Tools for Pictures of the Future

Applying IST to European Goals – Developing and Deploying Alternative Scenarios

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Abstract. *This chapter describes the philosophy, procedures, and results of a scenario workshop, which was undertaken to explore the EU's pathways into the Information Society. It gave participants a chance to discuss how EU goals might be realised in terms of specific IST applications and of these different pathways. The workshop participants were sceptical as to how far the Lisbon Objectives could be realised by 2010. Furthermore, trajectories that move more rapidly toward some of the objectives may not be those that move most rapidly towards others. The results suggest that a plausible future is likely to involve a mixture of four alternative scenarios that were contrasted in the workshop. It was noted that all scenarios would require substantial social and institutional change, as well as technological innovation.*

Introduction

Scenarios are here taken to be *articulated visions of future possibilities.* Alternative futures may be sketched out in terms of one or two key variables, as might be the case in studies relying on simple models or extrapolations. A scenario should present a more fleshed out picture, systematically linking many details together (an "image of the future"), possibly with an account of how these have coevolved (a "history of the future"). Often, scenarios will combine quantifiable and non-quantifiable components.

Alternative scenarios are frequently employed in *multiple scenario analyses* in order to examine a range of opportunities and challenges that are liable to confront us. Alternative scenarios can be used to examine and demonstrate the plausibility of several, possibly diverse, futures. They can explicate how different trends and countertrends might unfold and interact – and what implications might follow from variations from the standard account of these developments. A range of alternative futures is required to test the robustness of policy and strategy conclusions across different paths of development. It can be elaborated so as to provide guidance as to signals that we are on one or other path, and signposts as to possible turning points, etc. Substantially different views as to the fundamental drivers of change and their relationships can be examined (allowing for "heretical" views to be given an airing, and to promote dialogue among proponents of different viewpoints).

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Scenario workshops form one of the most common methods for elaborating multiple scenarios, since they provide an opportunity for informed participants to pool their expertise and insights in order to develop shared visions. In the FISTERA project, such a workshop was employed to examine IST futures for Europe. This Chapter outlines this workshop: for a full report see Miles, Popper and Green (2004).

A Workshop to Explore Alternative Scenarios

Procedural Arrangements

The first FISTERA scenario workshop took place in Seville, at the offices of IPTS. It involved 31 participants, of whom 17 were external to the FISTERA project, who had been identified by members of the project, as being expert in IST, specific IST applications, or the areas to which these applications are oriented. This wide-ranging group, from across the EU, was joined by members of the FISTERA team.

An important feature of many scenario workshops is the provision of relevant **background material** before the workshop, in order to make it more likely that participants will have a shared understanding of at least basic issues. They were given details of the FISTERA website, and circulated with especially prepared background material on IST trends, material on developments in a set of areas of social concern where IST could find applications. etc.

The workshop was physically structured in a large room which was divided into two main sections:

- *The people zone* was mainly used for plenary work and smaller group discussion. It featured four tables around which participants sat: they could talk in four small groups for some of the time. By turning their chairs around, they could watch presentations and take part in more collective discussions at other times.
- *The info zone* was organised with a series of benches at which individuals could work and input material into networked PCs.

Both "zones" had video projectors that were used to display material from laptop PCs. Originally it had been planned to equip each table with a set of laptops which participants could use, so that they would not have needed to move from zone to zone, and could have moved seamlessly from discussion to data input. However, physical constraints rules this out, and in the event the layout worked well – with some participants noting that the physical separation of the PCs meant that groupwork did not suffer from the detachment of some individuals preferring to gaze into screens than to interchange with colleagues nearby. The movement from zone to zone provided some exercise and a demarcation between different

parts of the work. The one problem we noted was that one participant regularly took this as an opportunity to disappear with his mobile phone.

A set of tasks for the workshop had been prepared in advance - though as discussions developed (and time pressures increased!) some new tasks and modifications were introduced during the workshop. Instructions were presented verbally and with use of PowerPoint displays by the overall coordinator (Ian Miles). These instructions were also printed onto sheets of paper that were handed out to participants at the beginning of the relevant task. (These were printed "on the fly", so that adaptations could be made during the course of the workshop.) The small group work was facilitated by FISTERA team members. PC inputs were structured and processed through the groupware used in the parallel Delphi exercise (the web-based system Surveylet XP, from the Calibrum Corporation, managed in the workshop by Rafael Popper). This software is generally used for online surveys over large distances, but proved to be adequate in this group setting for activities like brainstorming and voting. In this chapter we shall not discuss the specific Delphi results obtained from the small group of people at the workshop – except to note that the workshop was effectively a chance to pilot the survey, and various (small) modifications were introduced as a result of feed back from the participants.

The workshop lasted for roughly a day and a half, with a dinner in the intervening evening providing a good chance for more relaxed discussion. The main sections of the workshop were:

- **Introduction and welcome -** This session explained the purposes of the workshop and the programme.
- **Initial group work –** Mainly a chance for participants to introduce themselves, examine their areas of interest, and experience working in four subgroups.
- **Groupwork 1 – Social Issues –** Four groups explored potential applications of the increasing functionality of ISTs in a set of specified areas. Here, as in other activities, there was an alternation between groupwork, presentation of groupwork to plenaries, input of material into PCs on an individual basis, and presentation of the results of such online work to plenaries.
- **Groupwork 2 – Scenarios –** The four groups then elaborated scenarios of possible IST futures in Europe; this was the last activity of the first day of the workshop. This is the part of workshop which the present Chapter will focus on.
- **Groupwork 3 – Applications in scenarios –** the groups considered what the prospects might be for the different applications across the various scenarios.
- **Plenary - Critical needs for research –** this examined the key areas for research and development in the EU, with participants identifying prioritise among a list of selected challenges and issues that European R&D needs to address in relation to ISTs.

IT Application Areas

The workshop was designed to discuss eight application areas, a subset of those addressed in the Delphi survey. For practical reasons (we could not host eight groups), these were grouped into four pairs of application areas. Each pair was allocated to one subgroup, sitting at one table, in the workshop.

The four pairs of application areas were:

- Social & family relations / Security;
- Cultural diversity / Social welfare;
- Ageing population / Health;
- Transport & mobility / Leisure.

These eight areas are of course not exhaustive of IST applications. The other areas addressed in the Delphi (Education and Learning, Work Organisation and Management) had been addressed in an earlier FISTERA workshop, though not a scenario workshop. It would have been difficult to encompass more areas in the workshop described here, though in retrospect it could be argued that the more "industrial" applications of IST should have been included at the expense of some more "social" applications. These would be good topics for a further scenario workshop.

"Starter" Scenarios

Scenario workshops can proceed in various ways, but one major distinction is between those that work (a) by means of assembly of components to form contrasting scenarios, and those which work (b) within a predefined framework. A typical approach for *type (a)* is for the workshop to first spend time defining and assessing trends and drivers that impact upon or shape the topic of concern. Then, a procedure is adopted to identify those specific lines of evolution that are most interesting for structuring contrasting scenarios – for instance, but ranking the factors that are seen as being most important and most uncertain in terms of how they will develop and influence the topic. A set of scenarios is then chosen on the basis of different patterns of development of these factors. (In a scenario workshop there will typically be three or four scenarios derived in this way – in a more elaborate exercise, alternative scenarios may be defined for each of a large number of factors.) A typical approach for *type (b)* is for a predefined set of (multi-purpose) scenarios to be proposed to the workshop, which is encouraged to further elaborate on these scenarios as they influence the topic under consideration. An intermediate approach – *type (c)* – should also be sketched in. This involves starting with very skeletal archetypes of different patterns of development. These profiles of the future are very much less fleshed-out than the starter scenarios used in workshops of *type (b)*. One group that has made much use of such an approach is the Institute for Alternative Futures (IAF), as explicated, for instance, in Bezold

and Miles (2002). For instance, the IAF approach can request participants, after initially examining trends and drivers, to attempt to define what, in the topic of concern, would constitute futures that are better than business as usual would lead us to expect; that are worse than this; and that are substantially different in terms of the pattern of change. Often there has been some preparatory and tentative filling in of scenario details in an effort to provide material with which participants can engage.

The FISTERA workshop actually lay between *types (b) and (c)*. Four skeletal profiles of the future European Information Society had developed on the basis pf a literature review, and discussions with the FISTERA team. These were presented to the workshop as the starting point for its scenario analysis. The PowerPoint used for this purpose is reproduced in Figure 1 below. Table 1 presents a provocative overview of characteristics of the four profiles, that was presented to workgroups as a further point from which to launch their analyses. It was stressed that this was merely *one* person's view to react against, not as an authoritative account of the profiles (Table 1).

The verbal presentation explained the rationale for multiple scenario analysis, and stressed that the four profiles are not a simple two-by-two matrix created from contrasting high and low values of two parameters. This is why curved lines were used instead of graphical "axes" in the Figure. The groups were asked to give their scenarios descriptive names; a first shot at these is reproduced (in blue text) in Figure 1, and subsequent ideas are mentioned below. In order to help the groups consider the drivers that could move us from the present to one or other scenarios, a list of drivers for positive and negative scenarios of EU IST development that had been established in another recent study of IST futures (SEAMATE) was circulated.

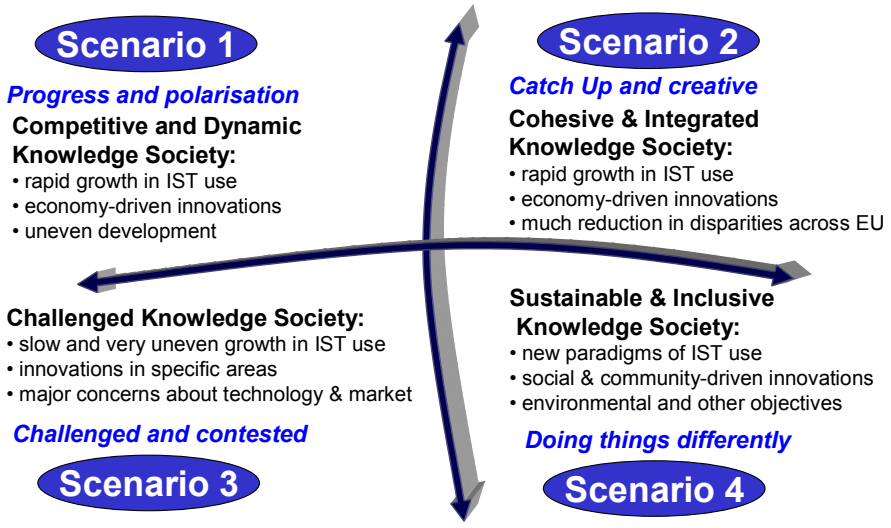


Figure 1. Four Profiles of the Future – "Starter Scenarios".

Table 1

A Speculation about the Characteristics of the Four Profiles

	Scenario 1	**Scenario 2**	**Scenario 3**	**Scenario 4**
EU competitiveness	++	+	-	+
EU dynamism (innovative)	++	+	-	++
EU productivity	++	++	-	+
Job creation	++	++	-	**?**
Job quality	+	+	**?**	++
Social Cohesion (regional)	-	++	-	+
Social Inclusion	**?**	+	-	++
Sustainability	**?**	-	**?**	++
IST Use Styles	**+Δ**	+	-	**ΔΔ**
IST in Work & Organisations	++	++	-	+
IST in Everyday Life	++	++	-	++
IST in Communities	**?**	**?**	--	++
Non-IST innovation	**?**	+	+	++

Key: - = decrease, + = increase, Δ = qualitative change

This was used as a provocative seeding of discussion of the profiles.

Results

IST Applications

The workshop participants were asked: what could be important applications of the new IST functionalities in the decade after 2010, in the EU? The idea was not to generate a comprehensive and exhaustive exploration of all conceivable applications – rather we hope to start to gain a more concrete perspective on what future IST applications could look like (breaking free of the present); and to capture enough of the range of IST applications both to enable participants to think in broad terms about future possibilities as engage in successive tasks in the workshop, and to provide useful insights for policy-making and post-workshop research.

The groups were asked to consider their two application areas sequentially, first by brainstorming on the two specific IST applications areas, and then by discussing what key applications of IST might be in the specific area, and what problems might confront such applications. After this discussion, they were asked to select 2-4 applications within each of their areas that they considered particularly important (in terms of being likely to be widely used and confer social and economic benefits to at least some parties). (Groups were advised that the choice of applications would be interesting should it involve very distinctive applications, raising very different issues and implications; disruptive innovations that could be used to change the way that people live and work in major ways would be

particularly interesting.) They were asked to prepare an account of the applications to be presented back the plenary, exploring ideas as to the social need and/or market opportunity concerned, the possible size and nature of the market or the target group of users/beneficiaries, and any obvious problems that are liable to arise in respect of the application.

Groups recorded their applications on the computer system, and presented their applications to the plenary, where issues arising were further discussed. We will not go into much detail about the applications that were considered in this stage of the workshop, and the workshop judgements on the contribution of different applications to EU goals has been subsumed into the discussion in the Delphi chapter in this book. We will discuss the thinking about applications *within* scenarios after considering the scenario analysis.

Fleshing Out the Scenarios

Four groups were each group was given one of the four profiles introduced earlier to work with. They were asked to construct a plausible scenario that could correspond to the profile, to consider how the circumstances that define the profile might come into being, and what these might then look like in more detail. First, the groups were asked to reach agreement about the overall characteristics of the scenario; if there are very different interpretations that the subgroup finds plausible, then they should choose one that is likely to be particularly interesting and instructive in terms of capturing issues that the EU really needs to attend to. Second, they were asked about the main forces that would lead to this state of affairs, the drivers of the scenario (using methods such as STEEPV (examining Social, Technological, Economic, Environmental, Political, and Values factors) to get a well-rounded view of drivers. They were asked to indicate the most important of these factors. Third, the subgroups were asked to describe the main social, economic and political characteristics of their scenario, e.g. what it looks like in terms of IST development, diffusion and use, among different types of user and society (government, large and small businesses, etc.). The subgroups were also asked to consider the main problems that the scenario might confront in terms of extending use of new IST.

After groupwork, and inputting material into the online system, groups presented and discussed the scenarios in a plenary session. The entire group was asked to indicate how far the future was seen as being likely to resemble each scenario. Note that this was not an effort to determine the likelihood of each scenario – the participants were NOT assigning probability ratings to each scenario. Though this approach is used in some studies, we believe it to be conceptually flawed. NO scenario will ever be realised in its entirety. The accurate probability of any scenario will be zero – it is more appropriate to consider *how far*

a scenario might materialise. The future can, however, feature a mixture of elements of each of the scenarios (which means that there is an interesting question about how the different elements might be coherently combined). Participants were asked to vote as to where they felt that each scenario would fall on a scale from being "not at all" to "completely" reflected in the future.

Figure 2 presents the results of this step, presented in terms of how far the future is seen to capture elements of each scenario. There was quite a lot of disagreement within the group, which could derive from (a) different estimates of the likelihood of specific scenario elements being realised and (b) different weightings put on these different elements by various respondents. There was little time to pursue these possibilities in the workshop, but a future workshop might design into the online tools the ability to capture information about precisely which scenario elements are seen as most liable to be reflected in the future, and to allow for scope as to how these might be combined.

As we would expect, none of the four scenarios is thought likely to be "completely" represented in the future. Indeed, overall, the most common rating was that the scenarios would be captured "a little bit" in the future.

The results indicate quite distinctive views as to the distribution of scores being very distinctive for each scenario. However, each of scenarios 1, 2 and 3 are rated by a majority (almost 2/3) of participants as characterising the future to "moderate" and "considerable" extents.

- Scenario 1 ("competitive and dynamic") received a wide spread of reactions, with the most common view being that it would be reflected "to a moderate amount". (This is the only scenario where this is the case.) Overall, it just manages to achieve the largest share of ratings for "moderate" and "considerable" amounts, but this is due to one vote only.
- Scenario 2 ("cohesive and integrated") is outstanding in that all participants consider it to have some representation in the future – there were no votes for "not at all". The most common expectation was that it would be captured only "a little bit" in the future that will be achieved. (It shares this feature with scenario 4, but differs from that in that there is otherwise more expectation that more of this scenario will be realsed.)
- Scenario 3 ("challenged") is the one which is felt most often to be substantially represented in the future. However, it evoked differing responses from participants. The most common expectation (though still a minority view) was that it would be realised "to a considerable extent" – and this was the only scenario where this proved to be the case. But more people thought this scenario would not happen "at all" than was applied to any other scenario, (The "considerable extent" rating was the smallest "peak" of ratings across the four scenarios, and indeed the distribution of views as to

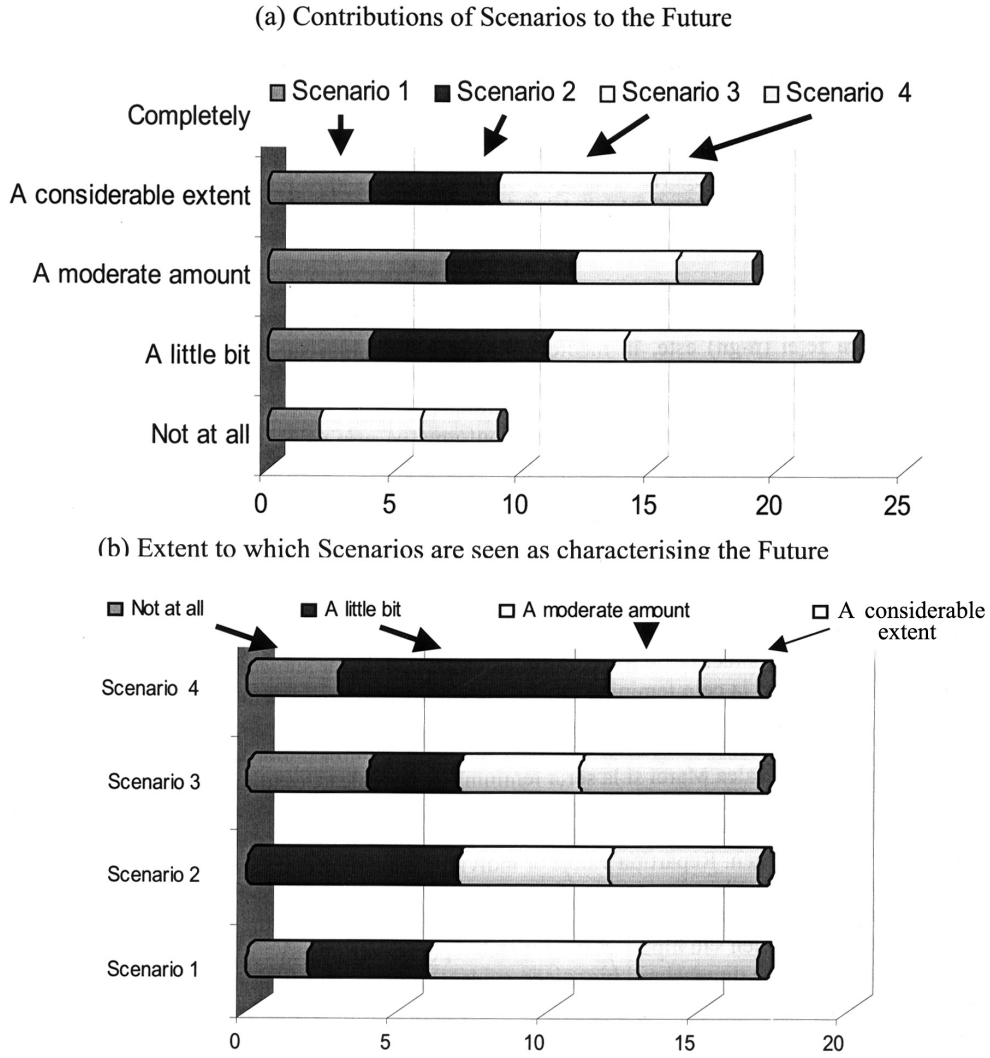
this scenario is somewhat bimodal with both "not at all" and "considerable extent" receiving more votes than "a little bit" and "a moderate amount".).

- Scenario 4 (the "different" scenario) was predominantly felt to be captured only "a little bit" in the future that will be realised. (More people actually felt that scenario 3 would be realised "not at all" than felt this for scenario 4, which was next in terms of this response.) This scenario had the fewest people believing that the future would reflect this scenario to a considerable extent.

So what were these four scenarios? The groups had been asked to flesh out scenarios from the four profiles that had been provided at the outset, introduced briefly in the previous section of this chapter. Below we present a summary of the points made by each group, followed by a brief account of points made by the groups as they considered how the supply of and demand for specific types of application might unfold in each scenario.

Scenario 1: The working group found some positive elements to this scenario, though overall it was considered to represent a largely undesirable, somewhat Americanised future (thus a possible title was "US or them?"). Here. governments would establish conditions for enterprise to flourish and markets to grow. Innovation is high and profit-driven, with markets appearing and high levels of consumer demand for new products. Companies increase their investment in new market-oriented R&D, while the state underpins this with investment in basic research, education and training. The attitudes are techno-optimistic, individualistic, entrepreneurial and materialistic (with expectations of high quality technologies and services). There is some push in environmentalist directions, supporting a substitution of telecommunications for travel that has also been driven by security concerns. There would be both large and visible innovation successes and failures, and a lack of general standards (proprietary systems increase their hold). Universality will not be mandated for new services, which will therefore be unevenly available - though basic services will be commonly offered. There will be considerable problems with social cohesion, and associated issues such as crime. Digital as well as social divides will be apparent, with a growing underclass of excluded people. One wild card suggested for this scenario was that some countries might pull out of the EU!

Applications - Scenario 1 is characterised by uneven development, so while social applications will have a role, most applications will be market-driven, demand driven and (in the case of the most advanced applications) exclusive (at least until ongoing innovation has cheapened them extensively). Expensive niche developments will proliferate, and even basic applications may not be available for all. The influence of US economy and culture may be profound.



Note: the data in the charts correspond to the numbers of respondents rating each scenario in terms of each of the five categories. (Note: no-one believed that any scenario would be "completely" reflected in the future.) 17 people answered these questions – the FISTERA core members tended not to participate in such votes.

Figure 2. How far will each Scenario describe the Future?

Scenario 2: This scenario can be characterised as involving a Europe that is creatively "catching up", with a largely successful policy of cohesion across member states. Member states and the EU provide cheap and affordable access to communication and education infrastructures, and create favourable conditions for

immigration and mobility of highly educated human resources. The IST supply-side is competitive and innovative, attending to major user requirements so as to stimulate high levels of uptake and efficient application of the new technologies and operating principles in government and business. Governments support improved links between the science base and industry, and help in the development of major innovations. Policies that can promote and support start-ups are important. Bankruptcy is no longer seen as a huge sin, but as a risk that can be accepted and recovered from. Being innovative is a valued trait, with the understanding that this need not be commercial innovation, but also involve cultural and social innovation and entrepreneurship of various kinds. Cultural diversity and EU specificities are valued and built into many of the new services – actually facilitating creation of competitive new products. Social cohesion and exclusion issues within countries may still be problematic however. Mobility and labour force harmonisation problems could be major barriers to progress here.

Applications - Scenario 2 would feature the availability of socially-oriented applications at different levels of service. Most basic services will be available to all, with subsidies for those in need. Compared to the first scenario, there are larger markets and more even patterns of development – and with a larger critical mass, with much R&D and public support, there could be more rapid development. More emphasis on user interfaces was expected, and the technical skills to use IST should not be too high. (User need analysis will be a part of support for research, then.)

Scenario 3: This scenario was felt to have many "business as usual" features, extrapolating many examples of current practice. The negative links between IST use and economic performance and employment, postulated in Table 1, were rejected: there was no necessary link between IST use and job creation or loss. The scenario could feature problems associated with overinvestment in some "overhyped" technologies and associated market distortions. (Some of the efforts to build e-learning and 3G services were seen as possible examples.) But there could well be a reaction to such excess, and there are some benefits for "laggards" in being able to learn from the mistakes of frontrunners. Security concerns, and problems with the technology itself, were expected to be major drivers of this scenario. Security concerns might lead to efforts to regulate Internet usage (and other data exchange): such efforts might limit use of and achieved benefits from many online services. Technology problems could lead to a lack of trust in advanced technologies, also reducing uptake, for instance, of ecommerce. Part of the problem is that market forces would be leading the IST supply side to develop solutions more oriented to the needs of large firms than those of smaller firms. There may be some niches and segments where small and regional companies can prosper. Examples here might be e-content and digital rights management systems – where we could see emergence of a 'pay for all' / 'pay per use' model. Some groups might resist paying for some services, with the consequences of reduced internet usage and cultural diversity. Another driver would be poor social cohesion across the

EU - which these trends might intensify. Market and technology problems might then lead to some efforts towards self-sufficiency, perhaps with more local-level development of user-orientated systems, reflecting diverse business and cultural orientations. In general, though, the view was that this scenario would tend towards more centralised development, for instance, of software.

Applications - Scenario 3 features more conflict and contestation – reflected in the persistence of conflicting standards. High concerns with respect to private data and other security issues will limit some applications, and the political crises faced by governments may make it difficult to develop major programmes and common standards.

Scenario 4: The workgroup provisionally entitled this the "Sustainable Social Market Economy". They listed many desirable features of the scenario – but, ironically, felt that only a serious crisis of some form would set us on this path. Among several possible crises, the group proposed a narrative in which war and political instability have given rise to a major energy crisis, with associated economic disruption, high levels of unemployment, etc. The US model of economic growth, along with its international relations and foreign policy, is seen to have failed comprehensively. Individualistic attitudes are seen as having contributed significantly to common problems. There is major dislocation and re-arrangement, with major political shifts and a new generation taking power– but note that there is no substantial invigoration of the far right (further work would be needed to explicate how this might be avoided). Europe moves toward something much closer to a Nordic model of socially-oriented development, with great stress on social inclusion, participation and consensus. The sustainable social market economy implies a retention of capitalist economic principles, a market state as the framework, with much more emphasis on sharing and ethical principles (thus increase in P2P transactions and the gift economy), attention to inequities in the International economy (e.g. giving preference to developing economies where possible). The financial system is more oriented to ethical investment. The green movement is in ascendance. Accordingly, there is much emphasis on environmental innovations – and exponential increase in social and regulatory innovations such as pollution and carbon emissions taxes. Travel and mobility become much more expensive. The implications for IST are severalfold. Open Systems becomes the key vector of software development, with much more tendency for users to produce their own applications- or at least for IST firms to develop new applications in combination with users. IST is applied to support participatory decision-making. High levels of bandwidth are seen as a right for all citizens. Environmental concerns support use of 3D video-conferencing and other very advanced communications, virtual travel and leisure at home, employment in environmental activities and technologies. New methods of working become prominent. It may take a period to recover from the mass unemployment induced by the economic crisis, however, and the EU is likely to experience continuing skills

mismatches, with some time for education and training systems to adapt. Accession countries may take even longer to catch up than they would otherwise. A possible wild card in this scenario (and indeed in others) would be the discovery of substantial health risks associated with mobile telephony or other ISTs. Other big questions raised in this group were the possible evolution of climate change and of nuclear power – these could drivers of the scenario and/or additional complications.

Applications - Scenario 4 would see customisable systems, driven by open source developments will make it easy for final users to conceive of new applications. There would be greater public participation in development and funding for R&D – progress will be driven by social and environmental objectives. (High levels of literacy and education will be required to make this scenario a success.)

The scenarios were presented and discussed in a plenary session, following which the voting described earlier took place, A number of points were raised which are important for considering further development of the scenarios.

- It was agreed that there were numerous feasible courses of development, while none of the scenarios was completely convincing in its current form (as the voting indicated). They conveyed elements of the possible future, but how these elements might be combined is a big question, with several possible answers.
- Some scenarios – not just scenario 4! - were seen to require major cultural change to be fully realised.
- It was noted that there was very little consideration of disruptive technologies in these accounts. The major exception is the rise of Open Systems in Scenario 4 – and the shift to this induced by social change. The local developments that might happen in Scenario 3 were not portrayed as having systemic significance. (It could be useful for a workshop to focus explicitly on possible disruptions, even though surprising disruptions are tautologically difficult to foresee. It was also suggested that more time could be spent with wild cards.)
- Some "techno-push" was felt to be evident in most scenarios, and there was possibly insufficient attention to the user orientation of applications, though some scenarios did identify this as a key issue. (The next session of the workshop explored applications in more detail, in the context of the scenarios.)

The workshop also provided some impressions as to the various drivers that would promote one or other scenario, classified into a STEEPV format. The views input into the computer system are reproduced below. In developing a fully-fledged history of the future, especially one that leads to the sort of mixture of scenario elements that was felt to be most plausible, it would be appropriate to select relevant factors from the list below.

Social factors supporting the development of the scenario

SCENARIO 1 – ▸ As the emergence of radically new technologies, systems and infrastructures allows for fast growth in newly established early markets, new generation of IT 'haves' and 'have nots' emerges. ▸ Societal progress is based on economic progress. Individualised work relation between employee and employer.

SCENARIO 2 – ▸ Redesign careers ▸ Universal access to the communication infrastructure Affordable and accessible education infrastructure

SCENARIO 3 – ▸ Restricted access to Internet Server Providers for security reasons. Regret to early 90s!

SCENARIO 4 – ▸ increase in unemployment in the short to medium-term - greater health concerns - greater cultural understanding ▸ We saw this scenario as a kind of extrapolation of the USA. Wide disparities in income mean that only some people can afford premium services - the vast majority can access basic level services. But this scenario widens disparities and division, digital divide widens, rising social problems and more crime. Lack of universal service, geographically and socio-economically. ▸ Massive social dislocation and a shift in political allegiances as a result. The need to limit physical movement that will be increasingly unsustainable will trigger innovation in the social drivers of ICT. ▸ People turn to more participatory approaches that aim for solutions to the serious issues, to more sustainable solutions. ▸ The US policy has failed. Big environmental crisis made people more aware of the use of oil. The decisions are mainly by consensus.

Technological factors supporting the development of the scenario

SCENARIO 1 ▸Based on the emergence of a cluster of radically new technologies (e.g. related to quantum IT), internationally unrivalled industries will emerge in Europe. Global trade of new IT systems boosts European economic growth. ▸ Proprietary specific IST products and services, with different levels (and price settings) of service and support.

SCENARIO 2 ▸ User friendly solutions ▸ Development of user friendly application.

SCENARIO 3 ▸ New intelligent devices will appear on the scene based on PC & equivalent models. Personal and regional new technological models.

SCENARIO 4 ▸ Infinite bandwidth – widespread access to broadband ▸ Open source directed at mass market for developing software Tools for allowing users to make their own applications – large bandwidth and high storage capacity allows for "dirty", non-engineer like programming by the lay end user. ▸ OSS is already there. The technological limitations to broadband access are being rapidly removed. The

perceived need for telcos to safeguard their investment will no longer be as important so the ISDN and ADSL stories will not be repeated. ▸ Not so much travel is feasible Change in the use of communication technologies to wire based approaches (this changes the way society communicates) ▸ Some of the recent developments in wi-fi (longer distance and higher bandwidth) + big jumps in developing powerline transmission supports the development of this scenario. ▸ Private sector investment in creases in near to market research National governments and EU supports basic research, more investment in education and training ▸ Lack of standards, proprietary systems dominate ▸ Investment in "green technologies"

Economic factors supporting the development of the scenario

SCENARIO 1 ▸ RTD efforts are dominated by private investments, e.g. by those of the multinational corporations aiming at exploiting the knowledge and skills available in Europe. ▸ Liberalisation; privatisation and free market approach; limiting distributive ability of government. Big companies show the way.

SCENARIO 2 ▸ Founding new excellence institutes Mobility of workforce in Europe ▸ Favourable environment for starting small business.

SCENARIO 3 ▸ Strength new payment mechanisms will appear in Internet and this will determine new rules of use.

SCENARIO 4 ▸ High petrol prices make transport too expensive so that transport becomes replaced by communications ▸ oil crises: dramatic increase in fuel costs - increase in transportation costs leads to greater use of telecoms - loss of jobs in energy-dependent sectors - creation of new jobs in green technology sectors and new IST applications ▸ labour market characterised by transitional skills mismatches ▸ increased demand for cultural IST applications, e.g. virtual travel; reduced demand for mobile telecoms ▸ Market driven - companies pursue profits, but find a markets for services from willing consumers Governments create conditions for competitive markets, through deregulation, liberalisation and privatisation ▸ Oil crisis. war in Iraq has caused a crisis in oil, which has change the traditional models of consumption. There are unavoidable trade-offs, people realise that they can not have the same level of growth anymore, they travel less, spend less, etc. ▸ Oil crisis Airlines became very expensive ▸ Unemployment is still an issue.

Environmental factors supporting the development of the scenario

SCENARIO 1 ▸ Looking for technological solutions of environmental problems. ▸ Environment is only dealt when it is disturbing, which means no anticipation or pro-active policy.

SCENARIO 2 ▸ These factors were not found relevant by the subgroup (at least, not in the time that they had to discuss the STEEPV factors).

SCENARIO 3 ▸ Uncertainly and uneven scenario based on powerful technology companies.

SCENARIO 4 ▸ Very polluted. People are aware of the danger. ▸ Wireless telecomm is a health issue ▸ There are significant environmental issues that worry society and that have also contributed to the realisation that there is need of change to more sustainable practices. It has been discovered that there are health issues with wireless communication. ▸ A wild card is the issue of nuclear power. This may well make a comeback after the next major middle east crisis. ▸ In terms of CO2 emissions/global warming and the needs of the Chinese economy it might be difficult to resist. ▸ Possibility that because travel becomes more difficult and expensive, pollution and urban congestion, companies go for telecommuting and teleconferencing etc in a big way - environmental degradation - climate change dirty environment, high petrol prices, reduces transport.

Political factors supporting the development of the scenario

SCENARIO 1 ▸ Liberal policy with few social corrections, because the market will solve social discrepancies (in the end). Lean government delivering efficient services. ▸ Little restrictions on extending market power and mergers.

SCENARIO 2 ▸ Innovative governmental policy for new enterprises. Innovative Gov. and private education policies ▸ Improve the link between research and industry development to exploit the Europe research base Create an favourable environment for attracting high quality immigrant work force in IST development.

SCENARIO 3 These factors were not found relevant by the subgroup (at least, not in the time that they had to discuss the STEEPV factors).

SCENARIO 4 ▸ US model has failed A better democratic system that is more participatory Nordic model has accepted by European people. ▸ Green party is more powerful People are highly participating in government ▸ Blowing up of the Near East due to US-led wars, produces dirty environment, high petrol prices, political change in favour of Green movement ▸ Emergence of a new political class – more direct participation by citizens in the decision-making process – politics based on consensus-building ▸ International terrorism and security fears, Middle East unstable lead to higher energy prices, stimulating substitution of telecoms and IT for travel. … if the EU becomes fragmented, some countries would be more likely to go down this path. ▸ The Spanish elections in 2004 highlighted the potential to remove unloved politicians. The same can be said of the UK, though an authoritarian backlash might be more likely there for cultural

reasons ▸ Countries with a more diversified economy with significant high tech sectors should find this option more politically acceptable. Those with a largely uneducated and de-skilled underclass concentrated in urban conglomerations will find it politically difficult to make the jump into this scenario.

Values & ethical factors supporting the development of the scenario

SCENARIO 1 ▸ Social divide is fostered further by the prevalence of individualistic values, including dominance of entrepreneurial, profit-orientated value systems. ▸ Individualism; materialism; quality of life expressed by income level; entrepreneurial spirit.

SCENARIO 2 ▸ Train high level scientists, professionals after retirement ▸ Cultural diversity and specificities of Europe is a base driver for the scenario ▸ Creating an innovation culture will be driver.

SCENARIO 3 These factors were not found relevant by the subgroup (at least, not in the time that they had to discuss the STEEPV factors).

SCENARIO 4 ▸ People are more healthy due to sport orientation (bike) Less polluting Learning is quite advanced but more skills are needed ▸ People do change their way of thinking to a way that is more responsible with the environment. There are probably better and deeper relationships between people. Sense of community also sees potential for improvement. ▸ Driven by individualism and entrepreneurial values, desire for more materialistic lifestyle, better standard of living, higher quality and cheaper service. ▸ Internalisation of externalities: polluter pays principle - greater concern for developing countries - green culture ▸ the open source movement changes from an expert to a mass user movement as the demand is so strong and the technology now allows for end user programming.

Critical Needs for Research

The key areas for research and development in the EU were examined in plenary (piloting the FISTERA Delphi survey) Participants were asked to prioritise among a list of selected challenges and issues that European R&D needs to address in relation to ISTs. A list of eight R&D issues (formulated during earlier meetings in the FISTERA project) was provided, and participants were asked to vote for the 3 issues that were believed to be of particular importance for Europe. Participants were also offered the option of adding new issues. (This is just one of a number of tasks, but will be focused on for reasons of brevity. Topics such as constraints on IST development were also considered.)

The full results of the exercise are described in the workshop report, but we can briefly note that three areas were highlighted by participants as the key foci for the application of IST R&D effort:

- *enhancing security of transactions and personal information;*
- *establishing more user-friendly systems;*
- *enabling trust and authentification of parties in IST-mediated activities.*

Conclusions

Of course, the results of a scenario workshop are dependent upon who is a member of the workshop, what inputs they have been given to work with, and what the workshop process is. A group comprised solely of engineers or political scientists, or drawn mainly from one or other set of EU countries, might have painted very different pictures of alternative futures. Discussions in the workshop itself speculated that had there been a larger share of business participants, different narratives might have been obtained for the four scenarios. It was also suggested that a business-oriented group might be more likely to endorse scenario 1. Finally, a different set of starter scenarios could have resulted in different sorts of analysis about EU prospects.

Nevertheless, the results do warrant serious attention, as being the conclusions of serious deliberation and debate from an informed group of experts of a range of IST-related topics. They suggest that Europe continues to face substantial challenges in its evolution as an Information Society. The Lisbon goals are unlikely to provide an adequate account of the state of the EU in 2010 and for at least some time later. A mixture of the four scenarios which the workshop considered was felt to be most probably - major issues need to be confronted in steering a course toward a more desirable version of this mixture. This could well form the basis of a norma6tice, "success scenario" workshop: but this would be another story.

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