LSE Public Policy Group

# The impact and value of the Foresight research programme

Report to Foresight
from the LSE Public Policy Group

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**Explanatory Note:** This report was commissioned by the Foresight Unit of the UK Department for Business, Enterprise and Regulatory Reform (BERR) in early 2008, and delivered in May that year. It was initially a confidential document. This public version was constructed in July 2002 and includes a different pagination from the original report. To cite particular parts of the report please use the relevant numbers for all paragraphs and Figures.
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# Executive Summary

1. The LSE Public Policy Group has been asked by the Foresight Programme in the Department for Business, Enterprise and Regulatory Reform (BERR) to review the impact and value of eight future-focused research projects completed as part of the Programme's work since 2002. We have looked at impacts of these research projects across government in policy making and practice, in academia and research science communities, in the commercial sector, and in civil society and the public at large. We list the Foresight research projects covered below:

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|---|
| ***Tackling obesities: Future choices*** *(October 2007)* How to deliver a sustainable response to obesity in the UK over the next 40 years. |
| ***Detection and identification of Infectious diseases*** *(April 2006)* in plants, animals and humans. |
| ***Intelligent infrastructure systems*** *(January 2006)* The future of transportation systems for goods and people, and alternatives to mass movement. |
| ***Brain science, addiction and drugs*** *(July 2005)* How scientific and technological advancement impacts on our understanding of addiction and drug use over the next 20 years. |
| ***Cyber trust and crime prevention*** *(June 2004)* Application of next generation technologies in computing, communication and personal security. |
| ***Exploiting the Electromagnetic spectrum*** *(April 2004)* to ensure increased innovation and capability over the long-term. |
| ***Future Flooding: Flood and coastal defences*** *(April 2004)* A 30 to 100 year vision on the future of flood and coastal defences in the UK. |
| ***Cognitive systems*** *(April 2002)* A study of future development in cognitive systems considering recent developments in neuroscience and computer science. |

2. Our report is structured in three Parts as follows:

- Impacts achieved by Foresight research projects *(Part 1)*;
- Enhancing impacts generated from the Foresight process *(Part 2)*;
- Future Flooding Case Review *(Part 3).* (We were asked to focus in more detail on the Future Flooding report launched in April 2004, and this Part provides a short case study review of this project and its impacts.)

We have used a mix of 'reactive' and 'non-reactive' measures and related methods to build a picture of the main impacts from Foresight work and how the Foresight process generates impacts. Our key reactive measures are:

- Fifty semi-structured stakeholder interviews *(see list of interviewees in Appendix A)*;
- Web surveys aimed at professionals and research users. See www.ppgsurvey.org/foresight; *and*

- Commissioned expert review of the Future Flooding report by independent academics.

Our key non-reactive measures are:

- Separate all-domain Google searches for all eight Foresight reports and systematic coding of the results, focusing on the extent and nature of research dissemination;
- Government-only (gov.uk) and academic-only (ac.uk) Google searches for each of the eight reports;
- Shorter systematic search of Research Councils websites for references to Foresight research;
- Press search for media references to Foresight research; *and*
- Systematic analysis of the Foresight one-year impact reviews, where available.

For full details on our Methodology, please see Appendix A.

## Impacts achieved by Foresight research

3. Overall the eight Foresight projects have achieved a wide and in parts impressive range of impacts. In our interviews with research scientists involved in the projects, almost all could point to some specific or relevant impact from the research work, and very few were dismissive of the Foresight work and its value. Most, if not all, research users in government and civil society were generally positive about Foresight research, and on the whole confirmed or corroborated impact claims made by researchers.

4. More experienced observers compared the current model of Foresight reports far more favourably to previous versions from an earlier period. Around half of our survey respondents agreed with the statement that the 'Foresight model works well' and only around 1 in 10 disagreed with this. More than one half of the references to Foresight research that we found in our Google searches were explicitly positive, a high rate, (with the vast majority of the rest neither positive nor negative) and we list some words below which conveyed the general mix of feeling (see Figure 1.21 in Part 1):

> 'interactive', 'open', 'innovative', 'cross-cutting', 'superb', 'wide ranging', 'extensive',
>
> 'unique', 'comprehensive', 'chilling', 'holistic' and 'challenging', 'heavyweight'

5. Despite the fact that most interviewees could point to at least some specific impacts from each project covered, quite a clear pattern emerged of variations in overall impact across the projects. As shown in Figure 1 below, two appeared to lead the way as 'big hitters', *Future Flooding* (2004) and *Tackling Obesities* (2007). These reports scored consistently near the top across practically all our non-reactive work in different sectors.

Interviewees also talked quite specifically about how these projects had made a difference and give well-evidenced illustrations or examples.

| **Figure 1: Top impact for each project** | |
|---|---|
| ***Consistent and major impacts all most sectors*** | *Tackling Obesities* |
| | *Future Flooding* |
| | |
| ***Major impacts but inconsistent across sectors*** | *Infectious Diseases* |
| | *Brain Science and Addiction* |
| | |
| ***Moderate impacts in some sectors*** | *Cognitive Systems* |
| | *Intelligent Infrastructure* |
| | *Cyber Trust* |
| | |
| ***Low or uncertain impacts*** | *Electromagnetic spectrum* |

6. Some projects tended to do well in certain sectors and less well in others, suggesting that they were more tuned in to narrower audiences or just a little more abstract or specific in terms of content. *Infectious Diseases* (2006) scored relatively highly in government sectors, moderately in academia, yet for some reason very low in the mainstream press. In interviews government officials particularly spoke highly of the way in which the research had led to further collaborations across plant, animal and human disease functions.

7. *Brain Science and Addiction* (2005) scored in a somewhat hit and miss way, showing quite strong referencing patterns across government and moderate ones in academia. Yet for some reason we struggled in our interviews to find many specific or large scale impacts, either in government or academic institutions. Other reports such as *Cyber Trust* (2004), *Intelligent Infrastructure* (2006) and *Cognitive Systems* (2002) exhibit rather similar lack of consistency across different sectors. *Electromagnetic Spectrum* (2004) is consistently lowest in all our areas of evidence gathering.

8. Foresight reports tend to have greatest impact in three main areas - UK government and policy making, academia and research institutions, and the 'third sector'. The projects frequently involve senior level civil servants in oversight roles and they target UK central government departments as prospective owners of the research post-completion. Projects also commission most of the research from relevant academics so it is not surprising that impacts appear to be strongest in these areas.

9. Interestingly, survey respondents did not score the third sector highly as targets for research. However, our own Google searches and interviews strongly suggested that third sector organizations pay close attention to relevant Foresight work, reference it as parts of

campaigns or policy work, and generally make it available on their websites. We found much more uncertainty about the extent of impact of Foresight research in the commercial sector and amongst consultants working in futures and strategic specialisms. (see Figures 1.1 and 1.2 in Part 1).

10. *In the UK government sector, Future Flooding* has shown most considerable impacts across all our sources of evidence and contributed directly to shaping the government's strategy *Making Space for Water* (2006) as well as to subsequent work by the Environment Agency to model flood risk. Civil servants told us that *Future Flooding* partially influenced the HM Treasury decision to increase funding for flood risk management to £800 million per year over the next three years. *Tacking Obesities*, the most recent of the Foresight projects, also had considerable impact on the recent cross-government strategy on obesity from the Department for Health *Healthy Weight, Healthy Lives* (2008). On both topics, Foresight seems to compare well in terms of coverage of its reports compared to other broadly equivalent research organizations, such as the highly funded UK National Audit Office (see Figure 1.11).

11. A wide range of civil servants spoke positively about the impact of Foresight research in reducing the negative effects of 'silo working' across different parts of government, and bringing to the fore pockets of potentially innovative government science. The *Infectious Diseases* project brought together plant and animal disease expertise in government, and from it new joint working between the Central Science Laboratory (CSL), Veterinary Laboratories Agency (VLA), and Defra has led to the development of a new handheld device, known as the Biochip, for the one-stop diagnosis of plant and animal diseases in the field.

12. Other projects such as *Intelligent Infrastructure* claimed more contextual or indirect impacts in government, the strongest of which we feature in Tables throughout Part 1. For example, one researcher told us that the Department for Transport (DT) worked the Foresight scenarios into their strategic business planning, but we were unable to find anyone at the Department to substantiate this. We struggled to find specific and major impacts in government for *Cognitive Systems, Brain Science, Cyber Trust*, and the *Electromagnetic Spectrum*.

13. *In the academic and research science sector*, we found strong illustration of how Foresight research has helped academics to develop professionally, gain access to decision makers, build capacity in academic institutions, and build links between research funding councils and new academic areas of research. Foresight projects have laid foundations for subsequent new research programmes based in universities. One direct and interesting innovation to have come out of the *Tackling Obesities* research is the recent establishment of the National Obesity Observatory at Oxford University, currently funded by the Department of Health at around £780,000 per year, and tasked to 'inhabit the territory between academia and policy'. An Observatory model has also been discussed as a potential follow-up to the *Infectious Diseases* project.

14. The academics we spoke to were all generally positive about opportunities to get involved with research work that could impact on government policy. STEM (science, technology, engineering and medicine) scientists in particular told us that opportunities to think about their work in a policy-making context were relatively rare. All scientists spoke glowingly about the opportunities created by projects to interact with radically different disciplines and to share ideas. A wide range of university interviewees told us that being involved in the Foresight research had 'opened new doors' and provided access to senior policy makers, that they would not have enjoyed otherwise. Some spoke of new opportunities to travel and to work with scientists internationally, particularly researchers from *Future Flooding* and *Infectious Diseases*. Having Foresight work on academic CVs tended to lend cachet to subsequent research grant bids submitted by researchers.

15. There is clearly an important link between Foresight research and subsequent funding opportunities through the Research Councils. A number of interesting new research programmes could be linked back to Foresight projects. The *Memories for Life* network, set up by psychologists, computer scientists, and neuroscientists from Southampton University, is an interdisciplinary programme jointly funded by the EPSRC looking for ways in which new technologies and scientific understanding can improve human memory capability (particularly for people with memory-harming illnesses such as Alzheimers). The *Cognitive Systems* and *Cyber Trust* projects also helped to shape subsequent research programmes funded by research councils.

16. *In the commercial sector*, it is difficult to say to what extent impacts from Foresight research have been widespread. Some of the projects such as *Tackling Obesities*, included commercial interests on expert panels or stakeholder committees, and interviewees confirmed that these representatives played an active part in the research oversight. *Future Flooding* and *Tackling Obesities* both had active participation from key commercial sector associations such as the Association of British Insurers and the Food and Drink Federation. Officials in such organizations could speak in impressive detail about the Foresight research and its significance for the commercial sector. We also spoke to representatives of individual firms who had detailed knowledge of Foresight and its work, notably in *Future Flooding*, *Tackling Obesitie*s, *Cyber Trust* and *Intelligent Infrastructure*. Our survey results and Google searches tended to confirm this picture of somewhat patchy impacts across the commercial sector. But nevertheless some household commercial names do seem to have taken notice of outputs (See Figure 1.2).

17. *In civil society and the 'third sector'* we found quite positive responses from major charitable or campaigning organizations, who had quite high levels of awareness of Foresight research. Most of the third sector bodies we spoke to, particularly regional and national flood forums, and some household name charities such as the British Heart Foundation and Cancer Research UK, told us that Foresight research had helped to raise awareness for their work inside and on the edges of policy communities. It had given

them valuable bases for further campaigning, and led to new joint programmes of working linking the third sector, government and commercial interests. For example, the National Flood Forum told us that Foresight had provided a basis on which to work together with the Association of British Insurers to develop insurance-linked incentives for householders to be more 'flood-aware'. There are often huge resources of expertise and activity in the third sector community, and some representatives said to us that Foresight could benefit from tapping into this more directly. Both in generating evidence and disseminating results. Our survey results do not confirm this picture, suggesting that third sector impacts are relatively low. (However our survey respondents are mostly academics from STEM disciplines, who may have little direct contact with third sector organizations.)

18. The impact of Foresight research on the *public at large* is relatively low and diffuse. Foresight is certainly not a widely known organization, even in government, and its corporate brand tends to play second fiddle to the stronger profile of individual projects. Most of our interviewees showed very detailed knowledge of individual projects but had relatively low awareness of Foresight as a corporate entity. In terms of press and media coverage, some projects tend to fly while others never really get going. *Future Flooding* and *Tackling Obesities* are by far ahead of the others in terms of achieving mainstream media coverage (in our press search). *Infectious Diseases* shows moderately well, but after that there is a sharp drop off. Some interviewees complained about the way in which their projects had been handled by government press offices. This may explain the disappointingly low press coverage for some potentially newsworthy studies.

## Enhancing impacts generated from the Foresight research process

### Timing, scoping and refining research questions

19. We found general agreement in our interviews that the Foresight research projects are well timed, and there has been good balance between policy-relevant projects and more experimental or 'blue sky' work. The influential projects in policy terms, *Tackling Obesities* and *Future Flooding*, both reached completion just prior to the publication of major government strategies, and others such as *Infectious Diseases* came in response to pressing new government priorities (and crises). The time horizons of projects were mostly seen to be appropriate, however some policy makers at local and regional level said that outputs could be more systematically phased to take account of shorter time horizons in delivery organizations.

20. Many of our interviewees commented on the very broad scope of Foresight projects and the difficulties of limiting the extent to which they grow as more and more extras are added. Researchers acknowledged the inevitability of scope creep, particularly as departments and other bodies come to the table with different requirements and as

| **WEAK MODEL** | **STRONG MODEL** |
|---|---|
| Research too broadly scoped and high-level research questions are not clear and defined… | Research covers a broad mix of disciplines but the high-level research questions are clear and tightly defined… |
| …Science reviews are disparate and insufficiently geared towards addressing common research questions… | …Science review writers are given clear research questions to answer, possibly in a pro-forma context… |
| …Impossible to synthesize the review evidence and core team end up having to write report independently… | …Research evidence feeds into answering the high-level research questions and core team are able to synthesize effectively… |
| …The final report lacks coherent thread of data and analysis, and is too general. Vast array of primary evidence has to be published separately | …The final report is a full and comprehensive single document, accompanied by a range of technical or case appendices. There is strong link between research questions, data collected and analysis. |

political pressure is applied. There is a risk that projects grow into an 'unfocused review of everything relating to a general area'. Some commentators suggested that research teams needed to have autonomy and confidence enough to be able to discern primary issues from other issues. They need to find ways of 'parking' non-primary issues and finding a place for them on peripheries of the final research outputs.

21. The importance of defining high-level research questions clearly and precisely has been a major theme from our interviews. In previous projects there has been a tendency for questions not to be defined precisely enough, and then for research team to go out and commission a whole range of science reviews, which are then so general and unfocused that it becomes almost impossible to synthesize them ex-post. The problem here is that evidence collection is not sufficiently driven by research questions, and the outcome is that research teams tend to produce reports that lack a strong thread pulling together research question, data collection and analysis. Summary reports tend to lack specifics and meanwhile primary evidence reports are published separately in a confusing array on the website. This makes it very difficult for observers to find accessible and 'need-to-know' versions of the research findings. We try to depict this in summary form above *(for more detailed discussion see Part 2)*. This is a potential disjuncture which could be rectified by insisting that projects have clear high-level research questions from the outset and that evidence collection feeds into those questions coherently.

22. We gathered a range of views on the extent to which Foresight projects *strike the right balance between disciplines and sciences, particularly between STEM* (science,

technology, engineering and medicine) *and HSS* (humanities and social sciences including economics) disciplines. We encountered some quite scathing criticism about how specific projects were not set up properly from the outset to include sufficient social science and economics approaches, or alternatively, how projects started out on the right track but veered off toward STEM approaches. Most main researchers did not see this as a problem however, suggesting that projects are underpinned by scenario-building and economic modelling work, and that this inherently gave them social science credibility.

23. Some STEM scientists that suggested that developments in neuroscience and genetics make the 'hard science' discourse of progress so powerful, that really STEM science will 'march on' regardless of whether HSS disciplines are involved or not. Other scientists told us that there is clearly a role for HSS disciplines to play in shaping this progression. For example, it is often surprising that one does not see certain HSS disciplines (such as philosophy) more heavily involved in Foresight projects. Social scientists often owned up to feeling some mild paranoia and some inferiority complex vis-à-vis 'hard' science disciplines.

## Building diversity and balance into the research

24. Every academic researcher involved in Foresight projects told us that the early stages of the research (particularly early workshops and seminars) project provided an exciting and challenging environment for academics from different disciplines to come together and to 'bounce ideas across disciplines'. Researchers used terms such as 'mind-stretching', 'spark thinking', 'contact-making forum', and 'mix of expertise'. Our survey evidence also overwhelmingly confirmed the value of this aspect of the Foresight research process: survey respondents almost universally agree that 'a major strength of Foresight is that it brings together people from different backgrounds' (see Figures 2.2 and 2.3).

25. Many academics who were involved in early stages told us that their involvement dwindled as projects went on. Amongst many respondents we detected quite widespread feelings of marginalisation or 'losing touch', particularly linked to the problem that projects appeared to veer off, lose focus, or be increasingly dominated by a small and select group. Some lead researchers responded to this by saying that the nature of running a Foresight requires very intensive and focused activity, and this somewhat inevitably leads to a 'narrowing down' of the people involved.

26. Many commentators agreed that Foresight has an 'elite feel' in the way that it operates. Most researchers agreed that having the authority and weight of the Chief Scientific Adviser (CSA) behind research projects was extremely important for their subsequent impacts. Researchers on the whole enjoyed this elite feel and we collected many examples of 'doors opening' for academics as a result of more informal contact with higher echelons of government. We detected some feeling of political or elite pressure on researchers to tow the line on certain issues, such as selecting academics or

changing the tone of findings to avoid political sensitivities. These cases were relatively few and most researchers felt that this kind of thing 'came with the territory' when working in or for government.

27. We found general satisfaction with the composition and commitment of the core research teams and the working arrangements. Interviewees showed high levels of admiration for the work rate and commitment of lead researchers, and acknowledged that the burdens are often extremely high, considering the breadth of scope and quick turnaround of projects. There was some discussion around finding the right mix of seniority, age and position in established networks of academics, and some interviewees suggested that core research teams could be slightly larger and incorporate a broader mix of youth and experience, and a more diverse mix of sector backgrounds. Some mentioned a tendency for researchers to call on favoured colleagues without much external challenge. As a result research outputs tended towards 'unimaginative' and 'incremental'. We found it difficult to substantiate such claims, but this was certainly a view which researchers on the outskirts of Foresight projects tended to agree with in varying degrees.

28. Government policy makers seemed to be involved in most projects from the outset, both through oversight committees or expert panels, and in more hand-on aspects of research. Although some interviewees did suggest that policy makers could be more intensively involved in the research design, we did not really find any obvious cases where organizations were excluded or overlooked. It is of course not always the case that government organizations will want to 'play ball', and we found numerous examples of researchers complaining about the difficulties of getting departments interested. In a small number of cases, some major departments openly refused to be involved in relevant projects, despite repeated encouragement from research teams.

29. A majority of interviewees told us that the private sector could be more directly involved, but most did not favour having private sector companies represented in research teams. A number of researchers suggested that having key commercial interests involved from the outset makes it much easier to bring about practical change in the way that consumers and firms operate. For example, regional flood forums told us that the Foresight research gave them a basis on which to work with the Association of British Insurers to offer reductions in home insurance premiums to householders who implement basic flood contingency measures.

30. We found an interesting contrast in views about how much Foresight should build extreme or radical options into its thinking and into its research outputs. We tended to get quite strong views from external consultants, essentially suggesting that Foresight makes a mistake of being too incremental and too cautious in its futures thinking. Some suggested that established academics are not well equipped to think into the future, and argued that most commercial organizations will use cutting-edge PhD students rather than established academics for an insight into what is round the corner. (This is a

potentially interesting option which Foresight may explore in collaboration with research councils.)

31. Other valued external commentators were less inclined to think radically about Foresight, arguing that the strength of its research lies in delivering robust and balanced reviews of the current knowledge and future challenges to government. On balance, Foresight could be more open to sources of radical thinking, involving them more systematically in the research process. This would not undermine a final output which is sensitive to incremental workings of government and provides robust and well-evidenced analysis.

## Research quality and methods approaches

32. The *Tackling Obesities* and *Future Flooding* projects were almost universally praised by researchers, policy makers, and policy 'watchers' alike for the quality and comprehensiveness of the research. Interviewees generally agreed that these reports have been difficult to challenge both in terms of their scientific credibility and their overall findings. Some commentators criticised some technical aspects of methodology and analysis of causality but these were seen as areas for follow-on or improvement of models, and relatively minor criticisms in light of what were generally to be considered to be pretty 'groundbreaking' research.

33. Some commentators suggested that much of the evidence base generated from science reviews appeared to have been produced in a bit of rush. Given the fast turnaround and very 'general' nature of the commissions, some felt that review writers did tend to 'go through the motions' of submitting overview pieces which lack focus and academic rigour. Critics said that many reviews would in fact struggle to make it through a standard journal peer review process. The quality of science reviews links closely to our comments above about framing high-level research questions in a more disciplined and systematic way, to ensure that review writers are responding to a more specific brief, rather than delivering overly generalized summaries of current thinking across a range of fields. Interviewees made interesting suggestions about the possibility of the research councils overseeing a light-touch peer review process.

34. Many interviewees complained about the confusing way in which Foresight posts project outputs on its website. Most projects produce a vast and confusing array of documentation, making it extremely difficult to find 'need-to-know' summaries and other comprehensive reports which bring together all the findings in one place and convey these findings in a coherent format. Our own research team has found it frustrating that for some projects we have struggled to locate up-to-date and comprehensive single reports. The complete lack of standardisation and, in places, unfathomable array of outputs seriously undermines the impact of Foresight research.

35. Despite radical over-production of outputs and a confusing lack of organization and layering to these outputs, we found an impressive array of dissemination activity carried out by Foresight researchers. Some core research teams have shown strong commitment in the way they have presented material to different audiences, undertaken research trips, done press and media work, and generally hyped the findings of research. However, some commentators suggested to us that Foresight projects could benefit more directly from more systematic and prestigious launch events, which target specific technical, policy making, commercial audiences in different ways.

36. In some projects we found quite significant and potentially important signs of a disjuncture between the work done by more technical or methodological experts (e.g. scenario-builders, systems mappers, software designers) and substantive subject experts or scientists. There was a tendency for technical work to be done in seeming isolation from substantive science review work. In some cases, technical experts admitted to doing their modelling bit of the work and never actually meeting the scientists who were going to apply it. Our discussions with technical consultants underlined to us that it is vitally necessary for modelling or scenario design work to be done in close proximity to the actual substance or knowledge. There is much to be done in our view to develop flexibility and integration in the way that technical aspects of Foresight work interweave with substantive aspects.

37. Researchers and scientists told us that they found scenario and futures techniques challenging, and not something that academics get a chance to do very often. However, some interviewees expressed a worry that Foresight has been too reliant on scenario-building. As one consultant said to us, ‘reading other people’s scenarios is notoriously boring’. If Foresight are going to use scenarios, then potential users of Foresight research may have to be involved in the process far more intensively, so that the scenarios which are developed operate on useful parameters for these organizations. A parallel and more focused study into the use of these kinds of technical tools in Foresight is currently underway, so we have intentionally limited our coverage of this aspect of the Foresight process.

## Sustaining research momentum and ownership

38. One of the most commonly cited challenges for the Foresight process is how to sustain momentum and ownership of projects once research has been completed. This emerged very strongly from our interviews and survey findings (see Figure 2.2 for example). As one interviewee put it in relation to *Brain Science*, ‘there was a fanfare and then it went flat’. This could conceivably apply to a good number of projects we covered. Perhaps really only the *Future Flooding* and *Infectious Diseases* projects have stood the test of time in government contexts. And given the strong launch and initial signs of impact from *Tackling Obesities*, we might reasonably expect this to maintain momentum, at least through institutional innovations such as the National Obesity Observatory.

39. We found a range of views about where Foresight projects should naturally 'end up', in other words, who should take ownership for them on completion. Some commentators felt that the difficulties of getting government departments to work together constructively on joined-up challenges were often too great to expect Foresight projects to live on coherently inside government. It would therefore be preferable to locate research ownership somewhere outside of government, either in co-funded academic programmes or institutions, or in relevant third sector bodies. A more pragmatic view however was that although Foresight is not supposed to be a policy development body, its research is essentially carried out with a view to informing government policy making, and hence ownership or responsibility for taking on the research should really rest with the relevant government departments. The reports with major impacts (such as *Future Flooding*, *Tackling Obesities*, or *Infectious Diseases*) have all to a large extent found 'natural' departmental homes, even if other departments are playing an integral role in taking forward policy work.

40. We found interesting examples of Foresight reports having significant influence in the introduction of new resources or institutional capacity inside government. For example, experts told us that the Department of Health has invested considerable resources in recent years to build its obesity team (currently between 30 and 50 staff). Although it is difficult to link this directly to the Foresight research, it is all part of the same push. Similarly, the new commercial opportunities realised from the Biochip programme across Defra partners will sustain impact that to a large degree grew out of the Foresight study. Ideally it seems that each Foresight project should aim in part to build new resources or institutional structures inside government which can sustain research momentum in meaningful ways.

41. Some commentators saw a tendency for Whitehall to distort and bureaucratize findings from Foresight research in such a way that the prospect for joined-up thinking and coordinated action are undermined. Even with far-reaching and apparently authoritative research projects such as *Tackling Obesities*, experts suggested to us that actual impact on society was inherently going to be limited – because the responsibility for bringing about such 'paradigm-shifting' changes falls essentially to one department, the Department for Health. We found quite widespread agreement amongst public health experts that the Department tends to be heavily influenced by the NHS, and clinical and pharmaceutical lobbies, and hence the status of public health interventions has historically been relatively low. Despite the fact that the DH has significantly grown its obesity team in recent years, experts were sceptical about the extent to which the Department would be able deliver the extent of changes required to tackle obesity in the joined-up way that Foresight report itself suggests.

42. Most interviewees pointed to the role of the research councils in sustaining opportunities and funding for interdisciplinary research of the kind which Foresight encourages. This is a potentially sensitive area. Because most researchers are in favour of maximising the autonomy of the research councils and felt that they should not have their

research funding agendas determined by other areas of government. Nevertheless, a more systematic relationship between Foresight projects and subsequent funding opportunities from the research councils could greatly benefit both parties. Academics generally supported the idea of allocating a much larger proportion of the Foresight research budgets to funding follow-on programmes, and this would create clearer incentives for academics to get involved in Foresight research from the off. Academics also told us that there is pressing need for research councils to work together to develop truly interdisciplinary funding opportunities, because many proposals in areas like Cognitive Systems, Brain Science, and Infectious Disease control have tended to fall into gaps between research council remits.

# Recommendations

We make four sets of provisional recommendations for enhancing the quality and impact of Foresight research.

## A. Scoping, timing and refining research questions

1. Foresight should encourage core research teams to work intensively at the start of the research to establish high-level questions, before any substantive review work is commissioned. The exploratory and interdisciplinary nature of Foresight research is a key strength, but in some projects has contributed to a 'scattergun scope'. Agreed lack high-level research questions should drive evidence collection from the outset *(see paragraphs 2.9 onwards)*. An interim review might be a useful milestone at this point.

2. Academics or consultants commissioned to do research should be provided with specific and systematic guidance and questions about the outputs expected. Core research teams should establish close working relationships with all experts commissioned. The two should meet at least once during the research and again on completion, to discuss emergent findings and the compatibility of evidence produced with the project's overall approach.

3. Some Foresight research teams have broken up their research scope into manageable chunks and instigated second-tier coordination structures for each of them, which seems to work well. Without being overly prescriptive, we suggest t that research projects should be chunked up into four or five manageable areas (mirroring obvious disciplinary or thematic parts of the research), but closely fitted within the overarching research objectives. Some core teams have

commissioned fifteen or more separate pieces of research and then found difficulty in synthesizing their outputs effectively.

4. Foresight leaders should support research teams in their efforts to keep control of project scope, and insulate teams from pressure to increase scope or add extra components arising from political or departmental pressure. Of course, research teams should consult closely with departments, but they should have sufficient autonomy to agree on and construct high-level research questions, and to 'park' other issues on one side, so as not to corrode or blur the core objectives of the research.

## B. Building diversity and balance into Foresight research teams

5. Some insiders believe that Foresight projects either start out with an imbalance between STEM and HSS disciplines, or that during the course of the research the projects tend to 'veer off' towards a STEM orientation. Projects should always begin as systematically joined-up initiatives, and have a social sciences and (where relevant) a humanities component. Some form of informal affirmative action is needed to ensure that there is an appropriate balance of physical science and social science disciplines within core research teams.

6. Foresight projects are primarily aimed at a policy making audience across UK central government departments and agencies and there is a great deal of intensive cooperation between research teams and departmental officials. Yet in most projects we found signs of either initial hostility or tension, or in the worst cases, some relevant departments not playing a part in the research at all. Achieving early buy-in from relevant departments greatly increases the chance that research will be taken forward by them on completion. Foresight should continue to find ways of incorporating and providing selective incentives for departments to be involved in research from early on.

7. Foresight research is time consuming and places huge burdens on senior researchers, particularly when they have other professional responsibilities. Building more of a mix of youthful energy and academic experience into Foresight core teams could help spread the burden, and help sustain momentum after projects complete. Younger researchers have much to gain from experience of policy-related research early in their careers, and greater incentives to take on responsibility for coordinating post-project research and liaison activity. Where senior researchers left Foresight to move on to new senior roles, academic follow-on may be less.

8. There is a highly active and well-informed community of individual consultants working with business and policy-relevant bodies. Foresight could gain from

building these communities more directly into research teams. Some consultants are people past formal retirement age, but with a vast range and depth of experience in different sectors and in future-focused projects. Building an independent all-rounder into the make-up of project teams may help encourage perspective and additional resources.

9. Private sector companies are at present rather weakly involved in the research projects. More should be done to systematise public sector involvement from an early stage, despite scepticism of many researchers about having commercial interests represented in core research teams. Interviewees supported close communication and interaction with commercial organizations that could be key stakeholders in bringing about change in relevant policy areas (e.g. insurance companies and flood risk). Projects that built in commercial sector expertise and interests early on, tended to have better communication and liaison with corporations and trade associations in taking forward subsequent work programmes.

10. Academics involved in providing ad-hoc or short term consultancy reported feeling somewhat marginalised or estranged from Foresight research projects. They had done their bit but then had heard very little about the research subsequently, and had little idea what impact it had. Academics are generally keen to be involved in policy-related work, and so these feelings of disappointment or uncertainty were often strong. Foresight should encourage much stronger ongoing communication with all researchers and academics who get involved with projects, with regular mailings and updates. Strengthening communities of interest and liaison between sectors in this way would also help to maximize the impact from research projects on completion.

## C. Research quality and integrating technical methods

11. Currently project outputs come in all shapes and sizes, and often the amount of information published makes it practically impossible for different audiences to find the right level of detail quickly and effectively. Foresight must streamline and standardise the outputs from research projects, setting a corporate publishing strategy, with different outputs providing gradated layers of detail. There should always be a comprehensive 30 to 40-page single, integrated report with an Executive Summary and the key relevant findings and analysis. Ideally it should be professionally written by experienced communicators to lay audiences. Other documents could be published as separate technical volumes or appendices and presented in an easy-to-follow format on the Foresight website that is standard across all reports. A 2 page digest for policy makers should accompany the main report.

12. Foresight processes at present can involve somewhat weak or inconsistent peer review and quality oversight. Some projects were phased in terms of the research and write-up stages, and provided natural breaks where work could be reviewed by academic or sector experts. Peer review should never slow down the research nor create new administrative burdens. But the science reviews and other research that feeds into the project work should be subject to some kind of systematic but light touch review. Perhaps this could be done in conjunction with relevant research councils. It may also provide a clearer incentive for academics to get involved in Foresight work (if peer-reviewed applied research can be better acknowledged in esteem indicators for RAE). Reviews could also help provide higher quality research briefings.

## D. Sustaining research impacts and ownership

13. Foresight projects tend to be quite well-funded, but much of the budget appears to be taken up with actual research activity, as opposed to follow-on development work once projects are completed. Foresight should consider a more systematic split of budget between the research phase and follow-on activity. We were unable to establish what the current average split is, but recommend a notional ratio somewhere between 60:40 or 70:30. This may involve more systematic funding of Foresight Development Programmes, making funds available to encourage coherent and joined-up research across academia, government and the third sector. These funds could be located in academic research institutions with matching funding from relevant government departments or agencies.

14. Foresight and the research councils should continue existing efforts to work together in designing flexible, forward-looking funding opportunities linked to Foresight research. The links between Foresight projects and subsequent research council funding opportunities have been variable in the past. For many of the more abstract or 'experimental' research projects, research council funding is critical in ensuring ongoing research, particularly as these projects tend to be further removed from direct practical application in government policy making. EPSRC and BBSRC have run programmes in field such as cognitive systems. But we have found evidence that these funding opportunities often have problems recognising and catering for interdisciplinary research proposals that cross organizational boundaries.

15. Foresight should work with academics and government to track more systematically any new institutional capacity and extra funding which is a direct or indirect result of Foresight projects. We found numerous examples of research institutes set up largely as a result of Foresight project work, or significantly based on connections and links made during the Foresight process.

16. At central government level and in some parts of the voluntary or third sector, Foresight research is visible and much referenced. However only limited resources have been devoted to getting messages across to regional government, local authorities and local NHS bodies where relevant. Foresight should ensure that local or regional bodies expertise and interests are brought into research teams early on. Local governments do not have Chief Scientific Advisors or equivalents, so relations need to be forged especially with specialist professions. Local or regional bodies should also be represented sufficiently in project oversight structures. In disseminating research findings quick and effective channels are needed to ensure that professionals, experts and decision makers in the localities and regions become aware of findings and are integrated into follow-on activity.

# Part 1:
# Impacts achieved by Foresight research

1.1 In this Part we review the range and quality of impacts which Foresight projects have achieved in:

- government policy and practice;
- academic and science communities;
- the commercial sector; *and*
- civil society and the public.

We draw on evidence collected from our online survey of stakeholders, around fifty interviews with researchers and research users, systematic searching for impacts using Google, and analysis of Foresight one-year reviews.

## Where has Foresight had most impact?

1.2 We asked our survey respondents to score the impacts of Foresight reports across different sectors. They clearly rated central government and academia above other sectors (see Figure 1.1), with a much smaller percentage of respondents expressing uncertainty about impact in these two sectors. The average impact score for other sectors tended to cluster around the half-way point (3.5), and suggested relatively high levels of uncertainty about the extent of impact. Outside of government and academia, it seems that most respondents are less aware of Foresight's impacts.

1.3 Another perspective on impact across different sectors comes from our systematic search for references to Foresight projects using Google. We coded the sector of all organizations that we found to be referencing Foresight studies on their website. (A more detailed description of our methods can be found in Appendix A.) Again UK central government and academia and research institutions both figure in the top three sectors. In this case, however, third sector organizations feature much higher in the ranking than in our survey results above, perhaps suggesting that NGOs and charities tend to make the most of their websites in the way they monitor and post relevant research. Impacts in the private sector tend to score in towards the middle in both our survey and Google search, suggesting a moderate impact only here.

1.4 The lower half of Figure 1.2 below shows a comparatively low referencing of Foresight research by local authorities, other local or regional bodies such as NHS trusts, and foreign governments. This pattern is largely confirmed by interview evidence. In general Foresight research is seen as aimed at senior level officials in central departments

**Figure 1.1: How respondents in our survey scored the likely impact of Foresight projects on different sectors**

| | Average impact score on scale from 1 to 7 | % who said they were 'Not sure' |
|---|---|---|
| Central UK government | 5.2 | 27 |
| Academics or research scientists | 4.4 | 4 |
| Private or commercial firms | 3.6 | 49 |
| International organizations | 3.6 | 56 |
| Local UK government | 3.5 | 40 |
| Foreign governments | 3.3 | 51 |
| Third sector | 3.3 | 57 |

**Notes:** We asked survey respondents to score the impact of Foresight research projects with which they were most familiar on different sectors. We gave them a scale from 1 to 7, where 1 = Very low and 7 = Very high. This Figure shows the average scores for each sector and the percentage of respondents who responded 'Not sure'.

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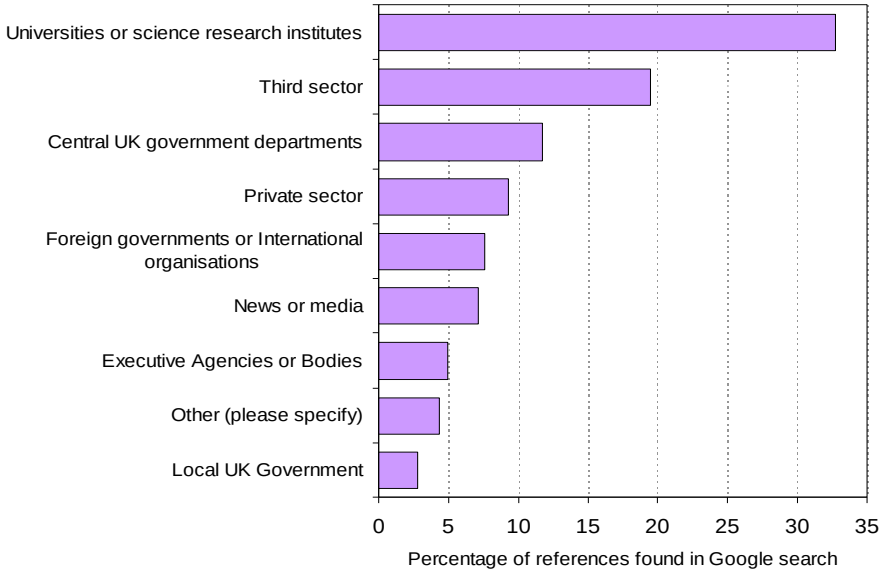
**Figure 1.2: How Foresight research is referenced by different types of organizations in our 'all-domain' Google search**




Note: We ran an all-domain Google search using search teams listed in Appendix 1. We reviewed the first 100 returns which were not on the Foresight website itself. We recorded the types of organizations referencing Foresight research by categories included in the Figure above.

reports as much as they might. We cite much evidence below to suggest that in isolated patches Foresight does impact on Agencies and NDPBs. However, this impact may be somewhat diffuse in more general termsand key agencies, and much less directed to local

and regional bodies. Executive Agencies and Non-departmental Public Bodies (NDPBs) also tend to feature lower down the scale of impacts than do central government departments, perhaps confirming that even delivery-focused bodies within central government do not reference Foresight

## Foresight impacts across UK government

1.5 The high impacts of Foresight research projects in UK central government policy making over recent years are largely confirmed in interviews and by evidence of the general value and use that Foresight projects have brought. Positive and constructive relations between experts and organizations also emerged from working together on new policy challenges. Most of our interviewees felt that Foresight research does help to boost the profile of new technology and policy challenges across government and relevant policy communities:

> *We are great fans of the Foresight process. [Senior government official]*
>
> *The Foresight research stirred everybody up.*
>
> *There is a lot of optimism attached to this Foresight report. This might be important in itself.*
>
> *It helped to bring flooding up the agenda […] Research councils were conscious of it and couldn't dismiss it.*

1.6 Looking at our 'government-domain only' Google search results (see Figure 1.3 above), by far the most visible research across the government domain is the report on *Future Flooding*, accounting for around one in three results surfaced. There were some strong links between this Foresight research and the subsequent development of Defra's *Making Space for Water* strategy, published around 18 months later (see Part 3 for more details here). This is also the only project where we found unmistakeable evidence that Foresight research had played a significant part in changing the budget profiles adopted by the Treasury.

**Figure 1.3: Visibility of research projects in the government domain (gov.uk)**

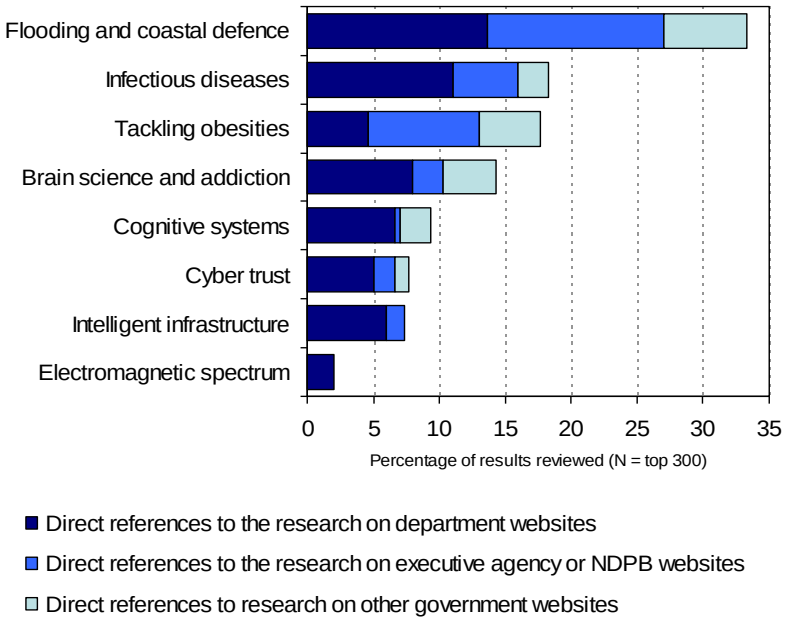



**Figure 1.4: Impacts of the *Flood and Coastal Defence* report (2004)**

| | |
|---|---|
| **Specific impacts** | Underpinned the Defra cross-governmental strategy *Making Space for Water* (2005) which adopts many of its findings. |
| | Led to HM Treasury increasing funding from £500 to £800 million per year over the next three years, specifically referring to the Foresight findings. |
| | Influenced the *Learning Lesson from the 2007 floods: An independent review by Sir Michael Pitt* (2007) interim report. |
| | Provided impetus for co-ordinated interdisciplinary research funding such as the Flood Risk Management Research Consortium. |
| | Stakeholders, such as the Environment Agency, water utility companies, insurance companies and local councils, now have a better understanding of the potential scale of flooding, and have helped to inform strategic planning and investment decisions to better manage floods in the future. |
| **Non-specific impacts** | Flood Risk Management approaches are now fully embedded in stakeholder organizations such as Defra and the Environment Agency. |
| | Provided the evidence for a shift in policy and has had a considerable impact throughout the user community, particularly central and local government. |
| | Provided the stimulus for coming to grips with an existing problem and brought into focus that flooding would become a much larger problem in the future if the "do nothing" option was adopted. |

1.7 In Figure 1.3 above two further reports (*Infectious Diseases* and *Tackling Obesities*) figured highly in terms of the number of references found across the government domain (i.e. gov.uk). *Tackling Obesities* was published much more recently than either *Future Flooding* or *Infectious Diseases*, and therefore has a much higher reference rate - it has built up almost equivalent references in a much shorter period of time. Central to this pattern of success was again a strong influence from the Foresight research on subsequent government strategy. Three months after *Tackling Obesities* was published, in January 2008 the government issued a new policy document on obesity, called *Health Weight, Healthy Lives: A cross-government strategy*. Our interviews suggested strong connections between the two projects: e.g. lead researchers on the Foresight project were also active in chairing and guiding relevant Advisory Panels on Obesity which oversaw the writing of the subsequent government strategy:

> *'The research was very timely. It linked to work going on in the Department for Health and in No 10 on food policy.' [Senior government official]*

> *[The Department of Health] were so overstretched and it is fair to say that the Foresight research, I think, led to some additional resources. It is difficult to separate out the effect of Foresight from the wider increase in profile for obesity, but you can't undervalue the Foresight effect. [Senior government official]*

> *Our report provided a strong blueprint for the government report. [Academic researcher]*

> *I'm just not sure how much this research filtered into the latest Department of Health strategy. The Department has not got its act together on obesity yet. [Academic researcher]*

1.8 Of course, as the second quote here notes, it is often very difficult to disentangle the inter-locking causal processes that lead to specific change in the institutional structures and funding of government policies. Obesity had been on the government's policy agenda in a low-key way for around ten years, and the National Audit Office published reports early on in decade looking at obesity as a problem of joined-up government. But senior policy makers and experienced observers we interviewed generally argued that the Foresight research did contribute to consolidating the relationship between obesity and public health as a cross-government priority.

> *No one has been able to challenge the findings from this research. [Public health academic expert]*

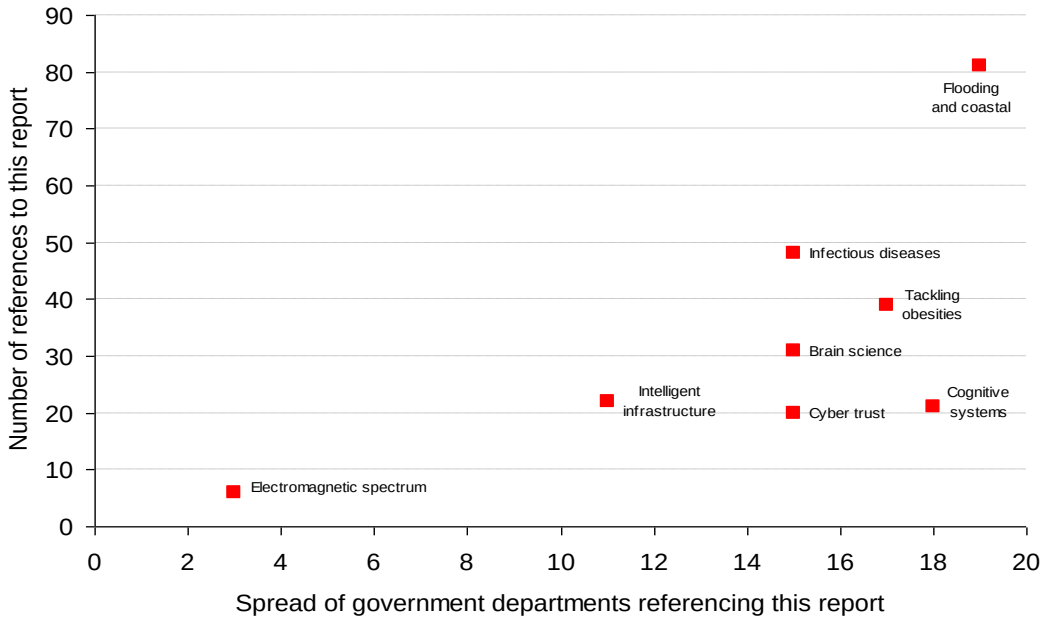
> *The work definitely had scientific credibility […] It was the biggest and most authoritative review ever… in the world. [Senior government official]*

**Figure 1.5: Impacts from the *Tacking Obesity: Future Choices* (2007) report**

| | |
|---|---|
| Specific impacts | Directly informed the *Healthy Weight, Healthy Lives: A Cross Government Strategy for England* report which was published in January 2008 by the Department of Health. |
| | Fed into the Interim Advisory Group. It was very directly involved in the development of cross government strategy set out in *Healthy Weight, Healthy Lives*. |
| | The Systems Map created as part of the Obesity report will provide a overall framework for the monitoring and analysis activities of the newly established National Obesity Observatory. The NOO was established in December 2007 with the aim of providing a single point of contact for wide-ranging authoritative information on data, evidence and practice related to obesity, overweight, underweight and their determinants. It has now receives funding of £784,000 per year. |
| | The Department of Health have since pulled together to better tackle obesity and the research has led to additional resources directed to the problem. |
| | Other governments are now seeking to emulate the Foresight program, including a new initiative in the US. When I submitted an expanded policy review for publication, the peer reviewers were impressed by the existence of a Foresight project. |
| Non-specific impacts | 'It pulls together diverse research on a given issue -- research that would otherwise not be collected and integrated. This function is vital to address the issues'. |
| | 'I know the report has had an impact in the NHS. The key influence has been to stimulate thought and discussion about the options to prevent obesity'. |
| | It has been widely cited in international policy and academic arenas and it provided a useful opportunity for engagement with the commercial sector and with other audiences not previously involved in the obesity debate. |
| | 'The report convinced policy makers about the multi-causal broad societal determinants involved in obesity and there is no magic pill solution'. |

Experienced public health academics told us that the obesity project has also boosted resources and budgets for obesity policy development at the Department of Health. Over recent years, and partially as a result of the Foresight research, the Department has committed increased budget and staff resources to taking forward the obesity agenda. Figure 1.5 below summarises some of the most striking impacts from the *Tackling Obesities* research.

**Figure 1.6: Depth and breadth of coverage of Foresight research in central government**




1.9 Many interviewees have stressed the importance and value of government commissioning inherently interdisciplinary or joined-up research on future policy challenges. We address in Part 2 of this report the positive impacts that Foresight projects can have in bringing together different departments around integrated policy aims and in helping to bridge well-documented 'silo' issues. However. It might well be the case that impacts of Foresight research are limited to a small number of departments or agencies, perhaps confined to those organizations thematically closest to the research. Using our Google search data, we therefore tested to what extent Foresight research projects were being referenced across a good mix of departments and other government bodies. This provides an indication of the extent to which inherently joined-up research is finding an equally joined-up home in government. Figure 1.6 above shows some interesting results.

1.10 As we have already seen, the report on *Future Flooding* is by far the most frequently referenced across the government domain, and it shows the widest spread across different government bodies, chiefly because of the number of arms-length bodies referencing this research on their websites. Interestingly, however, the *Cognitive Systems* research also shows a wide spread, given its relatively low position in terms of number of references found. The *Cognitive Systems* research was the earliest of the eight projects, and compared to the others could be seen as more abstract, experimental and even 'blue sky' than the rest. Interviewees working on the project told us that it seemed quite far removed from government policy making at the time, and had more of a 'pure academic science research' feel to it:

> *[Some projects] are easier to sell across government. This project was out there. We still wouldn't be that close to policy even if it were a mature subject area. [Academic researcher who worked on the Cognitive Systems research]*
>
> *We beetle away. The corridors of power are far away. [Academic researcher who worked on the Cognitive Systems research]*
>
> *I guess I am a naïve academic who gets involved at the edges…but really most of what goes on is mystifying. [Academic researcher who worked on the Brain Science project]*

Nevertheless the inherently interdisciplinary content of *Cognitive Systems* research also makes it relevant to a wide range of government bodies - hence its low volume/high spread reference profile. (See also below.) The *Tackling Obesities* research also scored highly on reference spread, confirming that this research impinges on a wide range of government bodies from local authorities and health trusts up to the Department of Health and Defra.

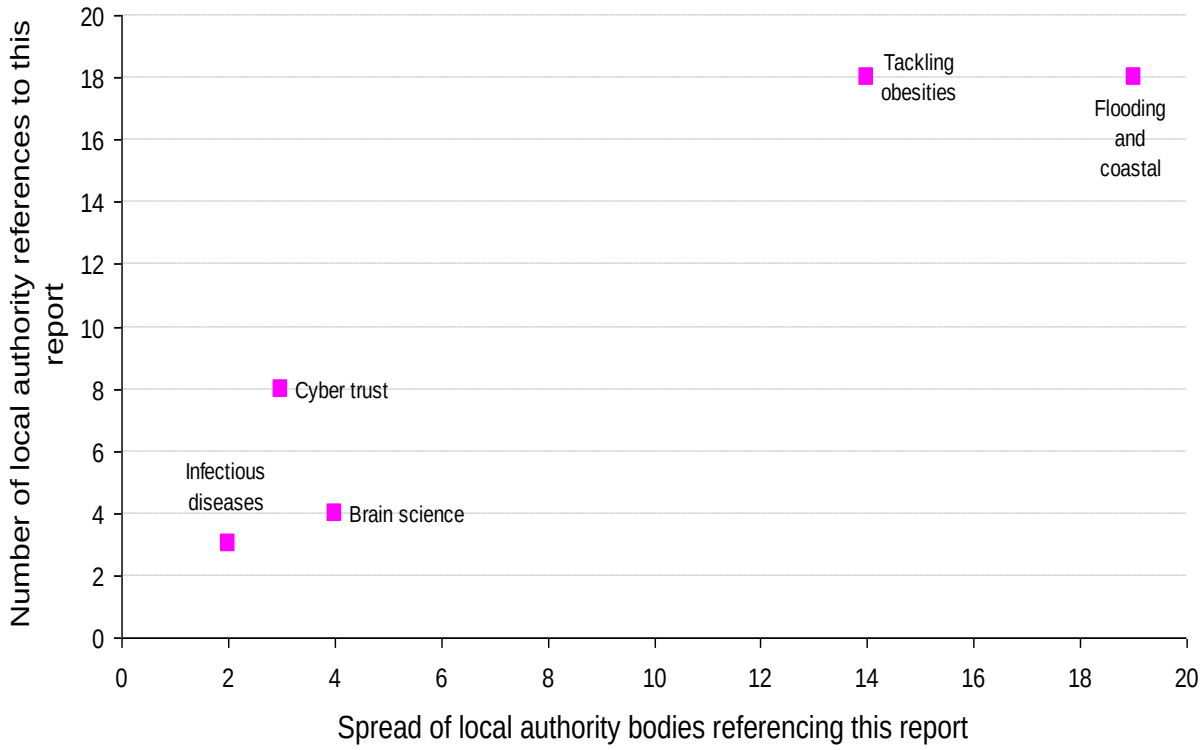
1.11 The local and regional spread of Foresight projects appears slightly more divisive when we focus on the extent to which local authorities reference Foresight research on their own websites (see Figure 1.7 above). Not surprisingly the *Future Flooding* report shows the largest spread across local authorities with around one reference per local authority. This suggests that local authorities have not really intensively referenced the research, and seem to have done little more than just post it on the website. *Tackling Obesities* also shows a good spread across local authorities, although there has been an increasing profile for this policy issue. All other reports showed comparatively low spread, perhaps not surprising given their narrower relevance for local authority agendas.

1.12 The *Infectious Diseases* report (April 2006) is the second most frequently referenced of all Foresight projects (see Figure 1.6 above and 1.8 below) and it scores relatively strongly on the diversity of government organizations referencing it on their websites. Interviews with government decision makers largely confirmed this impact profile. Although this research has not fed directly into prominent government strategies, it has led to some important follow-up programmes in government and some strong examples of new interdisciplinary working between different strands of government policy and research relating to plant, animal, and human disease diagnostics:

> *This is a competitive market place. There is no shortage of experts telling us what we could be doing. What can I say? We draw on the Foresight research for what we should be doing…but it is not the only research. [Senior government official]*

1.13 Academics involved and officials from Defra and the Central Science Laboratory (CSL) saw a major impact arising largely from this Foresight research as the Biochip

**Figure 1.7: The depth and breadth of coverage of Foresight research in local authorities**




programme. The government has given £1.5 million of funding over three years to develop a handheld device for rapid diagnosis or identification of animal and plant diseases in the field. This technology, developed largely by plant health scientists in Defra and the CSL, consists of a chip holding around 30,000 existing and known DNA disease structures against which new samples can be tested. Foresight research played a key role in bringing separate strands of human, animal and plant health together, and sparking the initiative for an integrated tool for disease diagnosis:

> *The Biochip project was a direct output from the FS research… linking fisheries, animal health and plants. FS research gave us confidence and drive to make that happen […]We wouldn't have thought of doing that if we hadn't been hanging out with animal and human health guys. [Senior government scientist]*

> *I would say we are a world leader in development of this technology and its application […] We'll see in the next five years widespread use of these handheld devices. [Senior government official]*

**Figure 1.8: Impacts of the *Detection and Identification of Infectious Diseases* (2006) report**

| | |
|---|---|
| Specific impacts | Partially led to £1.5 million of new investment from the government to Defra and the Central Science Laboratory to form a consortium to develop handheld 'biochip' disease diagnosis devices. Patents for this technology are held by CSL. This also led to same day screening of patient samples. |
| | Influenced developments within Defra in improving the detection of diseases. |
| | Led to international cooperation and awareness building between members of the Foresight team and African public organizations and scientific institutions. And a project with the African Union to build disease diagnostic capability and improve disease governance and management structures. |
| | Facilitated academic dissemination on the subject area through the EU Centre for Disease Control including a two-day workshop in July 2008 |
| Non-specific impacts | Encouraged more joint working between plant, animal and human disease experts within government. |

Government officials told us that they have set up a consortium to develop the device further, and to turn it into a commercial product. The consortium includes Defra and CSL, and CSL hold both an intellectual property agreement and patent for the handheld device (the technology itself is already patented). Forsite Diagnostics is a small start-up company, based at CSL and responsible for developing the technology to market.

1.14 Probably more than most Foresight projects, the work on *Infectious Diseases* had a internationalised flavour from the outset. Interviewees told us that the research process ran two separate streams for the UK and African continent. And since the completion of the research there has been active awareness and institution building through pan-African governance networks such as the African Union. Foresight researchers worked directly with African disease experts to improve governance systems, with a view to bringing down the risk of serious spread of diseases between 2015 and 2030. Researchers agreed that the Foresight project took on quite an ambitious international profile (particularly in the run up to the G8 summit), but also saw some restrictive limits:

> *We engaged widely with groups and officials in Africa. But we have not had the capacity to follow through. [Academic scientist]*

We found numerous examples in our interviews of the Foresight team and relevant government officials working with African government scientists and policy makers on disease diagnosis techniques. Surprisingly, many of the people we spoke to agreed that the Department for International Development (DfID) were conspicuously absent from this research, presumably because it had a predominantly UK focus. Researchers told us that this presented problems for developing the African governance aspects of the work

subsequently: 'We're now working on a project in Africa, but there is no DfID involvement'.

1.15 Our survey work and other review work suggests a moderate impact in government from the *Brain Science and Addiction* project, but we have not been able to identify from our interviews any major or specific impacts on government policy and practice (see Figure 1.9 below). Our Google website survey results show a reasonable profile for this project in terms of the number of references (see Figure 1.6 above). It ranks third in terms of the number of Departments referencing the research, such as the Home Office Drug Strategy Unit, the Cabinet Office, Number 10, and HM Treasury. Scanning the Foresight one-year review, we found that many of the same departments had taken part in a seminar to discuss the findings, including the Department of Health, Home Office, Department for Communities and Local Government, Nuffield Council, and various advisory bodies such as the Advisory Council on the Misuse of Drugs (Home Office). We interviewed researchers who contributed to the Foresight research, and many of them described their own links to professional and decision making bodies closely integrated into policy making processes. It is likely therefore that there were impact by association, in that many of the same people involved in Foresight are also closely linked to government policy bodies. Our interviewees were aware of relevant policy work going on in areas thematically linked to the Foresight research, but they generally found it difficult to point to anything more specific. It may be that this research area is still a little too abstract for specific implementation in public policy contexts:

> *I know that DCMS has done a lot of work on gambling regulations, and Health has a continued interest in alcohol research. There was also the Gambling Review Body which was part of the Home Office. I guess I am a naïve academic who gets involved at the edges. Most of what goes on is mystifying to me. [Academic scientist]*

1.16 Our interviews picked up on certain misgivings amongst academics involved in the *Brain Science* project about the way in which the research tended to 'veer off' towards harder science approaches and to marginalize social sciences such as psychology and health economics:

> *We went to a few meetings…wrote the review…Then you feel a little detached. Went to the final presentation and suddenly it was all about happy pills. [Academic scientist]*

> *The early view-gathering work went well…But then it went in a strange direction which didn't relate to the original discussion. [Academic scientist]*

> *I'm not sure what impact it had. [Academic scientist]*

**Figure 1.9: Impacts from the *Brain Science, Addition and Drugs* (2005) report**

| | |
|---|---|
| Specific impacts | Stimulated considerable interest from international policy makers. |
| Non-specific impacts | Consolidated all significant drug research, both licit and illicit, and their effects which acted as a real impetus for ' brain science' as a subject area. |
| | Acted as a very successful review of the state of the art which have them fed into work and teaching by academic researchers. |

> *I'm not aware that it had a lot of impact in my circles. I'm not sure whether this is just because people have taken the work in other directions or because it has really died a death. [Academic scientist]*
>
> *There are such strong influences coming from elsewhere, i.e. pharma, that it is very unlikely that FS research will have any lasting impact in the Department or related bodies. [Academic scientist]*

1.17 We discuss in more detail in Part 2 the issue of balance between STEM (science, technology, engineering and medicine) disciplines and humanities and social sciences. But it is worth noting here that interviewees repeatedly told us that any widespread misgivings about the way in which Foresight reports are balanced between the 'hard' science and other disciplines can potentially reduce the extent to which the research filters into policy making circles. Reports that are overly technical or that focus too heavily on technological aspects may not convey policy issues clearly enough. As one interviewee put it in relationship to the *Brain Science* project: 'Policy makers need to have things in black and white most of the time. They need to have the policy implications spelt out to them…including the budgets'.

1.18 More generally on impacts, one researcher said that it would have been good to have linked the Foresight research with the Stern report on climate change (published around six months later), but there was in effect no specific link made. Our interviewees raised a number of examples of subsequent impact from this work. Members of the Foresight research team told us that the department of transport (DT) had adopted a subsequently-developed fifth scenario (there were originally four in the report) as its own vision. In another case, a lead researcher from the Foresight project on Cyber Trust became Chief Science Advisor at the Department and is using the Foresight scenario work in developing the Intelligent Infrastructure Forum. Although we have traced some government-specific impacts from the *Intelligent Infrastructure* project, it is difficult to link this research with strategies and policies under development. Subsequently DT and the ESRC committed to a joint research programme on Future Intelligent Transport Systems, involving about £1.6 million of DT money, an investment that one of our interviewees saw as 'quite a strong gesture'. Regional development agencies SEEDA and One North East are also involved. We found reference to the *Intelligent Infrastructure*

report on the website of the Commission for Integrated Transport, the UK website of the Integrated Transport System (ITS) World Congress, and the London Climate Change Partnership Forum. Researchers interviewed told us that they presented work at the World Congress on ITS 2007. Local authorities have also been working with the research team on how to build capacity, such as Kent on piloting wireless networks and Gateshead on test site modelling for smart sensors on lampposts.

1.19 Despite signs of dissemination and further use of the Foresight research on *Intelligent Infrastructure*, we found some degree of uncertainty about the impacts of the research on amongst interviewees. As a way of testing this, we looked in more detail at our Google search results. Unlike the work on *Brain Science*, this research did not seem to score so well in our Google search and analysis of one-year reviews, suggesting perhaps that the dissemination and impact of this work fell away soon after completion. On government websites this work is referenced comparatively narrowly across different types of government bodies (see Figure 1.6 above). And surprisingly, we found no mention of it whatsoever on local authority websites (despite mention above of local authorities piloting new systems). Yet intelligent infrastructure is arguably more of a local and regional issue than a national one. Discussions with local authority officials showed that they had the impression that the research had really fallen away, and that compared to other Foresight reports such as *Tackling Obesities*, one hears little about it.

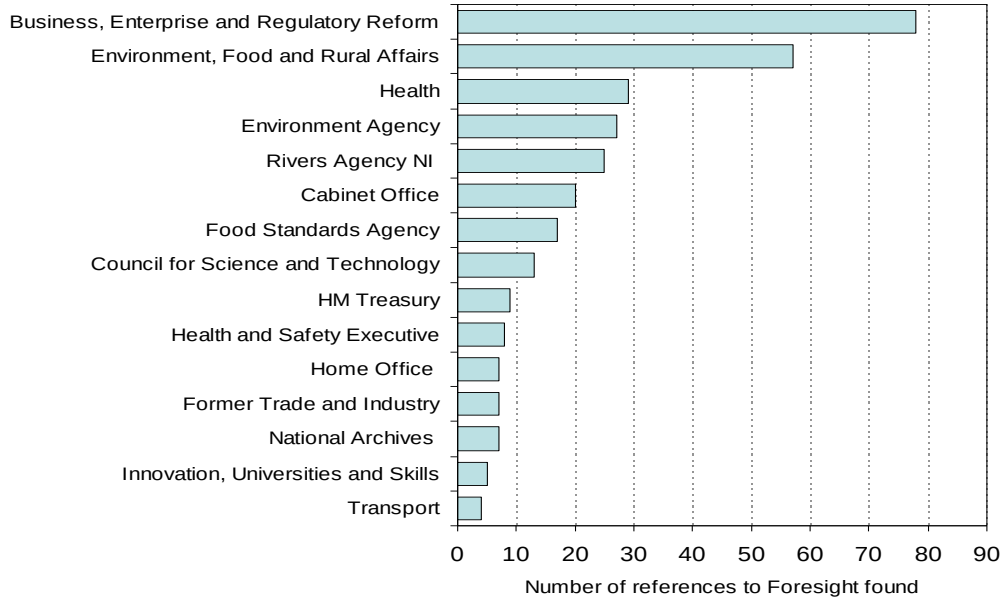
> *I have never heard people mention the Intelligent Infrastructure report. [Senior local authority official]*
>
> *The Intelligent Infrastructure report was a bit of a five minute wonder when it was launched. I'm not really sure that there was much else afterwards. They did a one year review, but I don't think that came to much. [Senior local authority official]*

Only seven central government organizations referenced the work on their website, and only the Department of Transport made more than one reference to it.

1.20 In all, across the full range of central government organizations 37 organizations referenced Foresight research projects. Most of the major Whitehall departments rank somewhere in the top 15, with the Department for Business, Enterprise and Regulatory Reform (BERR) the most frequent referencing body, accounting for just over 80 references (out of a possible 2,400). Inevitably the departmental interests relevant to the most frequently referenced reports also affect this picture. Hence Defra, various environmental agencies, and the Department of Health figure highly in the rankings (see Figure 1.10 below). The Cabinet Office is relatively prominent and less so HM Treasury.

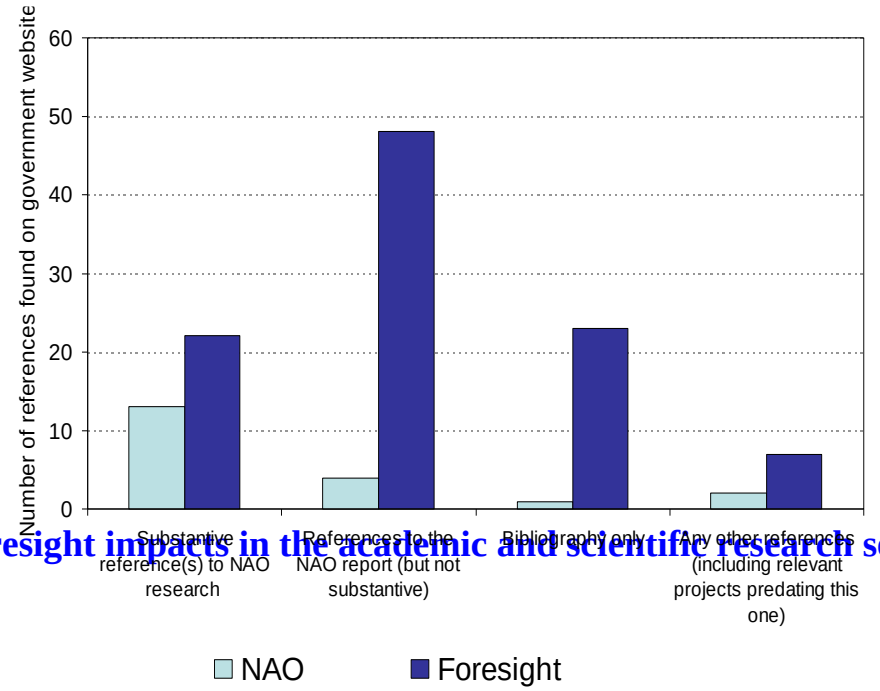
1.21 To gain some perspective this usage across government, we compared the number of references for the Foresight report on flooding with a recent NAO value for money study on flood defences (*Building and maintaining river and coastal flood defences in England* published in June 2007). It should be noted that the Foresight report combines science

**Figure 1.10: Central government departments referencing Foresight research most frequently**




*Foresight is streets ahead of the NAO. The NAO process has fatal flaws. […] [NAO] have to play to C&AG headlines and then work back to find evidence to support the headlines. The PAC is like a public flogging, a punitive process. FS explores the way forward. They have a different calibre of person.*

**Figure 1.11: A quick comparative review of the references to reports on flooding and flood defences, one by the NAO and the other by Foresight**




## Foresight impacts in the academic and scientific research sector

and policy related matters, whereas the NAO report is largely based on policy and its implementation. However, in terms of overall penetration, we might expect that they should be broadly comparable. We used a Google search within the government domain (gov.uk) with exactly the same search terms, but substituting 'NAO' or 'National Audit Office' instead of Foresight. The Foresight research clearly enjoys much greater coverage across government, and is far more likely to be referenced by government organizations (see Figure 1.11 below).

1.22 We turn now to impacts of Foresight research in academia and science, where our survey respondents identified the greatest impact from Foresight projects has been greatest (see Figure 1). Of course, many of our survey respondents are themselves academic scientists, with more insight in this area. Foresight research projects are generally led by career academics from both STEM disciplines and social sciences. And most of the research evidence and analysis underpinning projects has come from the academic science sector.

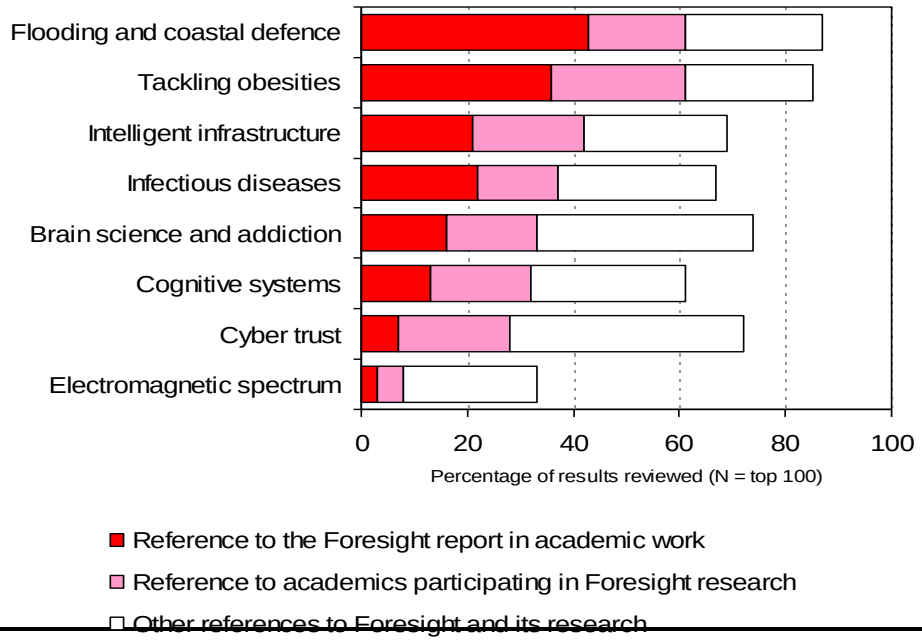
1.23 We found many examples of funding, career, or professional benefits flowing to academics as a result of being involved in Foresight projects. A good number of Foresight-involved academics now fill professional committee or government advisory roles, and some of these have in part sprung directly from contacts and profile which academics have gained during their work on projects. Others said they benefited from informal interaction with senior government officials:

> *Foresight has been very good for industry networking. I am a special adviser for the Biosecurity Select Committee, and this can be entirely attributed to the work that I did with Foresight. [Academic scientist]*

> *When you can get access to the government's Chief Science Adviser and get him to have lunch with members of the faculty, this helps enormously. [Academic scientist]*

1.24 We ran a similar Google search across all websites in the UK academic web domain (ac.uk) to see if the profile of dissemination and referencing showed any marked differences to the government domain. (This covers all main sites for higher education institutions and most research institutes. But some university-based research institutes may ell have other web domains not covered with dot.org or dot.co.uk addresses). Again Figure 1.12 shows that the reports on *Flooding* and *Obesity* were the most frequently referenced on the websites of academic institutions. The dark (red) bar on the left indicates direct references to these Foresight reports in published academic work. Around two fifths of the first 100 results for both *Flooding* and *Obesity* reports are direct references in academic work, a high level. At least a further fifth in each case are references to Foresight as part of academic biographical information or research listings.

**Figure 1.12: How academic institutions reference Foresight reports on their websites**




1.25 Foresight research also seem s to have lead to new or expanded funding opportunities for the academic researchers. An impressive example is the establishment of the National Obesity Observatory based at Oxford University in early 2008, a jointly funded programme involving the Department for Health with budget around £800,000 per year with one year review:

> *Without the Foresight research it would have been difficult to set up the* [the Observatory]. *The project has come out of Foresight really. [Academic scientist]*

*Cognitive Systems* was one of the earliest Foresight research projects in our sample and that was followed by a series of calls for grant proposals by the EPSRC, MRC and the BBSRC. Some academics involved in the original Foresight research were also successful in getting further grant money from the Research Councils:

> *Foresight was important as a lever to get more research funding, as this research is topical and relevant to what government is doing. [Academic scientist]*

1.26 One example is Memories for Life www.memoriesforlife.org, a network of academics coordinated by the University of Southampton and aiming to understand how memory works and how to develop techniques to enhance it. This programme was originally funded by EPSRC at around £60,000 from 2004 to 2006 with extension to 2007. It has since been adopted by the UK Computer Research Committee as one of their 'grand challenges'. As one researcher involved in this programme told us: 'Foresight kickstarted this whole process, this whole set of thoughts'. Also, interviewees confirmed that *Cyber Trust* helped shape the Interdisciplinary Research Collaboration in Dependability (DIRC), a six-year programme funded by the EPSRC and involving five UK universities.

1.27 Many of references to Foresight on university sites were academics referencing their involvement in Foresight studies. Many of our academic interviewees were not able to pinpoint specific follow-on funding or new capacity emerging directly from Foresight work. But most were very upbeat about the esteem and the professional profile benefits which flowed from being able to cite being involved with policy-relevant government research. Many academics told us that had gained peer reviewed publications from work originally done as part of the Foresight project:

> *I know that colleagues do put* [the Foresight research] *down as an accolade when writing the next bid and so on. [Academic scientist]*

> *The FS project gives you an extra couple of points on your card when applying to the MRC or BBSRC. [Academic scientist]*

> *Being involved in the Foresight project really impacted on my academic standing […] I've had a string of articles in* Science *based on this research. [Academic scientist]*

1.28 Some suggested that the Foresight project helped to boost the academic profile of the subject:

> *While the Foresight research did not result in any new discoveries, it did raise the profile of the research amongst social science academics. [Academic scientist]*

Many of the researchers also pointed to specific publications in leading applied journals which presented Foresight research to an academic audience.

1.29 Some academics working on the more experimental or technical projects (such as *Cognitive Systems* and the *Electromagnetic Spectrum*) tended to emphasize the importance of getting funding from research councils or other government science budgets for further work. For other impacts claimed for the *Electromagnetic Spectrum* report, see Figure 1.13 below. Some interviewees told us that there needs to be a much clearer post-project funding route for research scientists to take forward findings from Foresight research:

> *Cognitive systems is an oddball area. Most Foresight projects tend to be sectorized, and you can see clearly how they relate to UK plc. This is a bit of an odyssey - it is blank canvas stuff.*

> *Foresight could draw in more academics by showing that participation in the research could lead to future funding routes.*

We found evidence of intensive activity between Research Councils and former-DTI bodies such as the Technology Strategy Board (TSB – and see www.innovateuk.org).

**Figure 1.13: Impacts from the *Exploiting the Electromagnetic Spectrum* (2004) report**

| | |
|---|---|
| Specific impacts | May have been used by the Ministry of Defence in the area of remote sensing and the setting up of Terrahertz technology. |
| | Encouraged the Royal College of Engineers to begin a study into wireless technology, using both a sociological and technological perspective. |
| | Influenced the debate within professional bodies such as Ofcom. |
| Non-specific impacts | Led to the research discourse moving towards aspects around social interaction rather than having a solely technical focus. |

Numerous academics mentioned the TSB funding route as an important post-Foresight source of further money.

1.30 Lead researchers on projects mostly felt that the structure of professional incentives in UK academia does nothing to encourage academics to do applied research in practitioner and policy making environments:

> *The mechanisms are not well established through the RAE and TQA and so on. If an academic is contributing on these kinds of future studies, then surely it is worth some kind of professional recognition.*
>
> *Foresight struggles sometimes because the RAE does not provide any incentives for academics to branch out and get involved in applied research.*
>
> *It's far more common for US scientists to seem to have their own sidelines or companies. The RAE does not help UK scientists in this sense…There is a constant need to pick up RAE Brownie points.*
>
> *It wasn't clear what value this would have for authors. It doesn't relate to the RAE in any way, it was not clear what was meant to happen, and there was very little feedback from the peer review process.*

1.31 A report firmly within the remit of the Department for Business, Enterprise and Regulatory Reform is that on *Cyber Trust and Crime Prevention*. Along with the earlier *Tackling Crime* report, survey respondents saw it as influential in shaping thinking both within academic and stakeholder arenas. As Figure 1.14 shows, the subject area is one that is still relevant, with the continued debate of privacy versus security relating to online transactions, loss of electronic data and ID cards:

> *I think people were waiting for the WOW factor in terms of our results. But it wasn't really that kind of report. Things were much more incremental.*

**Figure 1.14: Impacts for the *Cyber Trust and Crime Prevention* (2004) report**

| | |
|---|---|
| Specific impacts | Shaped thinking in the Interdisciplinary Research Collaboration in Dependability (DIRC) which aims to address the dependability of computer-based systems. This is a six year programme funded by the EPSRC with academics from five universities. Two new projects (INDEED and TrAmS) will take the DIRC ideas forward. |
| | Encouraged the DTI Innovation Group to make cyber-security a priority proposal for Knowledge Transfer Networks. |
| | Findings filtered into other adjacent policy areas such as the ID programme and community surveillance. |
| | Influenced studies by the Royal Academy of Engineering, *Dilemmas of Privacy and Surveillance: Challenges of Technological Change* report published in March 2007. |
| Non-specific impacts | Led to heightened awareness that issues cannot be addressed solely by technological innovation, organisational innovation also matters. |
| | Has been referenced in academic and policy discussions about many associated areas within the cyber crime debate. |

> *I'm not sure what the life of the recommendations were post-project. I'm not sure what they accomplished. There wasn't much evidence of policy impact.*

1.32 Turning now to the diversity of academic institutions referencing Foresight reports, there were 35 different institutions referencing the *Obesity* and *Flooding* reports, and 60 references in all, with an average around 2 per university (see Figure 1.15 below). Each of the main cluster of reports were all referenced by at least 25 different academic institutions (out of possible maximum of 100 results), a solid indication that research is well integrated into university research environments. However, the *Electromagnetic Spectrum* research scores poorly even in the more technical academic research environment.

1.33 We also checked the calibre of academic institutions referencing Foresight research, and found an equally healthy picture of influence on the research environments in top ranking universities, both in the physical sciences and in the social sciences and humanities (Figure 1.16). A small caution is that result may be somewhat skewed by reports that have been most frequently cited. Newcastle, LSE and Cambridge all feature highly. The Medical Research Council is high in the results too, largely as a result of the *Obesity* report, along with the Engineering and Physical Sciences Research Council.

**Figure 1.15: Depth and breadth of coverage of Foresight reports across academia**

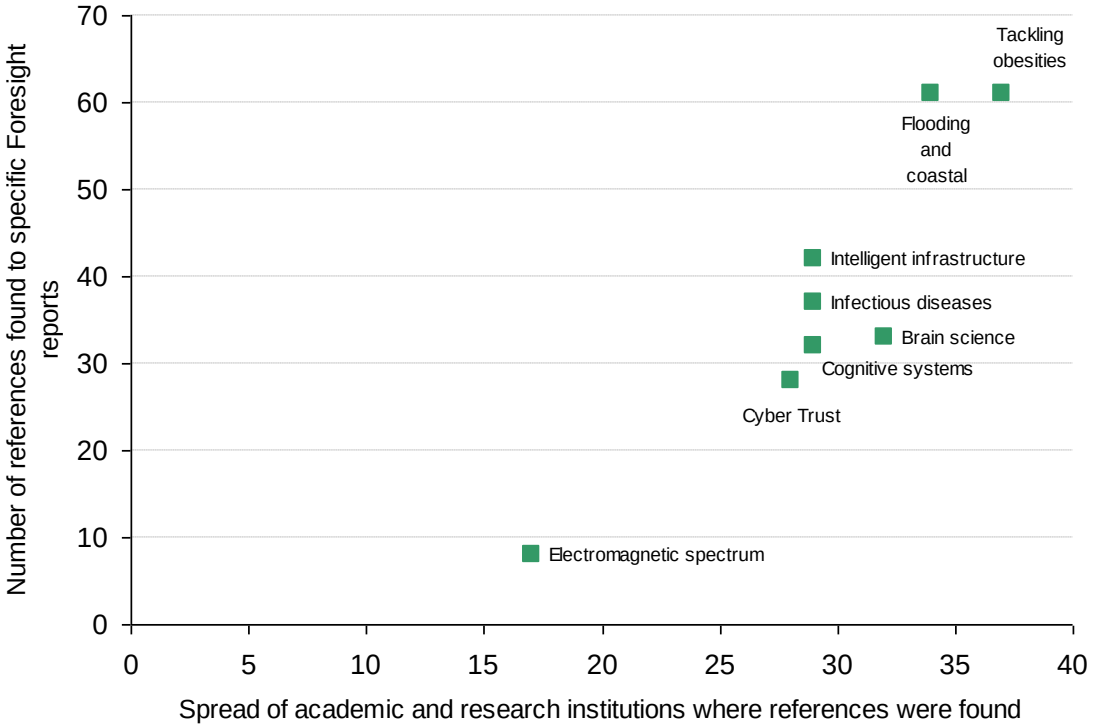
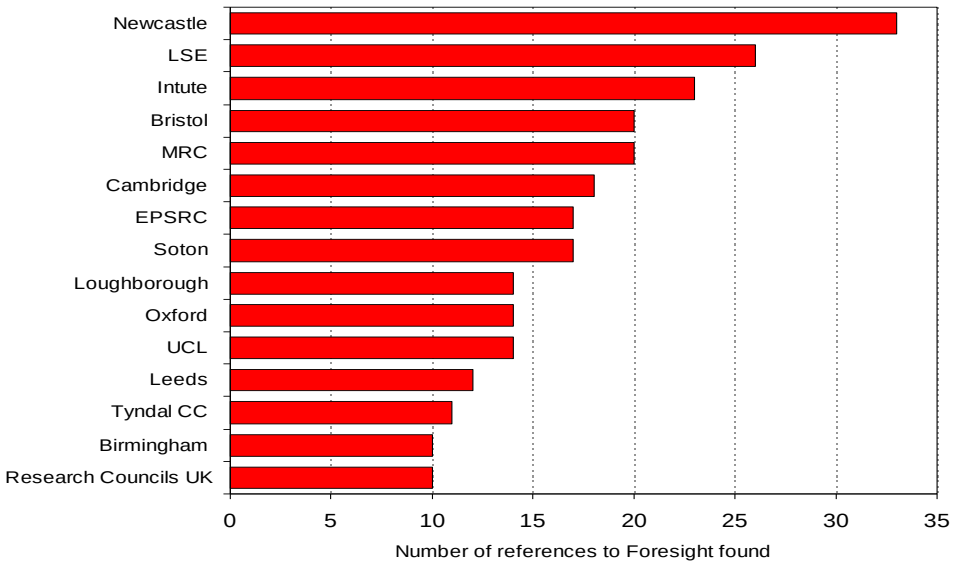



**Figure 1.16: Universities and academic-related bodies most frequently citing Foresight research**




1.34 We now move to examine the results of our all-domain Google search on who is referencing Foresight research (see Figure 1.17 below). A broadly representative mix of

**Figure 1.17: Selection of organizations referencing Foresight research found in our Google search**

| *Comment on spread and quality of referencing bodies found* | *Examples of referencing bodies* |
|---|---|
| ***Private sector***<br>Very few big names and representative associations referencing Foresight research. Some major private sector corporations found particularly in the insurance sector and new technology. | *Norwich Union*<br>*Royal Sun Alliance*<br>*Waverley Management Consultants*<br>*Silicon.com*<br>*BT*<br>*Simmons Professional Services Ltd* |
| ***Third sector***<br>Strong range of third sector organizations found particularly in health and environment. | *British Heart Foundation*<br>*The Wellcome Trust*<br>*Cancer Research UK*<br>*Climate Watch*<br>*British Psychological Association* |
| ***News or media***<br>Some well-known media organizations found such as the BBC or Guardian. But not a particularly strong array. | *BBC*<br>*Guardian*<br>*The Sun*<br>*Daily Telegraph*<br>*Public Technology.net* |
| ***Foreign government or international organization***<br>Impressive range of foreign or international organizations found. | *European Commission*<br>*UN (APEC)*<br>*Netherlands Organization for Scientific Research*<br>*Department of Justice (Canada)*<br>*World Futurist Society* |

third sector bodies prominently along with an impressive range of foreign government organizations and international bodies, including the UN and the European Commission. News and media organizations were relatively well covered, confirming our Lexis Nexis search above. Private sector organizations referencing Foresight research were not that common. We found references made by one or two major insurance companies, but beyond that the organizations listed did not include many 'household names'

## Foresight impacts in the commercial sector

1.35 The wider impact of Foresight research across whole sectors and industries proved somewhat harder to ascertain. We talked to officials from industry associations who might be able to discuss in detail the projects and their impacts. This included representative bodies from the food and drink, insurance, and ICT and business systems sectors. We found evidence of a good knowledge of relevant Foresight studies amongst officials from major international companies (for example, BT, Hewlett Packard, Tesco, Royal Sun Alliance) and key representative bodies (such as Association of British Insurers, and the Food and Drink Federation). Food and drink retail firms were largely impressed by the Foresight study on obesity, because it couched the question in much wider terms than simply being an issue of what food you eat. When we discussed supportive industry reactions with Foresight researchers some told us 'They would say that, wouldn't they'.

1.36 A good number of Foresight projects have had commercial sector involvement at oversight and steering level, but relatively few have built commercial sector people into the core research teams. As one lead researcher told us: 'The natural assumption behind the Foresight planning was to look for academics to consult, rather than industry experts'. Typically the core research teams have been established academics, but technical work has also been commissioned from private consultants or firms. Looking down the list of stakeholders involved in the various projects, it is not uncommon to see household names from the commercial sector. However, interviewees suggested that often there was quite a gap between involvement 'on paper' and the extent of full involvement:

> *There isn't much industry involvement in my area. It could possibly have been more involved, but I think the jump from regulatory to applied science in this area is quite quick and things lose commercial relevance quickly.*
>
> *While there has been some CBI lobbying and some EPSRC impacts, there is still no wide-ranging collective discourse on the topic. The possible positive inter-relationships between the public and private sectors in this area seem to have been largely ignored.*
>
> *Commercial organizations do seem absent from the process. I agree that there is a lack of industry. Infectious diseases had no representation from farmers, for example.*
>
> *I don't remember corporations being there at all. I wasn't really aware of their presence.*

Some researchers did report positive experiences from involvement by private sector stakeholders:

> *We had Hewlett Packard and BT involved. It was not the usual stand-off between academics and business.*

> *The insurance industry are taking an active interest. There is also more interest in the quality of information to homeowners. The ABI were involved in various workshops we ran.*

On *Intelligent Infrastructure* survey respondents said that this research impacted on private sector consulting firms, and one commented: 'We operate a number of tactical and short-term programmes at national level to develop good practice in intelligent transport systems. We clearly wish to do this informed by Foresight's long term thinking.'

## Foresight impacts in the third sector

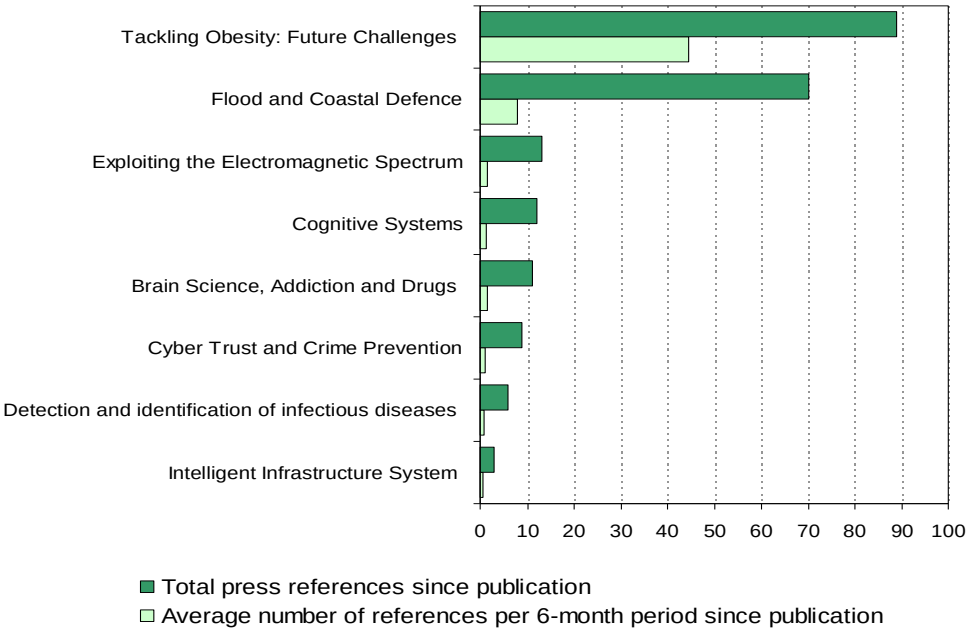
1.37 *In civil society*, including third sector and local or regional support organizations, we find Foresight doing relatively well in terms of the awareness and the degree of support for its research. Our all-domain Google search surfaced a strong range of third sector organizations particularly in health and environment. These included the British Heart Foundation, Wellcome Trust, Cancer Research UK, and Climate Watch. In interviews people from third sector organizations revealed a strong interest in, and knowledge of, Foresight projects. The reports provide useful overviews of policy issues and upcoming challenges that under-resourced third sector organizations can draw on for targeting their own activity. Campaigning organizations place a lot of store on these reports because they provide 'hooks which we can use to push our specific campaigns and messages'. These linkages were also quite diverse and wide-ranging. For instance, a link emerged with the African Union in the aftermath of the *Infectious Diseases* research, where researchers are working together with third sector bodies and African national governments to establish better governance systems and contingencies for the outbreak of plant, animal or human diseases on the sub-Saharan continent. And the flooding report helped local networks:

> *Local authorities are doing their best. You get councillors with portfolios for flooding who have little idea of their role […] [We] worked together with agencies and local authorities on the risk of pluvial floodings…It was like watching a jigsaw puzzle being put together.*

## Foresight impacts with the public at large

1.38 Some Foresight research, particularly *Tackling Obesities* and *Future Flooding*, has had good media coverage. Our Google searches surfaced a wide range of press publications and media organizations both in the UK and abroad which have covered stories relating to publication of Foresight research. In the local and regional press, the *Future Flooding* research got a lot of coverage and other reports also featured. At national press level, there was a rather large drop-off between the two big hitter projects and the other six covered. *Brain Science* generated some media interest but we found no references in the mainstream press to the *Intelligent Infrastructure* report. Some projects have published books summarizing the main findings and challenges for the future, the most widely referenced being *Cognitive Systems: Information Processing Meets Brain Science* by Richard Morris, Lionel Tarassenko and Michael Kenward.

**Figure 1.18: Coverage of Foresight reports in mainstream and specialist press**




1.39 A number of expert commentators argued that Foresight reports tend to have an inherent limitation on how far they can influence changes in the way society behaves. Interdisciplinary and joined-up projects can be hard to take in, and looking at different scenarios and future trends may require almost paradigm shifts in the way current organizational and social systems work. Widespread and concerted change of the kind often put forward in reports requires a whole host of public, private and third sector organizations to adjust their actions and priorities. As one expert policy watchers put it: 'I think the fundamental weakness is that the report maps out the enormity of how the society and economy has to change - and then it gets reduced to something that [one Department] has to do on its own'.

1.40 To gauge coverage of Foresight research in the mainstream and specialist press, we conducted a press search using the Lexis Nexis electronic archive using the terms outlined above. We inspected each return for specific references to Foresight research, and recorded their number, covering six-monthly periods over the last five years or so. Figure 1.18 below shows that the *Obesity* and *Flooding* reports accumulated the most press references in mainstream and specialist media. Particularly impressive is that the *Obesity* report has managed to accumulate more references than any other in just six months. Interviewees told us that it was published at a time when interest in obesity issues was at a 'frenzied peak'.

1.41 Figures 1.19 and 1.20 below show some variation in the types of publications which have picked up stories and issues from Foresight research. Perhaps the most striking point

**Figure 1.19: More detailed results from press and media search for Foresight reports**

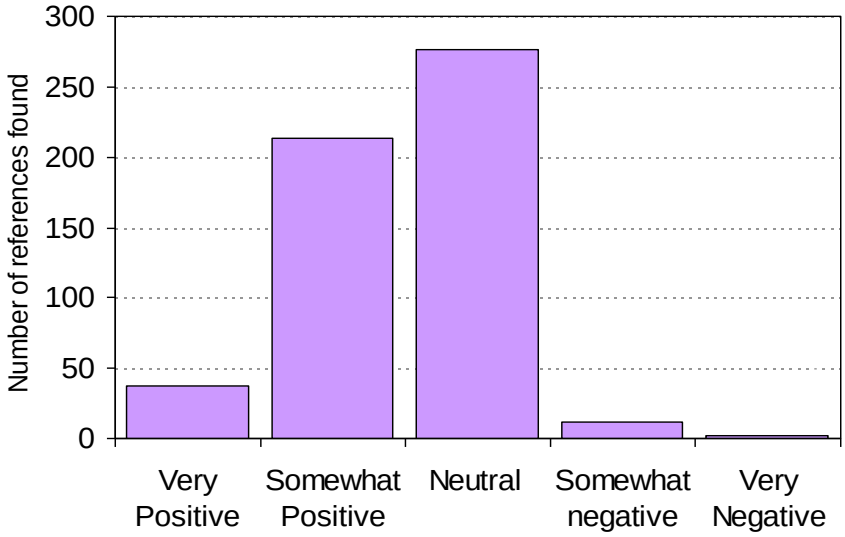
| | Local / regional press | Specialist press | National press | News database | Int'l press |
|---|---|---|---|---|---|
| Tackling obesity | 34 | 23 | 19 | 7 | 6 |
| Flood and coastal defence | 20 | 17 | 14 | 19 | 0 |
| Electromagnetic spectrum | 0 | 2 | 1 | 10 | 0 |
| Cognitive systems | 1 | 6 | 3 | 2 | 0 |
| Brain science and addiction | 2 | 2 | 5 | 2 | 0 |
| Cyber trust | 2 | 2 | 2 | 3 | 0 |
| Infectious diseases | 0 | 2 | 1 | 2 | 1 |
| Intelligent infrastructure | 0 | 3 | 0 | 0 | 0 |
| TOTAL | **59** | **57** | **45** | **45** | **7** |

**Figure 1.20: Examples of press and media publications referencing Foresight research**

| |
|---|
| ***Local / regional press*** |
| Bath Chronicle |
| Birmingham Evening Post |
| Eastbourne Herald |
| Gloucester Citizen |
| Grimsby Evening Journal |
| ***Specialist press*** |
| Chemistry and Industry |
| Computing |
| Geographical Journal |
| GP Magazine |
| Nutraceuticals International |
| ***3International press*** |
| The Australian |
| Times Colonist (Canada) |
| The Scotsman |
| Qatar News Agency |
| China Daily.com.cn |

is that local and regional press most commonly cite Foresight work, particularly issues around obesity and flooding. Local and regional newspapers seem particularly interested in future themes that impinge on local and regional life, an apparent contrast with local authorities. *Obesity* research appeared to play quite widely in the international press. *Intelligent Infrastructure* did not feature much in press coverage, rather going against the up-beat impression given in interviews by key its research staff.

**Figure 1.21: Range of positive and negative views found in references to Foresight research**




1.42 Interviewees often raised the issue of how to boost impact of Foresight research at local or frontline operational levels. The press results below suggest that some Foresight reports have had surprisingly good coverage in the local and regional press. We looked for similar indications in the extent to which Foresight research gets coverage across local authorities. Figure 1.19 below shows that reports on *Flooding* and *Obesity* have both played much more strongly than others at local authority level.

1.43 For each reference we found in our Google search, we also recorded the extent to which the article or paper was positive or negative about the Foresight research report. Such classifications by our researchers should be treated with some caution, but we sought for a very unambiguous method of classifying tone, with the 'resting state' being neutrality. Figure 1.21 shows that if any views were expressed either way in coverage, they were almost exclusively positive views about Foresight research. We found only a small handful of negative statements. We recorded all adjectives describing Foresight research, whether good or bad, and they included: 'interactive', 'open', 'innovative', 'cross-cutting', 'superb', 'wide ranging', 'extensive', 'unique', 'comprehensive', 'chilling', 'holistic' and 'challenging', to name a few.

# Part 2:
# Enhancing impacts from the Foresight research process

2.1 In this section look at some strengths and weaknesses of the Foresight process in four general areas:

- Scoping, timing, and refining research questions;
- Building diversity and balance into Foresight research teams;
- Research quality and integrating technical methods; *and*
- Sustaining research impacts and ownership.

## Scoping, timing, and refining research questions

2.2 Interviewees generally see the major strengths of the Foresight research model in addressing inherently interdisciplinary questions, consolidating current thinking and knowledge from different disciplines, and applying technical methodologies in a way that elucidates major future policy challenges. Inherently this kind of research tends not to generate 'breakthroughs' or indeed generate qualitatively new facts or knowledge. Instead it tends more to consolidate state-of-art knowledge, and systematize it around key future-focused research questions.

> *It was not a research project. It was more of a scoping exercise. No new research was done.*

Foresight generally involves taking stock and thinking about the future, and much less the kind of research which generates new findings and can 'literally change a field overnight'. Nevertheless, some experts suggested that the *Tackling Obesities* and *Future Flooding* reports could reasonably claim to have been new or 'ground breaking' in their approach.

> *This broke the dreaded mould of systematic reviews. We asked academics what were the most important things we needed to know from their respective disciplines relating to obesity.*

2.3 An important aspect of Foresight research is spotting new and upcoming issues, and initiating and completing projects at the right time. For *Future Flooding*, *Infectious Diseases*, and *Tackling Obesities* there was a consensus amongst government policy makers and other expert observers that the work was initiated in a very well timed way. They offered both a much-needed review in light of major crises (such as UK flooding incidents in 2000 or large scale outbreaks of disease like foot and mouth) and signposts for responding in the aftermath.

> *This research could not have been better timed.*

> *It was very timely research given the bio-security agenda in UK and internationally.*

> *The research was very timely. It linked to work going on in the Department for Health and in No 10 on food policy.*

2.4 In a more general way other projects also had applications – for instance, *Cyber Trust* - came as issues of data privacy, online fraud, and ID debates were gaining profile in the UK. Some interviewees suggested that the most successful Foresight projects are those close to current policy priorities. Some policy makers in major departments took this on a step, suggesting that Foresight research should specifically target current policy issues that have not been adequately addressed in the past.

> *Topics for research should be more clearly linked to policy challenges. We should have a study because there is a widespread belief that there has been some kind of policy failure or at least concerns about a current policy.*

It is clear that Foresight studies need to be reviewed in the wider context of policy work in relevant government departments. Interviewees suggested that the genesis of key Foresight studies has been the identification of 'policy gaps' or lack of integrated or 'joined up' analysis of issues which spread across more than one department or administrative jurisdiction.

2.5 Other projects involved more 'blue sky' or distant horizon scanning, and by inference much more extended timeframes stretching into the future. The *Cognitive Systems* project was generally seen by interviewees as more adventurous than most: many of the research areas discussed work which is still relatively experimental, involving modelling cognitive brain functions using computer software.

> *This project was 'out there'. We still wouldn't be that close to policy even if it were a mature subject area.*

Although researchers talked very fluently about the concepts and objectives behind their research, they were less able to identify specific impacts of this work outside of an academic or science research arena. Generally, interviewees felt that Foresight has achieved a good balance between some research that has direct and imminent policy relevance, and research that is more experimental or 'blue sky'.

2.6 Foresight projects generally look forward 10 to 50 years in the future, and the time spans chosen for projects attracted few criticisms. Interviewees felt that there was sufficient flexibility in the analyses for research users to expand and contract their own thinking about different areas. Some practitioners, such as local government representatives, suggested that project outputs could be more effectively phased for decision makers in more delivery based organizations. One suggested that most local authorities have little reason to think more than 20 years in advance: and so reports that set themselves 50 years in advance 'seem a little bit Dan Dare'.

2.7 The scope of Foresight projects is usually inclusive to encompass different science or policy aspects within overarching themes. Many interviewees pointed to the difficulty of

keeping projects under control and ensuring that the research rationale and questions are sufficiently focused and calibrated to be of use to policy makers.

> *It is a challenge to keep control of the complexity of it all. All sorts of issues sprayed in […] OST would say 'We need to do something about this and then that'. It leads to a piecemeal response to issues that all end up in the melting pot.*

> *The* [Department] *person seemed to want to add valuation of certain non-tangible assets into the model, for example, a valuation of the environmental impacts. I wanted to keep the model neat.*

2.8 The potential risk of scope creep from adding new elements into the research process also concerned lead researchers on Foresight projects. Those close to current policy priorities often result in high pressure on research teams to add in or scope out particular issues which often need to be revisited.

> *The research team need to be confident enough, and persuade OSI people who are being badgered from all sides. There needs to be a way of parking all issues, and then finding some way of locating them in the final report.*

2.9 Commentators felt that Foresight projects often lacked clear-sightedness and broad agreement across the stakeholders involved about what the research sought to achieve and specifically which questions to answer. Some interviewees said that overall research aims were not communicated to science review writers, creating a risk that teams end up commissioning reviews written from different perspectives and in different styles, and which actually bear little relationship to each other.

> *Questions were not articulated clearly enough. More direction would have helped on how people review their areas, instead of very different reviews all over the place. I think that the recent obesity report has managed to do a more careful partitioning of the question.*

2.10 Scoping clear high-level research questions and ensuring that these questions drive the evidence collection is hard to achieve with research that is inherently future-focused, wide ranging and speculative in its approach. Research teams need to look around to know what is out there. But without a clear enough set of research questions driving the looking-around process, there is danger of blanket collection of evidence, which becomes very hard to then synthesise ex-post. Foresight projects can end up publishing a vast array of primary evidence on their website, making it more and more difficult for observers to find accessible and 'need-to-know' versions of the research findings. The trick is to ensure that research questions drive the evidence collection, and not the other way around. We try to encapsulate a weak and a strong model of the overall process in Figure 2.1 below. Many Foresight reports display mixed characteristics of both these types. We put the 'weak' and 'strong' model to interviewees and suggested that it might explain the array of materials on the website, and found general agreement, such as:

*It is interesting that you found that by reading the outputs on the website…I don't think it is a coincidence.*

**Table 2.1: Different aspects of the Foresight research process and alternative weak or strong characteristics**

| *Key aspects of research* | Weak model | Strong model |
|---|---|---|
| Research team canvas views on themes and requirements from research | Under pressure from disparate interests, they include too much in the overall remit or miss out major areas | All issues are evaluated, and there are clear distinctions between primary and non-primary issues covered |
| Building the research team | Inadequate diversity or balance across disciplines and key sector perspectives | Good mix of experts across disciplines and sectors |
| Defining high level research questions | Weakly defined questions or no specific research questions | Well defined questions |
| Evidence collection | Is too speculative and broad. Not driven by specific research questions. Review writers produce very generalised summaries which are very difficult to synthesize | Is driven by key research questions and review writers are commissioned to address these questions from their own discipline. Reviews are compatible in the issues they address |
| Research outputs | Published in their raw format due to difficulties of synthesizing. Confusing and high-volume array of documents to trawl through. Main reports are surprisingly general and lack coherent thread of data and analysis | All evidence collected is focused on research questions. Evidence can be easily synthesised in one coherent overall report (plus appendices). There is coherent link between data and analysis |
| Impact on research team working | Narrows down to a very small group who have the impossible of synthesising numerous reviews. End up writing their own report. Researchers not in the core team feel marginalized | Evidence is driving the report writing, researchers see their work incorporated and feel like they have made impacts. Feel included and add to the positive impact of the research |

*I think that's about right actually.*

*It's a fair comment.*

2.11 When research questions do not sufficiently drive evidence collection, thousands of pounds can be spent commissioning science reviews from academics, which are then extremely difficult to bring together into a coherent analysis. As the 'weak model' suggests, the core team get back a collection of papers that cannot be synthesized, and which the team cannot use to drive their analysis. In the weak model case some lead researchers admitted that they end up writing the final report practically without reference to the reviews. One lead researcher admitted to us that although science reviews were commissioned from fifteen or so experts, they actually played little or no part in the final write up and product.

2.12 Reviewing the Foresight website, it is often difficult to find one definitive document that ties all aspects of the research together. Some interviewees suggested that the capacity to synthesise final evidence, editorialise, and boil it down to accessible and authoritative final documents has been relatively weak.

2.13 All eight projects in this review involve STEM (science, technology, engineering and medicine) researchers as well as themes relevant for HSS (humanities and social sciences including economics) disciplines. Getting the balance right between the STEM and HSS inputs is an important component of maximizing impact across different sectors, and this issue surfaced a wide range of opinion amongst interviewees. Does Foresight get the discipline balance right? Many acknowledged that the history of Foresight and its location across the former DTI and BERR mean that it was always going to lean towards hard science research. However in recent years, as government science has taken on a more inclusive and rounded profile, Foresight has been concerned to redress this balance and to build a more inclusive mix of disciplines into the research approach. Interviewees in some of the more high profile impact projects told us that much of the modelling and scenario work done is, by definition, social science.

> *Foresight definitely moved the discussion forward towards aspects of social interaction in the electromagnetic spectrum, rather than a more technical discourse, which had been prevalent.*
>
> *The risks of* [infectious disease] *threats were appreciated. But no-one had pulled together a united programme to examine future diseases and disease technology trends.*
>
> *This helped to break down the gulf between different strands of academic disciplines…dietary and physical sciences, basic sciences, built environment and so on.*
>
> [The Obesity report] *shows that it is possible to grapple with a multi-faceted system – it shows what can be done.*

2.14 Most interviewees felt that Foresight projects now bridge STEM and HSS cultures more effectively. But we found some often scathing criticism about the mix in some of the previous Foresight projects.

> *The report on infectious diseases was very narrowly conceived, a technical fix, showing signs of biological determinism. It was completely lacking in social science and economic perspectives.*
>
> *Editorial control excluded important issues. [We] provided a steer on this but were essentially ignored.*

2.15 Interestingly we found that some HSS academics tended to be quite critical of their own disciplines for not really doing enough to meet physical science disciplines head on. As one interviewee put it: 'Not many social scientists cross the boundary into science'. In the opposite direction, it was often acknowledged by both social and physical scientists that 'hard' science discovery and development was becoming the more dominant paradigm. Some even suggested that many hard scientists (for example neuroscientists and geneticists) could quite satisfactorily get on with their own research without the need to integrate social sciences and humanities into their approaches. There is a mix of lack of engagement from one side and disinterest from the other.

> *It blew my mind how unresponsive philosophy was to artificial intelligence. It is amazing [that] you can philosophize about a subject and not know anything about it. This is a field where all sorts of people can play a part, but philosophers are completely absent. And this area, or at least part of it, does seem to be their birthright.*
>
> *The neuroscientists say 'We can get on without philosophers'. And that is pretty much true. Brain scanning technology gives neuroscience such powerful dominance…It is such a powerful paradigm.*

2.16 We found many examples of STEM and HSS researchers working successfully together, but also found cases of both 'science envy' and nervousness:

> *The Chief Scientist introduced us all at the presentation. I had a bit of that feeling of paranoia. The more things go in the direction of genetics, the more social scientists feel that paranoia, I think.*

2.17 We found a refreshing perspective amongst many industry representatives, who tended to regard the science and social science distinction as a largely distracting concept, a preoccupation of academia but really not 'how industry works'. Research for them was about using any tools available to explore research questions, and not being hamstrung or hindered by distinctions between disciplines:

> *Industry doesn't give a damn about splits or distinctions between science and social science […] It is just not relevant to our purpose.*

2.18 Some interviewees cited examples from previous future-focused work in UK research bodies, where the interaction between physical and social science approaches had worked especially well - for example, recent research from the Nuffield Council Bioethics Research Programme on ethical frameworks for developments in biomedicine. One academic commented: 'It was a very Dutch way of doing things. Very evolved. Very interactive'.

# Building diversity and balance into the research team

2.19 Figures 2.2 and 2.3 below ranks some of the major aspects of the Foresight process in terms of the strength of their overall impact. Clearly the Foresight research process provides a valued opportunity for academics from different disciplines to get together and talk about specific issues from different perspectives:

> *I found it quite mind-stretching…having new conversations with people which I would not have had before.*
>
> *Foresight gives people from different backgrounds an excuse to talk to each other.*
>
> *It does get people talking, and it did spark thinking.*
>
> *It was a good contact-making forum…I got to talk to a lot of researchers. It was a positive experience.*

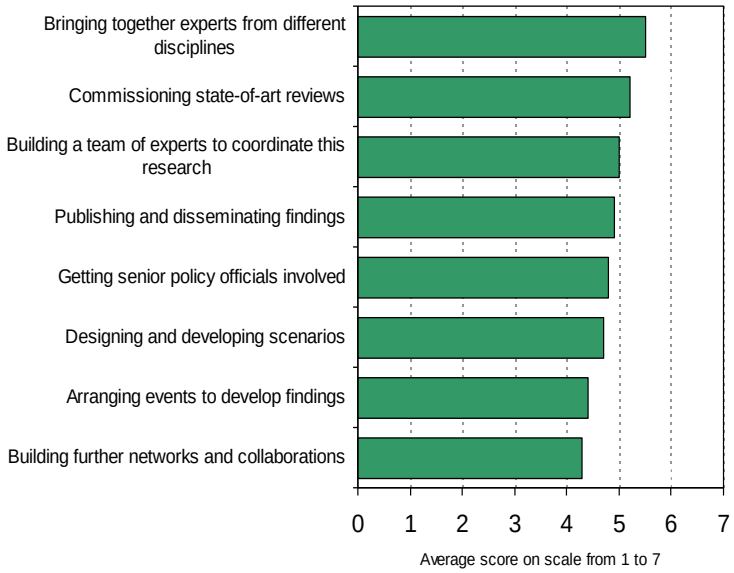
2.20 Interviewees found the initial workshops and early parts of the evidence gathering stages to be mixed, challenging and informative;

> *I went to the preliminary meetings, and there was a lot of discussion, it was quite an interesting day. I liked that the fact that they were bringing together different people from very different parts of the academic community.*
>
> *I was impressed by the mix of expertise […] It was mostly physical sciences, but really the first time that this kind of group had been brought together...The workshops were challenging.*
> *The group was interdisciplinary. It was well attended and although there was mutual suspicion at first, people were willing to suspend disbelief more than usual - because of the reputation of the scientists involved.*

2.21 However, academics contributors who were not directly involved in the core research teams, often expressed feelings estranged or marginalised as the research progressed. Academics often said in interviews that they played quite an intensive role for a while (i.e. science review writers, peer reviewers, and ad-hoc consultants), but then lost touch with the course of the research and subsequently have not had much to do with Foresight:.

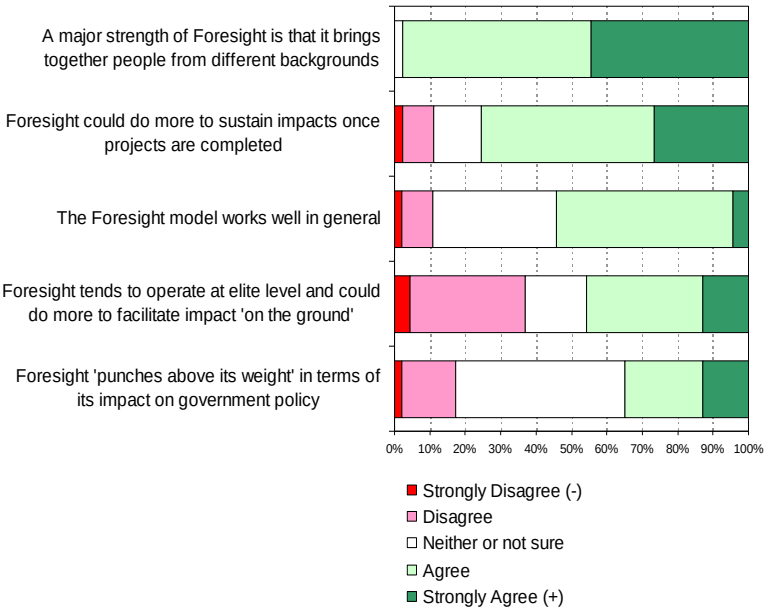
> *My experience was that it was quite intensive…and then I heard very little else.*
>
> *I have not discussed FS with anybody else since. This seems illustrative of something.*
>
> *We did see the report and that was it. We never heard from them again.*

## Figure 2.2: How survey respondents scored 'impact effect' of different aspects of the Foresight research process




We asked survey respondents to score different the 'impact effect' of different aspects or stages of the Foresight research process. We gave them a Likert scale from 1 to 7, where 1 = Very weak impact and 7 = Very strong impact. This Figure presents average scores across all XX respondents. Averages tend to lead to clustering around the mid-point of the scale, however we can read quite a lot from the variation in average scores.

## Figure 2.3: How survey respondents rated Foresight in different areas of its working




We asked survey respondents to tell us whether they agreed or disagreed with specific statements that interviewees gave us relating to general strengths and weaknesses of the way in which Foresight works.

2.22 Sometimes feeling estranged reflected the fact the research veered off in particular directions, or was seen as being subject to dominant individuals or cliques.

> *I think my own position became a bit marginalised. Scientists tended to dominate things towards the end. Thereafter I more or less lost touch.*
>
> *At some point I think I realised that this wasn't the project I had signed up for at the start.*
>
> *I'm not sure how many people precisely were involved. We never saw the draft afterwards. There was an inner cadre, of which I was not part.*
>
> *Academics are always interested in finding opportunities to influence policy…There is so little funding for policy related work…So when this [losing touch] happens, you feel a little bit rejected.*

2.23 Some interviewees suggested that once the project had been completed, there was a tendency for academic disciplines, particularly those from social sciences, to fall back into default subject groupings. Physical scientists tended to be less impressed by the interdisciplinary aspects of Foresight projects, perhaps because they are more used to working in networked groups already:

> *Most of the scientists were already joined up. Meanwhile economics, social sciences and others fell back into their places.*
>
> *In technical areas such as the EMS, academic networks are already established and interacting. While the study may have pulled some of these academics together, I wouldn't say that it has built up any new or important networks of collaboration.*

2.24 Many interviewees felt that the Foresight research model has a strong 'elite feel' to it, a cachet, where the 'great and the good' of government are present (or at least listed as expert overseers or panel members). Most people felt that this was an important strength of Foresight, a necessary one for research to filter properly into the priorities and workings of government departments. Researchers and expert observers alike generally acknowledged that the involvement of senior policy officials in the research from an early stage greatly boosted the authority and profile of the final reports across Whitehall.

> *The authority of the Chief Scientist was critical. It sparked a lot of personal interaction between science advisors and academics across government.*
>
> *The elite dimension is important. It certainly helps in 'up-streaming' social and economic aspects of what have been technology subjects in the past.*
>
> *It's absolutely vital to engage senior policy makers. Without that you are bound to fail.*

2.25 However some interviewees were sceptical of the emphasis on elite-level participation in the research process.

> *We got a call from the Chief Science Advisor saying that we should include Oxbridge people in our line up. He told us that the main opinion formers and users of the research would be Oxbridge people. It just goes to show that "The Establishment" is alive and kicking.*

> *There was some issue around who should be the consulted stakeholders. I have contacts with reputable officials and NGOs and activists. But I failed to get these people invited.*

2.26 Some researchers also expressed worry that the elite feel of this research meant that it was very unlikely that things would actually change 'on the ground' or at the point where public services get delivered. In Figure 2.3 above about half of our survey respondents felt that Foresight could do more to facilitate impact 'on the ground' at local and regional level:

> *Policy makers at high levels don't really talk to the people who move the dirt around […]Without systematic retraining, those in charge of flood management will continue to do what they are doing.*

> *There is always going to be an issue with the capacity to deliver in the Environment Agency, local authorities, and local resilience forums. This would require major programmes of capacity building.*

Nevertheless, most interviewees suggested that implementation issues were not really Foresight's responsibility and that there would obviously be a limit to what they could manage in terms of driving change down to the local level. Some were strongly in favour of Foresight focusing on how to encourage and support departments to develop clear and well-researched public policy measures and interventions that filter down through the system.

2.27 The interdisciplinary nature of most Foresight projects means that much hangs on the composition of the research team, the mix of different types of researchers, and ultimately the extent to which they gel. We found no obvious examples of strife or dissatisfaction with composition of the research teams, and generally found that interviewees showed high regard for the experience and input of lead researchers. We did find some concern that the composition of the research team is critical to the impact of the project, and perhaps Foresight could do more to reduce the risk of ill-communication or ineffective working arrangements.

> *The research process is heavily dependent on the choice of leader and the core team – it worked well in our case, but there is no guarantee that it would have done.*

2.28 Discussion around the level of seniority, age and position in academic networks of members of the core research teams raised some interesting points. A sometimes expressed concern was that research teams can fall back into 'usual suspect' mode, where established academics in charge of the research tend to commission or consult with peers or colleagues with whom they have worked in the past in ways that may narrow and skew the quality of the final research output. Some commentators suggested that more could be done to build in younger academics, who might be able to shoulder some of the considerable workload involved, and also gain experience of academic research with external policy and practice relevance.

2.29 Lead researchers on Foresight projects have often played active roles before in consulting with government on new policy or taking part in policy commissions or review committees. Professional communities are often linked up by the 'same people' performing different roles, with different hats on, and this is an important driver for dissemination and impact of Foresight research. Picking top researchers to carry out Foresight achieves important synergies because these researchers have access to other professional and policy-making forums.

> *Most of the people who set up these bodies up also worked on the project […] This is a tight community of experts.*

2.30 It is quite often the case with impact reviews, that one finds a 'vortex' of strong and intense opinion at the centre amongst people closely involved in the research. Some of the clearest views of projects' value-added came from commentators relatively close to retirement age, who had the benefit of a very broad range of professional experience on which to draw while still thinking about the future. Many were working as consultants and advisers to leading organizations in the commercial and business sector. Foresight research teams may well benefit from building in some kind of impartial and experienced all-rounder into the core research team to keep things fresh, assume some of the research burden, and encourage links with commercial and third sector stakeholders.

2.31 Foresight research provides an outlet for technical expertise to feed into broader issues and transfer good ideas or ways of doing things. As one research scientist told us: 'There is no lack of pioneering research in government and much of it deserves wider audience and application'. We found a number of examples of Foresight research tapping into existing government research and using it to develop their own approaches:

> *We have always had an eye on the future and a predictive outlook. We'll read about an organism in the journals and look at the significance and risk for the UK.*

> *I wasn't unhappy with our role in the research. I felt that we could bring a lot to the table. We are ahead in rapid diagnostic techniques.*

> *At* [the Central Science Laboratory] *we don't really do basic science…we have strong policy relevance in our work…we engage with international departments…and work on responsibility for plant health policy with WTO and FAO.*

2.32 As the quotes above suggest, the UK government has developed expertise in plant health diagnostics over the last 20 years as the degree of diversification in imported species has increased rapidly. Although this is a relatively unsung area compared to animal and human health, and relatively low priority in light of diseases such as foot and mouth and SARS, plant health experts in government are generally considered to have excellent worldwide standing and expertise. Some government organizations said that although they were fundamentally scientific research bodies, much of their work had a strong policy focus.

2.33 We found divided views on the extent to which commercial people should be integrated more closely into the core research work. Some commentators were critical about a perceived lack of private sector involvement, and would have liked more:

> *There should have been more secondments directly into this work, at least one from industry and one from academia. Unfortunately, Foresight did not seem willing to pay these sorts of expert market rates.*
>
> *The commercial sector is conspicuously absent from this research. I would recommend two things. More application based representation from industry and users such as Nokia and Vodafone. Second, more engagement with large communications research groups like Terrahertz.*
>
> *I know how important encouraging big pharma can be…it is driving policy. Because big pharma were not involved at the start, they were not really interested in the results.*
>
> *There didn't seem to be many 'action oriented' participants. There was a tendency for them to focus solely on the process, rather like Victorian gentlemen.*

2.34 However, other interviewees showed wariness or scepticism about the prospect of private firms having a more intensive role in the research production and dissemination. Although they felt that industry generally keeps abreast of new research and its commercial implications, they were sceptical about the extent to which industry would act on a Foresight report or get involved in the actual process:

> *I'm quite cynical about the involvement of industry. Retailers will probably study the report but won't do much more…There could have been more involvement from industry, but I'm not sure it would have helped […] In the end, I think it comes down to changing behaviour through better public policy making.*
>
> *We wanted to design the project without a commercial firm running it.*

2.35 Private sector stakeholders and consultants in futures modelling expressed a concern that the current Foresight process tends to be rather confined to a somewhat 'comfortable' or 'at times mutually unchallenging' relationship between academics and government. As

one commentator put it, 'it is a love in between government and a select group of academics friendly to government'. This is probably overstating the issue somewhat, however we did find concern that the research teams were not open enough to external input other than from established academics. It is illustrative here that we could find only a few examples of private sector companies using academics for future-focused research. Rather, they would be more inclined to employ in-house futures researchers (so-called futurologists), or tap into innovative work being done by doctoral students in leading science universities.

2.36 Interviewees almost universally agreed that Foresight research provides an opportunity to think creatively about future policy challenges, and test out or float solutions which might to be too radical or politically 'charged' for government departments to do themselves. A number of policy makers told us that a major value of Foresight research is that it takes place 'outside' of the relevant government departments, and can integrate and combine views in a way that is detached from day-to-day as well as political pressures faced by departmental officials.

> *We need to find to ways of managing flood risk creatively. Not just build high walls to keep it out […] This kind of thinking obviously comes with quite serious political implications.*
>
> [Foresight research] *encourages people to experiment a bit, find ways to take the pressure of existing systems by building a much more enlightened approach...you know, low-cost measures which improve public health.*
>
> *Foresight research has the feel of being independent and not too closely associated with government.*

2.37 Interviewees also told us that there is a fine line between the extent to which Foresight can talk about radical policy options and the extent to which it must consider political implications of these discussions. For example, researchers on the *Intelligent Infrastructure* project felt that Foresight tended to 'bat away' direct questions from the media about road charging schemes and leave the research team to comment on these independently. Some researchers were sanguine about political aspects of their research, others suggested that Foresight could be bolder in the way that they represent all aspects of research done in their name regardless of political sensitivities:

> *There were some political tensions but no more than usual. It helps that the report is framed as not being about tomorrow, but fifteen years from now.*
>
> *I was never asked not to say something but I was criticised several times. I had to take out one or two lines, which wasn't too bad for this kind of thing.*

2.38 We gathered quite a wide range of views about the extent to which Foresight research could be more radical or challenging in its assumptions and approaches. Although futures experts and futurologists interviewed were generally aware of Foresight

and the type of research conducted, we found that most tended to be quite critical about the incremental and somewhat comfortable of 'closed club' nature of the way Foresight apparently works. Some commentators questioned whether Foresight research is sufficiently radical in its approach and recommendations, and suggested that much of the research is incremental in nature.

> *In my experience* [Foresight] *made a cardinal error in that they took a mean view of views expressed, and any Foresight project should be taking the extreme views.*

> *I can't really see the point of having a study which advances the area incrementally by tying up existing work. I would have thought the real value is in encouraging new directions, and getting people to think outside of the box.*

2.39 These views were countered by more pragmatic and perhaps realistic views about the limitations and functions of government, both from researchers and policy officials. These championed the role of Foresight research in providing solid and reliable evidence to inform the work of government.

> *Ask yourself what is the job of a futurologist? It is to challenge assumptions and get people thinking. What is the job of government? To gather good solid information on which to base investment decisions. Solid is the key here. That is the value of Foresight.*

> *We are in a long term business. It's not radical in any way. We are making no more than 1 per cent change to our investment in any one year. If we have seen influence by 2015, then we are doing pretty well. We are planning on these new strategies really being embedded by 2012.*

> *As a means of bringing about stepwise change, it was really useful.*

## Research quality and integrating technical methods

2.40 Most of the lead researchers we interviewed told us that Foresight work had taken up considerable time and resources, almost always more than they had originally expected or bargained for:

> *You do have to bring quite a lot together in a short space of time.*

> *Senior people are exactly the type of people who don't have time to this kind of work. It might be a good idea to build younger academics into the process, with more to gain from these kinds of undertakings.*

A sense of over-commitment is perhaps characteristic of most major academic research projects which are done well, however we found signs of very large effort being made. Once projects had finished, key researchers were often under severe pressure to move on to other major commitments and could no longer commit adequate time to continuing or

developing Foresight findings. In most cases, the follow-up (and often the success) of the project hinged on whether a few people could continue to sustain their commitment.

2.41 We found a wide range of positive views about the quality and authoritativeness of Foresight research projects, particularly in the area of *Obesity* and *Future Flooding*. Academic and scientific independence is mostly seen as quite a powerful lever with which to affect change in policy making environments:

> *It came just at the right time. It helped us to quantify the scale of spending required and some of the likely benefits.*
>
> *We used it substantially. We have reused the methods, particularly the assessment of cost-benefits.*

However, some commentators were more sceptical about the extent to which Foresight reports are important in the greater scheme of things.

> *The 1983 and 1984 reports will be remembered in 20 years time as being important research contributions. I don't know whether the Foresight research will last as long. I cannot believe this to be the case.*
>
> *A report cannot change the world.*
>
> *The report is a stock quotable report mainly because it is one of the more recent. People have very short memories in this area though.*

A few commentators were more undecided or critical about the quality of the work produced.

> *Often review papers are seen as poor relation to academic research papers – they may be a tendency for authors to knock them out quite quickly.*
>
> *You got the sense with a lot of it that it had been put together in a bit of a rush.*
>
> *The final product would not be something that I would recommend to Masters or PhD students looking for research topics.*
>
> *Quality thresholds need to improve. If they went to peer review, they'd be shredded.*
>
> *Some of the papers were not publishable. They were rubbish.*

2.42 Building more systematic peer review into Foresight projects was a subject which came up frequently in interviews. Some academics had been asked to review the state-of-science papers or interim reports produced by the research teams, and told us that they had often been unsure to what extent their comments had been taken into account. There was a general feeling that for the amount of money Foresight spends on individual

projects, the research it commissions should be checked as being of the best possible quality. For a handful of projects or components commentators gave a distinct impression that research was often well below this benchmark. Given the quick turnaround and the need to build in a wide range of disciplines and stakeholders, it is clearly important that peer review should not hamper research. Nevertheless we found a general conviction that Foresight could do more to strengthen phased review processes over the course of its research projects.

2.43 A number of academics who were involved in providing mid-term or phased reviews of the research suggested that this system could be usefully systematized and perhaps even combined with an academic journal's standard peer review process to ensure that research commissioned is of the best quality available. Alternatively this might be feasibly done in conjunction with the research councils' peer review processes.

> *We could have proper standards of scientific review, linked to the main phases of the research. Interim reports could all be peer reviewed and time built into the schedule to accommodate this. It is difficult to get the phasing right on these things though.*

2.44 The sheer volume and diversity of evidence generated by Foresight projects is undoubtedly impressive. But many interviewees told us that Foresight has an 'over-production' problem. Some spoke of 'absurd' amounts of material they had been expected to read through:

> *The vast number of reports produced should have been inputs rather than research outputs. They should have informed the outcome of the work. In fact, they did not lay out the research space very well at all.*

> *I was faced with 2 feet of papers on my desk. There was no way I was going to read my way through all that. All that time and all that money!*

> *There is far too much reliance on stapling together thousands of pages and expecting people to read through them.*

Yet at the same time, there was often uncertainty about what the key findings for a project were and where to find a synthesized version of them. Figure 2.4 below gives a summary of the number of outputs and the total number of pages published with every Foresight report. In the most extreme case we found that the *Infectious Diseases* report came in 68 separate parts and ran to over 3,000 pages.

2.45 Others spoke of orientation problems, essentially difficulty in following any internal logic in the way that research teams organized their outputs. The current Foresight website makes it almost impossible to identify standardized summary documents for all eight projects. LSE Public Policy Group staff are experienced web researchers, yet we struggled to find manageable summaries for each project that could give us a 'need-to-know' introduction to the projects and key messages. For some projects, we still cannot locate suitable summary documents after many efforts. Interviewees said:

**Figure 2.4: The number of outputs and of total pages for each Foresight report**

| Report | Number of outputs | Total pages |
|---|---|---|
| Detection and identification of infectious diseases | 68 | 3,030 |
| Future Flooding: Flood and coastal defences | 10 | 935 |
| Tackling obesities: Future choices | 23 | 861 |
| Brain science, addiction and drugs | 15 | 752 |
| Cyber trust and crime prevention | 21 | 712 |
| Intelligent infrastructure systems | 26 | 675 |
| Cognitive systems | 18 | 348* |
| Exploiting the electromagnetic spectrum | 11 | 364 |

* Eight of the outputs are not available to download so this count is incomplete.

> *I had no idea what the project had produced. I had to phone up the lead and ask to be sent some kind of summary.*
>
> *Most academics simply do not have the time to investigate the large amounts of material produced by this EEMS study.*

These frequent complaints suggest that Foresight could benefit greatly by developing a more standardised way of publishing work, perhaps akin to a National Audit Office value for money report. NAO normally provide a manageable Executive Summary, a 30-page main text report, and then assorted appendices in web versions. Transposing this kind of

approach to the Foresight case might mean producing (as a first suggestion):

- a five page Executive Summary;
- a 50 page main report with key findings and evidence in it;
- detailed research review reports,designed for academic and professional audiences;
- papers on key methods or building blocks used; and
- in relevant cases a range of accessible guides or checklists designed to help corporations or trade associations on the one hand, or regional or local public sector bodies on the other, to incorporate the report's key findings and recommendations into their thinking or methods of working.

Currently, we can find no standard shape to the way in which Foresight reports are produced.

2.46 Some interviewees suggested that specialist journalists or copy writers could be used more extensively to write up 'accessible and thought-provoking' study reports, which might synthesize more effectively the large amount of data which is collected.

*You need someone who can pull together different areas and different strands of argument. Pulling things together is often very difficult. It is not something that academics are often very good at.*

*We use science journalists. They can editorialise and write things up in a way which makes them accessible and interesting.*

2.47 Some projects, such as *Tackling Obesities*, had diversified launch events, such as a technical launch for scientists and academics, press and media launches, and also events for practitioners and third sector organizations. Lead researchers had often undertaken quite a lot of activity to disseminate and 'translate' research findings to different audiences.

*I've talked to the world and his wife about the Foresight research. Talks go down very well and people really get engaged.*

*We held a technical launch for around 200 people, predominantly academics. This helped to get the work into the academic community, onto reading lists and referenced in peer review journals.*

*We held a launch seminar at the Institute of Civil Engineers. We invited the National Flood Forum, who told us 'it is the first time we have seen the facts.*

2.48 Most interviewees spoke favourably about these events: 'One hour listening to the lead researchers present their findings was worth hundreds of pages of written text'. However, some people said that they found Foresight sessions rather uninspiring compared to the types of events held by leading third sector bodies, such as the Wellcome Trust or the Nuffield Council. All our interviewees stressed that the overall profile and visibility of Foresight is shaped predominantly through specific projects. Quite often in the media the research will be presented as 'research by government' or 'research by the DTI/OST/BERR', which considerably limits how far any meaningful Foresight 'brand' can develop. A few lead researchers we spoke to were critical of the DIUS press strategy for launching a recent report, but this was not a widely shared view.

2.49 Most interviewees involved with Foresight know in detail how processes worked in their case, but they did not have much awareness otherwise of Foresight as a brand, organization or corporate entity. This low general visibility has potentially important consequences - for the authoritativeness of Foresight's research; the extent to which policy makers across government believe that what Foresight says matters; and the motivations for scientists to get involved, often to the detriment of their more standard academic career priorities.

*Foresight have low visibility unless you are specifically involved in a subject. It needs to think about how it can build generic added value for scientists.*

*We occasionally remember to remember what Foresight said.*
*To a lot of people, Foresight is a joke.*

*There is a feeling around the building that FS is a waste of time.*

2.50 Many academics told us that they found scenario-building exercises to be innovative and challenging, involving a range of techniques that helped them to think about their own subjects in new or different ways. Those exposed to scenario workshops tended to be positive about the experience.

*I found the whole scenario-building thing really wacky at the beginning. But it really opened up my thinking. This kind of training could be useful for academics as nobody is doing that at a generic level for scientists.*

*You do find that once you get outside the group of people who go through scenario process and enjoy it, the depth of interest and understanding drops off very quickly.*

2.54 Both academics and policy makers were generally aware of the inherent limitations of scenario approaches, and were often quick to point out that the value of scenario work is not necessarily in finding the right answers to the future but in providing opportunities for experts to structure collective thinking in more systematic ways.

*I like the projections bit. The scenario building work is useful. It may not have been done particularly well, but it is a valuable start to thinking about obesity more systematically.*

*You can waste a lot time debating these things…Scenarios were a useful way of getting our minds round various issues…I've no hang ups at all about the way they were used.*

2.55 We nevertheless found quite a lot of scepticism about the value of scenario-based approaches in Foresight's research. At the more extreme end, only a handful of people dismissed Foresight's use of scenarios completely, or questioned the sophistication or technical skills of Foresight to employ them usefully.

*Nobody ever reads the scenarios.*

*They are trying to do things that they are not equipped to do. They don't it well enough.*

In discussions with outside experts in scenario design and 'futurology', we identified some potentially important barriers to the successful use of these approaches, focusing on possible disjuncture or lack of coordination between three distinct groups: the designers of scenarios; the science experts leading the research; and the end users of research. Scenario experts emphasised the importance of close working relationships between these three groups, and the dangers of a more linear approach where scenario builders design the scenarios, experts substantiate them, and then users at the end have to operationalize them. Instead they felt that all three groups should be involved throughout the whole life of the research.

*Reading other peoples scenarios is notoriously boring.*

*It's not the process that is the issue. It's the structure of the relationship between those developing the scenarios and those consuming them.*

2.56 A number of experts pointed to the work done by Shell in previous decades to build futures work into their strategic thinking. Shell emphasized the importance of having close working links and understanding between the scenario builders and the employees doing the day-to-day work. It is difficult to change the minds of managers: achieving success in this area necessitates close dialogue with managers and giving them some feeling that they 'owned' the scenarios generated.

*When Shell started doing futures work all those years ago they had 30 or 40 of their own staff embedded in their organization, and they were working to change the minds of managers. They were in the thick of it, not doing scenarios from a distance.*

*The {Shell] outcomes were interesting and challenging, but getting managers to engage with the scenarios was difficult. It is difficult to get scenarios into people's minds.*

2.57 In a number of the projects we found that there had been some kind of disjuncture between the scenario-building work and the more substantive academic research produced. Often academic researchers reported that scenario work would seem to be independent of the substantive research, and in a couple of cases the two strands of work never really came together at all. Some consultants told us that they had almost no regular contact with the researchers they were working to, and that as a result, scenarios were produced largely blind. In projects where the scenarios appeared to work well, such as the *Future Flooding* work, we found that researchers, scenario builders, and potential users such as Defra and the Environment Agency all felt effectively integrated into this part of the work.

*Futures modelling is an excellent tool for creating strategic conversation inside an organization. But it is difficult to achieve the [necessary] quality and richness of conversation when the team you are working to is not really the client team. It is a problem of being one step removed.*

*Given the known problems with influencing readerships with scenarios, you generally need a whole of lot of aftercare to develop them further. And this doesn't generally happen with Foresight.*

2.52 Outside of Foresight projects, futures experts we spoke to found it difficult to think of specific examples where government departments had used scenario-building or futures approaches in their policy work.

> *I have not seen future techniques used in a constructive way in government. I cannot point to one example of explicit futures techniques leading through to a specific policy. That's not to say it hasn't happened, though.*

2.53 Policy makers tended to vary in their response to the value of the scenario work. In some projects, such as *Future Flooding*, scenario-building formed an important component of the analysis. Officials in Defra and the Environment Agency told us that the Foresight work has subsequently formed the basis for the development of more sophisticated flood risk projections.

> *I think there would be some benefit in re-running the scenarios, as modelling capability and baseline data have improved a lot in the last five years.*

2.58 Overall, some interviewees questioned whether Foresight could develop more diverse and varied tools in order to explore future challenges.

> *There is a danger that Foresight places too much emphasis on scenarios, and it is questionable whether they are really the right kind of tool for them to be using.*

> *Scenarios are only one tool amongst many. Scenarios have achieved a level of dominance within Foresight which is not necessarily helpful to what they want to achieve. Scenarios do not communicate well to people outside of the process.*

2.60 The most recent project on *Obesity* appeared to make a break from scenario approaches and uses system mapping as a way to encapsulate the multi-faceted and interrelated causal aspects of obesity. We found similar variation how interviewees saw the way that systems mapping tools had been applied. Interviewees familiar with this approach tended to be very optimistic about the sophistication and use of systems maps.

> *The systems map has become a very powerful tool […] The head of communicable diseases at the US CDC said that he was blown over by the Foresight work.*

> *People are definitely interested in modelling complex interactions behind something like obesity. For example, we are doing work to model taxes and their effects on health. This is the kind of thing that Foresight could really develop.*

Other interviewees, mostly those less immediately connected with the research, tended to put forward more circumspect or at times critical views.

> *The systems maps are complicated. You have to look at it in A3 to understand what on earth is going on. I'm not sure how much patience most people would have with them.*

> *I'm really anti the systems maps […] I don't know what the lines mean […] They don't systematize the factors responsible […]There is no causal mechanism […] They seem random […] They are really bad.*

2.61 We detected similar signs of disjuncture between research teams and other technical experts brought in to consult or provide methodological or systems-based support.

> *We did nothing on the electromagnetic spectrum side of things. We never met any of the electromagnetic team.*

> *The strange thing was that I delivered the model, they then used it with their researchers, but we were not involved. We only gave them a tutorial of how to use the model a week or so later […] We never met the scientists that did the report.*

## Sustaining research ownership and impacts

2.62 One of the most commonly mentioned weaknesses with the current Foresight model is the extent to which research projects tend to lose momentum or fizzle out once the main report has been published and early dissemination has taken place. There were of course exceptions to this, such as subsequent work done by the *Future Flooding* and *Infectious Diseases* teams for example. However, in general the issue of follow-up and maintaining momentum played high on the agenda. In Figure 2.2 above, the two lowest scoring impact effects were in building further networks and collaborations, as well as arranging further events to develop findings. Figure 2.3 shows that nearly four fifths of our survey respondents agreed that Foresight could do more to sustain impacts once projects are completed.

> *There was lots of fuss around this work going on…it generated a huge amount of interest…but I never saw a final copy. There was a fanfare, and then, as far as I'm concerned it went flat.*

> *Overall Foresight is a fantastic initiative…But it seems to have disappeared.*

> *There is a sustainability problem. Produce report, tick "Done". But what happens after that? I don't know.*

> *We didn't keep the network going and this caused quite a big disconnect. There was quite a lot of talk about having more to say, but not much action.*

> *There is a problem that once a project is done, people move onto other things.*

> *How to fund ongoing work and how to roll things out is really not clear at the moment. It seems to be a case of publish a report and hope that it happens.*

2.63 Some academics suggested that once the research is completed, much more could be done to establish similarly inclusive structures of ownership for it. Some felt that ownership of research should really lie with relevant government departments or clusters of departments.

> *I tend to think that these projects should start with fresh independent academic teams. But at some point they need to go into government - some arm of government needs to take ownership. This is probably the right way to go.*
>
> *At present there is not a great deal of momentum or even identity to the Foresight research. It is relatively old now. There is little to move it forward […] The debate would be continued through the creation of a dedicated flood management bureau, which would have considerable 'punching power'.*
>
> *There is always pressure on prioritization in the department […] Departments have to make hard decisions about where to put the money. There is no funding stream from Foresight. And so developing policy angles from their research is always going to rely on departmental funding.*

2.64 Others felt that follow-on work would be best located outside of government, with an independent academic institution or a funded programme in the university sector.

> *What we really need is follow-up work to support government in considering policy options…The broad stakeholder ownership of the research process works well. And so why shouldn't this be applied to development of policy options in the period after?*
>
> *The Environment Agency tends to do things their own way and the danger is that you would lose the freshness of perspective.*
>
> *The cyber trust and crime area is one of great interest at the moment, but very little seems to have come out of that research. There needs to be a way of handing over research to a university or industry body so that momentum continues.*

2.65 Interviewees told us that the broad ownership and participation in Foresight research projects brought benefits in terms of providing an independent platform and a basis for cross-departmental cooperation. They were sceptical that Foresight reports could solve deep-seated problems of joining up government, but many nevertheless acknowledged the value of Foresight reports in providing a working basis, on which further negotiations could be founded. Some government officials were specific about how Foresight research had led to new and subsequently very fruitful collaborations, such as the Biochip programme in Defra.

> *We wouldn't have thought of doing that if we hadn't been hanging out with animal and human health guys.*
>
> *Interdepartmental tension is alive and well […] Foresight offers non-partisan independence, and this has the effect of diffusing departmental tensions. It can act like a kind of glue.*

2.66 A major impediment to achieving coherent and ongoing impact with Foresight research has been a tendency for departmental tensions and priorities to impinge on the

implications of research findings. Some research projects showed key Whitehall departments being absent from the table at the beginning and throughout the research.

> *The future of disease diagnosis may well be in self-diagnosis, and particularly working towards one test which detects many diseases. This work could easily have very positive impacts for developing countries […] It would have been much better for the project had DfID been more engaged. [ID]*

> *DfID were difficult to engage on plant health issues […] They do fund their own research on plant health in the Third World. But we found it difficult to get them to work with us on the implications of diseased plants coming into the country.*

2.67 Researchers suggested that although the Foresight process provided joined up analysis, the process of passing these findings on to departments meant that they were susceptible to prevailing political and bureaucratic arrangements, and as a result would lose coherence and momentum.

> *There is a slight problem with the Foresight process that tends to mean that OST turns round to departments and says: "Here you are…This is our research, this is what you should do…These are your respective responsibilities…Now go away and do it". These are famous last words.*

> *We get a glossy report but no real answer as to what we should do next. OST tends to hand it on for departments to get on with.*

> *The lack of ownership of results from Foresight research is a major stumbling block. One of the biggest missed opportunities has been that there was no coherent national strategy built up afterwards.*

> *Because this topic is so wide ranging, it has prevented departments from taking responsibility. It has a tendency to fall through the cracks.*

> *One of the major issues with the EMS project is that carry-forward has mostly "fallen between the boards".*

> *It is always uncomfortable for departments to reach the point where they have to sign up to do something.*

2.68 Although the involvement of elite policy makers in the research process was widely welcomed, we found evidence that familiar public sector bureaucracy barriers still exist, which make it very hard to achieve more deep-seated impacts inside departments.

> *The churn of officials in* [the department] *is unhelpful…you build relationships and then six months later you find that these people have gone to do something else.*

2.69 Many interviewees said that Foresight research should not be seen to be telling departments what to do- with a consequent sensitivity around having specific

recommendations in reports, even if recommendation-like statements do come in the slightly veiled form of action plans.

> *Our report was careful not to tell Defra what to do, there were no recommendations for a reason.*
>
> *It was probably a good thing that Defra thought they were coming up with ideas themselves.*

The *Future Flooding* research team were keen to stress that they were not at any point looking to make recommendations to Defra or the Environment Agency. So perhaps it is interesting that this report has apparently had the most intensive follow-on activity with government of all eight that we investigated. Interviewees suggested that the balance here is to involve departments early enough, keep them briefed on development in the research, and provide them wide them with a set of evidence that is going to be useful for their own work in years to come.

2.70 The role of the UK research councils in maintaining momentum from Foresight research proved to be a controversial but potentially important issue for interviewees. Amongst research council officials and researchers there were strong views about the extent to which Foresight research should lead to subsequent research council programmes, as occurred with the *Cognitive Systems* project. Most felt that the research councils should not be expected to fund or to take responsibility for ongoing Foresight research. Nevertheless, many researchers suggested that there could be much more systematic coordination between Foresight research and research council programmes, and that it could have clear benefits for both parties, if it was carefully done. A commonly expressed view was that the budget for Foresight projects could be more evenly spread across the research and follow-up stages, and this could lead to follow-on programmes largely funded by Foresight but being run through the research councils. More systematic links between Foresight projects and research council programmes could help to reduce a tendency for joined-up research coming out of Foresight to 'fall between stools' in terms of areas covered by research councils.

> *There was some early commitment from the Research Councils to set up an interdisciplinary programme for cognitive systems research […] Despite best efforts, this did not really happen as we might have wanted it to. It was a case of the left hand not communicating with the right hand.*
>
> *Linking Foresight research to research council funding strategies is the equivalent of putting the cart in front of the horse […] The research councils would never agree to any kind of a priori right. Maybe the Foresight budget could include some money for follow on research, which would be allocated to research councils at the end.*
>
> *I sympathise with the research councils in that their independence is the most important variable. FS should not start dictating what the research councils fund.*

# Part 3: Case study
## *Future Flooding – Flood and coastal defences*

3.1 We focus here in more detail on one Foresight project, *Future Flooding – Flood and coastal defences* (launched April 2004). Looking first at the range and depth of impacts achieved, and then at some strengths and weaknesses of the research process itself. We noted above this is one of the more influential pieces of Foresight research (particularly in government).

***Future Flooding: Flood and coastal defences*** **A 30 to 100 year vision on the future of flood and coastal defences in the UK:**

- The research covers all of the UK and looks at flooding from rivers and the sea, and internal flooding in towns and cities. It also considers the risks of coastal erosion.
- It develops four future scenarios for flood risk based on varying types of *governance* and *social value* structures.
- The models developed estimate the extent of damages and costs from flooding incurred by the 2080s according to each of the four scenarios.
- The report evaluates the range and costs of technical and policy response to flood risks.
- It outlines key future challenges for policy makers.

3.2 The key findings from *Future Flooding* are clearly set out in an accessible and highly readable Executive Summary document (no more than 50 pages). The narrative for change is clearly established in this Summary, making the case for thinking seriously about the risk and future costs associated with taking a passive approach, and setting out an 'integrated portfolio of responses' which could considerably reduce the long-term costs of flooding in the UK.

**Some key findings from Future Flooding:**

- In 2003-04, over 2 million UK properties, valued at a total of over £2 billion, were at risk of flooding (either coastal, 'fluvial' or 'pluvial').
- If flood management policies remain unchanged, *annual* losses could increase according to the worst case scenario by up to £27 billion by the 2080s.
- By 2050s, annual losses according to the worst case scenario could already be at £14 billion.
- With implementation of 'integrated portfolio of responses' set out in this Foresight research, average annual damages could be limited to around £2 billion by the 2080s.
- The additional costs over the next 80 years of increasing engineered flood defences would be around £70 billion in total *(less than £1 billion per year).*

## Impacts achieved by Foresight research

3.3 In our discussions with researchers, policy makers, commercial sector organizations, local and regional stakeholders, and 'policy watchers', Future Flooding received the most categorical acclaim of all Foresight projects for its timing, comprehensiveness, accessibility, far-sightedness and dissemination.

> *The Foresight study is always mentioned…it is a catalyst…it has made a difference. [Senior government official]*
>
> *DEFRA have been thinking further ahead than most civil servants* – [they are a] *generally forward looking organization, but Foresight stepped things up a gear. [Academic scientist]*
>
> *It has forced thinking on the range of possible future scenarios and the implications of these on future flood risk and has highlighted potential future barriers and constraints to mitigating risk. Or, conversely, it has shown where future options may offer opportunities for reducing flood risk. [Academic scientist]*
>
> *It brought into focus a much larger problem in the future if the 'do-nothing' option was adopted. [Academic scientist]*
>
> *This was one of the most comprehensive studies ever…certainly in Europe and possibly internationally. Economists would slate me for this but the Foresight report was probably more influential for us than Stern. [Senior government official]*

*We grasped it to our bosom and loved it to death. [Senior government official]*

3.4 Non-reactive measures have generally confirmed the position of *Future Flooding* as the leading Foresight project in the eight covered in this report. In terms of direct and substantive references found in our Google searches, *Future Flooding* leads the way in the government and, to a lesser extent, in the academic domain. It also ranks second only to the more recent *Tackling Obesity* report in terms of the number of references found in mainstream and specialist press and media publications (see Figure 1.18 in Part 1 for further details). We used our all-domain Google search to evaluate which sectors were referencing *Future Flooding* most intensively. Third sector organizations appeared to be referencing the report at least as frequently as UK central government organizations, in terms of substantive references, and much more frequently than academic institutions and research institutes (shown in Figure 3.1). We give more detail on the coverage of the report in the third sector below. Local and regional flood bodies (not local authorities) told us in interviews that the Foresight research has provided a strong basis on which to build campaigns and awareness. Most of these organisations have quite proactive web strategies, which makes them visible in our web-based evaluation of dissemination.

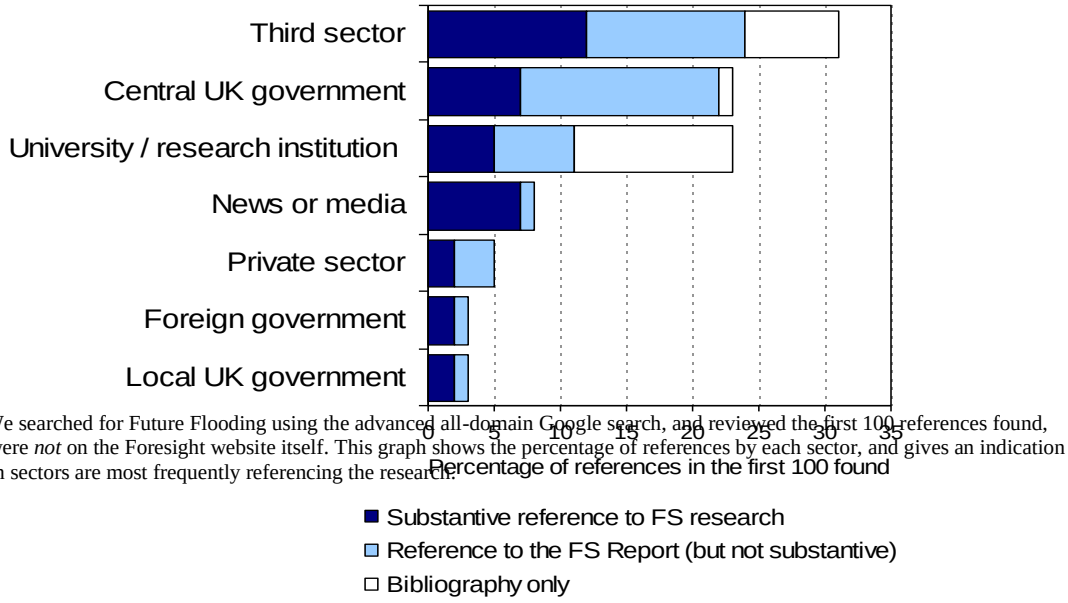
3.5 It is perhaps surprising to see that local authorities come below foreign governments in terms of referencing. In interviews some commentators suggested that Foresight reports in general often struggle to filter down to local authority level in a widespread way. Others said that the Foresight is beginning to filter down and influence change at local authority level.

> *There has been next to no impact at grassroots level […] Local bodies are often given flood defence-related tasks for which they are ill-equipped and under-resourced.*
>
> *There is a real lack of expertise in local authorities […] There are serious cases of de-prioritization of flood risk work - for example, drainage engineers getting taken away from their jobs and transferred elsewhere.*
>
> *The Future Flooding research had considerable impact throughout the user community, particularly central and local government.*

About five per cent of references found were on private sector or commercial organization websites (excluding press and media organisations). Again, this corresponds relatively closely with what interviewees and survey respondents told us in so far as some well-known insurance companies and representative associations showed interest and were involved in the research.

3.6 Turning to the overall impact scores given by survey respondents who had specific familiarity with the *Future Flooding* research. Figure 3.2 below shows how its average scores compare against average overall scores for all projects. The pattern of *Future Flooding* scores across audiences match the overall pattern quite well, with central UK government and academia seen as the major sectors for impact from Foresight research.

**Figure 3.1: Percentage of references to *Future Flooding* made by different types of organizations in our all-domain Google search**



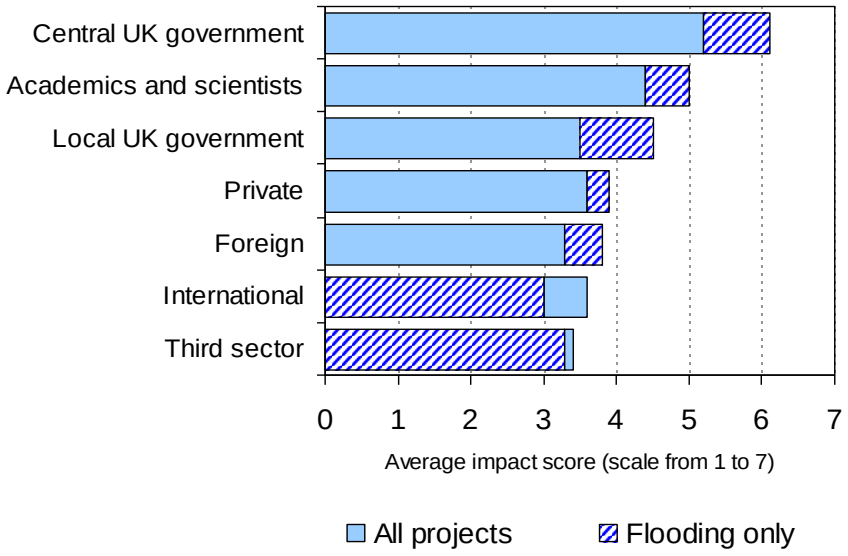

**Note**: We searched for Future Flooding using the advanced all-domain Google search, and reviewed the first 100 references found, which were *not* on the Foresight website itself. This graph shows the percentage of references by each sector, and gives an indication of which sectors are most frequently referencing the research.

But the average score for *Future Flooding* is almost one full point higher than the overall average, a clear sign that this project has impacted comparatively highly in Whitehall.

> *Foresight Flood and Coastal Defence was always primarily intended to provide central government a clear steer on future flood risk and policy response. The direct impact has been on UK government policy and funding. Most other impacts have been either indirect or moderate to low…reflecting the aims of the project.*
>
> *This research only has an impact on those organisations involved in flood protection, i.e. the Environment Agency, water utilities and various county and district councils, etc.*

3.7 Interestingly, local government survey respondents pointed to impacts (more than one point higher than the overall average). Their view does not fit with our Google search results, nor with the general feel from interviewees that *Future Flooding* has not had widespread coverage at local authority level. Even more confusingly, survey respondents saw less than average impact from *Future Flooding* on the third sector scores. The score here is the lowest in our survey (as opposed to highest in our Google searches). Most survey respondents were from government or academic science sector, and so may not have been well-versed on impacts across the third sector. Evan so, our findings on impact in the third sector and local authority respectively are clearly not consistent with each other.

**Figure 3.2: Average impact score given by survey respondents with specific knowledge of the *Future Flooding* project, compared with average scores for all projects**




## Impacts across UK central government

3.8 In Defra and the Environment Agency, senior policy officials and scientists have, almost without exception, confirmed that the Foresight research has been an important influencing factor in their policy and strategy work on flood risk. Generally in research impact studies it is often difficult to find clear and compelling examples of direct impact, because establishing causation is always such a 'messy' undertaking. But in this case, the range of confirming views we have collected reinforces the case that *Future Flooding* has had considerable impact on policy and practice in this area.

3.9 In March 2005 the government published '*Making Space for Water'*, its cross-departmental programme taking forward a strategy for flood and coastal erosion risk management in England (March 2005). Academics scientists we interviewed were generally complimentary about the tone and content of this report, suggesting that it had taken a strong line on the need for future action, and had at least given some assurance that investment in flood risk management has become embedded as a top government priority. One lead researcher on the Foresight work talked of his surprise at how radical or bold *Making Space* had been, tackling many of the central issues head on, even if it had left quite a number of questions unanswered about how to achieve these goals and how much things would cost. Some senior officials suggested that *Making Space for Water* had picked up on many of Foresight's findings, but that in other areas, it had shown a kind of serial tendency for potentially important issues to be ignored or overlooked.

> *We've taken part in consultations on Making Space for Water…these have been well structured. [Third sector representative]*
>
> *A lot of things were picked in Making Space, others were ignored…once more. [Senior government official]*

Government officials were quick to acknowledge the catalytic effect of the Foresight research. As one put it, 'without the support of DTI and Foresight we wouldn't have done as comprehensive a job as we did…We would have eventually got round to it'.

3.10 We asked civil servants, agency officials and Foresight researchers to identify which specific aspects of the Foresight research had been partially or wholly adopted in the *Making Space for Water* strategy. Interviewees generally agreed that the 'portfolio' approach of measures advocated by the Foresight team had formed the basis for the subsequent government strategy. This stresses the fact that there is no single solution and government needs to take a mix of hard measures (e.g. physical engineering) and soft measures (e.g. financial incentives and collective action). Some people acknowledged that this kind of 'portfolio' approach was not an exclusive intellectual property established by the Foresight work, and it had clearly existed in prevailing thinking prior to that. But most agreed that it was the Foresight work that had 'mainstreamed this idea in government' as one policy official put it.

3.11 When government officials were pressed to identify specific aspects of the Foresight research which had transferred to the *Making Space for Water* strategy, we found unprompted agreement across three or four key officials. All mentioned the scale of investment that would be required by government. In fact, one senior official went on to say that in light of more recent research by Defra and Treasury, the Foresight projections on increases in required investment had actually been somewhat conservatively scaled and significantly below where current projections are heading.

> *It nailed down the trajectory of spending. In fact, it is probably going to cost twice as much as FS predicted.*

Government officials also generally agreed on a range of other aspects of the Foresight research which were picked up in one way or the other in the government strategy. Big issues included a focus on urban drainage and surface water flooding, strategies for land management, flood resilience for buildings, PPS25 regulations and guidance (see text box below), and accountability structures for inland flooding. Some officials suggested to us that many of these issues had been 'knocking around' for years, but had not been properly dealt with at various stages of government policy intervention.

> The Planning Policy Statement 25 (or PPS25) sets out Government policy on development and flood risk. It's aims are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from the areas of highest risk. Exceptionally, where new development is necessary in such areas, policy aims to make it safe, without increasing flood risk elsewhere, and, where possible, reducing flood risk overall.

3.12 Despite the apparently positive picture of impact from *Future Flooding* implied in the evidence presented here, government officials were still somewhat cautious about attributing too much significance to one piece of research. Most were prepared to acknowledge that the *Making Space for Water* document 'built on' the Foresight research. And many of the people working on the Foresight project had been involved in the government consultation work which preceded the strategy and ran as part of the work programme between publication in 2005 and 2007. One policy official summed up a general impression thus: 'Foresight was not the only piece of research we used…it was 30 to 40 per cent significant'.

> *Much of what we did was based on work that Defra and the Environment Agency had already started – we 'misused' some Defra risk assessment models and developed them. We referred to it as structured knowledge elicitation. [Academic scientist]*
>
> *Much work existed prior to Foresight, but it was freshly brought together, some aspects were further developed, and it was brought to a wider audience. [Academic scientist]*
>
> *DEFRA fed a lot material into the project from NaFRA. Much of the same methodology and data was used for Foresight. [Senior policy official]*

Naturally government strategies are the product of multiple different sources of influence, evidence and thinking. Defra and the Environment Agency had already been very active in carrying out modelling work on flood risk from 2001 onwards, and so much of the Foresight research based itself on existing government research.

3.13 Isolating the impact of *Future Flooding* on funding decisions by HM Treasury brings with it similar uncertainty in determining lines of causality. None of our interviewees in government or academia suggested that Foresight *alone* had been responsible for additional money allocated to flood risk management. Nevertheless, most were prepared to acknowledge that the Foresight impact had played an integral part in getting Treasury agreement to up the budget for the next spending review period. In 2005 the Treasury agreed to commit a further £200 million, taking total spending to £800 million over three years. The increase in England was from £300 million to £450 million over the three year period. The Environment Agency told us that this had in effect doubled their budget for flood risk management over the three year period. As one government official told us, 'Treasury work differently…Unless you have evidence based research to support your arguments for more funding, you may as well forget it. Academics on the Foresight team reported that they had two or three meetings with Treasury officials and found discussions to be very positive:

> *I was pleased that we managed to engage Treasury. I was really impressed by their people, very bright indeed. I found it useful to interact with them outside of the usual department context. And they gained some insight which they probably would not have gained otherwise. [Academic scientist]*

3.14 We were told that there had been some attempt to get Treasury to commit to a permanent mark-up in funding year-on-year, but that instead a final agreement had involved presenting the new funding commitment for flood defences in a particularly opaque way, reducing the perceived size of the overall commitment by chunking it up into annual allocations. Some academics found this unnecessarily obfuscating.

> *HM Treasury were sensitive to the spending implications […]The results were deliberately confusing in the way they were presented in the study, in order not to alarm Treasury […] It is probably accurate to say that this was an unsaid agreement between Treasury and the research team. I found them frankly confusing and unclear.*

This is the only Foresight research project where we have been able to discern some degree of specific impact on Treasury decision making.

3.15 The continued relevance of flood risk management in more recent years has meant that the Foresight research seems to have sustained a profile. Policy officials at the Northern Ireland Rivers Agency told us that Foresight had helped them develop 'new impetus' to their policy making programme in flood risk management. Foresight was used subsequently in the Efracom 2007 research. And the recent interim report on lessons learned in the 2007 floods across the UK by Sir Michael Pitt (known as 'The Pitt Review') makes no less than eight separate references to the Foresight research, including this quote:

> *Flood risk is here to stay. The Review recognises the findings of other reports, such as Stern and Foresight, which predict climatic change and state that this country can expect more extreme weather, with periods of intensive rainfall.* [The Pitt Review, p. 3]

3.16 The Foresight modelling work, in essence the scenario building and development of associated risks, has continued to have relevance for the Environment Agency in recent years. Researchers on the project told us the Agency has committed to replaying the Foresight models on a five-year cycle. We were not able to confirm this commitment from Agency officials, but we did find general evidence that the Agency had developed further aspects of the Foresight quantitative modelling. For example, the Agency has downscaled some of the Foresight work to support regional initiatives such as the 2100 Thames Estuary Study, and has built much of the Foresight analysis into their own modelling of long term investment needs. Climate change scientists from leading UK research centres were also keen to stress that the quantitative credibility of *Future Flooding* was largely responsible for having the research referenced in recent IPCC reports.

3.17 We mentioned above the enigmatic impact of *Future Flooding* at local government level. Interviewees suggested that local government does tend to be aware of studies such as Foresight, but that local authorities are hampered by their lack of expertise, training and resources, particularly as around three quarters of government funding is allocated centrally. One environmental research expert told us that there remains a very strong centralizing tendency in government and responsibility for flooding tends to remain in the

hands of central government agencies. This places pressure on local authorities to respond to central initiatives, and may explain why, although there are signs of sporadic interest and involvement, widespread interaction at local level is still some way off. Policy officials told us that the Foresight research had formed the basis for negotiation with the former Office of the Deputy Prime Minister on the development of local strategic flood risk assessments. Various interviewees felt that there was a great deal of variation in the quality of these plans, suggesting that the capability and resources for handling flood risk at local level is questionable.

### Impacts across the academic and research science sector

3.18 Identifying the specific impacts of *Future Flooding* in the academic and research science sector is a harder task than looking for policy impacts, even though it scores well on academic dissemination. Figure 1.12 in Part 1 above shows that *Future Flooding* easily ranked top of our eight projects in terms of substance references found in our Google search of the UK academic web domain (ac.uk), and was widely referenced in academic bibliographies and CVs. Figure 1.12 ( in Part 1 above) shows that we found references to this work on the websites of nearly 35 UK institutions. Figure 3.3 below shows the institutions most frequently referencing this work.

**Figure 3.3: Top 10 institutions most frequently referencing Future Flooding research on their websites:**

- Newcastle University
- Tyndall Centre for Climate Change Research
- Southampton University
- Cranfield University
- York University
- Imperial College London
- Loughborough University
- Manchester University
- Sheffield University
- University of East Anglia

Source: LSE Public Policy Group Google search

3.19 In interviews, academics generally argued that the impact of *Future Flooding* on the research community was mediated mainly through experts from a wide range of disciplines being involved in the research process and attending various stakeholder meetings, a kind of viral form of achieving impacts. Looking through the long list of stakeholders at the back of the *Future Flooding* Executive Summary, this inclusive and comprehensive picture is very much confirmed. A research scientist from a world-leading UK institutions commented: ‘It is difficult to write about coastal flooding without referring to the Foresight results’.

3.20 This effect may reflect the existence of collaborative networks of academics working in this field prior to the initiation of Foresight, and which the Foresight team

could plug into. As one academic spoke of 'experts working almost seamlessly across different sectors […] academic, public policy and even commercial'.

3.21 The Flood Risk Management Consortium (FRMC established in 1999) is perhaps the most striking example of such closely knit research communities. FRMC was originally funded by the EPSRC in the late 1990s, and a quick review of its website provides an impressive array of research partners including NERC, Defra, Environment Agency , the Scottish Executive, the NI Rivers Agency, and UK Water Industry Research. From the wide range of academic institutions and researchers who are members of the Consortium, at least three or four were core members of the Future Flooding research team.

> *Many of the people who set up the Consortium also worked on the project. [Academic scientist]*
>
> *This is a tight community of experts. You can't underestimate the value of having this in place for a project like Foresight. [Academic scientist]*

3.22 From our evidence and a little basic network analysis, the FRMC was arguably at the heart of much of the *Future Flooding* activity. We received almost a full house of survey responses from officials in *all* Consortium partner organizations. Interviewees pointed out that the FRMC, as well as being an important conduit for Foresight findings, also gained from the status of the research. It greatly reinforced the position of the FRMC in the second phase of the EPSRC funding (Summer 2007), and as one interviewee put it, 'it provided a big kick to the programme'. Subsequently, new research units have been set up in other academic institutions, which are linked in to the FRMC and add to and increase the richness of the research community. For example, the Flood Defence Research Group was set up in January 2005 at the University of Strathclyde 'to investigate flood defences at a time when research in this area is becoming increasingly important'. Although not a direct impact from Foresight, it seems reasonable to argue that new research groups such as this are at least 'impact by association'.

### Impacts in the commercial sector

3.23 Our survey results and Google searches shows moderate impacts in the commercial sector, naturally enough perhaps since Foresight research is geared primarily toward policy and practice impacts. Survey respondents scored commercial sector impact on average at around 3.9 on a scale from 1 to 7. Only five per cent of the first 100 references we found in our Google searches were on commercial sector websites. This may be explained by the fact that commercial sector organizations tend not to use their websites for providing this kind of information.

3.24 Major firms in the flood defence engineering industry, such as HR Wallingford, were closely integrated in the research, both as consultants on expert reviews and through personal or professional links with key members of the research team. We were told that Halcrow already has a joint programme with Defra on flood management R&D. And as part of the initial project scoping, the Foresight team 'spied out the land' on how these

| **Figure 3.4: Private sector companies involved as stakeholders or experts:** | |
|---|---|
| Engineering / Consultancy | • ABP Marine Environmental Research<br>• Arup Consulting<br>• Black and Veatch Consulting Ltd.<br>• Cascade Consulting<br>• Environmental Futures<br>• HR Wallingford<br>• Hyder Consulting<br>• John Chatterton Associates<br>• TAUW<br>• WRc Group |
| Business associations | • Association of Drainage Authorities<br>• Country Land and Business Association |
| Engineering | • Montgomery Watson Harza |
| Insurance | • Association of British Insurers |
| Products and management services | • CIRIA<br>• Halcrow Group Ltd |
| Science publishing | • Kenward Words Ltd. |
| Water | • Severn Trent Water |

organizations might play a part. One of the lead researchers on the team told us that 'we wanted to design the project without a commercial firm running it'. However, it seems clear that these engineering firms were active participants (see Figure 3.4 below).

3.25 The insurance industry also took an active interest in the *Future Flooding* study. The Association of British Insurers took part in various workshops hosted by Defra, and were consulted as part of the Foresight research. Our Google results showed reference to the Foresight report by Norwich Union and Sun Alliance on their respective websites. There was little sign of any other industries referencing the research. This is born out by comments received in our survey.

> *The commercial sector were involved much less in the project and it is therefore not surprising that there was rather less impact in these sectors, although the insurance business engaged positively. [Academic scientist]*

> *The response for the private sector varies considerably. The insurance industry has been most impacted but then again it would and should have been. Other industries - it has hardly registered on their radar. [Academic scientist]*

A review of the stakeholder and participants list at the back of the Future Flooding Executive Summary shows 18 private sector organizations represented. There was little or no sign of property developers being involved in the research. Some commentators suggested that it would be a matter of time before property developers start to show more

active interest, particularly as 'higher demands for drainage facilities are placed upon them'.

3.26 Interviewees felt that the insurance industry have shown some (limited) signs of proactive and cooperative behaviour in terms of working with government and third sector organizations to improve the quality of information supplied to homeowners about flood awareness and flood-proofing. This is apparently more so the case in the light of the Civil Contingencies Act 2004. For example, Defra told us that the ABI had been involved in various workshops. There are clear signs that the insurance industry is doing its homework on these issues. For example, Norwich Union commissioned research which found that 95 per cent of people living in flood risk areas do not think that they can do anything to protect themselves against flooding. Regional flood forums have worked cooperatively with the insurance industry to develop premium-based incentives for homeowners to flood-proof their properties, and have co-written a leaflet with the ABI on how to flood-proof your home. Although undoubtedly beneficial, these initiatives seem relatively piecemeal and require quite significant changes in the prevailing culture and orientation of large private sector organizations. Representatives from these regional forums told us that the insurance is becoming slowly more responsive, but there were also indications of frustration and disappointment that change was not taking place more quickly.

### Impacts in the third sector and the public at large

3.27 As already noted third sector organisations were the most frequent referrers of the *Future Flooding* in our all-domain Google search, yet for some reason scored lowest in terms of perceived impacts according to our survey respondents (mainly academic and government elites). Our interviews revealed a highly active and committed community of grassroots organizations which 'do their best with limited resources'.

> *We go into the community…work with people…this empowers flood victims, and gives the Environment Agency and local authorities valuable insight. It is helpful for central government to have structured lines through which to negotiate and consult. [Third sector representative]*

> [We] *worked together with the Environment Agency, local authorities and others on the risk of pluvial floods…it was like watching a jigsaw puzzle being put together. [Third sector representative]*

3.28 This role seems valuable, particularly in light of the generally-accepted frailties of local authorities as guardians of local people at risk of being flooded. Policy watchers told us that the recent Pitt Review has put new emphasis on the role of such local resilience forums. However many expressed a sort of 'knowing scepticism' of this route alone, suggesting that the Review might be pinning too much hope on somewhat patchy and ad hoc local and regional structures. By their own admission these organisations are somewhat limited in resources and often lacking in nationwide coordination (although the National Flood Forum appears to have made significant progress in developing a national strategy in this respect). As one interviewee put it, 'very few organizations are tooled up

to do this work'. Some third sector bodies suggested to us that there needs to be much closer integration between government, the commercial sector and local authorities, to the extent that one interviewee suggested setting up regional hubs where representatives from all sectors 'share an office space'.

> *Where is the real policy application from this work that is identified at the grass roots? The dissemination of the work has not met the power of the project. [Academic scientist]*

The close-knit cooperation between elite academics and central government agencies (illustrated by the FRMC above) appears to be lacking in terms of 'frontline' activity and practice.

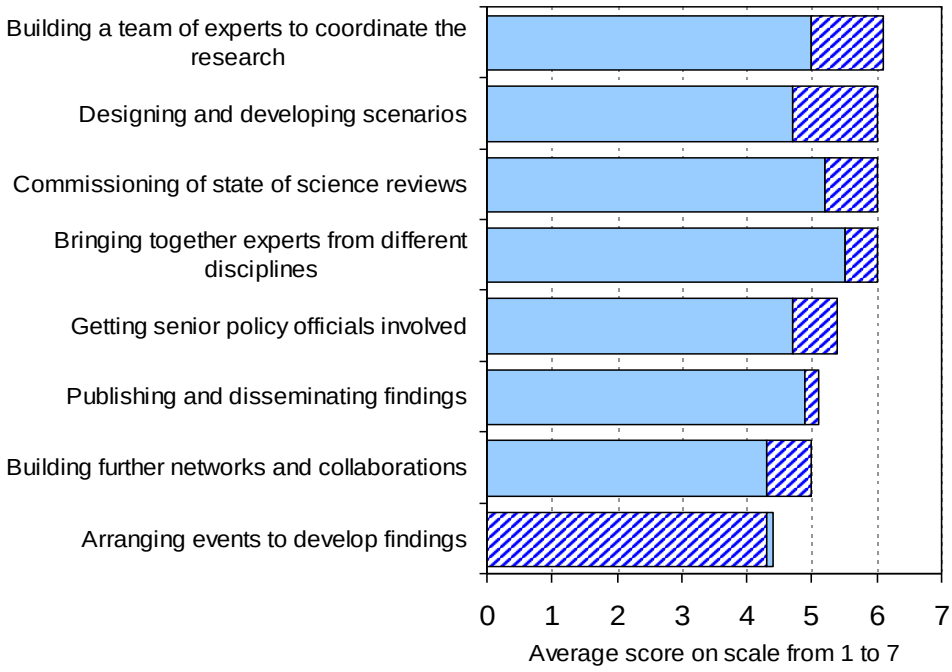
3.29 The handful of third sector organizations interviewed felt that generally the Foresight report had provided a basis on which to focus campaigns and leverage government and commercial organizations. Yet the broader picture at local and regional level is a mixed one with some degree of frustration that government tends to move quite slowly. One interviewee told us: 'The only thing I would say is that they have been a little slow. For example, the urban drainage consultation is only out now'. Nevertheless, there was some recognition that it had become easier for communities to get access to funding that previously they would not have qualified for. 'It is possible for [communities] to get access to a few thousand pounds for simple flood measures…We need to work on making it easier to release funding to smaller communities'.

3.30 Foresight research had least impact on the *public at large*, even though *Future Flooding* did gain moderate press coverage in national newspapers. However, we found more references to the research in local newspapers than national ones, a clear sign that these issues are 'playing out' at local and regional level. It is interesting that around two thirds of central funding flows to central government bodies, yet flooding and flood risk appears to be a policy issue which predominantly has to be dealt with locally or regionally.

## Enhancing impacts generated from the Foresight research process

3.31 To get a quick picture of comparative performance of the *Future Flooding* project against other Foresight projects covered in this report, we separated out the *Future Flooding* scores for 'impact-effect' of different aspects of the Foresight research process to see how they compared with overall averages. Figure 3.5 below shows that *Future Flooding* compares favourably. The cross-hatched bars show the score for *Future Flooding*, whereas the shaded blue bars show the overall average. Where cross-hatched sections form the tip of the bar, this indicates that the *Future Flooding* report scores higher than the overall average. In 6 out of 8 aspects, *Future Flooding* is almost one full point higher than the average.

**Figure 3.5: How survey respondents scored 'impact-effect' of different aspects of the Foresight research process, comparing *Future Flooding* against the overall average**




**Note:** The cross-hatched bars show the score for Future Flooding, whereas the shaded blue bars show the overall average. Where cross-hatched sections form the tip of the bar, this indicates that the Future Flooding report scores higher than the overall average. In 6 out of 8 aspects, Future Flooding is almost one full point higher than the average.

## Timing, scoping and refining research questions

3.32 The *Future Flooding* research project lasted approximately eighteen months, and ran from late 2002 through to publication and launch in April 2004. It consequently came right in the middle of what one government official described as a 'period of intense thinking' in government about flood risk management in the light of serious cases of regional flooding in the UK in 2000. Government officials told us that these cases had served as a wake-up call for government, and in the ensuing period relevant ministers (particularly Elliot Morley) sought to build agreement across departments for some kind of concerted strategy. Risk profiling and consultation work was reportedly underway in Defra and the Environment Agency from around 2002 onwards, and academics and third sector representatives frequently mentioned attending workshops and seminars hosted by Defra, and playing an active part in the early consulting process for what would eventually become the *Making Space for Water* strategy in 2005. Many survey respondents pointed out unprompted that Foresight's timing had been spot on.

> *It came just at the right time. It helped us to quantify the scale of spending required and some of the likely benefits. [Senior government official]*

The time horizons of projects were seen to be appropriate. However some policy makers at local and regional level said that outputs could be more systematically phased to take account of shorter time horizons in delivery organizations.

3.33 Compared to other Foresight projects such as *Cognitive Systems* or *Brain Science*, the *Future Flooding* research arguably had the advantage of being able to focus down on some key issues and objectives (i.e. it was probably less 'explorative' or 'speculative' in its coverage). Nevertheless we found strong indications from our interviews that the *Future Flooding* team did not take their research question for granted, and built an intensive four-month period (October 2002 to January 2003) into the research schedule to establish some clear aims from the work, identify main drivers, and work up initial parameters for the scenarios. We discuss in Part 2 'weak' and 'strong' research processes, suggesting that inadequate scoping and definition of research questions at an early stage can lead to somewhat fragmented outputs at a later stage which are hard to synthesise. Some interviewees hinted that scope creep could have been a problem with the *Future Flooding* work, but that the shape of the project was generally well defined from the outset and this helped to 'keep outputs under control' at the end. As one researcher put it: 'You have to somehow replace the great swath of issues and requirements with a coherent view, tackle the issue as a whole issue. It is important to the construct and agree on research design at an early stage'.

3.34 Our interviews with researchers, government officials, and our review of the final outputs from the *Future Flooding* study suggest that it bears many of the hallmarks of the 'strong model' outlined in Part 2. The intensive research scoping work at the beginning of the research led to 'chunking up' of the evidence collection, into four or five manageable studies commissioned from academics and private sector consultants.

> *We had a planning stage where we set out a logical framework for study, then qualitative and quantitative modelling where we generated models for precipitation levels and fed in varying levels of precipitation into the model. [Academic scientist]*

> *It was split up into work packages, contracted to the DTI, but people reported to me. [Academic scientist]*

Our interviews with the technical consultants suggested that these studies were carried out in close cooperation with those involved in doing scenario design. As a result, evidence could be more easily synthesized by the core team. This is evident also from the nature of the outputs emerging from the research – a concise Executive Summary, two detailed technical reports, and diversified outputs focusing on flood risk in Scotland and Wales (see Figure 3.6 below for a summary).

**Figure 3.6: How the Future Flooding research compares to a 'strong' model research process**

| STRONG MODEL | How Future Flooding fared? |
|---|---|
| Research covers a broad mix of disciplines but the high-level research questions are clear and tightly defined… | A small group of experts spent 4 months scoping the research, identifying key drivers, and framing scenario parameters |
| …Science review writers are given clear research questions to answer, possibly in a pro-forma context… | Work was divided up into four or five main chunks, and detailed studies were commissioned from academics and consultants |
| …Research evidence feeds into answering the high-level research questions and core team are able to synthesize effectively… | Intensive review and feedback was obtained from government and other experts to synthesize findings from detailed studies |
| …The final report is a full and comprehensive single document, accompanied by a range of technical or case appendices. There is strong link between research questions, data collected and analysis. | A concise Executive Summary was provided conveying key data and messages, plus two very detailed technical reports, and diversified outputs for devolved administrations |

3.35 Almost no interviewees mentioned any imbalance between STEM disciplines and HSS disciplines in the *Future Flooding* research. Previous quotes in this report suggest that researchers viewed their approach as fundamentally driven by social sciences and econometric modelling, even if many of the experts and input involved subjects more traditionally seen as STEM disciplines.

> *By definition this area encompasses physical sciences mainly but also social sciences and economics […] The scenario building approach is essentially socio-economic…it was pretty groundbreaking.*

### Building diversity and balance into the research

3.36 The *Future Flooding* project involved a wide range of experts from academia, research science, commercial sector and the third sector. Interviewees all agreed that this project successfully achieved a balance of inputs, whilst retaining a strong core group identity largely based in the academic research sector:.

> *The main mechanism for impact lies in the depth of this cross-fertilization […] Foresight was very inclusive – involving around 60 scientists. Everyone was involved in some degree.*

> *There was a real mix of subjects and disciplines in the flooding team. Natural processes, human and ecological systems, and institutional and governance issues were all in there. We engaged a few 'old hands' on economic and social impacts of flood defence.*
>
> *The main mechanism for impact lies in the depth of this cross-fertilization.*
>
> *All the usual suspects in the flood risk management business were involved in the FF research – it involved a free-thinking approach.*

3.37 Many of our most insightful interviews were with so-called 'all-rounders', many of whom are close to or past statutory retirement age but are still highly active in policy communities and debates. All-rounders generally have a range of experience in different sectors over a span of time, and can bring expertise and perspective to discussions around new technology and policy challenges. There is often a tendency for this discourse to be somewhat 'evangelistic'. Building in experienced people with 'no axe to grind' can help to 'ground' future-focused research, or as one official put it, 'stop it getting carried away with itself'. *Future Flooding* researchers pointed out that a 'few old hands' were helpful in this respect.

3.38 We found few signs that researchers or academics involved in the research felt marginalised or estranged from it, either in the sense that it lost direction or in the subsequent communication afterwards. One academic who had been involved in the research but not in the core team expressed surprise that we had found signs of estrangement in other projects. He acknowledged that: 'Building a multidisciplinary team was very important in the Flooding project, and we still come together regularly *[after a pause]* We are currently revisiting some of our original work for the Pitt Review'.

3.39 We noted in Part 2 that the *Future Flooding* research was very 'plugged in' to elite academic and professional networks from its outset. The response we have had to researching this case study confirmed a picture of an active and highly networked community incorporating leading research centres and consortia (such as the FRMC) and all the major central government stakeholders. The project also had high level political buy-in from Ministers, No 10, the Treasury, and especially the vital energy of the Chief Scientific Adviser.

> *David King's energetic championing of the floods Foresight - together with the occurrence in the UK of extreme flooding - greatly raised the climate variability agenda.*

There remains some question about the extent to which close cooperation at the elite level translates into widespread and effective cooperation at local or grassroots level. There are signs that much of the impetus for change 'on the ground' has been driven by highly committed and energetic third sector initiatives.

3.40 The evidence presented above supports the argument that impacts on government have been impressive from *Future Flooding*, and this has much to do with the proactive approach taken by the research team in the early stages of the research to get key government stakeholders on board. We found evidence of 'revolving doors' between the Foresight work and consultation on Defra's development of its own 2005 strategy.

> *The same people were involved in both studies but in slightly different roles. Key people from government were given voice in the Foresight workshops. And for Making Space, obviously government people were in the driving seat but with close communication to our team.*

3.41 There were some signs during our interviews that Defra had been quite hostile to or uninvolved with the project early on, and some suggestions that the Environment Agency lobbied quite actively to carry out the project themselves. As one interviewee put it: 'They possibly thought that we were interfering with their role as policy setters'. Another told us: 'I got the impression that Defra were tolerating the research rather than supporting it. They didn't want to explicitly analyse their current policies'. In seeking confirmation from other researchers, this was not widely recognised as a problem. However some did acknowledge that a bit of tension did seem plausible:

> *I wasn't aware of any, but I wouldn't be surprised. There were people in Flood Risk Management [Defra] who had been there for 25 or 30 years who may have had a problem.*

Some researchers told us that it is an important characteristic of Foresight studies that they should not be seen to be telling government departments what to do. This partly explains why few projects have contained recommendations in the same way that an NAO Value for Money study would. Recommendations in Foresight reports tend often to be dressed up in the language of 'action plans' and 'ways forward'. As one interviewee put it: 'It was probably a good thing that Defra thought they were coming up with ideas themselves'.

### Research quality and methods approaches

3.42 Future Flooding was almost universally praised by researchers, policy makers, and policy 'watchers' alike for the quality and technical detail of the research.

> *In the talks and presentations I have done, what has caught people's eye are the quantitative aspects.*

> *This is pioneering quantitative science […] It was the main reason why this report has had impact…mainly the numbers and thorough quantitative analysis. This was why Stern and IPCC have referenced it.*

> *We used it substantially. We have reused the methods, particularly the assessment of cost-benefits. [Senior government official]*

3.43 Some academics involved in the research suggested that there might have been scope to systematize the peer review of the research at critical junctures or end of phases. The Foresight website does provide a caveat with its electronic versions of the *Future Flooding* research papers that these papers are not peer reviewed. This does seem like a rather basic failing, since peer review could be easily built into what was a highly structured project schedule, possibly involving research councils. One academic argued:

> *We could have proper standards of scientific review, linked to the main phases of the research. Interim reports could all be peer reviewed and time built into the schedule to accommodate this.*

3.44 In terms of outputs, the project provided a readable and attractive 50-page Executive Summary (equivalent to about 20 full pages of text), which conveys the key messages clearly, plus two more in-depth technical reports providing supporting evidence and methods details. Specific reports were prepared for the Scottish Executive and the Welsh Assembly. Policy makers appreciated the way that the *Future Flooding*'s key messages were conveyed:

> *The magic with Foresight research is that there are a lot of findings but they are boiled down into a small number. Pitt has 127 recommendations for goodness sake. [Senior government official]*

3.45 Some interviewees made moderate criticism of the way that findings were compiled and presented, largely focusing on the need for short and easily readable digests of the work and key messages for public consumption. Others argued that the public are not the main target audience for Foresight. The Executive Summary is a fairly readable document even for well-informed novices, so quotes such as this below may be slightly exaggerated.

> *Like all other work on impacts of climate change the market is overcrowded with material. In essence, like the 1996 IPCC results, it needed a short booklet to explain the core elements to the government and public alike. This was not done and the sheer size of the report and technical language inevitably postpones public engagement.*

3.46 Our survey respondents scored the dissemination work done by the *Future Flooding* team lowest of all its aspects (see Figure 3.5 above). Yet we found quite a diverse array of activity to get the work out there. The Office for Science and Technology designed a communication plan, including three policy workshops, briefings for Permanent Secretaries, and informal discussions with relevant Ministers. A launch event was held at the Institute of Civil Engineers. Follow-up and outreach work as part of wider government science policy has also meant that members of the core research team have travelled to China and Russia to collaborate with government departments there on technology transfer and sustainability assessments. We are unsure to what extent this work has led to specific impacts, other than commitments to joint research projects and co-funding for overseas cooperation through the UN Fund (UNF).

3.47 The Future Flooding project costs in the region of £1 million over 18 months to carry out. Most researchers interviewed seemed quite surprised that the costs were so

high. But they could see how the commissioning of expert consultants, costs of core researchers, and costs of overseas travel for political and research elites might well account for this. National Audit Office Value for Money studies generally last eight months and tend to cost in the region of £320,000 each. This normally includes some commissioning of work from consultants and full time research activity of a team of about four or five staff. Compared with NAO therefore a Foresight report is considerably more expensive, incurring extra costs because of its basic research and its systematic and wide ranging involvement of academic elites. A senior government official summed up:

> *We would have been less enthusiastic if we'd been paying the bill. It was quite an expensive undertaking for the taxpayer. I don't think we would have spent that much. But you get what you pay for. I wonder whether they need quite the scale of operation to deliver what they did deliver. [Senior government official]*

3.48 Members of the *Future Flooding* research team told us that having close cooperation between the scenario experts and the scientists had been a critical factor for success. Their approach had also been a 'build it, test it, modify it' approach, and by their own admission the models had been 'pretty simplistic': 'We had moderation session where we ran the scenarios by people and got them to propose 'multiplier' effects'. We found some criticism of the scenarios from policy makers, involving limitations on underlying modelling assumptions and a lack of detailed information about some of the assumptions made. But there was general acknowledgement the team had used the best available data at the time and that keeping the models fairly simple had increased the re-use value. The Environment Agency told us: 'There would be some benefit in re-running the scenarios as modelling capability and baseline data has improved a lot in the last 5 years'.

[We commissioned two academic experts to read in full the Future Flooding documentation and make comments about the content and format of the work. We include detailed report of their comments in Appendix X, but summarise key comments in the section directly below].

### Sustaining research momentum and ownership

3.49 Some main concerns or uncertainties about the *Future Flooding* research remain in the area of follow-up and sustaining momentum in policy and practice. Figure 3.5 above shows that survey respondents ranked 'Building further networks and collaborations' second lowest on average, perhaps a reflection that in this case many durable networks were already in existence prior to the start of the research. Networks such as the FRMC seem to have been strengthened considerably by the Foresight work and there have been knock-on growth effects across the UK academic sector with the establishment of new research centres focusing on flood risk. Nevertheless, this theme of how to do follow-up has been a recurring one across all projects.

3.50 Most of the major impact reports, including *Future Flooding*, have all to a large extent found 'natural' departmental homes (even if other departments are playing an integral role in taking forward policy work). *Future Flooding* sits neatly in Defra and the Environment Agency, and interviews listed many signs that these organizations are committed to taking forward the *Future Flooding* work. Other relevant departments are now cooperating more intensively on their own relevant bits, as with DCLG's moves to

take flood risk more seriously in the development of local planning policies and how they are enacted. Nevertheless, there was a degree of scepticism or uncertainty amongst academics on the extent to which government bodies can retain the independent and inclusive ethos of Foresight research in taking forward further work. Worries have revolved around inherent contradictions in the policy objectives of key organizations, or some kind of inherent tendency for government bodies to bureaucratize radical proposals, fixate on misguided strategies, or respond too slowly to new challenges.

> *The Environment Agency is not set up well to work with Foresight's ideas – especially considering some of its conservation ideals may be in contradiction with some flood control strategies. [Academic scientist]*

> *There has been resistance in Environment Agency to agree funding for temporary defences […] In 2004, we had the first trial for temporary defences […] Now that they have seen them work, it is getting easier for the Environment Agency to think 'outside the box. [Third sector representative]*

> *It is a complete fallacy to think that it is just a question of reformulating the way that land is managed (i.e. flooding is the result of compacting the soil through heavy machinery). Some agricultural scientists in government have found differences in flooding depending on cultivation, and suggest that flooding could be reduced by reforming agricultural methods. This is neither true nor sufficient. During big floods we have had complete saturation regardless of the way the land has been treated. [Academic scientist]*

> *If we have seen real influence by 2015, then we are doing pretty well. Large scale plans only get reviewed every 6 years or so. We are planning on these new strategies being really embedded by 2012. [Senior government official]*

3.51 These concerns about embedding research suggest the importance of maintaining independent academic centres of excellence and hubs around which cross-sector networks can be built. For instance FRMC is going onward with co-funding from the EPSRC, providing a clear link to the community of research councils. Interviewees all stressed that the research councils have a key role to play in encouraging the development of institutional capacity in new areas of research such as flood risk. One interviewee also suggested that government should consider setting up a new flood management bureau which would 'have considerable punching power'. But the future looks relatively bright for flood risk policy and practice in the UK, providing that government funding remains stable; local and regional coordination can be reinforced; and policies are coordinated and radical enough to influence commercial sector behaviour. As one interviewee put it: 'The Foresight flooding research has set in train a whole new strain of research and good practice to create an improved management policy. This process is involving a wide range of some of the best brains in the industry'.

# Appendix A:
# Detailed description of methods

Not included here.

# Appendix B:
# Summary of Foresight one-year review findings

Not included here.

**Appendix C Breakdown of structure of each report** follows below

# Appendix C: Breakdown of structure of each report

**The Detection and Identification of Infectious Diseases**

E1: Executive Summary (Also available in French and Chinese) (65 pages)

S1: Science Review Summaries (22 pages)

T1: Future Threats (94 pages)

A1: Africa (130 pages)

D1: Vision of Future Detection, Identification and Monitoring Systems (118 pages)

P1: Action Plan (8 pages)

Detailed reviews of science
S3: Intelligent Sensor Networks (23 pages)
S4: Data Mining and Data Fusion (39 pages)
S5: Non-invasive screening and scanning (31 pages)
S6: Genomics and bioinformatics (25 pages)
S7: Biosensors and biomarkers (30 pages)
S8: Interrogation of natural signals (45 pages)
S9: Predictive and real time epidemiology (19 pages)
S10: Earth observation (30 pages)
S11: Host genetics and engineering (27 pages)
S12: Immunological techniques (529 pages)

Risk analysis
T2: Risk analysis (41 pages)
T3: Expert Survey of the UK and Africa (283 pages)

Disease case studies
T5.1: MRSA (8 pages)
T5.2: HIV / AIDS (23 pages)
T5.3: Influenza in humans (21 pages)
T5.5: Food borne pathogens (25 pages)
T5.6: Fish diseases (17 pages)
T5.7: Potato Late Blight (25 pages)
T5.8: Malaria (37 pages)
T5.9: Rinderpest (37 pages)
T5.10: Plant viruses in sub-Saharan Africa (SSA) (33 pages)

T5.11: Sudden Oak Death (26 pages)
T5.12: West Nile Virus (89 pages)

Climate change
T7.1: Overview (9 pages)
T7.2: Plant Diseases (31 pages)
T7.3: Animal Diseases (35 pages)
T7.4: Human Diseases (30 pages)

Modelling reviews
T8.1: Overview (15 pages)
T8.2: Malaria in SSA (43 pages)
T8.2 Tables (xls)
T8.3: Blue tongue in Europe (46 pages)
T8.4: TB control in SSA (22 pages)
T8.5: Global Traffic (45 pages)
T8.6: Foot-and-Mouth Disease (FMD) (13 pages)
T8.7: Paediatric HIV / AIDS (16 pages)
T8.8: Tsetse in SSA (11 pages)
T8.10: Malaria UK (15 pages)
T8.11: Eco costs of Potato Ring Rot (20 pages)

Further Reviews and Research
T9: Review of initiatives (14 pages)
T10: Travel and migration (12 pages)
T11: Effects of diseases on ecosystems (8 pages)
T12: Wildlife Trade (31 pages)
T13: China - human and zoonotic diseases (19 pages)
Appendix (xls)
T15: Plant pathogen database analysis (17 pages)
T16: Human pathogen database analysis (53 pages)

Africa Papers
A3.1 Paper for the commission for Africa (CfA) (14 pages)
A3.2 CfA paper appendices (60 pages)
A4: Report of a pan-African workshop (55 pages)
A5: Report of a pan-African workshop (French) (56 pages)

User Challenge Work
D2: Introduction to the user challenge work (6 pages)
D2.1: UC1 data mining and data fusion (31 pages)
D2.2: UC2 genomics and post-genomics for characterising new pathogens (25 pages)
D2.3: UC3 hand-held diagnostic devices (44 pages)
D2.4: UC4 fast throughput screening devices (30 pages)

Future control of diseases
D3.1 Plant diseases (35 pages)

D3.2: Animal diseases (24 pages)
D3.3: Human diseases (28 pages)

Culture and Governance
D4.1 Plants (59 pages)
D4.2: Animals (56 pages)
D4.3: Humans (47 pages)
D5: Historical perspectives (30 pages)
D7:Public perceptions of risk (55 pages)

**Future Flooding: Flood and coastal defences**

**Reports:**

- Executive Summary – 60 pages
- Scientific Summary: Volume 1 - Future risks and their drivers – 9 chapters, four appendices – 366 pages
- Scientific Summary: Volume 2 - Managing Future risks- 9 chapters, four appendices – 416 pages
- Scotland – 70 pages

**Key messages:**

- Key messages for Researchers – 4 pages
- Key messages for Environmentalists – 4 pages
- Key messages for Financial Services- 4 pages
- Key messages for Professionals at Local and Regional Level – 4 pages

**Action Plan:**
A co-ordinated plan of key stakeholder actions from across and outside Government developed in response to the project findings. Available here. – 7 pages

**FloodRanger:**
An interactive, educational computer-based flood simulator. Online only.

**Tackling obesities: Future choices**

Project Final Report (164 pages)
Summary of Key Messages (4 pages)
Science

- Short Science Reviews Obesity Reviews: Journal Volume 8 Supplement 1 (8 pages)
- Lifestyle Change - Evidence Review (51 pages)
- Obesogenic Environments - Evidence Review (61 pages)
- Obesogenic Environments - Summary of Discussion Workshops (25 pages)
- International Comparisons of Obesity Trends Determinants & Responses - Evidence Review (1 page)

Systems

- Building the Obesity System Map (80 pages)
- Obesity System Atlas
- Interactive Maps
- Obesity System Map Poster (Not available online)

Scenarios

- Visualising the Future: Scenarios to 2050 (81 pages)
- Future Trends in Technology and their Impact on Obesity (44 pages)
- Perspectives of 10 & 13 Year Olds:
    - Perspective of 10 Years Old (32 pages)
    - Perspective of 13 Years Old (34 pages)
- Food Chain Industries' Perspectives on the Future (82 pages)

Quantitative ERRATUM - revision to quantitative modelling report

- Modelling Future Trends in Obesity and the Impact on Health (76 pages)

Qualitative

- Qualitative Modelling of Policy Options (71 pages)

Poster for ICO2006 Sydney (1 pages)

Scoping the Foresight Project on Obesity (not available to download)

Trends and Drivers of Obesity: A Literature Review for the Foresight Project on Obesity (42 pages)

Challenges for research and research management (4 pages)

**Brain Science, Addiction and Drugs**

1 Problem Gambling and Other Behavioural Addictions
SUMMARY1 and FULL VERSION1 (40 pages)

2 Psychological Treatments of Substance Misuse and Dependence
SUMMARY2 and FULL VERSION2 (42 pages)

3 Cognition Enhancers
SUMMARY3 and FULL VERSION3 (44 pages)

4 Drug Testing
SUMMARY4 and FULL VERSION4 (33 pages)

5 Economics of Addiction and Drugs
SUMMARY5 and FULL VERSION5 (51 pages)

6 Ethical Aspects of Developments in Neuroscience and Drug Addiction
SUMMARY6 and FULL VERSION6 (65 pages)

7 Experimental Psychology and Research into Brain Science, Addiction and Drugs
SUMMARY7 and FULL VERSION7 (72 pages)

8 Genomics
SUMMARY8 and FULL VERSION8 (57 pages)

9 History and Future of Psychoactive Substances
SUMMARY9 and FULL VERSION9 (41 pages)

10 Neuroimaging
SUMMARY10 and FULL VERSION10 (63 pages)

11 Life Histories and Narratives of Addiction
SUMMARY11 and FULL VERSION11 (50 pages)

12 Neuroscience of Drugs and Addiction
SUMMARY12 and FULL VERSION12 (64 pages)

13 Pharmacology and Treatments
SUMMARY13 and FULL VERSION13 (41 pages)

14 Social Policy and Psychoactive Substances
SUMMARY14 and FULL VERSION14 (34 pages)

15 Sociology and Substance Use
SUMMARY15 and FULL VERSION15 (55 pages)

**Cyber trust and crime prevention**

Executive Summary (47 pages)
Technology Forward Look: ( User guide) (43 pages)
Technology Forward Look: Technical version (51 pages)
Gaining Insight from Three Different Futures (116 pages)
Cyber Trust & Crime Prevention: Foresight Overview (97 pages)

Short Review & Discussion Papers

- The ethics of cyber trust - Kieron O'Hara (5 pages)
- Cyber trust and crime prevention: towards generally accepted digital principles - John Edwards (4 pages)
- Privacy, Identity and Crime Prevention - Michelle Rogerson and Ken Pease (5 pages)
- The See-through Society: Openness and the future of the Internet - Paul Miller (4 pages)
- Cyberspace markets, social capital and trust - W. Edward Steinmueller (6 pages)

Science Reviews

- Synthesis of the Science Reviews -Brian Collins and Robin Mansell (101 pages)
- Confidence and Risk on the Internet - William H. Dutton and Adrian Shepherd (26 pages)
- Dependable Pervasive Systems - Cliff Jones and Brian Randall (20 pages)
- Identities and Authentication - Fred Piper, Matt J.B. Robshaw and Scarlet Schwiderski-Grosche (15 pages)
- Knowledge Technologies and the Semantic Web - Kieron O'Hara and Nigel Shadbolt (32 pages)
- Perceptions of Risk in Cyberspace - Jonathan Jackson, Nick Allum and George Gaskell (24 pages)
- Risk Management in Cyberspace - James Backhouse with Ayse Bener, Narisa Chauvidul, Frederick Wamala and Robert Willison (19 pages)
- The Economics of Trust Between Cyber Partners - Jonathan Cave (31 pages)
- The Future of Privacy Protection - Charles D. Raab (22 pages)
- Trust in Agent-based Software -Sarvapali D. Ramchurn and Nicholas R. Jennings (26 pages)
- Usability and Trust in Information Systems - M. Angela Sasse (18 pages)

**Intelligent Infrastructure Systems**

Project Overview (54 pages)
The Scenarios - Towards 2055 (89 pages)
Scenarios Toward 2055 - Perspective and Process (48 pages)
Technology Forward Look- Towards a Cyber Urban Ecology (44 pages)
Next Steps (4 pages)
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Intelligent Charging: Smart Market Protocols for Road Transport (22 pages)
Port Traffic Modelling (12 pages)

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Data Mining SUMMARY 33kb / Data Mining FULL VERSION (15 pages)

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economics and the Future of Transport
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Policy Issues for Intelligent Infrastructure
Policy Issues SUMMARY 32kb / Policy Issues FULL VERSION (16 pages)

**Exploiting the electromagnetic spectrum**

Real Options Model (9 pages plus excel spreadsheet)

EEMS Project Review (13 pages)

EEMS Launch Press Notice, 29 April 2004 (2 pages)

EEMS: Tales from the future (30 pages)

EEMS: Findings and analysis (41 pages)

EEMS: Executive summary (11 pages)

EEMS: State of the science overviews (20 pages)

EEMS: State of the science reviews

- Switching to light: all-optical data handling (59 pages)
- Manufacturing with light: photonics at the molecular level (58 pages)
- Inside the wavelength: electromagnetics in the near field (57 pages)
- Picturing people: non-intrusive imaging (64 pages)

## Cognitive Systems

### General Reports

- Cognitive Systems book (310 pages)
- Cognitive Systems Project - Applications and Impact Brief (2 pages)
- Cognitive Systems Project - Overview of the Project (8 pages)
- Cognitive Systems Project - Foresight Report on IJCAI-03 (10 pages)
- Cognitive Systems Project - Applications and Impact (not downloadable)
- Cognitive Systems Project Newsletter July 2003 (4 pages)
- Cognitive Systems Project - NIPS*2002 The State of the Art in Sensory Processing (8 pages)

### Research Reviews

How to design a cognitive system
Self-Organisation in the Nervous System BRIEF Self-Organisation in the Nervous System FULL VERSION (not available)
Large-scale, Small-scale Systems BRIEFLarge-scale, Small-scale Systems FULL VERSION (not available)

Cognitive systems in touch with the world
Representation BRIEF Representation FULL VERSION (2 pages)
Speech and Language BRIEF Speech and Language FULL VERSION (2 pages)
Sensory Processing BRIEF Sensory Processing FULL VERSION (2 pages)

Cognitive systems in action
Action BRIEF Action FULL VERSION (not available)
Social Cognition BRIEF Social Cognition FULL VERSION (not available)
Interaction, Planning and Motivation BRIEF Interaction, Planning and Motivation FULL VERSION (not available)

Memory
Learning and Memory BRIEF Learning and Memory FULL VERSION (not available)
Memory, Reasoning and Learning BRIEF Memory, Reasoning and Learning FULL VERSION (not available)

Advanced Neuroscience Technologies - BRIEF / FULL VERSION (not available)

### Robotic Reviews

Not available