

**TECHNOLOGY FORESIGHT:
IMPLICATIONS FOR SOCIAL SCIENCE**

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Technology Foresight: Implications for Social Science

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University of Manchester, 1997¹

Executive Summary

This paper examines the mutual contributions that social research and Foresight activities can make to each other, drawing on the experience of the UK Foresight Programme. The two fields clearly overlap in practice. Some Foresight activities are implicitly or explicitly social research, and Foresight is an element in at least the planning of social research programmes and priorities. Social research and Foresight activities can even be said to be interdependent, in the sense of mutually dependent, in the contemporary world of science and technology policymaking.

This paper is not the first to note this synergy. It seeks to explore the issues in more depth than previously, on the grounds that the synergy is currently recognised imperfectly. A large number of potential points of mutual contribution can be identified. We set out to do just that in a fairly broad-brush way - other contributions have shown the scope for examining detailed issues connected with the work of specific Foresight Panels.² The paper provides a view of areas where social research inputs can be used in the elaboration and implementation of Foresight, based on an analysis of various contributions to the Foresight exercise; and suggests that Foresight might be applied in social science itself.

The recommendations emerging from this study (highlighted in the text by being placed in shaded boxes) are:

¹ This paper was prepared for the ESRC, but all views and opinions are the responsibility of the author. Thanks for feedback to Peter Linthwaite of the ESRC and to the Human Factors subgroup of the Foresight Health & Life Sciences Panel. Thanks especially to Kieron Flanagan for assistance with analysis of Foresight Panel reports and the survey of ESRC researchers.

² Particularly relevant here is the detailed study by Andrew Webster and colleagues from SATSU on issues connected with the work of the Health and Life Sciences Panel. Unlike the present study, this provides an extensive review of the social science literature bearing on a selection of themes related to that work.

- Secondary analysis of materials such as the survey data arising in the course of Foresight should be encouraged. There is scope for extracting much more insight from these sources. (p6)
- The lessons of social research concerning the nature of public responses to technology and technological change, and the processes of “social shaping” of technology, have not yet been fully absorbed by all of those involved with Foresight. Effort should be made to understand how far this is “resistance to social science” itself (!) and how far a failure of dissemination. If the latter, a fairly straightforward task of presenting research results in an appropriate format/variety of formats and distributing these should be undertaken. If the former, study of the use and non-use of social research results, and the divergence of views between social scientists and other practitioners, may be indicated. (p10)
- The Foresight Process was oriented to establishing areas where technical and market opportunities coincide, and determining the requirements for and barriers to exploiting these. Policy analysis and instruments frequently emerged as issues here, but given the framing of Foresight, they could not take a central role. There is scope for building on Foresight to address these issues more directly, perhaps by cross-Panel working groups. Inputs from several existing programmes of social research - e.g. current ESRC Programmes on environmental issues, innovation and IPR - could be input into such groups. (p13)
- Panel recommendations with respect to specific instruments such as those for risk, life cycle and financial analysis, and more generally to the need for research, training, and links between the two in the field of management sciences and business processes, should be reviewed in detail by those in Higher Education. The Panel accounts are more elaborate than the points made by the Steering Group in its report. (p15)

- There is already an extensive body of both theoretical and applied work on innovation processes, technology transfer, and the problems of SMEs in the UK. Efforts have been made to render this work available in the form of teaching materials and consultancy advice. But it is clear that such efforts need to be extended (and examined to better appreciate why their impact has been so limited, if the Panels' diagnoses are to be believed). (p16)
- It is important to identify where the key points of contact in the social research community are in connection with the long list of issues, noted in this [study]. Efforts should be fostered to develop links between centres of excellence and the Foresight practitioners most concerned with these issues. A first step might simply be to encourage relevant research leaders to read those Panel reports which do raise issues germane to their efforts, and to liaise with Panels as then seems appropriate. (p20)
- Social scientists should conduct systematic appraisals of promising opportunities for using data and methods in social research, which have been identified or implied by the results of Foresight. The Foresight community should also identify such opportunities where they would contribute to better realisation of projects and goals suggested through the Foresight process. (p20)
- One clear role for social science, is the evaluation of the extent to which Foresight has succeeded in these aims. There is scope for comparative analysis of different Foresight programmes in other countries, and Foresight might also be compared to other instruments for creating networks and identifying priorities. There is also considerable scope for further work on the extent to which the now-familiar diagnosis of disarticulation between research and exploitation in the UK is a helpful one. (p21)
- Consideration should be given to the scope for launching Social Foresight programmes. These would give due weight to social research and social innovations (while not neglecting technological issues any more than social ones are

absent from Technology Foresight). These might be organised in terms of standard social science domains, or, perhaps better, deal with broad themes - e.g. Democracy Foresight, Urban or Rural Foresight, Welfare Foresight, even Ethnicity Foresight - that have not been tackled in the current exercise. Such activities could identify priorities for improved social understanding that would be complementary to those pinpointed in the OST work. Some may be political minefields - others may be found to be highly appropriate in the context of dissatisfaction with established party politics and representational structures. (p22)

- Social Scientists might have more input into the process of “sectoralisation” used in Foresight exercises; more importantly, perhaps, they should be encouraged to identify gaps and lacunae, and indicate how these might be addressed through the Foresight process or via additional measures. (p23)
- Existing research on group processes might be organised and used to allow for more effective group work in the course of Foresight. New (action?) research on group processes might also be opportune. (p23)
- Sponsors of social research such as the ESRC and major Foundations have had little involvement with formal methods for prospective studies, such as Delphi, for some time (if ever). Support for serious research in such fields would be welcome. For instance, how valid are the criticisms of methods (and particular implementations of methods) like Delphi, and what alternative procedures might be available? (p23)
- Secondary analysis of materials arising in the course of Foresight could be encouraged - this includes the group discussions and reports and background papers, as well as the survey material discussed earlier. (p23)
- The social science community should develop mechanisms whereby appropriate social research material could be delivered in a timely fashion to be used by Foresight Panels and the Steering Group in any future exercises. This will include broad descriptive and extrapolative material on demographic, economic and social

trends; insights into scenario construction, draft scenarios of various kinds (including “wildcard” scenarios), and suggestions as to sources of expertise for development of scenarios in particular domains; similar presentations of material and sources relevant to background issues of competitiveness, globalisation, and other matters of this sort that may arise. A basic set of bibliographies could be prepared, material placed on a Website (“Social Foresight”), a database made available for locating expertise, etc. Bearing the issue of international capabilities and factors in mind, it should also be noted that there must be scope to engage in many of the tasks mentioned in this paper in co-operation with partners in other countries and the EC. (p24)

- More systematic representation of relevant social research expertise might be sought for all Panels which desired it. Certain Panels would be likely to require more input than others. As well as representation on Panels, various other types of input might be systematically arranged. (At the very least, opportunities to consult with relevant expertise.) This will require due awareness of the likely sensitivities concerning lobbying to have “special interests” included on Panels. In the event of significant reservations being expressed, some social science “shadowing” of Foresight might be instituted. (p25)
- The Social Science community - e.g. the ESRC, the Social Research Association, professional bodies - might seek to establish ways in which social scientists could help in the identification and recruitment of relevant network members for the activities of Foresight Panels. (p26)

Introduction

The relation between social science and Foresight is of interest for several reasons. For those concerned with Foresight more generally:

- The prominence of social issues in Foresight demonstrates the importance of examining these issues systematically *throughout* the Foresight process.

- *Implementation* of Foresight, and *learning* from the current exercise for future programmes, is liable to be far more effective if social research capabilities and resources are adequately used.

For social scientists in particular:

- Research Councils and government departments, including those funding social research, have been required to assess how their work fits into Foresight priorities.
- Foresight priorities may well be of use in suggesting avenues for development of the ESRC's own Thematic Priorities.
- There may also be valuable spurs to research from the problem definitions reached in the Foresight process. Many areas where improved social understanding was required were indicated
- In addition there are areas where the task at least equally involves rendering existing social scientific knowledge in forms more readily used by the Foresight constituency.

A number of possibilities for action to build on these opportunities are embedded in the text, as shaded boxes with text in italics. The essay begins by briefly reviewing the Foresight Process and its main stages, and then examines some of the key results of main Foresight as they bear on social research and needs for such research. We then examine social science inputs to the Foresight process more generally.

The Foresight Process

Foresight has proceeded through a number of phases. Long before the White Paper which committed the OST to launching the exercise, there were studies of initiatives undertaken in other countries³, which paid considerable experience to the Japanese experience. (Further comparative work has been generated during and in the wake of the formulation of the UK Programme.⁴) The message enunciated in such studies was that many lessons could be

³ J Irvine & B Martin, 1984 Foresight in Science, London, Pinter; 1989 Research Foresight, London, Pinter

B Martin, 1993, Research Foresight and the Exploitation of the Science Base, London, HMSO (OST); H Cameron, D Loveridge, et al, 1996, Technology Foresight: Perspectives for European and International Co-operation, Manchester, PREST, report to DGXII European Commission

drawn for British science and technology policy - not just research policy or research prioritisation - from such overseas experience.

Since the launch of the programme, a number of overlapping stages of work have been undertaken⁵:

- **preForesight** Steering Committee appointed. Methodological principles established. Participants identified and trained. Consultation seminars round UK. Conomination study of expertise in UK. Panels established.
- **main Foresight** Delphi framework developed by consultants. Panels identified key issues and trends (with help of questionnaire survey and consultation), examined scenarios, constituted subgroups where appropriate, defined questions for Delphi survey, prepared interim and final reports.
- **Foresight reporting** Panel reports reviewed by steering committee, Steering Committee synthesis, Panel reports, and Delphi analysis published.⁶
- **Foresight implementation - Public Sector** Research Council and government department responses prepared. MiniForesight exercise by NERC. Foresight Challenge Fund launched. Dissemination activities.
Foresight implementation - Panels Dissemination activities (including pressure for action on priorities and proposals); further analyses initiated.
Foresight implementation -Industrial Analyses of results of Foresight, bids to Foresight challenge, some firm- and industry-association miniForesight exercises.

This essay begins by discussing some of the results of the main Foresight phase, as published in Foresight reporting above.

⁵ cf. L. Georghiou, 1996, "The UK Technology Foresight Programme, Futures, vol. 28 no 4 pp359-377

⁶ In practice, reports on various matters of methodology and analysis have been published throughout the Programme.

Social Science and the Results of Foresight

The OST Technology Foresight exercise took most social scientists by surprise. Its objectives, methods, and results still remain mysterious or of little interest to much of the community. Though certain social scientists have been heavily involved with parts of the exercise, and the documentation produced draw conclusions for social research as well as for natural sciences and technology, much of the community sees Foresight as having little connection to their current or future work.

This section examines the calls for social science inputs made in the course of the Foresight process. We can draw both on social science perspectives on where such inputs would be most appropriate, and on analyses of the perceptions of Foresight participants themselves on this topic.

The Steering Group Report

In this draft, at least, we do not discuss this source in any detail. It has already been the subject for response from Research Councils and government departments, including those sponsoring social science. (It would be interesting to examine the response from social science as indicated in the submissions to the Research Assessment exercise (RAE).) Demand for social research knowledge received more attention than many social scientists might have expected in this report. The first of the six themes which the Steering Group used to classify its 27 priority topics was “social shaping and impact of new technology”. “Understanding total business processes” was among the priority areas, and there was mention of various related issues at numerous points. The report provides a valuable synthesis of the Panel studies; below we attempt a more comprehensive listing of the topics they highlighted individually.

The Delphi Surveys

Several surveys were organised to elicit knowledge from the relevant expert communities in the course of Foresight. The issues survey was highly innovative, but remains largely underexploited: its results were used to a very varying extent by different Panels, and have not been put into a common electronic format (though a couple of Panels did undertake such an effort for the purposes of their own analyses). It could provide a rich source of insight into social research issues, but we have not been able to undertake the data input task required here.

The Delphi survey in contrast is readily available for analysis. This has been fairly limited to date, since its full results only became available to Panels at a relatively late stage in the preparation of their reports. The data offer considerable scope for secondary analysis (in particular, there has been no use of the raw data - organised with the individual respondent rather than the topic as the unit of observation, and very little application of mathematical statistics such as cluster and factor analysis).

Secondary analysis of materials such as the survey data arising in the course of Foresight should be encouraged. There is scope for extracting much more insight from these sources.

Several elements of the survey provide indications of issues for social scientific analysis - for one thing, many of the Delphi topics themselves concern social and organisational trends and innovations. Here we focus on just one set of questions - those dealing with the incidence of various types of obstacle to the innovations or other topics discussed. [Table 1](#) outlines the results when we aggregate the individual topic responses for each Panel, thus giving a view of how far the types of topic raised in each Panel are seen as liable to encounter particular obstacles.

While all of the obstacles have a social content, problems of *Social and/or Ethical Acceptability* are of obvious relevance. Overall, these are among the least prevalent obstacles - technical feasibility and economic viability are most commonly seen as critical issues. But these aspects of acceptability are the most prevalent issues in the Learning & Leisure Panel's topics

and are high (and second ranked) for Retail & Distribution (among experts these are the top obstacles for this sector), Financial Services and Communications. (For experts, Food & Drink, Health & Life Sciences, and IT & Electronics are also areas where such concerns are prominent) *Lack of funding* affects Defence & Aerospace (not surprisingly), Materials (perhaps more so), and those sectors with a high public sector component: Health & Life Sciences, Leisure & Education, Transport. Industrial/Commercial and Economic Viability issues loom for Communications and Construction (and also for Transport), and these two together with Financial Services are most influenced by policy and regulations. (Transport would appear to be affected strongly here if just the experts' views are taken. It is important to recognise that regulations are as much a driver of change as a constraint in this sector.)

The Foresight Steering Group Report of May 1995 presented a summary view (its [Figure A.1](#)) which agrees largely with this analysis. They saw most of the Panels whose main concern is service industries as being influenced by social, ethical and consumer constraints, with Health and Life Sciences (as in our Table) facing problems of Technical Feasibility, and Communications, Transport and Construction being under more economic pressures.

Table 1 Constraints on occurrence in UK - percentage of topics with level of agreement 50% & higher (all respondents) ⁷

Panel	Social/ Ethical acceptability	Technical feasibility	Industrial/ Commercial	Lack of funding	Economic viability	Regulations Policy	Education, Skills
ANRE	11	42	1	21	47	13	3
Chemicals	4	79	1	1	39	4	2
Communications	29	9	11	0	57	26	0
Construction	14	15	17	16	52	17	16
Defence & Aerospace	1	74	2	86	1	5	0
Energy	9	41	4	1	80	21	0
Financial Services	31	21	3	4	16	40	7
Food & Drink	21	47	12	7	26	22	6
Health & Life Sciences	21	59	0	40	1	5	1
Information Technology	32	16	34	2	20	14	1
Learning & Leisure	40	3	0	24	33	4	3
Manufacturing	4	33	26	5	22	7	4
Materials	0	76	7	51	14	4	1
Retail & Distribution	44	15	9	0	49	10	1
Transport	15	27	7	44	51	12	0
Total (all panels)	18	38	9	21	34	13	3

⁷ Data presented here differ from those in the published report, which concern only experts (scale rating 3-5) rather than as here all respondents; cf [Table 10.1\(b\)](#), p51.

The Panel Reports⁸

Two types of issue are apparent here. There are numerous instances across the reports where there are calls for specific sorts of research knowledge. But there are also many instances where there are more general suggestions that “something needs to be done”, where it is readily apparent that social research has contributions to make, though this is not stated in the reports. In the following discussion we draw on ideas of both sorts without seeking to distinguish them. Instead, we categorise the ideas in terms of the areas of knowledge which are being identified.

Knowledge about “Public Acceptance/Understanding of Science and Technology (S&T)”

The Steering Group’s thoughts on this issue reflected its being highlighted by a number of Panels. The reports often expressed a sophisticated view of interactions between S&T and social and political processes. Explicitly rejecting the view that regulations and social influences are impeding progress, The Agriculture, Natural Resources and Environment Panel (ANRE) noted that:

“Regulation, policy and standards are means to achieve progress. They need to be soundly based - particularly in relation to biotechnology, agriculture and environmental programmes... Public pressure on legislative and policy development [is] an important driving force in developing environmental technology. The UK public is concerned about noise and water pollution, and animal health and welfare... It is important that such immediate needs of the population are included in the development of science and technology.” And again that: “Social and ethical considerations of new technologies, or new applications for established technologies, constitute part of the definition of progress and are not in themselves barriers to progress. Acceptability of new technologies and

⁸ The following discussion is based on a search -using qualitative analysis software -of the electronic versions of the Panel reports as available from the University of Edinburgh Website; due to this, page references to the reports are not available (but it has been easy to use direct quotations). Emboldening has been added to highlight key issues; the text as retrieved from the analysis was ASCII.

applications is crucial to implementing several of the priority opportunities and needs identified...”

The Health and Life Sciences Panel (H&LSP) saw the need for interaction and even conflict between lay and expert views:

“...society must be able to engage in broad debate about the ways in which technology is used. We do not... expect that a better informed public will inevitably align with the views of the scientific community. This is neither plausible nor desirable. However, the greatest danger is that lack of information produces indiscriminating risk-aversion, or blind complacency. The public must be able to participate in carefully judged choices, with sufficient mutual understanding between specialist and non-specialist for debate to be positive and constructive.”

But such views of public opinion and the influence of regulations coexisted with an interpretation of many public concerns about S&T as deriving from a lack of understanding of the key issues on the part of the public. Public Understanding thus becomes interpreted as applying better means of communicating the wisdom of the S&T community to lay audiences. Thus ANRE follows up the remarks reproduced above by suggesting that:

”... the Panel's workshops provided a firm view that public concern about many of the scientific issues in the Panel's remit could be reduced by better communication, although issues of current interest to the public were not necessarily the same as those which would be important for wealth creation or improving the quality of life in the future.”

The flow of information is not entirely one way though: there is a call for

“experts' appreciation of the importance of taking proper account of the public's perspective of their work”.

And the Food Panel argued that:

“Within the food chain public acceptance of new technology is a particular barrier to progress. This requires increased investment by Government and industry together in generating the factual basis for education and informed communication. ...Limited public acceptance of new technology in food and drink production is caused by lack of informed understanding... there needs to be effective communication to the public and the media about genetic modification of food producing organisms...”

Social scientists have made the case that this *deficit* model of public acceptance misrepresents the complexity of the issues that are involved. The relevant social research itself seems to have a problem in achieving public acceptance! There is much basis on which to challenge the tendency to identify public understanding of S&T with the ability to absorb and reproduce the perspectives of scientists and engineers on their domains. The same goes for analysis of social resistance to technological change as being mainly or entirely a matter of lack of appreciation of manifest benefits, rather than as involving at least in part different rationalities, values and experience of the deployment of expertise. The more subtle social scientific analyses of popular attitudes to science and technology, and of the ways in which various responses to actual or potential technological change themselves may affect the directions or trajectories of change, have received little attention.⁹

The articulation of concerns about public acceptance varies (not surprisingly) across sectors. Thus for Communications, the call is upbeat:

“the UK needs to promote a culture that is at ease with exploiting these new technologies. Business and the public must become aware of the crucial importance of IT and telecommunications to the future of the UK.”

The Chemicals Panel, in contrast, frequently expressed concern about public attitudes to their sector, and saw the solutions as lying in communication and education:

“the major barrier... a general lack of science awareness amongst non-scientists... often giving rise to a poor public image of the chemical industry. This problem will only be resolved through better communication between the industry, the public, the media and the government.... negative perceptions of the chemical industry in the public mind ... general lack of awareness and understanding of the importance of science and technology to wealth creation and quality of life... It is important to address the image problem through co-ordinated initiatives targeted at teachers and children in the schools....”

For H&LSP, public understanding is not just an influence on the acceptance of technologies, but also on their impact:

⁹ Some of the more relativistic formulations of the social constructivist analysis of natural sciences, however, have achieved a degree of notoriety (cf. the recent hoax involving Social Text) - and perhaps led to a rejection of many more social research contributions to the area?

“public understanding of science and medicine, and attitudes to individual responsibility determine, to a large extent, the effectiveness of preventive medicine.”

Even though the Communications Panel was more upbeat than Chemicals, it still proposed that action was needed:

“The Government should set an example to industry and to the public by becoming a leading-edge user of telecommunications and information technology...”

The question was sometimes framed in terms of general negativism toward acquiring knowledge of S&T, rather than public antagonism toward specific developments. This “Two cultures” problem was formulated by H&LSP, who talked about:

“...the view that in the UK the public, and especially those in positions of influence in business, education, government and the media, have either negative, or disinterested attitudes towards science and technology. We are not aware of any objective evidence that the public here have more negative attitudes than in other countries: indeed, the UK has been more receptive of biotechnology than most other European countries. ...Nonetheless ...a broad, general public understanding of current science and technology is an essential for any nation which expects to reap the full economic and social benefits of science... the good work already in train in this area ... should be continued and expanded, and should include dissemination of the Foresight vision of the applications of science and technology. “

This also implies an agenda for social research.

As well as the general public being of concern as resistant consumers, or as pressures on policymakers, there was concern about the understanding and acceptance of change on the part of managers and workers.¹⁰ “Two cultures” problems, in particular, were also seen as operating within industry, thus the Chemicals Panel:

“The biggest barrier to innovation and commercialisation of technology is frequently within companies themselves. Research managers in industry require a better appreciation of business aims, while commercial managers need a better understanding of

¹⁰ This recalls the PANTS -Public Acceptance of New Technologies - project in the mid-1980s (Hartley et al), where attitudes were generally found to be rather favourable. In the industrial sphere,

science and technology and the relevance of technical solutions to achieving business aims.”

While the Retail Panel proposed that action be taken to:

“Establish a programme to improve and promote IT literacy in the UK population from primary school age onwards to ensure that the UK Retail and Distribution work force has the skills it needs to function in an industry that is becoming increasingly dependent on IT. This must build upon new (and welcome) developments in the National Curriculum and address how "techno-phobic" adults are not to be excluded from use of new tools and services. “

Again social research might be expected to cast light on these problems. Two final topics within this theme are the complicated calculus which people bring to bear on changes in social organisation that may be associated with radical uses of new technology, and the need for appropriate design of new technologies and especially interfaces if people’s initial resistance is to be overcome. Thus the Retail Panel touched on both when it suggested:

“...design services, video, graphics, audio-visual production, education, leisure, travel, entertainment and home shopping. The main restriction on the adoption of this type of service is cultural. This form of retailing invades the home and has the potential to modify the family hierarchy as children tend to have a better understanding of technology than their parents. There are also significant technology barriers to be breached if the techno-phobia common amongst the older generations, and surprisingly frequent amongst many younger ones, is to be overcome and understanding of the benefits of the services is to become widespread. The challenge will be to create user-friendly services that can be navigated with no more difficulty than is currently experienced in finding products in the average store.”

The lessons of social research concerning the nature of public responses to technology and technological change, and the processes of “social shaping” of technology, have not yet been fully absorbed by all of those involved with Foresight. Effort should be made to understand how far this is “resistance to social science” itself (!) and how far a failure of dissemination. If the latter, a fairly straightforward task of presenting research results in an appropriate format/variety of formats and distributing these should be undertaken. If the former, study of the use and non-use of social research results, and the divergence of views between social scientists and other practitioners, may be indicated.

contrary to the expectations of the programme’s sponsors, Jim Northcott concluded that the problems were more likely to involve managerial than workforce reluctance.

Knowledge about Policies, Policy Process, and Policy Impacts

Various policy proposals, stemming from several panels, and varying in the extent to which they mark a break with existing policies, are apparent in the Panel reports. These imply the need for serious policy analysis (both *ex ante* and *post hoc*). A sampling of some should indicate the sorts of work that might be involved:

- “Central government should encourage innovation through legislation; for instance,...tax breaks or levies or grants for investment in R&D. “ (Construction Panel)
- “We recommend that the Office of Science and Technology reviews possible new mechanisms for technology and information transfer ..., taking particular account of the need to increase Government funding for precompetitive work and technology transfer.” (Food Panel)
- “The government must ensure that the UK is a competitive base for a thriving manufacturing and production industry. Necessary infrastructures include education to the highest international standards, a world-class science and technology base, and effective communication and transportation systems. The government must continue its deregulation initiative, and press for minimal and sensible EU regulation. The government must support the creation and operation of networks of support to industry. It must also support programmes which connect the science and technology base to industry, such as LINK, and programmes which improve the industrial experience of individuals - The Teaching Company Scheme, for example. Finance for industry is a crucial requirement if improvements are to be made by firms. The government and others supporting industry must take measures to encourage and help firms to invest in the longer term” (Manufacturing, Production And Business Processes - MPBP)

One feature that cropped up in many Panel reports was the need to re-examine aspects of education and training, to provide better access to technical knowledge -and better linkages between such knowledge and knowledge of design, markets, business processes, social considerations, etc. We have already encountered some instances of this, and it will be

touched upon subsequently. But space limitations preclude a detailed discussion of these issues here - they could even form the substance of a stand-alone report!

Some Panels pointed to the need not only to develop policy instruments, but to link these to broader analysis of social factors:

“Advances in medical technology and innovations in health care resource allocation, organisation, and evaluation, must be linked with effective sociological R&D ...in areas such as ageing, genetic risk indicators, and medical application of IT...” (H&LSP)

Policy Analysis

Contributions of social science to policy analysis additionally include, for instance, technology and impact assessment and monitoring, and policy modelling - and evaluation research. Evaluation research (a sufficiently well-developed field to have its own journals and even journals dealing with specialisms within the field) examines the extent to which policies and programmes are fulfilling their objectives. It can be used to monitor and improve policy formation and implementation. The need for such research was also implied on several occasions, e.g.:

- “It is essential that the Government develops conditions that empower full application of science and technology. This may include... reviewing the monitoring of public sector science and the provision of grants to user industries - as well as funding feasibility studies for technology transfer.” (ANRE)
- “...Monitoring the impact of UK and EEC regulatory and copyright policies and of new media technologies on the health of the UK software sectors.” (Leisure & Learning Panel)
- “Action ... to consider ...why, in the UK, there persists a higher level of distribution of dividends and a lower level of reinvestment, particularly in R & D, than in comparable OECD countries and whether changes can be made to remedy this, for example through personal incentives for savings.” (MPBP)
- “Finance for industry is a key to future success... the government has a large influence [which] must be reviewed ... against the evidence of poor UK productivity and insufficient long-term investment compared with other industrial nations , and

against an economic scenario which shows the dependence of future national success upon increased UK manufacturing strength. Measures must be taken to encourage firms to invest in the longer term as well as in near term productivity improvements.” (MPBP)

- “The national science and technology base must work in closer co-operation with industry and must maintain excellence in basic research. Those in academe must gain recognition for partnerships with industry, and the Research Assessment Exercise must change to reflect the importance of this work.” (MPBP)

Regulations, Standards, Security, and IPR

These form a set of related issues, where public policies and business strategies alike are both users of and subjects for social research. We have already seen several statements discussing the role of regulation, with few Panels being as quick to reach conclusions as MPBP:

“UK and EU to minimise burden of regulation ... Need improved institutional frameworks for firms to influence regulations”

In contrast the Materials Panel argued that:

“Environmental pressures are often perceived as being a threat to wealth creation rather than an opportunity to create new business. This will be true in specific cases where a particular company relies on a product or process which is environmentally damaging. But such a threat is accompanied by a clear opportunity for a different and environmentally acceptable approach to be developed. The rate at which such changes can be introduced is important and needs to be considered in framing new regulations in order not to damage the competitiveness of industry or force industrial activity offshore. Equally, legislation can stimulate competitive advantage by driving the development of exportable technology. “

Likewise for the Transport Panel, which proposed major projects with a regulatory element:

“...Such developments are best delivered by competitive markets, but they flourish only if the rules are clear and the goals are known. This is particularly true of transport where government has the on-going responsibility of trying to reconcile individual choice with the collective good, often in conflict in this sector. ... the Transport Foresight

Projects... provide structure to emerging opportunities either by creating a framework to focus demand, or through regulation or industry standards. Industry's willingness to invest will mirror its confidence in the overall commitment to, and permanence of, the structure. Elsewhere, the route to commercialisation is more clear cut. Technologies like quieter aero-engines or car safety systems which address a direct customer need in an industrial or consumer marketplace will be developed because social and regulatory pressures for quieter and safer transport already exist. The Panel has identified many technologies of this type. It is important to maintain such regulatory pressure and tighten it gradually in line with increasing social expectations. Judiciously applied, regulation can create new market opportunities and stimulate technological development.”

And a related research agenda was proposed by the Retail Panel:

“...Does regulation stifle innovation? Can we determine the nature of appropriate regulatory frameworks to stimulate innovation? A UK programme should be undertaken to address these questions and determine the nature of regulation required to ensure innovation.”

This Panel also had a specific proposal to make for research:

“Regulation ...A programme should be undertaken to establish the requirements for new forms of automated reporting, monitoring and fraud detection to protect the interests of the retailers and the customers.”

A number of issues are cited frequently across Panels: privacy, security against fraud and other problems, IPR, etc. (The fraud and security issues have become areas for active work in the current phase of Foresight, and have been most prominently raised by the Financial Services Panel.) Thus:

“... protection of individual privacy in the Internet world, and agreement on methods for providing adequate levels of security and authentication, e.g. for cashless transactions, and audit and traceability against fraud and crime, are rapidly going to become pacing functions.” (Information Technology & Electronics Panel- ITEP)

This Panel proposed:

“a programme to review the work currently being undertaken in both the UK and overseas in this area and to define the areas of technology, standards and legislation which must be accelerated to ensure adequate protection of Intellectual Property Rights,

privacy, security, access, audit and fraud detection, prosecution and prevention in the future Information Superhighway environments.”

The Retail Panel echoed concerns expressed by Financial Services when it stated that in connection with:

“Regulation... A programme should be undertaken to establish the requirements for new forms of automated reporting, monitoring and fraud detection to protect the interests of the retailers and the customers...

The recurring themes that evolved were concerned with: the socio-economic aspects of retailing; the prevention of **fraud**; concomitant concern about the protection of electronically held **personal data**; the role of intelligent materials in the distribution chain; the need for concerted effort to improve the nation's IT awareness, knowledge and skills; and the need for **imaginative government intervention in regulation and standardisation.**” (our italics)

The Foresight Process was oriented to establishing areas where technical and market opportunities coincide, and determining the requirements for and barriers to exploiting these. Policy analysis and instruments frequently emerged as issues here, but given the framing of Foresight, they could not take a central role. There is scope for building on Foresight to address these issues more directly, perhaps by cross-Panel working groups. Inputs from several existing programmes of social research - e.g. current ESRC Programmes on environmental issues, innovation and IPR - could be input into such groups.

Knowledge about Business Processes

Panels frequently pointed to needs for examination and transformation of business processes. An example of a call both for research and for improved practices in its sector was made by the Construction Panel:

“EPSRC & ESRC should jointly fund multi-disciplinary research into the development and application of improved business processes to construction. Business process analysis should be applied more vigorously to improve the efficiency and effectiveness of the construction industry”

Similar suggestions were made by many other panels, especially MPBP, who explicitly set out the case for social research (and a particular kind of social research) in the field:

“One serious nationally co-ordinated research programme must oversee, integrate and set goals for business process research. All research programmes involving the science and technology base and industry must use business process disciplines. Many more nationally supported research programmes must have activities leading to business process improvement in industry and its supporting infrastructure. Objectives set for the Innovative Manufacturing Initiative must become exemplars of future practice.

(Action must be taken by the Research Councils - particularly EPSRC and ESRC - with Higher Education Institutions (HEIs) and Industry.) “

The Retail Panel also proposed:

“a programme to address the implications of changes in the methods of delivery of retail merchandise, both from supplier-to-retail outlet and from retailer-to-consumer. The programme should identify the requirements for improved delivery systems, encompassing areas such as automated warehousing, home delivery vehicles, remote collection points and the use of eco-friendly vehicles.”

While this programme would not primarily be social research, but would certainly contain elements of it.

Among other contributions dealing with business processes and related issues such as training we note a few that make distinctive points, adding highlighting to key phrases as far as research is concerned:

- “Clients should include companies' **innovation profiles** as part of their supplier assessment procedures. (Construction Panel)
- Training in **understanding and implementing innovation processes** continues to be essential in both industry and academe... as does the development of an infrastructure to allow commercialisation of science and technology (Chemicals Panel)
- “Companies must develop and implement plans to increase Industry R&D investment significantly. Companies should review their technology plans, and their **processes for developing such plans**, in relation to this report. Industry should foster **technology benchmarking**, share best practice in technology planning and exploitation, and

promote increased levels of networking and collaboration.” (Defence & Aerospace Panel)

- “Those who support manufacturing, whether in business, education, research or government must help industry implement competitive business processes. Frequently this will require a number of disciplines to work together. **Process mapping, modelling, benchmarking, analysis, simplification, integration and related skills** must be improved and then competently applied... The best processes will be rapid, efficient, integrated, measured and controlled... Organisations and resources supporting the processes will be shaped and trained to achieve continually higher levels of performance. The national objective will be to raise standards in many thousands of companies up to those of the best internationally competitive firms.” (MPBP)
- “Manufacturers must be encouraged and educated to improve their **technology management** disciplines. One of the benefits of a disciplined approach would be the easier quantification by the science and technology base of manufacturers' priorities.” (MPBP)
- “Those who acquire information or study **trends and scenarios** must assist industry improve its knowledge of international markets and the drivers of change. Those who study and improve creativity and innovation must also assist industry.” (MPBP)
- “A proportion of the manufacturing base appears to be moving towards highly flexible, small scale plant (driven by customisation, need to minimise inventory and transport to market). For the remainder, economies of scale and improved utilisation of assets must be matched by excellent demand side management (**market analysis**) and risk management (**cost/benefit analysis**) in order to plan for the future.” (Chemicals Panel)

It is worth noting that there were frequent calls for improved education and training of managers and other sections of the workforce.

Knowledge about, and Development of, Specific Techniques, Tools and Instruments

Social science has contributions to make to many more formal methods of analysis that can be applied to private and public bodies' management practices. Various specific approaches to addressing business processes and decision support in particular were mentioned in the reports. We group these under a set of loose headings below.

Risk Analysis

Risk analysis and management is an area mentioned on several occasions, and not just in the context of cost/benefit analysis as in the preceding quotation. Thus ANRE identified a need for:

“Improving public security and safety, especially in the monitoring, predicting, and avoiding human-related and natural disasters, such as storms, floods, fires, earthquakes, droughts, tidal waves, shipwrecks, pollution incidents.”

Life Cycle Analysis

Techniques to examine the environmental impacts of products and processes across the whole of their life cycle have attracted a great deal of attention recently, and in this context the Construction Panel suggested:

“Life cycle assessment (needs) common agreement regarding methodology or data (offering) the opportunity to distinguish between the life of components and the life of complete buildings and constructions.... a comprehensive procedure to identify total environmental and social costs and to weigh the benefits of alternative solutions to construction problems... (to) provide information and develop holistic techniques for social and environmental benefit analysis and the 'whole life' assessment of the performance of constructed facilities. “

Life cycle analysis was also mentioned several times by ANRE as an important area where methods should be further developed, thus the need for:

“Widespread use of life cycle evaluation and management, and eco-design principles and practice studies; evaluation of vulnerability of natural resource production and socio-economic systems to climatic, pollution, and land-use changes; clean, cost-effective

sustainable technologies; building, urban and transport design to reduce pollution and environmental impacts, and to improve energy use...”

Financial Analysis

Not surprisingly, the Finance Services Panel expressed interest in:

“new research programmes...might cover areas such as the design of financial instruments, tools for quantitative asset management, financial modelling and psychological responses to risk and uncertainty. (e.g. "The Innovative Finance Initiative")...”

Panel recommendations with respect to specific instruments such as those for risk, life cycle and financial analysis, and more generally to the need for research, training, and links between the two in the field of management sciences and business processes, should be reviewed in detail by those in Higher Education. The Panel accounts are more elaborate than the points made by the Steering Group in its report.

Knowledge about Technology Diffusion, Technology Transfer, and SMEs

The problems associated with diffusing the Foresight message, and with the take-up of new technology and the contribution to innovation of large swathes of the UK economy, and small firms in particular, was often cited. It is interesting to note that this rarely took the form of specifying needs for knowledge (though better understanding of the innovation process in general was cited, as we have seen elsewhere). Among the points being made were:

“it is essential that the Government develops conditions that empower full application of science and technology. This may include delaminating administration, and reviewing the monitoring of public sector science and the provision of grants to user industries - as well as funding feasibility studies for technology transfer (approaches used in other countries where technology oriented solutions are given pride of place ... may provide useful starting points). New technology-based, product-oriented small and medium-sized enterprises should be specifically and actively encouraged, and extension of the network system ... for small and medium-sized enterprises should be considered. Effective arrangements for sponsoring secondment between and within public- and private-sector

bodies, especially small and medium-sized enterprises, would give greater fluidity across disciplines and interests.” (ANRE)

“Particular emphasis is required on developing better mechanisms for involving smaller companies instead of relying mainly on personal contacts. Chambers of Commerce, Industry/Trade Associations, Research and Technology Organisations, and supply chain links with big companies could all provide valuable bridging mechanisms to smaller companies.” (Chemical Panel)

“The transfer of technology, particularly to small and medium-sized manufacturing enterprises, is critical to the continued success of this sector. This includes ... specification and adoption of 'best proven practice' for current products; the identification of processes from other manufacturing sectors which may have value in the food sector; and the use of novel options identified by primary research. While the sector is well served by existing research associations, additional structures and procedures are required.... new mechanisms for technology and information transfer ... taking particular account of the need to increase Government funding for precompetitive work and technology transfer... Weak infrastructure between primary research and the market. .. limits the potential exploitation of the UK's strength in science and engineering in... manufacture of specialised process equipment; large scale production of novel ingredients; and user- friendly software for modelling and control... we should develop greater collaboration between funding bodies, and routes to disseminate innovation to small and medium-sized enterprises..” (Food & Drink Panel)

“... the value of research on semi-conductor materials is restricted to its perceived ability to attract inward investment.... very few UK companies are in a position to exploit this type of research and development.” (Materials Panel)

Nor are problems restricted to SMEs:

“Although there are notable exceptions, some people with responsibility for IT in insurance companies and in the reinsurance business seemed to have almost no awareness of current research activity in IT and communications technology and only a meagre understanding of the current state of the art in these areas. In one major organisation, for example, the person responsible for IT Policy had not heard of neural

networks (one of the most publicised areas of research in advanced computing).”
(Finance Panel)

Clearly there are requirements for better understanding, and application of existing knowledge concerning, the processes of and obstacles to diffusion of such knowledge. This needs to be related to the frequent calls for better training (these make elaborate proposals which we are unable to review here) and the development of a Foresight or innovation culture in the UK. Finally, other obstacles connected with the climate for investment and entrepreneurship were also cited by several Panels, e.g.:

“the numbers of new, life-sciences company start ups in the UK have been reasonably good by European standards... we still lag well behind the USA, and are not yet fully realising the potential offered by our strong academic science base. Obtaining seed capital, and access to early stage venture capital, and mechanisms for flotation, remain problems, and are proving a significant obstacle to the formation and development of new businesses... We recommend further steps to improve the investment environment for new, high-technology companies, by introducing tax credit notes, loosening limits on share sales after flotation, and working towards a European equivalent of NASDAQ (National Association of Security Dealers Automated Quotations USA)... science parks in the UK... tend to be passively managed, and are no more effective than the average in nurturing new business, or in linking with academic strengths [20]. We recommend additional investment in technology incubators.” (H&LSP)

There is already an extensive body of both theoretical and applied work on innovation processes, technology transfer, and the problems of SMEs in the UK. Efforts have been made to render this work available in the form of teaching materials and consultancy advice. But it is clear that such efforts need to be extended (and examined to better appreciate why their impact has been so limited, if the Panels' diagnoses are to be believed).

Knowledge about Markets and Consumer Behaviour and Attitudes

Among the numerous issues raised here we note requirements for research in respect of a wide range of topics:

“..**public understanding of science and medicine**, and **attitudes to individual responsibility** determine, to a large extent, the effectiveness of preventive medicine. ... the **development of more literate, aware "health consumers"**, with high expectations ...[and its].... effects on the quality and effectiveness of care and communication, and the transparency of decision making... [and on]... individual and regional variations in care... divert[ing] resources into treatments and types of service focused on the subjective well- being of the patient rather than measurable health benefits.” (H&LSP)

“...better understanding of the retail dynamics of **overseas markets** and the potential for exporting UK retail concepts, knowledge, practice and techniques.... to identify the market conditions, competitive situations and cultural and psychological profiles of consumers in these markets... Smaller Retailers, specialist suppliers and designers do not have the facilities available to them to research the requirements for their products and services in other countries... To enable UK retailers to move into the global market it is necessary to **investigate and address the cultural, psychological, legal and technological barriers that exist outside the UK.**” (Retail Panel)

“ Establish a programme to determine **methods for assessing the social acceptability of new technologies**, such as virtual reality, in leisure activities and in retailing generally.... to determine the **requirements of customers** in relation to changes in the modes of retailing. ... to promote an understanding of **land use and accessibility issues ...**” (Retail Panel)

“Incorrect assumptions about which retail/distribution functions can be profitably transferred from a human to a machine interface could be exceedingly expensive. The same is true if incorrect assumptions are made about the kind of technology which will be acceptable to consumers as a home shopping terminal. Lack of adequate research in this area - and in associated areas such as **human machine interfaces and acceptable biometric methods for identification purposes** could prove a barrier to development of retail and distribution technology. “(Retail Panel)

... A programme to study the dynamics of UK consumer behaviour when purchasing products. The study should: generate UK consumer information that can be made freely available to UK retailers through the DTI; include the development of a **model that can be refined to predict consumer purchasing behaviour** in "westernised" societies; include proposals for the generation of the refined data; generate proposals for future research into other societal structures." (Retail Panel)

"a better understanding is needed of **why people travel**, looking in particular at the dynamic nature of the issue since attitudes change in response to the prevailing circumstances.... to **determine the extent to which modern life- styles are unavoidably car dependent**, to identify the real potential for modifying car use and increasing the uptake of public transport alternatives. (Transport Panel)

"...a supporting programme is needed to study **the impact of awareness and education on transport users** about the (often-conflicting) consequences of different transport policies and choices." (Transport Panel)

"... there is an urgent need to develop a **better understanding of operator and user /driver interfaces** and associated workload. The aim is to look at the consequences for design, safety and security while delivering desired improvements in system performance." (Transport Panel)

"...richer information about travel and traffic creates the potential for feedback on an unprecedented scale. This in turn demands the development of new, more accurate **dynamic models** in almost every aspect of transport whether it is giving traffic controllers real- time predictions for the alternative strategies they might choose or predicting driver response to an incident warning on the motorway." (Transport Panel)

Knowledge about Social Trends and the Assimilation of New Technologies

Several Panels noted a wide range of issues connected with the interaction between technological change and the evolution of social structures, practices, and ways of life. For instance, a rich list of issues was highlighted by the Leisure & Learning Panel:

“The media technologies that will begin to spread over the next decade are known. The services they will carry, the demand for these, and their economic and social impacts, are major unknowns. The first challenge is to reduce this uncertainty. ... the new technologies could have a substantial impact on households and on the wider society in the UK. What will those effects be? What are the social constraints on teleshopping? Will teleshopping transfer control over the shopping budget within the household? Will culture become more fragmented? Will the traditional media and sources of opinion-forming lose their influence over the public? We feel these are critical areas for social research.... Uptake of the new media services will be highly polarised and could increasingly compound social divisions. Maximising access to the benefits that will derive from the new technologies must be a priority for the realisation of human potential and maintaining social cohesion.... There is urgent need for research into changes in key household and social trends as people begin to engage with the new media. .. The delivery of education, training and general information might change radically over the next 20 years. Public demand for wide-ranging interactive and multimedia learning materials, and employer demand for highly flexible and adaptive skills, together suggest a reworking of education... Will they be used to control or liberate education? And can employers and those traditionally responsible for the supply of learning materials adapt to a situation where learners 'market' their learning in their own way?.... _New media and communications technologies have the capacity to 'empower' the individual through greater access to and control over sources of information and learning. At the same time, the distribution of access will depend on supplier decisions and household spending power. The social and economic effects should form a focus of future research... A programme of research is needed into the likely household impacts of the new technologies, including... needs for services, the potential effects of greater transfer of out-of-home functions such as work or shopping to the home, the effectiveness of

and constraints in home-based learning, or the impact on labour participation and retraining through distance-learning. (Leisure & Learning Panel)

This Panel also identified as areas for further study:

“...teaching and research in the arts and music, in particular where these sectors provide skills for new media technologies or material for domestic learning applications. These are not 'soft' options but economically important software options...The key need is for better and more widespread understanding of the vital role the UK software industries have in UK wealth creation.... effective planning to maximise UK potential in this sector... in some areas we feel that Technology Foresight has a continuing role...”

Another Panel with a rich list of social research topics was Retail & Distribution:

“...Establish and review on a rolling basis the demographic and social changes likely to occur in the 21st century and determine the specific retail and distribution requirements, including both infrastructure, product-related and service formats.... study the dynamics of household and population change, the methodologies for predicting these and the interpretation of these findings for retail purposes. .. establish the best methodologies for predicting such change; predict long-term changes in the population and household structure of the UK, disaggregated by geographical areas; identify the drivers of this change, including planning controls and policies; assess how relevant such methodologies are to other countries; anticipate the consequences for retail and distribution of the changes predicted; identify any potential gaps in the retail and distribution arena which the market itself will not take up (specific socio-economic groupings, etc.) and address whether their needs will be met in the future; disseminate the results of the research through the DTI and relevant departments to UK Retailers, distributors, local authorities, healthcare providers, charities, etc.

.... A programme that brings together specialists from all of the associated fields that addresses the long-term sociological and psychological implications and the acceptability of the introduction of IT-related leisure, entertainment, retail products into the home and business environments. ” (Retail Panel)

Knowledge about Other Topics

A host of other issues were raised, and these are listed below with key words and phrases highlighted:

“...substantial leisure sectors such as **drugs and pornography**. ... are difficult areas to consider in view of the overwhelming impact on their 'markets' of legal factors outside the scope of the project...” (Leisure & Learning Panel)

“Action is required to co-ordinate the **documentation** of sectors which are either new or whose contribution to wealth creation and quality of life is difficult to assess. The leisure and learning sectors are very different from sectors .. which have relatively clear and direct boundaries and ... economic implications. This is reflected in the problem of obtaining adequate statistical evidence. There is, for instance, no clear measure of the impact of either of these sectors on the economy. This is especially the case with IPR, data on which - insofar as they are measurable - are scattered throughout different data sources.” (Leisure & Learning Panel)

“**Information Overload, Saturation and Devaluation**... in environments like the Internet, when a few keystrokes and mouse clicks can send hundreds of thousands of copies almost instantly and invisibly to addressees anywhere in the global net. These addressees in turn can repeat the process easily and quickly, and furthermore can alter, append and otherwise modify the document very easily and virtually undetectably... users could find quite quickly that: they are swamped with huge quantities of 'junk' electronic information that they cannot even afford the time to scan, and - they no longer trust documents they receive, especially as they start seeing the same spurious information being rapidly recycled and fed back as true, and they could lose all feel for who has seen their material and whether comment being offered is valid or not.”. (ITEP)

Several discussions specified the need for knowledge about Interdisciplinary Issues, requiring collaboration across several social sciences and more broadly between social scientists and natural scientists and/or engineers. A few examples of this (note the prescriptions for research organisation) are:

“The Councils should also support academic work relevant to other listed actions, namely on multimedia and displays, and on pilot multisector projects such as Tele-Healthcare.” (ITEP)

“The need for funding and research assessment methodologies to give strong support to multi-disciplinary science and technology. In this context a review of the current research assessment procedures and funding methodologies currently adopted by the Funding Councils... is recommended. Support for regional centres of excellence is highlighted.” (Materials Panel)

“Very many new products and processes result from the combination of different disciplines. This combination ... increasingly must involve those with a greater knowledge of human factors, sociology, economics or a multitude of disciplines which give a stronger market or user influence. (This could lead, for example, to the design of products capable of rapid customisation near the point-of-sale to match the needs of each specific market.) ...Multi-discipline R&D projects must be encouraged in education, research and industry. The Research Councils must work with HEIs to promote multidiscipline projects which overcome departmental or other barriers to co-operation.” (MPBP)

“Collaborative planning and management of research on food science and technology by research councils (BBSRC, EPSRC, MRC and ESRC) and Government departments (MAFF, DTI, DH, SO and DANI), and the promotion of multi-disciplinary research, would greatly help the effective use of funds. We recommend that research councils and Government departments report jointly on the implementation of our main findings to the Chief Scientific Adviser to the Government within nine months of publication of this report. ...Multi-disciplinary work: A mechanism is needed to promote more transfer of research and development between the different sciences relevant to food and drink manufacture, to promote co-ordination of scientific and technological work with production processes. Barriers between the many scientific disciplines involved - including social science such as risk assessment - must be reduced. (Food Panel)

Finally, it is worth noting that Scenario analysis was one task with which Panels were charged, but which they undertook to very different degrees. Some reports carry only

cursory reference to scenarios, presumably only mentioning them because this was a subheading in the template provided by OST for the reports. Others develop more or less detailed scenarios, but with little sign of a common methodology; it is evident that some of these have drawn upon social science inputs. This is evidently an area which could utilise both methodological and substantive inputs.

Summary

Numerous topics that apply across many, if not all, Panels, and about which social research has much to say, have been noted, including:

- **innovation processes** and the needs of particular sectors and types of firm;
- the role of **human factors** in engineering technological change - referring here to: issues of work organisation, skills, and change management; and more general attention to **business processes**;
- the broader **social dimensions** of technological change - public understanding and responses, unintended consequences, user reinvention, risks and security issues, impacts on non-users, etc.;
- understanding broader **social trends** which may influence the markets and needs for various types of innovation;
- **policy analyses** of various kinds, including those dealing with challenges that may be confronted by existing **regimes for managing technologies** - IPR, risk assessment, regulations, etc.;
- development of **methods and instruments** to assist policy and management decisions - life cycle analysis, risk analysis, simulation, etc.

Most of these topics (the list could be extended) were indeed identified in one or other Panel report, but their treatment has generally been brief, more a matter of noting a topic for further attention than grappling with it in depth. (In some cases more detailed attention has been forthcoming, for example the follow-up work on security launched by the Financial services Panel, and drawing in other Panels.) There may well be opportunities for delivering the results of past and current research on such themes to those involved in Foresight, and for relating ongoing research to the Foresight exercise as it unfolds.

It is important to identify where the key points of contact in the social research community are in connection with the long list of issues, noted in this subsection and its predecessors. Efforts should be fostered to develop links between centres of excellence and the Foresight practitioners most concerned with these issues. A first step might simply be to encourage relevant research leaders to read those Panel reports which do raise issues germane to their efforts, and to liaise with Panels as then seems appropriate.

New Data and Tools for Social Research?

Opportunities for social science, which may arise as by-products of technological advance, are incidentally implied in the Foresight studies. Such opportunities, for example, One case where this was made explicit was in the work of the Transport Panel. This pointed to the future availability of large volumes of data on travel behaviour as a by-product of transport telematics, and suggested that this would facilitate future efforts at modelling transport and personal mobility (presumably some geographical and economic dimensions of interfirm transactions and the movement of goods could similarly be examined). Similar developments may be forthcoming with other IT systems: new telecommunications infrastructures are liable to generate large volumes of by-product data on communications traffic, new transactional systems on consumer purchasing patterns, and new sensor technology might find application to many phenomena. (In each of these cases legitimate concerns over privacy and data security may be raised.)

As well as new sources of data, new technical tools may be made available. This applies not only to new types of equipment such as portable computing and data capture equipment. It also involves software tools of various kinds. The new tools for modelling complex processes, suggested as likely developments by some Panels, might also provide instruments and methods for social science applications. Geographical Information Systems, mentioned by the Retail Panel, are another case in point.

Finally, such data and tools can be used for purposes of teaching and dissemination of social research, as well as for the generation of new knowledge.

Social scientists should conduct systematic appraisals of promising opportunities for using data and methods in social research, which have been identified or implied by the results of Foresight. The Foresight community should also identify such opportunities where they would contribute to better realisation of projects and goals suggested through the Foresight process.

The Organisation of Foresight

The programme, with its focus on **Technology** Foresight, was interpreted in some quarters as an exercise which took little heed of social science, and which would have little bearing on it. Neither of these perceptions was accurate. Social scientists specialising in science and technology policy research **had** been highly influential both in pressing for such a Programme, and in designing the methods that were employed in it. Societal issues such as wealth creation and quality of life, and an interest in scenarios, were integral elements of the main Foresight phase. And the results emerging from individual Panels, and the Steering Group report, also had substantial implications for social research, as we have seen. More attention to at least some areas of social research was called for, to the surprise and relief of many social scientists. Given the implicit and explicit calls for support from social research for Foresight that have thus emerged, it makes good sense indeed to consider how the social sciences may better contribute to Foresight.

Foresight Process - Overall Features

Technology Foresight as it has been practised in the UK has been frequently represented as largely an exercise in setting scientific priorities.¹¹ Certainly the work of the Panels did involve an assessment of areas where research and development opportunities and social needs/market demands were liable to coincide in the future. This was seen as an input to the formulation of British (applied) science and technology policy.

But an equally important objective from the outset, reported in official documentation and communicated to Panellists in the course of training, was to stimulate the formation of new

networks and collaboration between innovators and users, in academia, industry and the civil service. This is effectively a piece of social engineering, hopefully intended (though these precise words were not employed) to help shift the national innovation system to a more dynamic state. The aim has been described as that of building a “Foresight culture”, where exchange of knowledge (of science, engineering, markets, user needs, etc.) is much more frequent and intense. This feature of Foresight was drawn from the analyses of the Japanese experience in particular, as reported by Irvine and Martin and others.¹²

One clear role for social science, is the evaluation of the extent to which Foresight has succeeded in these aims. There is scope for comparative analysis of different Foresight programmes in other countries, and Foresight might also be compared to other instruments for creating networks and identifying priorities. There is also considerable scope for further work on the extent to which the now-familiar diagnosis of disarticulation between research and exploitation in the UK is a helpful one.¹³

While social requirements and market opportunities loomed large in the exercise, **Technology** Foresight by its nature leads to a focus on points at which technological opportunities arise. The evident danger is that of instituting “technological fixes” - in other words, seeing technological solutions as the self-evident response to social problems.¹⁴ The Steering Group and Panels’ work was explicitly oriented in this frame - to identify technological opportunities and to link research communities with their prospective markets. This did not mean that Panels completely neglected social policies or social innovations in practice: some of the Panels had points to make about these.¹⁵

¹¹ E.g. in Nigel Gilbert’s “Lost from Foresight?” in the ESRC’s *Social Sciences* (January 1995), and by David Edgerton in a debate organised by the SPSG and British Library in 1996.

¹² And thus in the SPSG meeting referred to in the previous footnote, a Foresight Panel chair was among those reacting angrily to the suggestion that networking was in any way a secondary outcome of the process.

¹³ There are plans for a formal official evaluation of Foresight, and already some elements of national and comparative appraisals are underway - the existing science and technology policy research community share membership with the (research and related) evaluation communities, and there is much policy interest in many countries in the process. There is also a TSER network - ASTPP - which is seeking to accumulate experiences from foresight and evaluation studies; and the new ESRC Centre at Manchester, CRIC, has such work on its agenda.

¹⁴ This topic generated a great deal of literature in the late 1960s and early 1970s, though the theme has been little-developed since then. However, it is commonly asserted that in many fields of social policy, e.g. education, it is frequently easier to gain funding for technological activities than for social ones.

¹⁵ It is worth noting that the Panel chairs at one point collectively advised the OST that it would be appropriate for them to include analysis of social trends in their purview, despite pressure to the contrary. Several of the items featured in Delphi surveys concern social and regulatory trends and innovations - e.g. flexible working, vegetarianism.

But the exercise as a whole was heavily weighted toward natural science and technology. This is not such a forceful criticism as might at first appear. Indeed it is quite appropriate, given the sponsorship and underlying policy agenda of Foresight that it should have such a focus. The OST does have some responsibility for social sciences; but social science Foresight might be expected to place more emphasis on social innovations of all kinds, as compared to technological innovations. (Of course, Foresight itself is a social innovation, and one diffusing (and mutating) across countries and sectors.)

This emphasis did not preclude the exercise generating a good deal of material dealing with the need to develop better social scientific understanding, and indicating some opportunities arising for social research, as we have seen above. But this is not the same thing as social science Foresight - which is indeed part of the Dutch Foresight programme.¹⁶

Consideration should be given to the scope for launching Social Foresight programmes. These would give due weight to social research and social innovations (while not neglecting technological issues any more than social ones are absent from Technology Foresight). These might be organised in terms of standard social science domains¹⁷, or, perhaps better, deal with broad themes - e.g. Democracy Foresight, Urban or Rural Foresight, Welfare Foresight, even Ethnicity Foresight - that have not been tackled in the current exercise.¹⁸ Such activities could identify priorities for improved social understanding that would be complementary to those pinpointed in the OST work. Some may be political minefields - others may be found to be highly appropriate in the context of dissatisfaction with established party politics and representational structures.

A related point is the partial sectoralisation of economy and society employed in Foresight. In particular, large swathes of the public sector are missing, as are many activities of the “informal economy”. This is probably best explained by political factors swaying the Steering Group (consciously or otherwise), but is remarkable given the role of public administration in pioneering several new technologies (e.g. it was the leading sector in IT

¹⁶ Along with humanities¹ cf. Foresight Steering Committee, 1996, A Vital Knowledge System: Dutch research with a view to the future, FSC, Amsterdam. The process of establishing the ESRC Thematic priorities is not a Foresight exercise in this sense, though it is clearly future-oriented.

¹⁷ Note that the Foresight Programme itself sought to avoid being science and technology driven, by ensuring that some Panels were much more to do with markets and functional areas (e.g. Transport, Leisure and Learning) than with the industrial or technological domains (such as IT & Electronics).

¹⁸ To an extent themes like education, health, and leisure have been tackled, though within the “tech fix” framework mentioned above.

use for many years), and of security concerns driving much innovation in policing and domestic technologies. Omission of informal sector activities means neglect of (especially) women's work and the experience of children. Other types of aggregation/disaggregation of social life might also provide a significant focus for Foresight, whether Technology or Social Foresight - for example, a focus on cities, on regional dimensions of change, on specific social groups or intergroup relations.

Social Scientists might have more input¹⁹ into the process of “sectoralisation” used in Foresight exercises; more importantly, perhaps, they should be encouraged to identify gaps and lacunae, and indicate how these might be addressed through the Foresight process or via additional measures

Foresight Process - Methodology

As part of the consultation and information-gathering methods used in Foresight, a number of social research methods were employed. There was *little* use of focus group and related semistructured methods of group interaction (for the generation of knowledge, as opposed to structured dissemination meetings), though the Regional Workshops held by each Panel did adopt a common framework. On the whole the meetings, though generally meeting with a very positive response, took quite conventional formats. (There was equally little use of technological innovation, such as video- or computer-conferencing in the process, except where specific Panels were able to call on their own specialist resources.)

The surveys carried out on behalf of the Steering Committee and Panels did utilise existing specialist knowledge in the design of such instruments, and methodologically these instruments are regarded as being of high quality by those in the field. (Again, little use was made of technological innovations, it being felt that the level of access to and familiarity with the World Wide Web at that point precluded online answering of questionnaires - however, this situation may well be changing.) The issues survey may be regarded as underexploited: its results were used to a very varying extent by different Panels, and have

¹⁹ It would be misleading to suggest they had no input - consider the roles of Ben Martin and Howard Newby on the Steering Committee, or of PREST researchers in the conomination exercise which contributed to the sectoralisation employed.

not been put into a common electronic format (though a couple of Panels did undertake such an effort for the purposes of their own analyses). The Delphi survey was widely criticised, in part simply because defining the set of questions to be used proved to be a time-consuming process for Panels that were already operating under severe pressures, in part because of distrust of the method itself,²⁰ or even of the philosophy of consultation that was employed. The full results only became available at a relatively late stage, and offer considerable scope for secondary analysis (in particular, there has been no use of the raw data - organised with the individual respondent rather than the topic as the unit of observation).

Existing research on group processes might be organised and used to allow for more effective group work in the course of Foresight. New (action?) research on group processes might also be opportune.

Sponsors of social research such as the ESRC and major Foundations have had little involvement with formal methods for prospective studies, such as Delphi, for some time (if ever). Support for serious research in such fields would be welcome. For instance, how valid are the criticisms of methods (and particular implementations of methods) like Delphi, and what alternative procedures might be available?

Secondary analysis of materials arising in the course of Foresight could be encouraged - this includes the group discussions and reports and background papers, as well as the survey material discussed earlier.

Panels were encouraged to develop their own scenarios, and to undertake a SWOT-type assessment of the sectors with which they were dealing. Limited assistance was provided for these tasks, however, which were carried out very unevenly across Panels. The OST made available one working paper on scenarios, a stimulating think-piece which was not utilised to any great extent by Panels, however, who found it hard to integrate into their own concerns.²¹

²⁰ This distrust was often founded on a misunderstanding of the purpose of the method: rather than being seen as a tool for eliciting knowledge and structuring expert judgements, it was portrayed as a simplistic device for technological prediction and the generation of artificial consensus. This corresponds to even more widespread views that identify Delphi method in general with just one narrow type of application of the technique.

²¹ This claim is based on a mixture of anecdotal and first hand views, supported by the lack of reference to the work in question in Panel reports.

Some Panels found the absence of clear guidance on scenarios to be a limitation, and in the press of work decided to pay very little attention to this element of the work. The Transport Panel, which made a great deal of use of seminar presentations by outside experts, had as one of its earliest presentations a report by Jim Northcott of the Policy Studies Institute of his work on UK 2010, which provided a broad sweep of data on social and economic trends, and engaged in some (fairly surprise-free) scenario analysis. Another Panel (MPBP) is, at the time of writing, convening a subgroup to undertake new work on scenarios relevant to its concerns (e.g. protectionism, different global divisions of labour). Inputs from social scientists as to critical driving forces, alternative futures and policy choices, and researchers' views as to the substance behind fashionable claims about social trends, might have been used to a much greater and more systematic extent.

The same is true of the comparative analysis of the different sectors addressed by the Panels. There was some provision of material from DTI surveys of competitiveness and other topics, and some Panels engaged consultancy and their own members in detailed investigation of this theme. More use could have been made of social science expertise that is already in existence, and the challenge of providing material appropriate to Foresight Panels could have positively benefited social scientists. As it was, Foresight Panels drew very selectively upon the knowledge accumulated by social researchers, usually in ignorance of the volume and variety of material available - and of the problems with "common-sense" interpretation of some more well-known material.

Related to the question of the competitiveness of UK firms or sectors is the issue of the globalisation of economic activity and the internationalisation of science and technology. In many respects the Foresight Programme seems to have been constructed around assumptions that science and technology are national affairs. (Note, however, that the Delphi did explore questions of need for international collaboration of various kinds in respect of the topics it featured.) There could well be inputs from social science concerning the regional and national appropriability of the value arising from (various kinds of) knowledge and their exploitation.

The social science community should develop mechanisms whereby appropriate social research material could be delivered in a timely fashion to be used by Foresight Panels and the Steering Group in any future exercises. This will include broad descriptive and extrapolative material on demographic, economic and social trends; insights into scenario construction, draft scenarios of various kinds (including “wildcard” scenarios), and suggestions as to sources of expertise for development of scenarios in particular domains; similar presentations of material and sources relevant to background issues of competitiveness, globalisation, and other matters of this sort that may arise. A basic set of bibliographies could be prepared, material placed on a Website (“Social Foresight”), a database made available for locating expertise, etc. Bearing the issue of international capabilities and factors in mind, it should also be noted that there must be scope to engage in many of the tasks mentioned in this paper in co-operation with partners in other countries and the EC.

Foresight Process - Panel Activities and Outputs

Social scientists did contribute to Panel activities to a greater extent than may be realised, but again this was typically a matter of chance and took place in an unsystematic fashion. The survey of social researchers conducted for the present study asked which Panels were thought to have most need for social science inputs. The preliminary results indicate that the Panels with most citations are: Leisure & Learning; IT & Electronics; Communications; Finance; Manufacturing & Business Processes; Health and Construction. Panels where no inputs are thought likely are Agriculture, Materials and Marine fields. The specific details of these results are of little relevance: a slightly different set of respondents might have yielded a very different pattern, and in any case the picture very much depends on respondents’ partial awareness of different Panel activities and issues. However, the results are equally not very surprising: the Panels most often cited are among those with the most obvious links to social organisations and human factors (though Retail & Distribution, and Transport might also be expected to have been viewed in a similar light).

Nevertheless, it is quite arguable that all Panels have clear requirements for social science inputs. Earlier sections of this essay have noted numerous generic issues that confront Panels to greater or lesser degrees, where little input has apparently been forthcoming from social research. In addition to the pervasive themes such as human factors mentioned above, we might also recall that the Delphi study included a set of questions concerning

social, ethical, economic and other obstacles to the various topics developing as anticipated. Not only is the incidence of these perceived obstacles and its relation to the substantive and statistical features of the topics worthy of investigation. It might also be of interest to see how far social scientists, expert in topics such as public attitudes to science and technology, and trends in social attitudes more generally, responded to these questions. Would their judgements be similar to those of the domain experts?

The citations of Panels which has just been outlined presumably draws much more on judgements of panel-specific issues, relating for example to user demands, consumption and lifestyle patterns, and to organisational processes. In some cases Panels were equipped with members who could readily draw on existing social research knowledge; in other cases Panels were able to arrange for relevant seminars and other modes of access to knowledge. But in the pressure of work, which was very intense in the main Foresight stage, many Panels were barely able to recognise the social issues implicated in their work, let alone address them in sufficient depth.²²

More systematic representation of relevant social research expertise might be sought for all Panels which desired it. Certain Panels would be likely to require more input than others. As well as representation on Panels, various other types of input might be systematically arranged. (At the very least, opportunities to consult with relevant expertise.) This will require due awareness of the likely sensitivities concerning lobbying to have “special interests” included on Panels. In the event of significant reservations being expressed, some social science “shadowing” of Foresight might be instituted.

With this said, it is also quite possible that social scientists have themselves not been as active in following Foresight as they might be. A review of Panel reports indicates themes emerging where social research could immediately be mobilised - e.g. on the vexed issue of conviviality/sociability versus privatism as implications of the use of new IT; the implications of telework and teleservices for ways of life; the changing pattern of use of space and its implications for planning. In a later draft we intend to enlarge and substantiate

²² The argument is not that more attention should be paid to such issues in order to satisfy the curiosity or professional interests of social scientists, but rather that absence of systematic consideration of these issues impairs the exercise and its recommendations. Social factors are often being cited as obstacles to implementation of Foresight - e.g. in contacting SMEs: thus there is a strong case for social scientific inputs.

this list on the basis of analysis of Panel reports; whether further investigation of the calls for social understanding that emerge from the Panels is required should then be apparent.

Panels also engaged in network-building as one of their prime activities, both as part of the consultation process and as part of the dissemination of results and their implementation. Some activities were mandated by the Steering Committee (e.g. organisation of regional workshops), while others were undertaken on a more ad hoc basis. Panel members may be assumed to have generally been in a prime position to identify whom they should have been seeking to communicate with and build into ongoing networks, but there may have been exceptions - some Panels being less effective in this process (for example, the more “social” Panels seem to have had more difficulty than might have been anticipated in finding expert respondents for their Delphi surveys), and, quite possibly, some relevant constituencies being overlooked in the process. There could then be scope for external inputs as to these activities, again with due regard to Panel sensitivities.

The Social Science community - e.g. the ESRC, the Social Research Association, professional bodies - might seek to establish ways in which social scientists could help in the identification and recruitment of relevant network members for the activities of Foresight Panels.

Foresight Process - Implementation and Follow-Up

Foresight follow-up activities are manifold, and this is not the place for a full review of them. However, certain common issues can be briefly touched on. First is the evident difficulty in getting Foresight messages across to particular types of audience, in particular to SMEs²³ and to many firms that are not research-intensive but which nevertheless are engaged in innovation processes.²⁴ The social research literatures -e.g. those concerning the processes of **diffusion, adoption and implementation** of knowledge, technologies and practices - should have much to offer those responsible for fostering such efforts.

²³ Problems with accessing SMEs in other phases of Foresight should also be considered.

²⁴ Several large utilities have proved to be remarkably ignorant of the Foresight programme, even in the wake of considerable publicity. Even in research-intensive organisations, there are doubts about how far the messages of the programme have permeated through the organisational structure.

We might secondly raise questions as to the level of participation of social scientists in Foresight Challenge and related activities. However, three of the 24 successful bids (from over 500 entries) in the first round did involve the ESRC in a leading role, which is certainly better than might have been anticipated.²⁵ It would be of interest to examine the extent of social science participation in other successful bids.

Third, there is considerable scope for more detailed examining of priority-setting mechanisms in public S&T policy. Examination of and the ways in which the messages of Foresight have been incorporated or accommodated within the prioritisation processes in different Research Councils and government departments is part of the evaluation of Foresight. But it could also contribute to the development of improved understanding of these processes, and perhaps for benchmarking the methods used and improving instruments.

Conclusions

This essay has suggested that as well as pointing to a number of areas where social science knowledge might be developed or better utilised, the Foresight process as a whole is suffused with matters of interest to social researchers. There are many points at which they can make inputs. And there are many features of Foresight from which they can derive not only ideas for interesting research studies, but also ideas for setting priorities and relating social research to wider constituencies. We have made several recommendations indicating ways in which these possibilities might be realised (mindful of the several audiences for this paper, we have developed broad-brush recommendations rather than precise ones for specific actors).. How far they will be taken up could be the subject of a miniForesight exercise itself!

²⁵ These are the *National Creative Technologies Initiative*, the *Use of Synthetic Environments for Risk Management*, and *Innovation in London's Financial Markets* - reflecting issues raised in panel reports.

ANNEXE 1: Questionnaire Survey of Social Researchers

Several methods have been employed in the course of preparing this study. As well as a scanning of Foresight documentation, the fifteen Foresight Panels' final reports have all been analysed with the use of NUDIST qualitative software, searching for keywords relevant to the study. A short piece of survey research was also undertaken.

18 useable responses were gathered by our survey of social science experts (these were members of a list of ESRC programme and Centre directors). This represents better than a 25% response rate, which is encouraging given the survey was distributed over the Xmas/New Year period. It is possible that there is some bias toward those more enthusiastic about or involved in Foresight. (Additionally, there has been one cogent reply as to why the respondent feels unable to respond in an informed way to specific questions, with some raising of concerns about the orientation of the exercise.) A copy of the questionnaire is appended.

Contact with Foresight

Table 1 sets out the results here. In terms of their own personal contact with the Programme, 7 (almost 40%) report **no contact** themselves with Foresight. A similar number had examined documentation the Programme produced (and there was almost no overlap between these two groups - only one instance). As for other sources of information about the programme, 3 (17%) received most information from the media (though 7 again thought that most of their staff/programme members had done so).

In terms of involvement with the Programme, 3 reported involvement in its design (6 reported other members of their Programmes/Centres being involved here), 2 as being involved in preForesight consultation; 5 were Panel members. (None were themselves, Steering Group members, though 1 correctly reported that another member of their Centre was one). 1 gave verbal and 2 gave written inputs to Panels, and 4 responded to Delphi (or

other - in practice most likely Delphi) questionnaires and 4 again participated in meetings. Finally, 3 took part in follow-up activities or Foresight Challenge bids.

In almost all of these instances, the respondents reported higher levels of activity than their Centre/Programme members. (They were asked to describe whether few or most members would be engaged in each of the relationships with Foresight.) In practice, though our respondents are likely to have been more active than average, there may well be gaps in their knowledge of others' activities. It is however worth noting that 3 of the 7 respondents who reported no personal contact nevertheless thought that other members would have some contact; while only 3 of those reporting contact themselves thought that this would apply to none of their members.

Table 1 Involvement in Foresight

What contact have you or members of your Centre or Programme, had with the OST's Technology Foresight Programme? <i>(Please check all statements that apply, and provide elaboration if relevant)</i>	• No contact	7	2	5
	• Most knowledge of Foresight gained through media	3	7	4
	• Examined documentation produced by Programme	7	5	0
	• Contributed to design of Foresight exercise	3	6	0
	• Took part in "pre-Foresight" consultation workshops	2	4	1
	• Member of a Foresight Panel(<i>which?</i>)	5	3	0
	• Member of Steering Group	0	1	0
	• Gave verbal input (e.g. seminar) to Foresight Panels(<i>which?</i>)	1	1	0
	• Provided written evidence to Foresight Panels(<i>which?</i>)	2	2	0
	• Responded to Foresight Delphi (or earlier) questionnaire(s) (<i>which Panels?</i>)	4	4	0
	• Participated in Foresight meetings (regional workshops/Megaforum (<i>which?</i>))	4	5	0
	• Taking part in Foresight follow-up activities/ bids to Foresight Challenge project (<i>which?</i>)	4	3	0

Views on Foresight and Social Science

Where it comes to having views about the Foresight process, it is reassuring to find that the social scientists who indicate little personal relation with Foresight do not leap to judgement about its practices! 7 or 8 “don’t know’s” are common in the questions dealing with Foresight’s use of social science. Among the remainder, views were widely dispersed, but with a marked slant. Thus the majority view was clearly that social science was used partially or worse in the design, work and conclusions of Foresight - though several respondents perceived more extensive use.

Few respondents abstained from questions dealing more with how social science should respond to Foresight. A large majority disagreed with the view that it was irrelevant to social science priorities, and there was some support for the view that the ESRC needed to develop its response to Foresight further. Stronger support was voiced for the view that one’s own area has contributions to make and stronger still for the suggestions that social scientists should work more with Foresight in the future, that Foresight has identified issues for social scientists to work more on, and that further work in one’s own area can have further contributions to make.

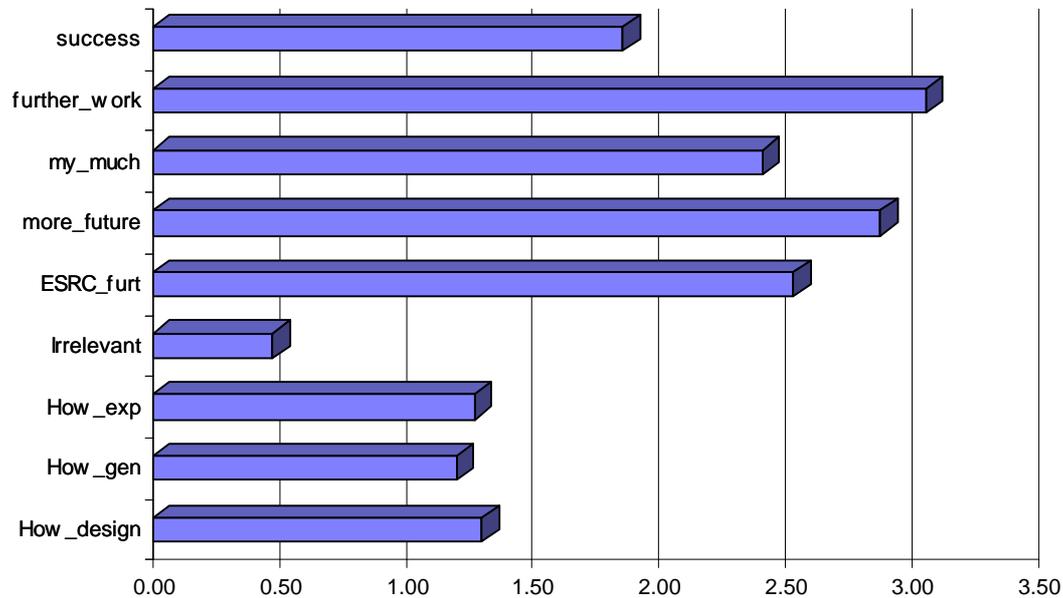
Table 2 Views on Foresight and Social Science

<i>Please use the scale on the right to indicate your view, providing more elaboration as you see fit - especially if your comments are at all critical</i>	Don't know/Not applicable					
	↓	No, highly inadequate, very limited use				
	↓	↓	Partial, incomplete use			
	↓	↓	↓	Extensive use		
	-1	0	1	2	3	4
1. How far was contemporary social science knowledge applied in the <u>design</u> of Foresight?	8	2	4	2	2	0
2. How far was contemporary social science knowledge <u>in general</u> applied in the work and conclusions of Foresight?	8	5	1	1	2	1
3. How far was contemporary social science knowledge <u>in your areas of expertise</u> applied in the work and conclusions of Foresight?	7	4	2	2	3	0

<i>Please use the scale on the right to indicate your view, providing more elaboration as you see fit - especially if your comments are at all critical</i>	Don't know/Not applicable					
	↓	Strongly disagree				
	↓	↓	Agree in part			
	↓	↓	↓	Strongly agree		
	1	11	3	3	0	0
The Foresight Exercise should be treated as largely irrelevant to social science priorities	1	11	3	3	0	0
The response of the ESRC to the Foresight Programme needs further development	3	0	2	7	2	4
Social scientists should be encouraged to work more with future Foresight exercises	2	1	1	5	1	8
My area of work already has much to contribute to the work and conclusions of Foresight	1	1	3	4	5	4
Further work in my area of social science could contribute substantially to Foresight	0	0	0	8	1	9
The Foresight Programme has successfully identified a range of issues which it is important for social research to address more fully	4	0	1	2	8	3

Figure 1 Views on Foresight and Social Science

Note: for details of questions see [Table 1](#). Figures are mean responses of those not answering “don’t know”.



Where can Social Science contribute?

[Table 3](#) and [Figure 2](#) outline responses to the questions whether one’s own area of social science, and/or other areas, can contribute to various elements of Foresight. Networking and dissemination (obvious areas for application of social knowledge) were the most frequently chosen of the set, followed by design of Foresight. In terms of which panels were seen as potentially benefiting most from social research inputs, the outstanding case was Leisure & learning, followed at some distance by Communications and then by IT, Finance, and Manufacturing & Business Processes, and then Health & Life Sciences. Retail attracted surprisingly few votes, though some sectors received hardly any - most notably, Agriculture and the new Marine Panel. (See [Table 4](#) and [Figure 3](#).) These results do not correspond in any straightforward way to the views expressed by the Panels themselves, where Retail for instance was strident in calling for social research inputs.

Table 3 Areas of Contribution to Foresight from Social Science

	your area	other areas	both own and other areas	No. of respondents finding some area relevant	No. of cases of some area being found relevant
Steering	2	2	1	3	4
Networking	3	5	3	5	8
Dissemination	5	3	1	7	8
Challenge	1	1	0	2	2
Design	3	3	1	5	6
Other	0	0	0	0	0

Figure 2 Contributions of Social Science to Aspects of Foresight

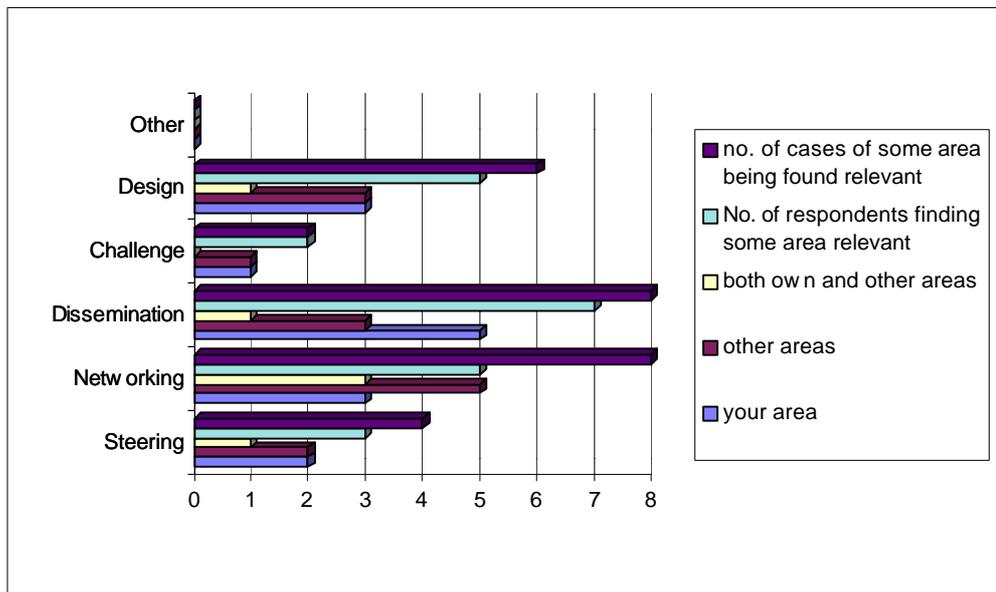


Table 4 Panels/Sectors where Social Sciences might contribute most

	your area	other areas	both own and other areas	No. of respondents finding own area relevant	No. of cases of some area being found relevant
Agriculture	0	0	0	0	0
Chemical	1	0	0	1	1
Comm	5	8	3	10	13
Constr	4	3	1	6	7
Defence	1	2	1	2	3
Energy	1	3	1	3	4
Finance	5	6	2	9	11
Food	4	2	2	4	6
Health	4	6	3	7	10
ITE	7	5	4	8	12
Leisure	11	6	4	13	17
MPBP	8	3	2	9	11
NR&E	3	3	2	4	6
Retail	3	3	2	4	6
Marine	0	0	0	0	0
Materials	2	0	0	2	2
Transport	1	1	0	2	2

Figure 3 Contributions of Social Science to Sectors of Foresight

