	6%	6.7%
Health	9%	9%	8%	7%	8%	8%	9%	8%	6%	9%	5%	9%	7.8%
Education and learning	18%	20%	22%	21%	20%	21%	22%	18%	21%	20%	21%	20%	20.2%
Social welfare / public services	8%	6%	10%	10%	10%	10%	9%	8%	11%	8%	10%	9%	9.2%
Leisure and recreation	5%	4%	5%	3%	5%	5%	1%	6%	4%	5%	3%	6%	5.1%
Security	7%	6%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5.1%
Government	9%	8%	8%	11%	7%	8%	8%	8%	9%	8%	8%	8%	8.1%
Management	9%	11%	8%	12%	9%	9%	14%	10%	10%	9%	11%	9%	9.4%
Work organisation	11%	13%	12%	13%	13%	13%	14%	9%	13%	12%	16%	11%	12.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Wealth Creation within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Social / family relationships	5%	4%	5%	5%	4%	4%	6%	6%	5%	4%	3%	5%	4.8%
Cultural diversity	6%	5%	4%	3%	5%	5%	3%	5%	4%	5%	6%	5%	4.8%
Transport	5%	6%	7%	4%	7%	6%	1%	6%	5%	6%	5%	6%	6.0%
Ageing	5%	6%	3%	4%	5%	5%	1%	3%	4%	4%	5%	4%	4.3%
Health	9%	10%	9%	10%	9%	10%	10%	9%	9%	10%	8%	10%	9.4%
Education and learning	17%	18%	19%	17%	18%	18%	23%	19%	17%	18%	19%	18%	18.0%
Social welfare / public services	10%	8%	10%	10%	9%	9%	13%	9%	11%	9%	11%	9%	9.4%
Leisure and recreation	6%	5%	5%	4%	5%	5%	6%	7%	6%	5%	4%	6%	5.4%
Security	5%	5%	6%	6%	5%	5%	8%	7%	6%	5%	6%	5%	5.5%
Government	9%	10%	10%	10%	9%	10%	8%	9%	9%	10%	9%	10%	9.5%
Management	10%	11%	10%	13%	10%	11%	11%	11%	11%	10%	10%	11%	10.9%
Work organisation	12%	13%	11%	13%	12%	12%	10%	9%	12%	12%	13%	12%	11.9%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Competitiveness within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Social / family relationships	2%	2%	1%	1%	1%	1%	1%	3%	2%	2%	1%	2%	1.6%
Cultural diversity	6%	5%	4%	5%	5%	5%	4%	4%	5%	5%	5%	5%	4.6%
Transport	7%	11%	10%	9%	10%	9%	9%	9%	9%	10%	8%	10%	9.3%
Ageing	2%	4%	2%	1%	2%	2%	3%	3%	3%	2%	2%	2%	2.3%
Health	3%	5%	6%	5%	4%	5%	1%	5%	5%	5%	4%	5%	4.7%
Education and learning	17%	17%	21%	21%	19%	19%	18%	19%	19%	20%	19%	19%	19.3%
Social welfare / public services	7%	6%	7%	7%	7%	7%	4%	6%	8%	6%	8%	6%	6.7%
Leisure and recreation	1%	1%	1%	0%	1%	1%	1%	2%	1%	1%	2%	1%	1.3%
Security	6%	4%	5%	3%	5%	4%	7%	6%	5%	4%	3%	5%	4.7%
Government	16%	12%	13%	12%	14%	13%	13%	12%	13%	13%	13%	13%	13.2%
Management	16%	16%	15%	19%	15%	16%	21%	17%	15%	16%	16%	16%	16.3%
Work organisation	17%	17%	15%	18%	16%	16%	17%	14%	16%	16%	18%	16%	15.8%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

…BRC (main results)

Social Cohesion within the EU	S (BRC)			R (BRC)					A (BRC)		G (BRC)		
	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Social / family relationships	13%	15%	15%	17%	15%	15%	17%	17%	18%	14%	16%	15%	15.4%
Cultural diversity	16%	17%	17%	15%	17%	17%	20%	17%	17%	17%	19%	16%	16.8%
Transport	2%	3%	2%	1%	2%	2%	4%	4%	2%	2%	2%	2%	2.5%
Ageing	7%	8%	6%	6%	7%	7%	3%	6%	6%	7%	5%	7%	6.6%
Health	8%	7%	7%	7%	7%	7%	10%	7%	7%	7%	6%	7%	6.7%
Education and learning	17%	15%	16%	14%	17%	16%	14%	15%	14%	17%	18%	16%	16.1%
Social welfare / public services	15%	16%	17%	18%	17%	17%	14%	14%	16%	16%	17%	16%	16.2%
Leisure and recreation	4%	2%	4%	5%	3%	3%	8%	5%	4%	3%	2%	4%	3.6%
Security	5%	5%	4%	4%	4%	4%	3%	2%	4%	4%	3%	4%	3.6%
Government	8%	8%	8%	9%	8%	8%	7%	8%	7%	8%	8%	8%	8.0%
Management	2%	3%	1%	3%	1%	2%	0%	2%	1%	2%	2%	2%	1.7%
Work organisation	3%	4%	2%	3%	3%	3%	0%	2%	3%	3%	3%	3%	2.7%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Environmental Sustainability and environmental quality within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Social / family relationships	4%	2%	3%	5%	3%	3%	3%	4%	5%	3%	4%	4%	3.7%
Cultural diversity	4%	3%	4%	4%	3%	4%	6%	4%	3%	4%	3%	4%	3.7%
Transport	13%	17%	16%	14%	17%	16%	15%	15%	15%	16%	17%	16%	16.1%
Ageing	3%	2%	1%	1%	2%	2%	1%	2%	1%	2%	1%	2%	1.6%
Health	8%	7%	8%	8%	6%	7%	9%	10%	7%	7%	7%	7%	7.4%
Education and learning	17%	15%	18%	19%	17%	17%	18%	16%	18%	17%	18%	17%	16.8%
Social welfare / public services	7%	7%	8%	5%	8%	7%	9%	9%	8%	7%	7%	7%	7.5%
Leisure and recreation	4%	7%	6%	5%	6%	6%	4%	6%	7%	5%	7%	5%	6.0%
Security	5%	5%	4%	5%	4%	4%	6%	5%	5%	4%	5%	4%	4.1%
Government	15%	17%	16%	15%	17%	17%	10%	14%	16%	16%	16%	16%	16.0%
Management	10%	9%	8%	11%	8%	9%	9%	9%	8%	9%	7%	9%	9.0%
Work organisation	9%	9%	8%	8%	9%	9%	9%	5%	8%	9%	8%	9%	8.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Social Inclusion within the EU	P	B	Sc	NMS	EU15	EU25	CCs	N-EU	<40	>40	F	M	BRC
Social / family relationships	17%	17%	15%	17%	16%	16%	16%	16%	17%	16%	17%	16%	16.4%
Cultural diversity	13%	16%	16%	15%	15%	15%	16%	16%	15%	16%	17%	15%	15.5%
Transport	2%	1%	2%	1%	2%	2%	3%	1%	2%	2%	2%	2%	1.8%
Ageing	9%	9%	9%	9%	9%	9%	13%	10%	9%	8%	10%	8%	8.7%
Health	9%	8%	7%	6%	7%	7%	11%	8%	7%	7%	8%	7%	7.4%
Education and learning	15%	15%	18%	16%	17%	17%	13%	16%	17%	16%	16%	17%	16.7%
Social welfare / public services	17%	16%	16%	16%	16%	16%	19%	15%	17%	16%	15%	16%	16.0%
Leisure and recreation	2%	3%	3%	3%	2%	3%	3%	3%	2%	3%	2%	3%	2.7%
Security	2%	2%	2%	1%	2%	2%	3%	2%	2%	2%	2%	2%	2.1%
Government	8%	7%	8%	9%	8%	8%	4%	7%	8%	8%	7%	8%	7.8%
Management	3%	2%	1%	4%	1%	2%	0%	2%	1%	2%	2%	2%	1.8%
Work organisation	4%	5%	3%	3%	4%	4%	0%	2%	3%	4%	3%	3%	3.2%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

ANNEXE F – AGE & GENDER ANALYSIS FOR IST CHALLENGES

CHALLENGES that R&D needs to address in IST
Results by age ---------------------------------

☐ **<40**   ■ **>40**

Challenge	<40	>40
Establishing more user-friendly systems	52%	66%
Enhancing security of transactions and personal information	57%	59%
Reducing threats to privacy and civil liberties	39%	30%
Freedom from intrusion (advertising, spam, etc)	32%	31%
Enabling trust/ authentication of parties in IST-mediated activity	28%	33%
Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests	30%	28%
Improving measurement of effectiveness of interventions	20%	17%
Enhancing protection of Intellectual Property Rights	24%	14%

FISTERA Delphi 2004-5   *% of respondents*   *<40 Base: 176 Resp.*   *>40 Base: 299 Resp.*

Age & gender analysis: Notice that the most important challenge for participants younger than 40 (above) is shared by female respondents (below), that is: *enhancing security of transactions and personal information*).
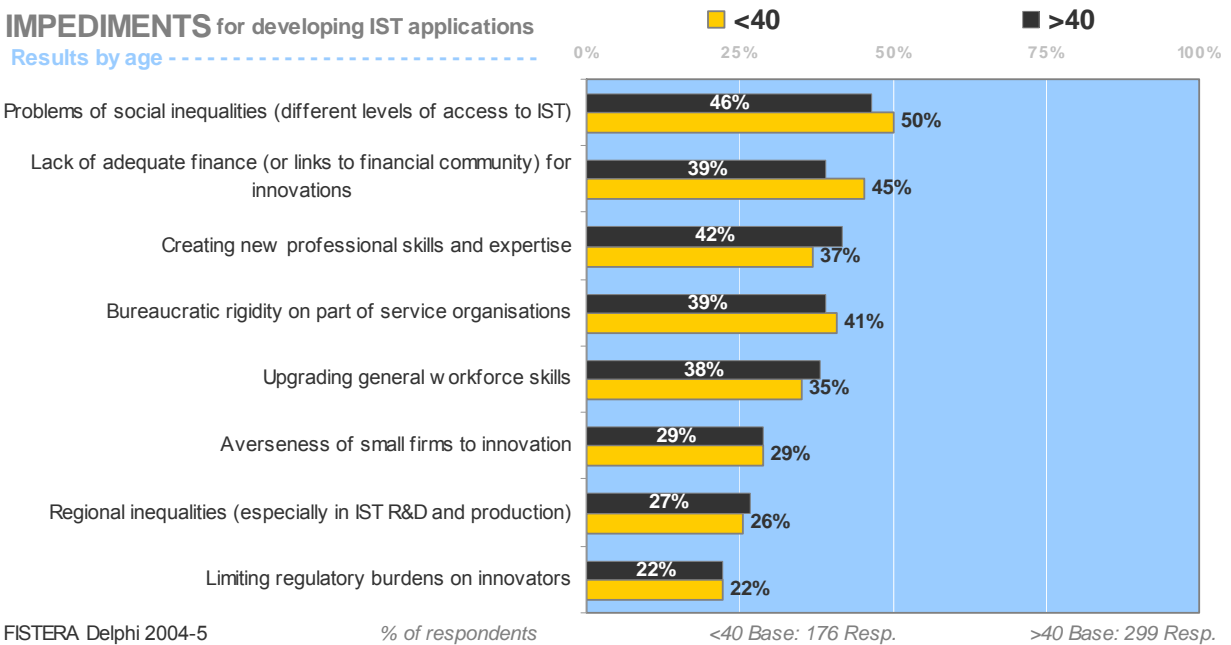
In general, these results are similar to the previous regional and occupational analysis, but perhaps we should highlight the strong consensus among female participants with regards to the second challenge.

CHALLENGES that R&D needs to address in IST
Results by gender ---------------------------

☐ **Female**   ■ **Male**

Challenge	Female	Male
Establishing more user-friendly systems	57%	62%
Enhancing security of transactions and personal information	65%	56%
Reducing threats to privacy and civil liberties	35%	33%
Freedom from intrusion (advertising, spam, etc)	30%	31%
Enabling trust/ authentication of parties in IST-mediated activity	24%	34%
Protecting vulnerable individuals from exploitation by unscrupulous people or commercial interests	34%	27%
Improving measurement of effectiveness of interventions	18%	19%
Enhancing protection of Intellectual Property Rights	25%	15%

FISTERA Delphi 2004-5   *% of respondents*   *Female Base: 115 Resp.*   *Male Base: 362 Resp.*

ANNEXE G – AGE & GENDER ANALYSIS FOR IST IMPEDIMENTS

IMPEDIMENTS for developing IST applications
Results by age -

■ <40   ■ >40

Impediment	<40	>40
Problems of social inequalities (different levels of access to IST)	50%	46%
Lack of adequate finance (or links to financial community) for innovations	45%	39%
Creating new professional skills and expertise	37%	42%
Bureaucratic rigidity on part of service organisations	41%	39%
Upgrading general workforce skills	35%	38%
Averseness of small firms to innovation	29%	29%
Regional inequalities (especially in IST R&D and production)	26%	27%
Limiting regulatory burdens on innovators	22%	22%

FISTERA Delphi 2004-5   *% of respondents*   *<40 Base: 176 Resp.*   *>40 Base: 299 Resp.*

Age & gender analysis: Here we can see that participants younger that 40 (above) and female respondents (below) managed to reach a high consensus on the top impediment.

We should also notice that *bureaucratic rigidity on part of service organisations* have a 49% of the women votes but in terms of EU25 it is in fourth position.

IMPEDIMENTS for developing IST applications
Results by gender -

■ **Female**   ■ **Male**

Impediment	Female	Male
Problems of social inequalities (different levels of access to IST)	50%	47%
Lack of adequate finance (or links to financial community) for innovations	45%	40%
Creating new professional skills and expertise	40%	40%
Bureaucratic rigidity on part of service organisations	49%	37%
Upgrading general workforce skills	37%	37%
Averseness of small firms to innovation	24%	30%
Regional inequalities (especially in IST R&D and production)	31%	25%
Limiting regulatory burdens on innovators	14%	25%

FISTERA Delphi 2004-5   *% of respondents*   *Female Base: 115 Resp.*   *Male Base: 362 Resp.*

26/04/05   137

ANNEXE H – AGE & GENDER ANALYSIS FOR EU ACTIONS

EU ACTIONS for effective & socially beneficial IST   ☐ **<40**   ■ **>40**
Results by age -

Action	
Social and institutional innovations	62% / 63%
Reducing the "digital divide"	50% / 34%
Improved communications infrastructure	39% / 47%
Development of new & improved IST applications	39% / 38%
Better IST training and awareness programmes	36% / 39%
More diffusion & deployment of current applications	35% / 36%
Application of other technologies (e.g. biotechnology)	23% / 25%

FISTERA Delphi 2004-5   *% of respondents*   *<40 Base: 176 Resp.*   *>40 Base: 299 Resp.*

Age analysis: Results show high level of consensus on actions towards *social and institutional innovations*. With regards to *reducing the digital divide* there is a consensus for Over 40s but this not the case for Under 40s.

Gender analysis: here we see a 59% consensus among female respondents on the importance of reducing digital divide.

EU ACTIONS for effective & socially beneficial IST   ☐ **Female**   ■ **Male**
Results by gender -

Action	
Social and institutional innovations	61% / 55%
Reducing the "digital divide"	47% / 59%
Improved communications infrastructure	42% / 42%
Development of new & improved IST applications	44% / 33%
Better IST training and awareness programmes	31% / 43%
More diffusion & deployment of current applications	28% / 30%
Application of other technologies (e.g. biotechnology)	27% / 22%

FISTERA Delphi 2004-5   *% of respondents*   *Female Base: 115 Resp.*   *Male Base: 362 Resp.*

ANNEXE I – PANORAMIC DESCRIPTIONS FOR IST AREAS

I.01. Social and family relationships

Do social and family relationships need support, now more than at any other time? This is a hard question to answer definitively, since even such trends as rising levels of divorce and alcoholism might be due to factors such as relaxed social norms. But some of the factors that might be putting greater stress on relationships are the following:

❖ With increased geographical mobility families and social networks tend to be more dispersed.

❖ With pressure on work-life balances, many social groups find it difficult to maintain social contacts, or to invest enough "quality time" into relationships.

❖ Furthermore, many technological developments permit more individualisation of activities that were traditionally carried out in groups or collectivities. (Examples: microwaves make it easier for family members can eat at different times, videorecorders allow people to watch the same programme at different times (while increased numbers of channels mean that fewer people will share the same televisual experience, private cars isolate individual drivers….)

❖ And additionally, there is evidence for lifestyle differentiation, for the fragmentation of relatively common cultures (largely based on gender and occupational class) into a multitude of subcultures differentiated by consumption tastes and leisure pursuits. With less conformity to traditional.

Perhaps not coincidentally, there are also studies indicating decline in various forms of community participation, such as voluntary group membership and activity. Since social relationships involve communication, communication technologies are obviously relevant to them. However, there are some fears that technology will get in the way of person-to-person connections, and possibly lead to neglect or devaluing of face-to-face and physical contact.

There have been over two decades of experience with using ISTs in various ways to support social relationships:

❖ Meeting and making friends (particularly important to isolated people)

❖ Maintaining existing social relationships, e.g. by keeping in touch with family members, checking on the health and security of household members, etc.

❖ Supporting everyday functions by means of mobile communications and messaging, to help planning, coordination of activities, and the like.

❖ Engaging in joint social activities, e.g. gaming, discussions, hobbies

❖ Supporting working relationships

❖ Supporting Communities of practice, professional and otherwise

❖ Creating virtual communities around shared interests

❖ Enhancing physical communities by means of e-democracy and other activities with a spatial reference.

Alongside all of this have been continual expressions of concern about problematic features of such networking. As well as the pervasive issue of digital divides, these features include:

❖ Abuses of trust (especially those connected with paedophilia and fraud)

❖ Socially disapproved content (from pornography to terrorism)

❖ Risks to security and confidentiality of information
❖ Possible negative impacts on non-virtual social life and skills.

If we assume that pressure on social relationships pursued by traditional means will continue to grow, there will clearly be scope for further application of IST to support, complement, or even substitute for such relationships. We can confidently anticipate substantial increase in IST markets devoted to (or products capable of being applied to) social relationships, and alongside this an ongoing evolution of everyday and working life practices to use relevant devices and services. There will probably be policy efforts to encourage innovation along socially desirable lines, to reduce digital divides, and so on.

There will also be concern about protection of vulnerable groups, in particular, and about threats to privacy and civil liberties associated with increased capability to monitor the location and activities of individuals. These latter concerns are likely to be fuelled by all sorts of development in ubiquitous computing and personal location systems, and applications in the area of social relationships are no exception. Exactly what balance is established between different types of concern (physical security, criminality, terror versus privacy, freedom of information, liberties, etc.) and between institutional structures and regulations and innovations in technologies and services, is hard to predict. But the resolution(s) that evolve will influence and be influenced by technology development and especially by pioneering applications.

I.02. Cultural diversity

 "Culture" is a disputed term. Its meanings extend beyond those associated with ethnicity or national identity. What is evident in Europe is that whatever the homogenising effects of globalisation might be (and there are arguments suggesting that these are outweighed by centrifugal forces), the increasing integration of the EU, not to mention its enlargement, is necessarily bringing more cultures into closer contact with each other. This adds to a long tradition of cultural interchange, sometimes harmonious, sometimes with more friction. (Several EU countries have a number of distinct linguistic populations; some countries also have sizeable populations of Roma, etc.)

Data on migration also suggest that there will be more mingling of people from diverse backgrounds. The OECD's Trends in international migration (Paris, 2001) shows practically all of the EU15 experiencing a considerable growth in foreign residents over the period 1980-2000. The figure varies radically across countries; from 2% is Spain and Portugal to around 36% in Luxembourg (exceptionally high – most countries are below 10%). We can expect the figures for metropolitan areas to be much higher. And naturally these figures will not capture the cultural exchange associated with some other groups. (These include: naturalised citizens, second-generation (and later) minority populations, and those not classed as residents but nevertheless in a country for longer or shorter periods.) Though immigration is a politically sensitive issue in many EU countries, their economies also require workers at various skills levels, and the projected demographic ageing will need further support. (The EU15's population increased over the decade 1990–by 12.7 million – but most of this was due to net inward migration. Whereas in 1990 births outnumbered deaths by 658 000 in 1990, this fell to only 261 000 in 1999.) A review of TSER studies concerning immigrant cultures was published in 2003. This points out that the future is liable to lie somewhere between Open Door and Fortress Europe? Three main themes are addressed.

Migration: Migration is seen to be in large part a matter of "pull" – e.g. "the informal/underground economy is not caused by the presence of (often illegal) immigrants – rather the availability of work (illegal or otherwise) attracts migrants.

Living conditions of migrants: these are generally lower than those of local citizens (e.g. employment and housing) and while children tend to be better integrated than their parents, they are liable to perform relatively poorly in school, though there are of course many exceptions to this.

Migration and social cohesion: experience varies across the EU, with some countries being more assimilationist, some more "multi cultural". It was suggested that some convergence is taking place, and that no country can be considered to have a perfect strategy. While immigrants are not the only groups in society suffering social exclusion, they are more likely to be stigmatized, and this is reflected in figures for imprisonment etc.

Let us turn to the issues that are raised for IST and IST R&D. First, let us assume that multiple cultures are here to stay, whatever the vagaries of multiculturalism as a policy slogan. Indeed, we can expect that EU enlargement will mean that many countries, regions and cities will experience more migration from accession countries. Though these may fill many of the demands for work, formal or underground, global pressures are likely to mean that immigration from developing countries will continue in the search for income (as well as for reasons of family reunion, political asylum, etc.). Some implications are:

* ❖ IST can play roles in language training, multicultural education
* ❖ IST may provide tools for translation of speech and text
* ❖ IST may provide tools for linking immigrant communities to their countries of origin, possibly boosting trade and cultural ties
* ❖ IST may require adaptation to deal with cultural specificities – different languages and norms, most obviously. Possibly there will be moves to make websites etc. more accessible to people from different countries, just as disability discrimination is being addressed
* ❖ Efforts to deal with social exclusion of minorities from IST access and training may be required. There may be demands for more inclusion within IST R&D and production
* ❖ IST may be applied directly in efforts to counter discrimination, racism, abuse and the like. Conversely, fears of institutional racism may limit some applications of IST to collect data on ethnicity, etc

I.03. Transport and Mobility

There has been a considerable increase in practically all sorts of vehicular traffic, both for short- and long-distance trips, over recent years. Some commentators regard the demand for travel as effectively insatiable. But for many years IST protagonists have argued that there could well be substitution of much travel by telecommunications, "decoupling" transport from economic growth. Whether accomplished by IST or by policy interventions such as pricing and taxation, environmentalists have also argued for such a decoupling. The primary reason for this is that the increase in vehicular traffic is associated with serious environmental problems – carbon dioxide and other polluting emissions, depletion of resources, impacts of road-building, air and sea ports, and other related programmes. Thus attention has been given to "sustainable mobility", without which it will be very difficult if not impossible to meet targets for greenhouse gas emissions. Thus attention is given to limiting overall transport demand, and on shifting transport from private motor cars to other, less problematic,

modes. More energy-efficient and "clean" cars, lorries, and public transport are also seen as possible elements of the mix. But other problems are associated with the increase in land traffic, in particular. **Congestion** (reflecting imbalance between demand for road facilities and their supply) is associated with local chemical and noise pollution, as well as considerable waste of travellers' time. **Safety** is another concern, with transport-related accidents a major source of death and injury. Driving in difficult conditions, including congestion and other sources of delay, is a major source of **stress**. Insensitive road building programmes and the general increase in traffic impinges severely upon social and recreational **amenities** as streets become unsafe for children's play, unrelaxing, etc. Numerous EU projects have addressed future scenarios and research needs related to these concerns. The solution to the mobility dilemma is complicated and will involve reforms in regulation, taxation and transport markets, but in relation to IST there are numerous particular lines of interest. ISTs can be applied in long-term and daily transport and traffic planning, in the physical operation of automotive transport and in the informational operation of all types of mobility, in dealing with emergencies and in meeting emergency transport needs (e.g. evacuation) as well as routine ones. In relation to personal land transport some applications of "advanced transport telematics" include:

- ❖ **Demand Management** technologies and associated strategies for transport planners and managers to control the use of road space, to control access, and provide and price parking.
- ❖ **Travel and Traffic Information Systems** technologies and associated systems for capturing and making available such data (including route guidance, etc.) for those planning or engaged on trips.
- ❖ **Integrated Urban and Inter-urban Traffic Management Systems**: traffic network control, route guidance, travel and traffic information, parking management, emergency management and environmental control systems, ways of protecting vulnerable road users, etc.
- ❖ **Driver Assistance & Co-operative Driving**: systems to assist the driver and to communicate between the vehicles, with appropriate and effective human-machine interfaces, etc…
- ❖ **Public Transport Management and Information Systems**: together with technologies that give priority to public transport.

Though the emphasis above is largely on private cars and to a lesser extent public transport, many of the same sorts of IST application could be involved for pedestrian and bicycle/motorcycle use. In addition, IST is liable to play an important role in the operation and diffusion of less polluting vehicles, and in opportunities for extension of car hire and pooling practices. The demand management option above focuses on demand management by decreasing the supply or increasing the cost of transport opportunities. Of course, a longstanding theme in IST research has centred on acting on demand itself. Reducing the need to travel by allowing communications to substitute for movement. This has most been discussed in relation to telecommuting, and to some extent in relation to teleshopping, though in both cases there are various doubts expressed as to the efficacy of the strategy without complementary measures. (E.g. Teleshopping unless carried out with effective logistics and planning can mean large vehicles with paid drivers substituting inefficiently for smaller cars and unpaid drivers.) Various sorts of leisure travel appear to be less substitutable by communications, though it is easy to see how low-cost and high-quality video communications could displace some trips. In the case of tourism, much attention focuses on reducing demand for air travel. In all of these areas there is more scope for IST applications – e.g. in the creation of more local leisure environments, reducing the impacts of (and the need for) an exodus to rural areas, in better organisation of teleshopping, etc.

I.04. Ageing

It is well-known that EU populations are getting older. The details of this are spelled out by Coomans in an IPTS report. This points to three particular elements of the European ageing process, illustrated in the figure below. Each has implications for social and economic affairs.

First are the striking general ageing trends - increasing average age of the population. The share of people aged 65 and over in EU15 is projected to increase from 15.4 % in 1995 to 17.9 % in 2010, and this trend is expected to then accelerate significantly so that by 2025 this share will be 22% of total population (85 million elderly people).

The trend is significantly slower in Accession Countries, who in many respects are demographically lagging 10 to 15 years behind the EU15. The political concerns generated round general ageing mainly involve pension and health budgets. Coomans reports estimates that health and pension contribution rates would need to be increased by over 10% on average for the EU, just to cope with the age shift between 1995 and 2010 - and more dramatically after this date.
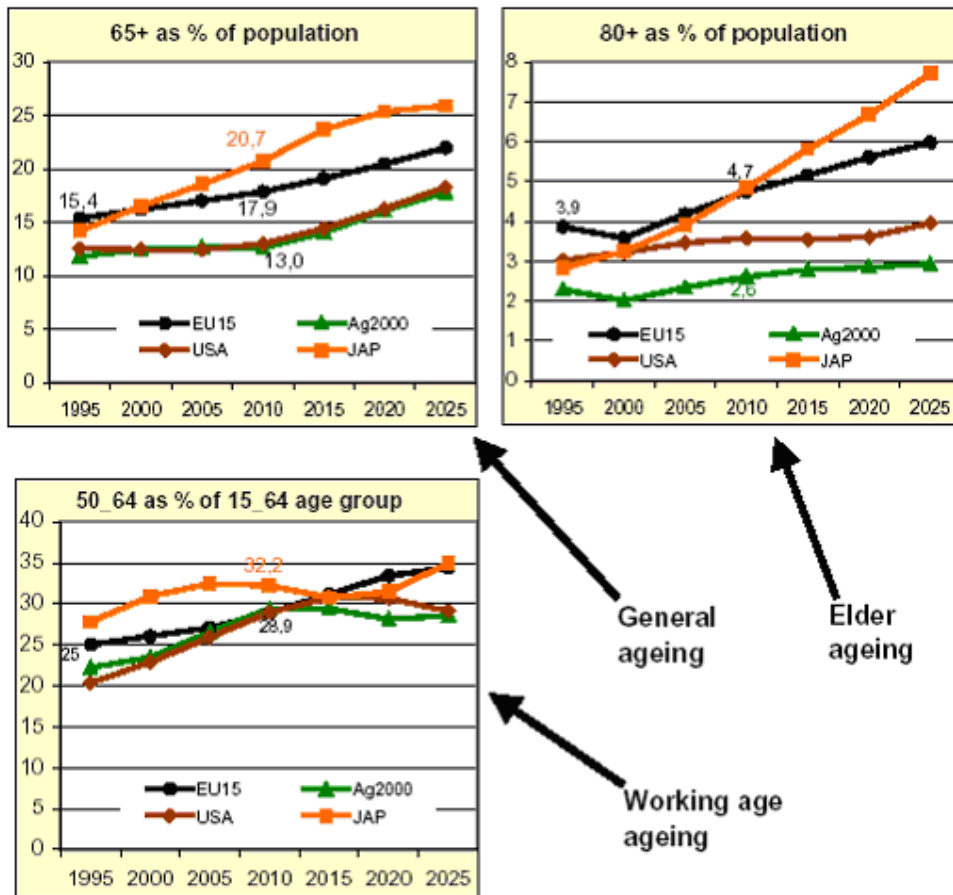
Source :   Eurostat 1997 Demographic projections (Baseline scen.)
                  UNO 1996 Revision World Population (Medium var.)

The second element is the ageing of the elderly, the growth of the share of substantially older people within the elderly and general populations. This has particular implications for health budgets. The number of people aged 80 and over is forecast to rise from 13.4 million in 1995 to 18.3 millions in 2010 (4.7 % of the population). This

accounts for around four-fifths of the expected 10% increases in calls on health budgets. Considerable work in eldercare will also be created.

Both of these first two developments imply shifts in final demand and consumption expenditures. Essentially, older people are less liable to purchase .household equipment and personal vehicles, while they spend more on health, personal services and leisure.

The third element - the ageing of the workforce - is also highly significant. The median age of members of the working age group (i.e. 15-64 year olds), is forecast to increase, too, from 37.2 in 1995 to 40.6 in 2010 There will be a substantial increase in the share of people aged 50-64, and a marked decrease in young entrants into the labour force. . This has substantial implications for job design, labour conditions, life-long learning and retraining, and such matters as work-life balances. Work force ageing may also be a matter of policy choice. Unless there were to be large-scale immigration, later age of retirement will be needed if employment growth is to follow its historic trends. This would mean the reversal of another trend – that towards earlier retirement.

It would be possible to consider these developments, and the ways in which they vary from country to country, in considerably more depth. It would also be possible to consider how IST is being applied in the health field at great length. But already it is possible to identify a number of clear implications of the discussed trends for IST and IST R&D:

❖ Shifts are likely in the types of product required by final consumers, and in the ease of use and design features of products in general. Substantial markets are liable to be created for more age-friendly designs.

❖ IST for life-long learning and retraining will also offer substantial opportunities, not least where it comes to training people in use of the rapidly changing spectrum of workplace ISTs.

❖ IST could be applied in the workplace to render more jobs age-friendly.

❖ However, there may well be shortages in terms of skilled and motivated labour for some of the more high-pressure IST jobs. This might support trends to offshoring, for example.

❖ A wide range of IST applications can be anticipated making all sorts of goods and services more attractive and easy to use by older people.

❖ Social needs for security and welfare support for older people – from alarms and communication systems to decision support and maintenance of social contacts and family support – will be inescapable.

I.05. Health

Overall, the EU is one of the world's healthiest regions, with the accession countries slightly behind the established members if the EU on most indicators. Life expectancy rates are high (the average length of life in 1991 for the EU15 was 76.5 years – a year higher than the United States, but three years less than Japan's). Infant mortality is low and falling, and children's dental health and experience of serious infectious diseases is improving. The major sources of death and chronic illness are "diseases of civilisation" such as heart problems, cancers, road accidents and the like. Chronic diseases and disabilities are major problems for elderly people, with problems like Alzheimer's becoming evident alongside arthritis and loss of hearing and vision. Variations in

health between countries and regions persist, and death rates are higher in people in lower socioeconomic groups and subject to unemployment. There are considerable problems and opportunities ahead.

Major problems include:

❖ Possible epidemics, and highly probable growth of hard-to-treat conditions, associated with development of antibiotic resistant bacteria.

❖ New disease vectors associated with globalisation and global warming.

❖ Financial problems as health services strive to cope with rising expectations and the ageing of populations.

❖ Promoting behavioural change required to combat obesity, addictions, and the like.

❖ Popular suspicion about medical expertise, and about unknown health consequences of environmental and technological factors.

Major opportunities involve:

❖ The emergence of new biotechnology-based methods of treatment, raising the possibility of more effective (personalised) conventional treatment, as well as new types of treatment such as gene therapy, therapeutic cloning.

❖ Improved understanding of brain function through neurological and neuropharmacological research.

❖ Improved surgical treatment and devices, based on new materials and other technologies.

❖ And of course, application of IST in the health arena.

IST can be applied in the course of medical treatment, as well as in health research and information programmes, aftercare, and health administration. The term "Ehealth" has been coined to describe such applications and Denise Silber, 2003, (in The Case For Ehealth) defines eHealth as "the application of information and communications technologies (ICT) across the whole range of functions that affect healthcare, from diagnosis to follow-up". Health applications will be motivated both by financial pressures and budgetary constraints, and by the health and medical requirements of older people. This will span a huge spectrum of applications. Some will be efficiency- and administrative- driven, such ad informatics support systems. (These also respond to the demands of a more mobile society, where individuals will need to have records transported across borders.) At the other end of the spectrum will be IST-enhanced medical support – prosthetics and surgical devices, drug delivery and biological monitoring and testing, and the like. In between will be many information services, advice and decision support services, and opportunities for patients and family members, as well as health professionals, to form communities and share experience and action.

Examples of applications within the health area are:

❖ Computer-assisted diagnosis

❖ Electronic health records

❖ Hospital information systems

❖ Online communities of professionals interested in particular conditions, and of patients and carers dealing with them

❖ Telemedicine (including remote diagnosis, monitoring of conditions, and support for surgery)

❖ There has been a considerable increase in practically all sorts of vehicular traffic, both for short- and long-distance trips, over recent years.

I.06. Education and learning

The importance of education and learning in the knowledge society reflects both economic imperatives (the future prosperity of the EU is liable to depend on its innovative use of knowledge) and social and democratic ones (individual empowerment). Economic concerns particularly focus on shortages of specific technical skills, not least IST-related ones – both high-level and more mundane. There are many voices arguing that skills are liable to become rapidly obsolescent, and workers retrained more often. Thus we hear suggestions that education may be becoming the EU's "largest industry". But this refers mainly to formal education. Lifelong learning has become a policy goal, and this involves providing wide access to learning opportunities of various kinds. There may be both formal and informal forms of educations following on from formal qualifications; and learning more broadly can happen in many circumstances. Traditional industrial training (in-house on-the-job, experience-based) may be supported by commercial provision, state and industry provision, and even voluntary initiatives – all of which may make use of IST. The issues will arise of setting standards, 'certifying' providers, and making attainments and credits transparent.

IST can have many roles to play in formal education:

❖ Helping design and deliver elements of the curriculum in new ways – ranging from enhanced classroom presentations through to online education.

❖ Allowing for new modes of learning, such as the use of simulations and virtual experiments, remote control of distant facilities, "immersive" virtual reality experiences.

❖ Allowing for new forms of interaction among groups of educators and of learners, using email and videoconferencing to share experiences and participate in joint activities.

Adult and Community Learning (ACL) is a term used by the National learning Network's Adult and Community Learning Information and Learning Technology Strategy (2003).[11] This does not just describe a sector (distinguished from further and higher education sectors, and from workplace training) – since, for example some educational establishments do provide ACL. ACL can be used to describe specific types of learning programme (e.g. those delivered by local authorities and/or voluntary sector organisations; those which are non-accredited adult education; those following particular informal and flexible approaches to adult learning; and so on). Given the difficulties in demarcating boundaries between ACL and other adult learning, the NLN concludes that a main characteristic of ACL is diversity (including diversity of locations at which it is provided, of sources of funding, of types of instructional material and experience). It can be, but need not be, of vocational relevance. It may be "information society awareness raising" courses, about everyday financial and health management, parenting, active citizenship, community renewal, and so on. Much of this is directed toward the socially excluded (and sometimes SMEs), but there are also functions relevant to people dealing with life transitions of all sorts.

Community learning is fostered by demands from communities, as well as from policy initiatives for life long learning, information society awareness, active citizenship, and the like. The likely scenario is for such demands and initiatives to expand, though there will be much uncertainty over precisely what areas of content will be prioritised, which social groups will be most targeted (or demanding), which sorts of provider will be involved (public, private and voluntary organisations all have roles), and what technological supports are used.

The likelihood, then, is that there will be growth in demand for devices and services that support various sorts of community learning. These will range from support to conventional instruction (e.g. presentation aids) through online learning systems, to new types of learning environment such as (possibly) virtual reality and video conferencing facilities. There will particular demands associated with:

❖ Excluded groups

❖ Trainers and content developers themselves

❖ Monitoring and evaluation of the process and outcomes of interventions.

It is widely believed that IST has a substantial role to play in:

❖ Supporting trainers in development of access to material, best practice guidelines, professional support

❖ Providing learners with open and distance, flexible learning resources tailored to their requirements, and with access to relevant learning communities

❖ Being a subject of learning in its own right (as providing tools to empower learners in many areas).

I.07. Social welfare / public services

The public sector is a huge consumer of economic resources across the EU, though it must immediately be said in its defence that many of thee resources go back into providing necessary infrastructural, human resources, and other conditions for economic activity. The EU-15's public expenditure in 2001 was over 44% of GDP, considerably higher than that of Japan (37%) or the US (30%). EU public sector employment was also correspondingly larger at 18% of all employment (US 15%, Japan 8%). Pressure has grown to limit public expenditure. At the same time, there is vocal criticism in many member states about the quality of public services – they are not seen as coping with new challenges adequately, and even the effectiveness of delivery of "mainstream" traditional services like basic health and education is under attack. Whether these criticisms are fully justified is naturally a subject of great debate, especially since many indicators appear to show improvements. Performance Improvement is thus seen as a priority by many governments, and this has at least three elements – efficiency, effectiveness, and governance.

Efficiency is pursued to reduce costs and bureaucracy, and release major resources into frontline services, allowing frontline professionals to focus more on the needs of clients. Given the high volumes of expenditure, even small proportional efficiency savings could free up considerable sums for service improvement. The UK government's Efficiency Review considers that efficiency gains can be achieved in:

❖ Procurement of goods and services from third parties

❖ Back office functions such as HR, finance, ICT, and estate management

❖ Transactional services such as payment of benefits and collection of tax revenues

❖ Policy, funding and regulation of devolved public services

❖ Policy, funding and regulation of the private

❖ Productive time of frontline staff who devote time to servicing the organisation rather than their clients

IST has long been seen as vital to efficiency improvements. However, many public sector IST programmes have encountered significant problems – cost and time overruns, failure to meet up to specifications, etc. While the scale of public sector organisations poses particular problems. It is likely that there will continue to be

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[11] http://www.aclearn.net/leadership/strategy/nln-acl-strategy.pdf

substantial pressure to find better ways of applying IST here. Efficiency savings may encounter limits posed by privacy and data protection rules.

Effectiveness includes better delivery of existing services (e.g. more timely and higher quality delivery, better supporting information and availability of choice to citizens, etc.). Often this can be facilitated through the use of IST, though this is no panacea for shortages of staff and funding.

Additionally, effectiveness can involve the provision of new services. These may be technological or service innovations such as new medical treatments, new educational modules, or rather wide-ranging conceptual innovations such as altogether new types of welfare service. The demands of a complex, rapidly changing, and ageing society (not to mention issues such as integration, security, and risk perception) means that there are liable to be demands for service improvement and innovation.

IST can find application in the innovation process itself – in innovation management, diffusion, assessment, and so on. There is much private sector interest in new tools for innovation management, and there are liable to be parallel developments in the public sector. But IST is also employed within innovations. Many of these innovations concern the informational components of services to the public – e-government, e-learning and e-health support, for instance. Telephone and online services have mushroomed in recent years, and much more sophisticated developments are likely in the future. (Not least as expectations are raised through experience of private sector e-services such as online and telephone banking). Health informatics systems demonstrate how information about patients and their treatment can be captured and used in the medical process, and similar approaches can be adopted elsewhere. Other IST applications relate to instrumentation (e.g. in medical devices, testing equipment, robotic surgery, etc.), training and logistics. There are again many ways in which public sector IST developments have parallels with developments in private firms.

Governance: public services are under pressure to be more accountable and transparent, and to allow for greater citizen participation in policy formation and implementation. The challenges of freedom of information, e-democracy, and dialogue between service providers and clients are liable to create demands for more IST applications in public services.

I.08. Leisure and recreation

There has been a long-term trend for the amount of leisure time experienced by the EU population (and by most groups within the population) to increase. In large part this is related to decreasing amounts of time spent in employment, but it also reflects such factors as population ageing. Alongside the increase in time is an increase in disposable income, with more resources to be spent on leisure activities; and, of course, a widening range of things to spend this money on, with proliferation of consumer electronics and other products, various types of holiday, and growth of leisure facilities from theme parks to sports and recreation centres, from heritage sites and museums to nature study and rambling[12].

Leisure and consumption activities are believed by many sociologists to become more important elements in defining who we are: to be more central a source of identity, some argue, than occupational or ethnic affiliation. Despite the growth of mass media and mass leisure experiences like he festivals, package holidays, major

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[12] A useful discussion of future tourist trends in Europe is European Travel Commission's Trends of Tourism in Europe available at: http://www.ntr.invanor.no/items/875.pdf

sporting events, there are also arguments that lifestyles are becoming more diverse and thus different leisure cultures are emerging and coexisting. In part this is associated with the trend towards smaller family groups and more single-person households, in part it is related to differentiation among age groups (e.g. marketing aimed at teenagers). Consumer electronics devices have long been a site of IST innovation, and while these were predominantly home-based audiovisual systems in the past, these have now been joined by personal and portable devices of many kinds (including those based around mobile phones and portable computers).   In-car devices have also proliferated. Traditional consumer electronic products have evolved, with widescreen TV, surround sound, and digital broadcasting being cases in point. Electronic devices have been introduced in competition with other types of consumer product – for taking photographs, performing music, and so on. IST has been used to enhance other leisure and recreational goods, for instance sports and training equipment, even do-it-yourself and gardening tools.

Many of these products have had extremely rapid uptake in the last decade, while there has been much slower development of more integrated systems. For a long time now, IST enthusiasts have talked of "interactive home systems", "smart houses", "home networking", "home automation", "domotique", and the like. There has been some spread of communications systems in the home to support distribution of media or computer access, to link up security alarms, and the like, but these are mostly limited and fairly isolated developments. Efforts to introduce products around standards such as Bluetooth are continuing.

In addition to products directly purchased but consumers, IST is applied in many leisure facilities outside the home. This has long been apparent in the case of electronic arcade games, but new technology is also being employed in cinemas (e.g. digital projection), theme parks, gymnasia (sports equipment providing detailed feedback on performance) even in museums and heritage sites (e.g. more advanced forms of hand-held information devices and guides, interactive exhibits). Often it has been the case that technologies and applications pioneered in commercial and educational environments have become the inspiration for consumer products. Thus we can anticipate IST applications to enhance leisure experiences, ranging from consumption of music and film through to participation in strenuous activity and hobbies. The technology may be used for purposes of planning, record-keeping, discussion of activities in virtual communities. It may be used to provide access to an increasing range of electronic materials, to provide more realistic and immersive experiences. It may be used to "escape" reality, or to "augment" it.

Some key Trajectories in Consumer IST can be summarised as:

❖ **Decreasing Size**. Smaller products are commonplace, as microelectronics devices (themselves 'miniaturised') replace bulky valves and transistorised circuit boards (transistors already allowed for the development and diffusion of battery-powered portable radios and tape recorders in the 1960s and '70s, for example.). The personal stereo which often features a very small amplifier and radio together with a cassette audiotape player became widespread in the 1980s - some recent models feature a CD player instead of a tape recorder. Portable TVs and videorecorders are now becoming commonplace.

❖ **Interface Innovations**. New Controls and Displays are being added to devices, as IT permits more detailed monitoring and reporting on performance. Microelectronic push-button and 'touch' switches and liquid crystal and LED displays, are being used in place of mechanical and electromechanical dials and switches; the new displays present more (or apparently more) precise data, often in numerical form.   The new controls may be designed so as decision aids for users of complex devices (e.g.

camera focusing systems, sensors in microwave ovens); in contrast, there is a move toward more programmable "brown goods" and "white goods", which may increase the complexity confronting the user. Safety features and warning systems may be introduced to inform users if equipment is malfunctioning or being badly used. Remote controls (mainly hand-held infrared devices) have become ubiquitous for audiovisual equipment, (and are now being applied to car locks and garage door systems); we are also seeing the emergence of long-distance controls, such as the devices that permit remote interrogation of telephone answering machines.

❖ **Data Storage and Retrieval Systems**. We later address the question of familiar products acquiring 'memories', here we consider the increase in memory of devices where data storage has long been a feature. However, many data storage/retrieval systems are sold as separate devices to 'plug in' to home entertainment systems, and thus they might better be thought of as new products which just happen to be improved components of hi-fi and TV systems. Thus, videorecorders add data storage capacity to TV systems, just as audiorecorders did to radio systems historically - though probably audio recording was largely a matter of the piracy of LP records, while much videorecording is taping of TV broadcasts. Recent instances of improving the capacity of existing (hi-fi) systems which use data storage are digital storage systems such as Compact Discs (CDs) and Minidisc and MP3 systems, which enable better quality reproduction, more rapid access to material, and storage of larger volumes of information, than earlier components like analogue record players and audiotapes. These devices are often capable of high levels of programmability (e.g. so specific tracks can be selected in a specific order). New IT products often involve data storage, and thus are on a trajectory of increasing storage power - e.g. home computers have moved from keyboard data input only, to being able to access programs and data from tape, floppy disc, CD-ROM, etc.

❖ **Improved Telecommunications**. Many innovations in the telecommunications infrastructure are reflected in changes in consumer products, e.g.: new methods of delivery of data, including Direct Broadcast Satellite (DBS) systems, new cable TV (CATV) networks, and the early stages of the evolution from existing telephone systems by the Integrated Services Digital Network (ISDN); mobile communications (cellular and portable telephones) which relax the traditional constraints on telecommunications services, and may well mean that telephone numbers come to identify individuals rather than locations; and communications systems within the home, including devices (e.g. baby alarms, local telephones) that communicate via the household electric circuitry ("mains signalling") and others that use radio, infrared, or other media.

❖ **New Functionality**. IT is being widely applied to products so that they are able to monitor and respond to new types of input, and provide new types of output: essentially, when microprocessors are being used to control devices, such functions appear to engineers as fairly obvious capabilities to build in. (The major problems are conformance to communications standards, and writing appropriate software). The addition of new functions to products is not always easy to distinguish from the improvements discussed in the previous subsection. Among the key trajectories here are the development of:

  o Memories. Here we refer to adding data storage capabilities to devices and services that did not function on this basis before. These capabilities can be based on tape, chips, or on new storage methods now becoming available (e.g. smart cards). Memories can be added to

household devices so that they can recall previous sets of instructions, and to communication devices to improve communications. The telephone answering machine can (like the CD) either be seen as a new product, or as a new peripheral adding increased functionality to an existing product (the telephone). Many new telephones themselves can store and recall frequently required numbers.

o   Safety and maintenance features. Microelectronic monitors can report on malfunctions and/or react on this automatically. As well as simple warning lights, there are, for example in some motor cars, autodiagnostic features which help garages to establish the source of problems. Cars are now being equipped with automatic braking and more advanced safety features.

o   Energy conservation features. Greater energy efficiency of motor cars is most notably being achieved by regulating their performance with microelectronic controls; and similar innovations may be applied to other energy-intensive goods, such as washing machines and dryers. There have been experiments, too, in shifting the time of energy use to reduce the load on power stations, by making high energy-consuming household devices operate at times of low electricity tariffs (a long-standing effort in this direction was the Economy 7 heating systems which drew from the electricity system at times of lower overall demand).

o   Digital features.   Digitalisation of consumer goods apply digital technology enables new capabilities for delivering and processing information; sometimes simple improvements of existing functions (e.g. the ability to open up multiple 'screens' or 'windows' on a TV), but often new features - e.g. the addition of teletext capabilities to ordinary domestic TV sets, which allows them to display news and other text and graphics data broadcast alongside the conventional TV signal. Since one of the most basic features of microelectronics technology is the ability to monitor the passage of time, a function added to many products is a digital clock - sometimes as a display only, but often this is a new feature of the product, since the clock can act as a timer to control the device.

❖ **New Types of Consumer Product**. Rather than enhancing familiar products by incorporating microelectronics within them, or producing their output via microelectronics, altogether new products are being created. Often these accomplish familiar activities in new ways. (It is hard to think of completely new activities, unless we are making very detailed distinctions between activities.) Some products that we have already mentioned may be seen as new products substituting for traditional products: CD systems are substituting for conventional record players to the extent that many recordings are only released on this medium and not on the conventional vinyl LP medium, and probably DAT or Minidisc systems for audio tape recorders over the next decade (if MP3 chips do not take over!). Push-button, memory, and mobile phones are becoming prevalent, to the extent that old dial phones are acquiring nostalgia value. The microwave oven has proved very popular as a novel way of preparing food, and while it is not strictly dependent upon microelectronics, new IT has been important in supplying robust and simple controls for these devices, without which their success might not have been so marked. Some of the products add to the functionality of existing products: the VCR releasing TV viewers from broadcasting schedules, the answering machine adding messaging capabilities to the telephone. Other products are more in a class of their own: video games consoles

and home computers used for games-playing might be thought of as substituting for traditional board games and the like (but they might also be thought of as adding interactivity to TV viewing). Security systems - intruder alarms, smoke detectors and health alarms, panic buttons, etc. - are another set of radical innovations that are difficult to categorise: are these adding to traditional home security devices (locks, doorbells, traditional fire alarms) and emergency messaging (999 calls), are they substituting for or supplementing human oversight, or what? New health products are also being introduced: e.g. digital thermometers and sphygamometers.

❖ **From Products to Systems**. Many consumer innovations are dependent upon wider networks: electricity and gas products require supply systems; the motor car depends upon a system of roads. Many products are associated with the introduction of complementary products that add to their functionality - for example, new types of convenience food have grown up alongside the microwave cooker. Many new IT products demand new complementary products: software programs for computers and consoles, TV and video programmes for new TV systems. However, new IT is associated with new types of networking capability in particular. Some products have always been network products - the telephone and fax, for example - but now many more devices can be communicated with remotely. This derives from the fact that microelectronic equipment handles data in digital ways, can be controlled by electronic signals, and can report on its activity in this form. In other words, it is possible to have devices controlled by other devices (we have already encountered one application, in the remote control). It is possible to have devices communicate with each other (e.g. in France "periTelevision" has been promoted, as a method whereby domestic TVs can display messages from doorbells, alarms, etc.). It thus becomes possible to think of systems or networks of consumer technologies, rather than of single products. To the long tradition of combining products, such as radio alarm clocks, radio tape recorder, and so on, new IT (due to miniaturisation and digitalisation) makes it feasible to put more devices into the same chassis. When new functions are added to existing products, this can be developed further: by using common controls, and swapping messages between components (the TV, the VCR, the timer, etc.), some integration of functions can be attained within a single unit. The networking of products that are distributed around (and even outside of) the house is a further step. Mobility has been added within some classes of product (the portable phone), but networking can extend this to effectively all IT-using domestic technologies. This goes beyond, say, simply sending audio signals from an amplifier to other rooms in the house: it allows control of the amplifier, the radio, and other types of equipment.

This class of innovations potentially represents a substantial transformation of domestic equipment. Specific items of equipment can no longer be viewed in relative isolation: their use will be affected by the structure of the network in which they are located. The trajectory here would seem to be one where common control systems are introduced enabling more and more devices to be operated from the same controls - with, frequently, the opportunity to consult and control devices remotely (e.g. turning on heating from the office, checking to see that devices have been switched off, being warned if there is an intruder, etc.)

I.09. Security

Here we are concerned with threats to individual and social well-being that stem from human actions such as crime, war and terrorism. Ways of dealing with such threats by using of IST often run into conflict with desires

to preserve privacy and civil liberties, which can be (or feel) threatened by techniques of personal identification (e.g. biometrics, face recognition systems) and location (e.g. determining the whereabouts of a mobile phone), monitoring public space (CCTV and the like) and communications traffic (interception/scanning of emails and telephone calls), inspection (e.g. alternatives to X-rays as means of detecting chemicals and devices), and information processing (large-scale databases on citizens, immigrants, etc., profiling of possible offenders). Technologies from bioscience, such as DNA profiling, have already become very important in policing, allowing for crimes from decades past to be solved in some cases. But technological systems can themselves be used for criminal purposes, or be the subject of attack.

Crime covers a huge spectrum, and just to mention some of the recent instances of cybercrime gives some indication of this:

- ❖ Blackmail of Internet-based firms by threatening their websites with Denial of service attacks.
- ❖ Various forms of online credit card fraud and "phishing" for individual financial data. (One recent US case also involves use of "keylogging" software to capture information being input in confidence into corporate PCs.
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New technology is widely used by police and other law enforcement agencies, though these widely report problems in keeping abreast of high-tech crime.   Technologies employed range very widely – databases and decision support systems (for recording and helping to solve crimes, and also to restrict access by certain types of offender to certain types of position of power), equipment for testing for drug use, systems for monitoring offenders (e.g. electronic tagging).

We might anticipate further use of IST by citizens, too, for instance in the form of emergency alarms (portable as well as household-based), remote observation of children when they are out of the home, and improved advice and counselling services of various kinds[13]. Terrorism has risen in prominence on the political agenda and in public awareness since the events of 911 and the Madrid bombing. But terrorism of one form or another has been experienced within Europe (e.g. Northern Ireland, the Basque region) and elsewhere. This reminds us that alongside the current issue of Islamist terror, there are threats associated with separatist movements. And – in addition to political extremes of various sorts and spill-overs from conflicts in other parts of the world – from cult-like groups, and more inchoate individuals (as in the US high-school massacres). The original definition of terrorism refers to actions designed to threaten and intimidate ordinary members of the public on a large scale, rather than those aimed mainly at military, economic, or state targets. Several recent attacks are of this form, and are designed to create large-scale death and destruction. Notably, they do not need to depend on weapons – they can turn some of the everyday tools of industrial society (such as aircraft) upon itself. In

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I.10. Government

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I.12. Work organisation

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