

# Scientific Advice, Risk & Management: How Government handles them

## Summary

UKCRC is an independent, expert body whose members are leading researchers in computing. We have experience of offering scientific advice to Government in an area that is central to the Science and Technology Committee's first case-study: the technologies supporting the Government's proposals for identity cards.

This paper summarises the occasions on which we have offered scientific advice and any follow-up by Government departments or related bodies. We conclude that Government has made no real attempt to base computing policy on scientific evidence.

## Introduction

1. This evidence is submitted by the UK Computing Research Committee (UKCRC), an Expert Panel of the British Computer Society (BCS), the Institution of Electrical Engineers (IEE) and the Council of Professors and Heads of Computing (CPHC). The UK ranks first or second in the world in many areas of computing research. UKCRC was formed in November 2000 as a policy committee for computing research in the UK; its members are leading computing researchers from UK academia and industry; within our membership we have considerable experience of applying scientific methods to the problems of building industrial-scale computer-based systems.
2. Our area of expertise addresses a central element of the first of your chosen case-studies: the technologies supporting the Government's proposals for identity cards.
3. The UK computing research community is committed to addressing areas of national importance, as well as those of scientific promise. We devote significant efforts to engagement with industry and with users of our technology. As a consequence, UKCRC has substantial recent experience of offering scientific evidence to inform Government policy in these technologies. As an independent expert panel of the two relevant Professional Institutions, we are able to provide scientifically sound advice that is visibly free from any commercial bias.
4. UKCRC members are involved in several departmental advisory committees, including the Council for Science and Technology (CST), the Scottish Science Advisory Committee (SSAC), and the Defence Science Advisory Committee (DSAC).
5. UKCRC members have acted as expert witnesses in major litigation over failed computing projects. We welcome any opportunity to provide assistance that would reduce the risk of such failures in the future.
6. We believe that greater use of modern computing science would substantially reduce the risk of overrun or failure of the computer-based projects that are an essential part of the Government's strategy for e-Government and the modernisation of public services, potentially saving hundreds of millions of pounds each year and improving service delivery and security. The relevant computing science includes mathematically rigorous approaches to specifying and validating systems, security and dependability technologies, statistically-based methods of system evaluation, and science-based engineering methods. We have suggested that Government could take active steps to encourage the software industry to develop, document and share best practice, working through the professional bodies, and perhaps extending as far as accreditation.
7. We have evidence that science-based development methods are practical and cost-effective. They are used by some organisations to great effect: Microsoft, for example, uses rigorous mathematical approaches to designing and specifying systems (for example, the program analysis tool PREFIX, which is widely used by developers within the Company for automatic 'program review')

before testing or delivery, and the Windows static device driver verifier tool), and some statistical techniques for systems evaluation. The Motor industry and the aircraft industry are also increasingly using mathematically formal development methods cost-effectively.

## What advice have we given?

8. We have sought the opportunity to present this evidence to policy makers. We believe that the case history of our recent engagement with policy will illuminate the extent to which ministers and scientific advisors consider scientific evidence in formulating policy in our area of expertise.
9. Overall, we have been disappointed with the extent to which scientific evidence has been sought or used in our area of expertise. This may be due to the difficulty of understanding the issues associated with building non-physical systems of great complexity, but we believe that computing science is in general no more complex than many other areas of science.
10. In November 2002, UKCRC sought and achieved a meeting with Science Minister, Lord Sainsbury. We explained the great opportunities open to the UK to benefit from exploiting the UK's leading position in computing science research. Lord Sainsbury said that he was very interested and asked us to contact the Information Age Partnership (David Jordan), the Office of Government Commerce (David Hughes) and EPSRC (John O'Reilly). He also asked for a briefing paper on educational technology, which we provided. There was no other follow-up by his Department.
11. UKCRC met David Jordan in February 2003 and offered to contribute expertise to the Information Age Partnership. We were told that it would be inappropriate for UKCRC to become a member of the IAP but that we could provide very valuable input to their work. To date we have not been asked for any assistance.
12. UKCRC met David Hughes (OGC) and John O'Reilly (EPSRC) in April 2003, where we again offered expertise to help transfer computing science into industrial use, to benefit the public sector and industry. The meeting went well, but David Hughes said he had to wait for the replacement of Peter Gershon as OGC Director before organising a follow-up meeting. Despite reminders, and constructive criticism of the OGC's procurement guidelines for computer-based business change projects, no such follow-up has occurred.
13. John O'Reilly said that it would be inappropriate for EPSRC to have further meetings with UKCRC alone, but that he would welcome UKCRC's involvement in his meeting with the BCS, IEE and CPHC.
14. In April 2003, the Royal Academy of Engineering and the British Computer Society (BCS) published a report: The Challenges of Complex IT Projects. Several UKCRC members had contributed to the report, which called for the introduction of "Systems Architects" to support the use of better science and engineering in the development of complex IT projects. (Systems Architects would be people with advanced skills in adopting rigorous approaches to software development and project evaluation). Despite repeated efforts by the BCS, the Royal Academy, the Institution of Electrical Engineers and UKCRC, no Government Department has adopted this recommendation or (so far as we are aware) asked for a meeting to discuss it further.
15. In 2004, UKCRC responded to the Home Affairs Select Committee Inquiry into the Government's proposals for ID Cards and a National Identity Register. We gave written and oral evidence, arguing once more that the use of better computer science could reduce the high risk of overruns or failure of this project. We have followed this up with a meeting with the Home Office official managing the ID card project, and with two meetings organised by the Law Society attended by a Home Office Minister and officials. We have not been asked to clarify or expand on the ideas we presented at these meetings.
16. Also in 2004, UKCRC assisted the National Audit Office's review of the National Programme for IT in the Health Service (NPfIT – now Connecting for Health). We discussed the system issues and risks, and drafted a check-list of simple questions which was also sent to the Connecting for Health team. They have not requested a meeting with UKCRC.
17. In October 2004, UKCRC responded to a call for evidence on Civil Service effectiveness by the Public Affairs Select Committee. We gave written evidence on the difficulty we were having in influencing the civil service to base their computer systems procurement policy on the best

computing science and software engineering.

18. UKCRC members have been involved in the advisory panels for several Foresight Directorate projects. This has given us the opportunity to raise with Sir David King (Chief Scientific Adviser) the difficulty of getting Government Departments to engage with first class computing science and engineering. Sir David King asked for a briefing paper and made an oral commitment to “make something happen”. The briefing paper was sent to Sir David on May 10th 2005. On August 8th, after reminders, his office replied that it had been forwarded to the Head of e-Government, Ian Watmore, who would set up a meeting. Despite further reminders, no meeting has been set up.
19. Copies of the briefing papers, reports and presentations referred to above can be provided to the committee on request.
20. This (incomplete) chronology provides the background to our answers to your specific questions, below.

### **Answers to specific questions**

#### ***Sources and handling of advice***

21. *What impact are departmental Chief Scientific Advisers having on the policy making process?*  
In our experience, none.
22. *What is the role of the Government Chief Scientific Adviser in the policy making process and what impact has he made to date?*  
The Chief Scientific Adviser seems unable to influence the policy making process in our area.
23. *Are existing advisory bodies being used in a satisfactory manner?*  
We see little evidence that they are effective in stimulating the take-up of relevant computing science.
24. *Are Government departments establishing the right balance between maintaining an in-house scientific capability and accessing external advice?*  
Our interpretation of the recently published Government IT Strategy is that the Chief Information Officer has recognized that the Government needs to rebuild and nurture departmental expertise in Computing. UKCRC will respond to the current consultation on this IT Strategy. To date, external advice on computing policy has been sought primarily from Intellect, the trade body that represents the UK IT industry, and whose members have been involved in almost all of the public sector IT projects that have overrun or failed. The voice of industry is important, of course, but it cannot be expected to be free of commercial bias.

#### ***Relationship between scientific advice and policy development***

25. *What mechanisms are in place to ensure that policies are based on available evidence?*  
In this area, none that we have been able to discover.
26. *Are departments engaging effectively in horizon scanning activities and how are these influencing policy?*  
The Foresight projects in CyberTrust and Intelligent Infrastructures are excellent examples of horizon scanning. It is too early to know how much their output will influence policy. UKCRC has been calling for urgent action, based on the best science and engineering that is currently available for exploitation (most of which originated in the 1980s and 1990s). There is little point in horizon scanning unless you are already using the best science currently available!
27. *Is Government managing scientific advice on cross-departmental issues effectively?*  
Our experiences with the Chief Scientific Adviser and with the NAO suggest that cross-departmental issues are a severe barrier to effective action.

#### ***Treatment of risk***

28. *Is risk being analysed in a consistent and appropriate manner across Government?*  
Poor risk analysis and risk management is repeatedly identified as a significant factor in the failure of public sector IT-enabled business change projects.

29. *Has the precautionary principle been adequately defined and is it being applied consistently and appropriately across Government?*

We understand the precautionary principle to be the principle that where a scientific advance or new technology poses unquantifiable risks to health or the environment, it should not be licensed for use until the risks are sufficiently well understood. The use of computing science does not present such risks; indeed, a major benefit of greater use of rigorous, science-based methods would be that the risks of projects overrunning or failing would become smaller and easier to manage.

30. *How does the media treatment of risk issues impact on the Government approach?*

We do not have relevant experience to answer this.

### **Transparency, communication and public engagement**

31. *Is there sufficient transparency in the process by which scientific advice is incorporated into policy development?*

No. It is unclear how science influences Government computing policy, if it does at all.

32. *Is publicly-funded research informing policy development being published?*

Yes, a great deal of excellent research that should inform policy development is published every year by the academic community. For example, the EPSRC Interdisciplinary Research Collaboration on Dependability has published many papers and two or three books on approaches to assuring dependability in complex, socio-technical systems. Some of this work has informed policy – for example, MoD has incorporated some of the work in revisions to Defence Standards, and National Air Traffic Services Ltd are paying serious attention to some counterintuitive results on the negative impact of advisory systems on the performance of human experts – but this results from specific action by individual researchers rather than from any Government policy to track and utilise research.

33. *Is scientific advice being communicated effectively to the public?*

UKCRC, the BCS, the IEE, the RAEng, EPSRC and many others do our best in the computing area. The media's appetite for scientific advice is sporadic and tends to focus on post-hoc discussions about problems (such as difficulties with the Inland Revenue systems or the Child Support Agency) rather than on policy formation.

### **Evaluation and follow-up**

34. *Are peer review and other quality assurance mechanisms working well?*

Our main experience is with EPSRC, where peer review works well in general, but it is often difficult to get peer support for work which would provide the sort of evidence, for example metrics from large-scale projects, on which policy ought to be based.

35. *What steps are taken to re-evaluate the evidence base after the implementation of policy?*

We look forward to having some evidence-based policy to evaluate!

### **Conclusion**

36. Our experience leads us to conclude that the Government has made no real attempt to base computing policy on scientific evidence, possibly because so many departments would be affected by changes in computing policy, and because there is a powerful industry group that has shown little interest in greater adoption of science-based engineering methods (other than in highly safety-critical or security-critical applications). In our opinion, such considerations should not be allowed to become a barrier to proper consideration of the evidence, nor to carrying out limited trials. The potential benefits are very great indeed.

37. UKCRC would welcome the opportunity to assist the Committee by clarifying or expanding on any of the points above.

Martyn Thomas, for the UK Computing Research Committee January 2006.