Evaluation of the Organisation and Management of the GMHT Farm Scale Evaluations (FSEs)

by
Brian Jamieson & Associates

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Contents

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Executive Summary

i) Brian Jamieson & Associates were commissioned in early 2004 to carry out an *ex-post* evaluation of the planning, organisation, management and communication of the £6M Farm Scale Evaluations (FSEs) project (1999-2004) and derive conclusions of potential benefit to similar studies in the future. The study involved a review of previous reports and assessments of the FSEs, interviews with key participants and a workshop discussion of the emerging findings.

Outcome of the evaluation

ii) The overall conclusion of our evaluation of organisation and management is that the FSEs project was outstandingly successful in terms of its rigorous execution and its delivery of robust scientific results on schedule and within budget. The principal factors contributing to this were:

- An intelligent Government customer that consulted widely at the concept stage and was flexible on scientific approach and finance during the planning stage of the project.
- The Scientific Steering Committee (SSC), which assumed proxy ownership of the project and acted as the gatekeeper of confidentiality.
- The research consortium, which had considerable intrinsic strengths based on its skill base and experience of agricultural field experiments and ecological monitoring, and was embedded in research institutes that could provide resource back-up.
- Effective project co-ordination and management, including:
    - An outstanding personal contribution by the project co-coordinator.
    - A policy of motivating and empowering staff.
    - Web-based document management system.
    - Web-based communications.
    - Attention to quality control.
    - Development and adoption of automated data analysis.
- A professional approach to preparing and communicating the final results.
- The commitment and dedication of all the staff involved.

iii) However, the organisation and management of the FSEs project had some weaknesses, notably:

- The consortium and the SSC had few formal procedures for risk assessment and management, despite the project facing many uncertainties and risks.
- Patchy communication between the SSC/research consortium and SCIMAC.
- Some initial communication failures between the project and local site management.
- Uneven, and generally insufficient, engagement with the three consortium institute directors.
- A lack of detailed budgets, so financial management by the consortium was necessarily pragmatic, but nevertheless transparent and effective.

Lessons for the future

iv) The main generic lessons we draw for future large-scale agri-environmental and ecological projects conducted by research consortia are:

- Where there is strong public and/or political interest in the outcome of publicly funded research, scientific probity is best achieved by independence from the public funder, policy makers and Ministers. An arm's length relationship is likely to increase the acceptability of the results to all parties. An independent steering committee is one approach to achieving this separation.
- Public interest has to be recognised and managed by researchers. A communication strategy, developed with professional advice, should be adopted early on.
- Successful project management is crucial, but is unlikely to be achieved without initial foresight and planning and continuous monitoring throughout the project. The flexibility to accommodate necessary change is essential.
- On financial management, the need is for robust and auditable procedures appropriate to the degree of organisational complexity. Within a research consortium, central systems for project budgeting and control should mesh with local systems of financial control. Degrees of delegated authority should match operational requirements for resources.
- Data management and archiving systems are crucial for projects that create large datasets. Appropriately qualified staff should be identified, or marked for recruitment. Data quality assurance systems are vital.
- Risk assessment and mitigation should be scoped at the outset and reviewed critically by the senior project management team at regular intervals. The process must be properly documented.
- Smooth execution of the research requires that participating institutions consciously buy-in to the project. Potential boundary problems between the project and participating institution, for instance in costing, and resource allocation, need to be identified, addressed at the outset and kept under regular review.

The government-industry partnership

v) Finally, we recognise the project was a laudable initiative by Government and industry to work in partnership to conduct research in an area that had major, and potentially opposed, public and commercial interests. The availability of SCIMAC to represent and mobilise the range of commercial interests in GM crops and to engage directly with farmers was crucial to the success of the project.

vi) Several organisations and many individuals worked hard to make the Government-industry partnership effective during the planning and fieldwork phases. The complex dynamics between industry, Government and research consortium, however, added to both the task of project coordination and management and to the SSC's overseeing role. Unfortunately, the initial sense of partnership weakened as the project developed and SCIMAC were left nursing a sense of grievance at their exclusion from the final stages of the project when results were emerging.

vii) A final lesson of the FSEs is that it is very difficult to accommodate public and commercial interests in a single scientific project without giving the impression that one, or both, of these legitimate interests has been compromised.

Evaluation of the Organisation and Management of the GMHT Farm Scale Evaluations (FSEs)

November 2004

1. INTRODUCTION

Background

1. The farm-scale evaluations (FSEs) are a four-year programme of ecological studies into the effects on the abundance and diversity of farmland wildlife associated with genetically modified herbicide tolerant (GMHT) crops managed with their companion herbicide as compared with equivalent non-GM crops. The GMHT crops in the FSEs were oil seed rape (winter and spring sown) and maize tolerant to the broad-spectrum herbicide glufosinate-ammonium, *Liberty*, and sugar and fodder beet tolerant to glyphosate, *Roundup*. The studies were carried out by controlled trials on commercial farms throughout Great Britain during 1999-2003.

2. The FSEs were announced in autumn 1998 as part of the Government's initiative to strengthen and coordinate the assessment and control of GM crops. This comprised:

- A voluntary agreement between Government and the industry body, SCIMAC[1], for a programme of farm-scale evaluations of GMHT crops; and no general unrestricted cultivation of GM crops in the UK until the farm-scale evaluations were complete;
- The setting up of a subgroup of the Advisory Committee on Releases to the Environment (ACRE) to consider the wider biodiversity implications of the introduction into agriculture of GM crops and to make recommendations on how such impacts should be assessed and controlled;
- Review of the controls on pesticides with respect to their use on GM crops.

3. At the time the FSEs were started it was not a requirement under the EU Directive that governs the release of GM crops (known as the Deliberate Release Directive, then 90/220/EEC, now replaced by 2001/18/EC) that such an assessment of management effects on the environment be undertaken. However the Deliberate Release Directive was under revision, and now includes such a requirement. Anticipating this change in requirement was the main reason for Government initiating the trials.

4. Any GMO proposed for release in the EU has to undergo an assessment of all 'direct and indirect, immediate and delayed effects'. This must include an assessment of the effects of any management practice specifically associated with the GM crop – such as herbicide use in the case of a herbicide tolerant crop, in addition to other direct effects of the GM crop – such as effects on non-target organisms.

[1] The Supply Chain Initiative on Modified Agricultural Crops (SCIMAC), a grouping of industry organisations along the UK farm supply chain.

5. After extensive consultation, Government, in the form of the Department of the Environment, Transport & Regions (DETR), the Ministry of Agriculture, Fisheries and Food (MAFF)[2], and the Scottish Executive Environment and Rural Affairs Department (SEERAD) agreed to fund the FSEs with the following objectives:

- The hypothesis to be tested was that there were no significant differences between the biodiversity associated with the management of the particular GMHT crop and the comparable non-GM crop at the farm scale.
- The secondary objective was to contribute to an assessment of the wider question of whether the commercial use of GMHT crops will change the management of farming systems and the agricultural landscape.

6. After a competitive tendering process in spring 1999, contracts for the FSEs were let to a successful consortium of independent research institutes comprising the Centre for Ecology and Hydrology (CEH), Rothamsted Research (RRes)[3] and the Scottish Crop Research Institute (SCRI).

7. In October 2003 the results of the trials with spring sown crops were submitted to the Secretary of State for Environment, Food and Rural Affairs, published in a special theme issue of *The Philosophical Transactions of the Royal Society (Biological Sciences)*[4] and presented to the press and to the public at separate launches. The results from the autumn rape trials will be published later in 2004 or early in 2005.

Objective of the current evaluation

8. Brian Jamieson & Associates have been commissioned to carry out an *ex-post* evaluation of the planning, organisation, management and communication of the £6M FSEs project (1999-2004) and derive conclusions of potential benefit to similar studies in the future. The expectation is that this evaluation will have generic relevance to future large-scale integrated agri-ecological field studies addressing issues such as farmland biodiversity and environmental impact.

Approaches adopted

9. While recognising that much discussion and planning took place earlier, the starting point for this evaluation is the issue of the tender document for the FSEs by DETR, in early 1999.

10. We agreed with our client, the Institute of Grassland and Environmental Research (IGER), acting on behalf of the FSEs Scientific Steering Committee (SSC), that the main elements of our evaluation would be:

[2] The responsibilities of DETR and the MAFF were merged to create the Department for Environment, Food and Rural Affairs (Defra) in May 2001, halfway through the FSEs. Where historically accurate, we refer to DETR and to MAFF. Otherwise we use the current name, Defra.

[3] Then operating as the Institute of Arable Crops Research (IACR).

[4] *Philosophical Transactions of the Royal Society: (Biological Sciences).* Volume 358. Number 1439. 2003.

A. Awarding the contract

- Roles and responsibilities of the instigators and funders
- The research consortium: strengths, effectiveness
- Impacts on the consortium institutes
- Managerial challenges
- Communication

B. Conducting the farm trials

- Experimental design
- Project management
- Field and laboratory work
- Quality assurance
- Data management
- Evaluation of experimental results
- Preparing publications
- Archiving data
- Financial management
- Coordination and leadership
- Inputs by SCIMAC and host farmers

C. Communication strategy

- Preparing the results for publication
- Publication
- Public and media relations

D. The Scientific Steering Committee

- Remit
- Membership
- Method of operating
- Effectiveness
- Communication

E: Risk assessment and management

11. We made full use of the extensive documentation available on the Defra dedicated website[5] and had access to several key written records.

12. The main information gathering phase of the study was between April-June 2004, when we conducted structured interviews with key participants – funders, the SSC, SCIMAC, researchers, farmers and communicators (Listed in Annex 1).

[5] www.defra.gov.uk/environment/gm/fse/

13. We discussed emerging findings with Professor Chris Pollock, as Chairman of the SSC, in mid-June and submitted a Draft Report in early-July.

14. We presented a Draft Final Report to a Consultation Workshop on 29 September 2004. Thirty-four people associated with the FSEs project attended. We finalised our Report in the light of feedback from the consultation.

2. RELATED STUDIES

15. The FSEs have already been subject to scrutiny and audit. This partly reflects the intense public, political and media interest in all aspects of GM crops.

Parliamentary scrutiny

16. In a report published in May 1999[6] the House of Commons Environmental Audit Committee briefly considered the Government's decision to set up the FSEs. It recommended that the Government, its statutory advisers and industry should agree a protocol covering the terms under which the farm-scale trials would be conducted, inspected and concluded (including the disposal of crops) and the data interpreted. This recommendation was broadly incorporated in the subsequent agreements between DETR and SCIMAC.

17. In September 2003 the Environmental Audit Committee embarked on an enquiry into the value and relevance of the FSEs. This was essentially a policy audit of the FSEs, particularly the bearing of the conclusions on consents for commercial growing of GM crops in the UK. Nevertheless, the Committee made it clear that it also intended to examine the design and operation of the trials, as well as the implications for future commercialisation of GM crops.

18. The Committee published this report in March 2004[7]. Consistent with its declared remit, the Committee raised several concerns about the design and conduct of the trials. Principal amongst these were:

- The benchmark against which GMHT crops were measured was not ambitious since biodiversity has suffered greatly over the past half-century.
- It was unfortunate that crop yield was not measured in the FSEs. The Committee would expect to see robust protocols for yield in future trials.
- Because of the subsequent decision to ban the use of atrazine as a herbicide for maize, the forage maize trials were based on an unsatisfactory comparison.
- Industry was responsible for a number of key inputs into the trials which appeared to have been assessed only against very broad criteria, or were taken on trust.

19. The Chairman of SSC had addressed several of these points in evidence he gave to the enquiry. The Committee's conclusions on design and operation were also disputed by the research consortium, who were not invited to give oral evidence.

20. In April 2004 the Government published its response to the Committee's Report. In a robust defence of the FSEs, Government said that it:

> '*continues to stand by the design and operation of the FSEs. They are the biggest ecological study ever undertaken on the effect of any farming practice, and are a credit to British science. The work has been internationally recognised and widely applauded. They produced robust*

[6] House of Commons Environmental Audit Committee. *GMOs and the Environment: Coordination of Government Policy*. Fifth Report of Session 1998-99. HC 384.

[7] House of Commons Environmental Audit Committee. *GM Foods – Evaluating the Farm Scale Trials*. Second Report of Session 2003-04. HC 90-1.

> *and reliable data on the impact on biodiversity of the herbicide management of the GM crops in the trials. They have contributed to the consideration of our policy on GM crops, and our position on the particular crops in the trials.'*

21. The response also records the Government's view that the Environmental Audit Committee's decision not to take oral evidence from the research consortium was a 'serious weakness' in the enquiry.

Compliance audits

22. Both the research consortium and SCIMAC were keen to demonstrate that the FSEs were conducted rigorously and complied with standards of good practice in scientific research and with the legal requirements for growing GM crops.

SCIMAC Code of Practice & Guidelines

23. As the GM crops were being grown on a field scale on commercial farms, the trials had to conform with the SCIMAC Code of Practice on the introduction of genetically modified crops and Guidelines for growing newly developed herbicide tolerant crops. To monitor compliance with the SCIMAC Code of Practice and Guidelines, ADAS Consulting Ltd were contracted to provide third party audits of all growers within the FSEs.

24. ADAS audited all FSEs trial sites harvested in 2000, 2001 and 2002 to measure compliance with SCIMAC system. This involved a total of 257 crops over the three-year period on 97 farms. The approach combined remote and on-farm verifications and focussed on critical control points agreed with SCIMAC.

25. The audits[8] concluded that over the three-year reporting period there had been a high level of compliance with the SCIMAC Code of Practice and Guidelines. No major non-compliance was found in the eight critical control points identified by SCIMAC.

Internal Audit of agronomic practice

26. In addition, the research consortium carried out an internal audit of herbicide use on the FSEs crops, overseen by a BASIS-qualified agronomist. This showed that farmer decisions were in line with the principles laid down for both the GM and the non-GM crops.

[8] ADAS Consulting Ltd**.** *Summary Report: Audits of GM-HT crops within the farm scale evaluation trial.* April 2004.

Other studies

27. As part of a study commissioned by Defra to assess the practicalities of implementing a new Joint Code of Practice for Research[9], the CEH, Lancaster element of the FSEs was examined for quality assurance. The study showed that the FSEs would have complied with the new Joint Code in all major respects even though the project was planned long before the Code was conceived.

Relationship with the present evaluation

28. The present evaluation complements these earlier studies. Whereas the Commons Environmental Audit Committee was focussed on the outcomes and their wider policy relevance, our evaluation is concerned with the organisation and management of the processes that delivered these outcomes.

29. Our evaluation is driven by the SSC's desire that the lessons of undertaking this major, complex project should not be lost. We seek to benchmark the organisation and management of the FSEs against best practice. We highlight what happened, what went well and where improvements could be made in future agri-environmental or farm biodiversity research projects involving large numbers of field sites.

[9] The Joint Code of Practice for Research is now being applied as a quality assurance measure to all research funded by Defra, the Food Standards Agency (FSA) and the UK devolved administrations, as well as to research funded by BBSRC and NERC in their own institutes. All research contractors were expected to comply with the Code from June 2004.

3. ROLES AND RESPONSIBILITIES OF THE MAIN PLAYERS

Government

30. Reflecting its origins in the DETR, the research costs of the FSEs project were largely funded by that Department, with smaller contributions from MAFF and the Scottish Executive. On its creation in 2001, Defra assumed the responsibilities for the FSEs previously shared by DETR and MAFF.

31. Once the tender had been awarded to the research consortium in April 1999, DETR set up the Scientific Steering Committee (SSC) to oversee the project and to advise Ministers on progress and the outcome. The DETR, subsequently Defra, provided the secretariat for the SSC, but, where results from the FSEs were concerned, operated a Chinese wall between the Department, on the one hand, and the SSC and the research consortium, on the other. Defra did not have its own monitoring process, other than the SSC, and was not involved in the preparation of publications or the launch of the results.

32. Thus, although Government funded the research elements of the FSEs, amounting to over £6m, it was content to delegate oversight of the project to an advisory body and to forego any insight into emerging, or even final, results until those findings had been peer-reviewed and published.

The Supply Chain Initiative on Modified Agricultural Crops (SCIMAC)

33. SCIMAC, an umbrella body comprising UK Agricultural Supply Trade Association[10], National Farmers Union, Crop Protection Association, British Society of Plant Breeders and British Sugar Beet Seed Producers Association, played an essential role conceiving, organising and resourcing the FSEs in partnership with Government. SCIMAC provided the GM seed and produced the guidelines for planting and managing the GM crops. They identified and recruited potential farmers to take part in the trial in sufficient numbers to allow the consortium to make selections on the basis of their statistical needs. SCIMAC arranged the commercial sowings of GMHT crops, which had to be managed in strict compliance with the SCIMAC guidelines for GM crops, alongside comparable non-GM crops.

34. A second agreement between SCIMAC and Government was necessary when it become clear that, after the trials, the GMHT crops would have to be destroyed and disposed of in an approved manner at considerable cost. SCIMAC agreed to meet these new costs while Government agreed to meet the research consortium's costs of the beet trials, which SCIMAC had originally been prepared to fund.

35. SCIMAC members' actual costs and contributions in kind are not fully documented. But, overall, SCIMAC probably contributed as much to the FSEs project as Government did through its £6m funding of research costs.

[10] Now the Agricultural Industries Confederation.

The Scientific Steering Committee (SSC)

36. The SSC was established by Government very shortly after the research contract had been let. It had an independent chairman, expert members appointed on an *ad hominem* basis, and observers from DETR, MAFF, the Scottish Executive, SCIMAC and statutory conservation bodies. Its membership is set out in Table 1. The Committee met for the first time in June 1999.

37. Its terms of reference were:

> *To advise the Secretary of State for the Environment, Transport & Regions, the Minister for Agriculture, Fisheries & Food, the Scottish Executive and the Welsh Assembly on the ecological studies in the GM crop farm-scale evaluations, particularly:*
>
> - *The progress of the ecological studies;*
> - *All aspects of the design and methodology used in the studies;*
> - *Statistical analysis of data;*
> - *The conclusions which may be drawn from the results;*
> - *Publication of results;*
> - *The need for further research.*

38. More details of the SSC's role and our assessment of its contribution to the overall management of the FSEs are set out in our evaluation findings (Paras. 177-190).

Table 1: Membership of the Scientific Steering Committee

Professor Christopher Pollock CBE (Chairman)	Institute of Grassland and Environmental Research (IGER)
Dr Nicholas Aebischer	Game Conservancy Trust
Dr Alastair Burn	English Nature
Professor Mick Crawley FRS	Imperial College
Dr David Gibbons	RSPB
Mr Jim Orson	Morley Research Centre
Dr Nick Sotherton	Game Conservancy Trust

The research consortium

39. The way in which the consortium of CEH, RRes and SCRI was organised and how it managed the project is central to our evaluation (Section 4). In Para. 62 we comment particularly on the consortium and its many strengths and in Paras. 114-119 on some managerial challenges it faced.

Host farmers

40. Over the 5 years of the FSEs, 108 farmers from across England and Scotland provided and managed sites on which the research consortium monitored GM and non-GM crops. Participating farmers, whose fields were selected by the consortium in conjunction with the SSC, had to treat GM crops according to SCIMAC guidelines and treat non-GM crops according to best practice.

They had to provide historical data on past field treatments as well as treatments applied to field sites during the study. Access had to be given to consortium field workers, so that measurements could be carried out at appropriate times. Farmers had to keep in touch with consortium staff about the timing and types of treatments applied during the growing period, so that judgments could be made about the timeliness of field measurements.

41. Farmers had to put up with harassment and even intimidation from local residents, protesters and vandals. A few withdrew from the trials, but for many the protests stiffened their resolve to complete the trials.

The Royal Society

42. Early in 2003, the Society was approached by SSC to gauge their interest in publishing a special issue of the FSEs results. The request fitted with the format of *Philosophical Transaction of the Royal Society: Biological Sciences*, whose editors expressed interest in publishing a series of papers in a themed issue of the journal, subject to the normal processes of peer-review.

43. The Royal Society press and publications offices were both involved in the news briefing and public media launch on 16 October 2003, working closely with SMC.

Science Media Centre

44. The Science Media Centre (SMC) is a relatively new 'independent press office for science' funded by 60 commercial and not-for-profit organisations. Its aims are to achieve better news coverage of science by encouraging and facilitating more scientists to engage with the popular media when their subject hits the headlines.

45. At the suggestion of the SSC, SMC did some background briefing for journalists on the FSEs about six months before results were available. The SSC then asked SMC to do the press briefing of the FSEs results, which they wanted to be organised by a body independent of Government.

46. The SMC organised the press briefing for national news journalists on the morning of 16 October 2003, but were not involved in the public launch for stakeholders, industry, NGOs etc, arranged by a commercial media agency later the same day.

4. EVALUATION OF ORGANISATION AND MANAGEMENT

1. Awarding the contract

47. The concept of farm scale trials to assess the ecological impact of management systems for growing GMHT crops developed in informal discussions during 1998 between DETR officials, their research advisers and senior members of the scientific community.

Tendering and selection

Best practice benchmarks

- *Clear policy question to be addressed.*
- *Development of the research concept in consultation with scientists.*
- *Consideration of national capacity; i.e. availability of the skills needed to carry out the research.*
- *Open tendering.*
- *Objective selection criteria.*

48. In October 1998, the Ministers for Environment and Food Safety (in DETR and MAFF respectively) announced agreement with SCIMAC for a programme of managed development of GMHT crops, including the FSEs project to assess the effects of the agricultural management of field scale releases of GMHT crops on farmland wildlife as compared with plantings and treatments of non-GM crops.

49. After this announcement, DETR officials and scientists had discussions with other government departments, members of ACRE, wildlife and research advisors and the scientific community aimed at scoping the ecological studies.

50. These discussions helped DETR officials shape an outline for a programme of farm scale trials, based on a £5m budget. The hypothesis to be tested was that there were no significant differences between the biodiversity associated with the management of the particular GMHT crop and the comparable non-GM crop at the farm scale – the null hypothesis. At this stage, DETR were ready to go out to tender.

51. In February 1999, 15 leading research organisations were invited to tender for the work, which involved the design and implementation of the monitoring programme, specification of the methodologies to be used and the level of statistical significance that could be obtained. Officials in DETR agreed practical arrangements with SCIMAC on providing the GM seeds and arranging for suitable farmers to grow and manage both the GM crops and the conventional crops in the trials.

52. Tenders were received from eight organisations. A tender review panel comprising Professor John Lawton FRS and scientists from English Nature, DETR, MAFF, the Scottish Office and the British Society of Plant Breeders assessed the various proposals. Ministers announced the decision on the appointment of the successful research consortium on 15 April 1999.

53. Once those involved in carrying out the research had been decided, Ministers appointed the SSC, which was independent of the research consortium and arm's length from Government, to oversee the research programme and advise on the outcome.

54. **We consider that throughout these planning, tendering and selection stages DETR acted as an exemplary intelligent customer. The Department set out a broad policy need, engaged informally with scientific advisers and the scientific community to define an aim that could be addressed by rigorous science and to scope a study that would deliver robust results. The aim and specification of the study were then subjected to rigorous open tendering and appraisal, again involving external scientific advice.**

The contract

Best practice benchmarks

- *State financial envelope while retaining flexibility for contingencies.*
- *Produce clear contract documentation for agreed work and deliverables.*
- *Clarity of budget, timescale and any other parameters.*
- *Transparency of process.*

55. The contract was awarded on a fixed price basis to the consortium of independent research institutes comprising the CEH, IACR (now RRes) and the SCRI. For contractual purposes DETR let four separate contracts – those for maize and rape (winter- and spring-sown) in 1999, and the beet contract in 2000, when Government agreed to include biodiversity trials on beet in the FSEs and meet the extra research costs.

Table 2: Contracts with the research consortium

Crop	Contractor	Cost (millions)	Notes
Maize	Centre for Ecology and Hydrology	£1.843	Includes extras [11]
Spring rape	Scottish Crop Research Institute	£1.307	
Beet	Centre for Ecology and Hydrology	£1.460	
Winter rape	Rothamsted Research	£1.306	
TOTAL		**£5.916**	

56. SEERAD contributed £0.610m to the costs of the programme. SCIMAC provided the seed and herbicide and funded the farmers to grow the crops and dispose of the GM crops after harvest.

57. It probably seemed logical at the time to award contracts on a crop basis; indeed that was how the invitation to tender was structured. In the event this division of what was essentially a single contract for a single project created financial management problems for the consortium, which we describe in Para. 135**. Once it became clear that the same consortium had been successful in all three initial tender exercises, it would have been better, had time allowed, to have**

[11] DETR and Defra additionally funded the costs of the SSC and funded events to publicise and disseminate the results.

awarded only two contracts, for maize and rape in 1999, followed by a supplementary contract for beet in 2000, to a single lead institute. That institute would then have performed a central financial management function for the consortium. In the event, the consortium subsequently achieved a similar end by voluntarily centralising the project finance function at CEH Monks Wood.

58. DETR agreed the initial contract costs and subsequent cost increases as a result of advice from the SSC. We found that the total money to be paid to the consortium was clear throughout to both parties. While DETR did not operate a formal contingency fund, their ability to fund the extra sites recommended by the SSC demonstrated sufficient flexibility to ensure that value for money was possible.

59. The four contracts between DETR and the consortium institutes were limited to letters from DETR agreeing that they would pay for the work as set out in the original bids. The actual work done was changed very considerably in the light of advice from the SSC, but no revised contracts appear to have been issued. **We consider this does not meet current best practice in procurement and could have resulted in confusion if there had been conflicts over the work to be done.**

60. Despite our concern at the lack of formality at some stages in the procurement process, we believe that the sequence of planning activities carried out by the funders for the FSEs has much to commend it. These were:

- Set policy objective.
- Decide scientific objective to inform policy needs.
- Let contract.
- Develop detailed project in discussion with contractor.
- Re-cost contract.
- Initiate work.

61. The strength of this approach is that the detailed project planning phase results in a much greater likelihood of the final results meeting the original policy objective. While recognising that re-costing will often mean a cost increase over the initial bid, this will often represent better value for money. **We consider that this approach contributed to the success of the FSEs.**

The research consortium

62. The selection process was not part of our remit and we have not seen the unsuccessful tender documents or the selection criteria. It is apparent, however, that the successful research consortium of CEH, RRes and SCRI had the considerable breadth and depth of skills needed for the project. These institutes have complementary expertise in agricultural and environmental science; strengths in biometrics and data management experience of Countryside Surveys and of the Joint (research council) Agriculture and the Environment Programme (JAEP) of the early-1990s. The independence of the institutes from influence by Government, industry and campaigning NGOs was also an important factor. **We believe that research institute management style and culture, characterised by resource management and quality assurance, adequate infrastructure and full-time commitment to research, were important strengths that contributed to the successful outcome of the FSEs project, with its operational complexity, extensive field work and large volumes of experimental data.**

2. Conducting the farm trials

Design and planning

Best practice benchmarks

- *Analysis to ensure results will be statistically significant.*
- *Developing and testing scientific methodologies (protocols).*
- *Quality assurance for data acquisition and handling.*
- *Plans for archiving and accessing datasets.*
- *Constructive interaction with science advisers (SSC).*

63. The null hypothesis and the basic design involving annual sites of the three study crops over three years had been established by DETR and included in the invitation to tender. The winning bids from the consortium proposed that paired fields should be compared at each site. The consortium also set out a list of parameters to be assessed on each site and where on the site those parameters should be measured. Further the bid recommended that 20 sites of each crop should be monitored over each of the 3 years of the evaluation. Costings were done on an assumption of 45 completed sites of each spring-sown crop over 3 years.

64. The original invitation to tender required the contractor to work on a small number of sites in 1999. This was seen as a build-up year and, in practice, seed supply limited the number of sites that SCIMAC members could run. If full data collection had been attempted in this year, the lack of both staff and fully developed protocols would have resulted in poor quality data. Even with the pilot year, some protocols needed refining during the first full monitoring year. **It is clear to us that experience of logistics and protocols gained during the pilot year helped with planning the main phase of the FSEs.**

65. During the 1999 season, the SSC and the consortium worked together to scrutinise key aspects of the bid proposal. Work was done to investigate whether paired or split fields were preferable. Both were included in the pilot trials. Analysis of other available datasets showed the advantage of split fields and this design was adopted for the main study.

66. During this period of interaction between the consortium and the SSC, much more detailed power analysis was done to determine how many sites per year were likely to be required to provide a statistically acceptable test of the null hypothesis. This resulted in an agreed requirement for 60 completed sites for each crop over three years. More were added to take account of site losses. All the protocols for the field and laboratory assessments were developed, tested by the consortium and scrutinised by the SSC during this pilot year. Some were subject to very detailed input by members of the SSC outside the formal meetings. Decisions were also taken on whether any assessments should be dropped.

67. We must highlight the essential contribution of senior statisticians to the design stage. We were told that these contributions had been underestimated when the tenders were costed and the project may have benefited from several person years of ‘free’ statistical input. While this is clearly a discrepancy that management of the consortium institutes will wish to avoid in future, it does emphasise the importance of placing large, complex research contracts of this type with institutions with the capability to call upon extra resource at mission critical stages.

68. The consortium also agreed the protocol for field site selection with the SSC. SCIMAC were able to provide factual input to this part of the decision-making as observers attending the SSC meetings. Decisions on how herbicide advice should be obtained by farmers and the extent to which SCIMAC could provide farmers with advice on the management of GM crops were taken. On the latter, draft label guidance for the application of *Roundup* and *Liberty* on GM crops were produced by the companies for farmers to follow.

69. The relationship between the SSC and the senior members of the consortium evolved during this period. Under Chris Pollock's chairmanship, their meetings were conducted in a vigorous, but constructive, manner. At no time did the consortium members feel that their scientific views were being overruled. Most soon came to value the contribution that the SSC members could make to the FSEs, even if the process of getting their endorsement was demanding.

70. The SSC was concerned to ensure bolt-on studies could be carried out on FSEs sites as long as the primary work was not prejudiced. Work on gene flow was considered and agreed. Separately funded work on birds was carried out in 2000 and reported to the SSC. Although some SSC members were keen to see bird counts integrated into the full study, the SSC decision was that timing and statistical problems associated with doing this ruled it out.

71. **Our overview of the main design features of the FSEs shows the way in which SSC members collectively, and as individuals, played a pivotal role in developing the original proposal. While we accept that all of these design features could have been re-examined by the consortium without this level of SSC scrutiny, we found there was general agreement that the systematic and rigorous assessment carried out by the SSC during this pilot year (1999) contributed enormously to the ultimate scientific success of the FSEs.**

Site selection and management

Best practice benchmarks

- *Develop timely site selection criteria.*
- *Communicate site management requirements to those involved.*
- *Reliable documentation of crop management.*

Site selection

72. The consortium selected farm sites each year from those identified by SCIMAC. Finding enough potential sites that matched the agreed protocol was a challenge for SCIMAC throughout the study. Many farmers, often influenced by their family or business partners, were discouraged from offering sites by the level of hostility and harassment from well organised local and national pressure groups against the field testing of GM crops. SCIMAC wisely only put forward farmers if they were persuaded that he or she was sufficiently strong-willed to stand up to such aggravation. Consequently, it was not possible to organise as large a pool of sites as the consortium had expected. Indeed, the companies had to work very hard to satisfy the minimum requirement for sites agreed with the SSC. Numbers were less than planned in the first full year of monitoring.

73. There was real concern within the consortium and the SSC that the reduced number of sites would prove to be insufficient to test the null hypothesis, especially if there turned out to be significant interaction between site characteristics and the impact of crop management on biota. Fortunately, this interaction was shown to be very limited.

74. The restricted number of field sites offered also had an important operational and resource consequence. The consortium had planned on a maximum of one-hour journey time between a site and their base. In practice, sites were located all over England and Scotland with journey times in excess of three hours between some sites.

75. **We were impressed by the enormous effort and commitment shown by both SCIMAC and the host farmers first in finding the sites and subsequently in managing them in such a hostile environment. The restricted choice of sites could have been a problem had there been significant interaction between site characteristics and biodiversity.**

Site management

76. The FSEs were unusual in that SCIMAC and the farmers were together fully responsible for the management of the sites, separate from the work of the research consortium. The consortium was responsible for final decisions on site selection, for the randomisation of each split field site and for a final audit of the management of the trial crops, particularly herbicide use, to ensure that the agreed decision criteria had been followed.

77. SCIMAC companies contracted the cooperating farmers to manage individual sites and were responsible for ensuring the legal requirements of growing GM crops were met. SCIMAC companies also compensated the farmers for loss of the GM crop area and paid for crop disposal. They provided advice to the farmers, supported by the draft labels, on appropriate herbicide application to the GM part of each site. The non-GM crops received applications based on the requirement of 'cost effective weed control', often based on advice from an agronomist. The consortium carried out an internal audit of herbicide use on the FSEs crops, overseen by a BASIS-qualified agronomist. This showed that farmer decisions were in line with the principles laid down for both the GM and the non-GM crops.

78. The legal requirements of growing GM crops dictated this shared responsibility for each site. It was not possible for the consortium to work directly with the farmer, using seed and herbicide supplied by the SCIMAC companies. And the comparison needed the expert input from the companies on growing the GM crops.

79. **We consider that site selection and crop management the partnership between industry and the consortium generally worked well operationally. SCIMAC's role was crucial and could not have been carried out by the consortium. The consortium's audit of farmer practice on the sites provided assurance against any concern that the applications had been chosen to bias the results rather than following the principles laid down**.

Carrying out the field and laboratory work

Best practice benchmarks

- *Standard procedures (protocols) applied consistently in space and time.*
- *Comprehensive planning of day-to-day work.*
- *Staff training to deliver project requirements.*
- *Match staffing to workload.*
- *Quality assurance and audit trail.*

80. The project co-ordinator, Dr Les Firbank, knew from previous experience of the Countryside Survey and other large ecological studies that strong, centralised control of the enormous amount of data generated by a monitoring project on this scale was critical to the overall success of the project. He concentrated on getting this organised and on establishing tight protocols for each biological assessment. Acknowledged experts drawn from across the consortium members drew up the protocols. Institutes were given considerable local autonomy in how they organised themselves to monitor their agreed number of sites as long as they met the data quantity and quality requirements specified in the protocols.

81. After the pilot year, each institute centre became responsible for the field and laboratory work associated with the agreed monitoring programme on the sites allocated to it on a territorial basis each year. Numbers varied, but Monks Wood, Rothamsted and Brooms Barn each had approximately twice as many sites as Merlewood, Dorset and the SCRI. In addition, the SCRI received soil samples from all sites nationally for seedbank assessment. This was organised separately from the Scottish site programme.

Table 3: Field trials managed by each institute site

Research centre	No of sites managed						
	2000	2001		2002		2003	
	New	New	Follow-up	New	Follow-up	New	Follow-up
SCRI	1	7	1	7	8	2	14
CEH Lancaster	3	8	3	11	11	3	19
CEH Monks Wood	16	32	16	26	48	6	58
RRes Brooms Barn	12	21	12	23	33	1	44
RRes	14	21	12	24	33	5	45
CEH Dorset	4	12	4	12	16	1	24

82. The three centres with greater numbers needed more management input to organise and manage the large number of staff needed in the summer season. Rothamsted had eight team leaders and a total of 35 staff employed on field and laboratory work in the summer of 2002. For the centres with fewer sites, one experienced team leader could organise both the field and laboratory work. Many staff at most centres were on short term contracts, sometimes as short as six weeks.

83. The key lesson quickly learned by those organising this work was to keep on top of planning and monitoring outputs on a weekly basis. If left longer, memories faded and it was not possible to identify, let alone correct, mistakes. The management time needed to do this properly is considerable and easy to underestimate.

84. Considerable effort was put into national protocol training in the early years. This helped to ensure a consistent field interpretation of the written text provided by protocol leaders. There were also annual, national wash-up meetings in the early years so that junior staff had a chance to exchange experiences and feel part of one large activity. These meetings were much valued by the field and laboratory staff with whom we communicated.

85. The skill requirement for the individual assessments went beyond the normal requirements for routine field and laboratory procedures. The main need was for identification of bees, butterflies, molluscs and pests in the field and invertebrates and seeds in the laboratory. Most staff recruited had a science background and some had specific identification skills. Most training was carried out on the job, supported by charts of the main species. Staff were supervised until they had mastered a particular taxonomic group. All data sheets were checked before being sent to Merlewood.

86. Some consortium staff were critical of the 30 page document used to collect farm site details. But our discussions with farmers did not indicate a problem. While the document may have been capable of improvement, we conclude that the main problem was a lack of knowledge of farming systems among the staff collecting the data and perhaps a lack of experience of collecting such data from farmers. This led to a rather inefficient collection of the farm treatment data in some cases. Perhaps more agronomic training and guidance could have been provided.

87. **We conclude that the complex logistics of carrying out the FSEs caused some problems and not everything was completed on time, but the outcome was a very clean database that enabled the scientific objective to be unequivocally met.**

Document control

Best practice benchmarks

- *Robust system that ensures all key documents can be accessed, retrieved and audited.*
- *Document security.*

88. A key feature of the management of the evaluation was the early establishment of a website with controlled access for staff working on the FSEs. This was a state of the art facility at the time it was set up. Managed from Merlewood, it contained the latest versions of all key documents, particularly the protocols. It also allowed access to all the minutes of Project Management meetings and other relevant papers. Access to all back copies of papers was retained so changes could be audited.

89. We are in no doubt as to the value of the project website as a means of controlling key documents and ensuring that the latest versions were available when needed.

Data management and analysis

Best practice benchmarks

- *Plan data management and analysis requirements of project.*
- *Develop systems to deliver requirement.*
- *Manage systems to ensure data integrity and quality.*
- *Archiving and disaster recovery.*

90. Data management was centralised at Merlewood, with various parts of the data handling being carried out at other sites. All field and laboratory data sheets were developed to a consistent format. These were completed by hand and checked by the site coordinator/team leader before being sent to Rod Scott at Merlewood. Copies were then dispatched to Rothamsted for double entry by the dedicated data entry team. Finally they were entered into the CEH Oracle database set up by Rod Scott. Photocopies of fieldsheets used for data entry are now all archived at CEH, Lancaster. The original fieldsheets are filed at the site that did the fieldwork.

91. During the early years, Rod Scott developed the Oracle database. At Rothamsted, Suzanne Clarke was appointed and she developed the suite of GENSTAT-based programmes into a software package to analyse all the data. Rod Scott then interfaced this with the Oracle database, which allowed the automatic analysis of pre-selected analysis options. The system also provided an audit of all analyses undertaken. This automatic analysis capability was new in agro-ecological research and offered researchers the major advantage of being able to carry out an unlimited number of standard analyses.

92. Data analysis, a mission critical element, generally worked well. The results from the third year's trials were analysed in two months, thus enabling the project to keep to the planned schedule. The development lead-time for the auto-analysis system meant it was not possible to carry out automated analyses before October 2002, though some manual analyses were done in time to inform sample strategies. The late availability of automated analyses limited assessment of interim data. Some members of the SSC found this frustrating as it meant that they could not make any interim judgment on progress. And some of the non-CEH consortium members, who did not have direct access to Oracle on site, found this an inconvenience.

93. The consortium assured us, however, that the development of the crucial data analysis went according to schedule. For a research project like the FSEs, focused on a single outcome – testing the null hypothesis, it was neither necessary nor helpful to analyse data at the end of each season. Protocols had been determined at the outset and had to be applied consistently for the duration of the project.

94. The seedbank data and subsequent analyses were all handled on an Access database at SCRI. This was partly because the long time periods over which emerging seedlings had to be counted did not allow early transfer to Merlewood for inclusion with the main dataset. But it did mean that analyses could be done quickly and data from the first year samples was used to satisfy the SSC that sites selected contained a sufficiently wide range of weed seed levels.

95. Digitised data are stored in an Oracle database at CEH, Lancaster. There is a schedule of full and partial backups of the database. Partial backups are made nightly of any data tables that have changed that day. A full backup of the database is made weekly; copies of this backup are stored in fire safes, one at Lancaster, and the other at another location. Researchers in the consortium are continuing to write papers. A website is being developed under a separate Defra contract to disseminate the data from the FSEs.

96. **Overall we conclude that the development and implementation of the critical data systems were important successes. We have a concern that internal communication of plans and progress on data issues was patchy and led to the varying expectations that we found in interviews. Data handling and manipulation does not appear to have been scrutinised in detail by the SSC, which did not have a data systems or informatics expertise among its members.**

97. **We are satisfied that adequate measures have been taken to archive and protect this unique dataset, which will be invaluable as a benchmark for future biodiversity studies.**

Quality assurance

Best practice benchmarks

- *Determine quality needs of project.*
- *Ensure staff trained to meet required standards.*
- *Manage data to ensure standards maintained.*

98. We found the consortium had adopted all the elements of a comprehensive approach to quality assurance of the FSEs results, though none at the time had formal ISO accreditation of its laboratory practices.

99. The key requirements that we found to have been in place were:

- Standard laboratory procedures.
- Detailed protocols for all assessments.
- Appropriate supervision and training for all field and laboratory staff.
- Annual wash-up meeting for staff to exchange experiences gained during the season.
- Data checks carried out at each stage from field sheet to final analyses.
- Low staff turnover, high morale and a sense of loyalty to the project.

100. Defra commissioned a baseline assessment of the FSEs (carried out at Lancaster) to test the emerging Joint Code of Practice for Research (details in Footnote 9). Although started five years before the Code was finally introduced, in 2004, the project conformed to the Code's requirements for experimental quality assurance in all major respects.

101. We do not consider that any one isolated data collection error would have had a major impact on the interpretation of the results. The database was well managed so the likelihood of data being misinterpreted once it was in the system was remote. All analyses were audited by the auto-analysis system.

102. **We consider the consortium performed well, judged against the criteria of the day, and achieved a high QA standard and clean datasets.**

Project management

Best practice benchmarks

- *Clear financial and management responsibilities and authorities.*
- *Procedures for regular monitoring of progress.*
- *Good communications between all consortium staff.*
- *Commitment from institute senior management.*

Roles and responsibilities

103. Les Firbank was project co-ordinator throughout the life of the project, from the initial bid to the final launch of the results. Although he gave priority to the FSEs, it was not designated as a full time role. **We wish to acknowledge the outstanding contribution Les Firbank made to the success of the FSEs. We consider that it would have been more appropriate, and perhaps eased his task, if he had been designated Project Manager and appointed full time on the FSEs.**

104. The need to manage staff on (initially) seven sites spread across three institutes, each answerable to different line management required early decisions on how much should be centralised and how much local autonomy to allow individual institute sites. To provide central direction, Les Firbank initially established the need for full-time crop co-ordinators to manage the national sites of each of the crops.

105. By the time these posts were filled, it became clear that the geographic distribution of actual sites required that they should be managed according to their proximity to an institute site, irrespective of crop. This was appropriate because the monitoring programme was similar for each crop. Thus, the initial management matrix was modified as the needs of the first full monitoring year became clear.

106. The main generic management responsibilities were then established as follows.

Table 4: Project-wide management responsibilities

Position	Responsibilities
Protocol leader	The development, adoption, implementation and monitoring of the methodology for a particular assessment.
Crop co-ordinator	All aspects of site selection and planning of the agreed work programme for one crop nationally.
Site co-ordinator	The execution of the agreed programme on all the sites run by that institute and resulting data.
Lead author	Responsible for one of the final papers**.**

107. Several activities, mainly concerned with data processing, were centralised. Principally these were:

Table 5: Centralised functions

Activity	Responsibility of
Data management	Merlewood
Statistics	Rothamsted & Monks Wood
Data entry	Rothamsted
Seedbank assessments	SCRI
Financial management	Monks Wood

108. **We consider that the responsibilities of the key staff to the project were clearly defined and kept under review to meet the changing needs of the FSEs. Clarity at these levels helped ensure that all staff knew what was expected of them and of other consortium staff.**

Internal consortium communications

109. Numerous Project Management meetings (38 in total) were held, particularly in the early days of the work. These were designed to be inclusive. Any member of staff involved in the evaluation could attend. These meetings considered all aspects of the progress and satisfactory delivery of the FSEs and were usually structured systematically under the headings that ranged from the object of the FSEs to project staff welfare, thus:

- *To test the null hypotheses of no effects on GMHT maize, spring rape, winter rape and sugar beet on biodiversity.*
- *To conduct high quality science on the biodiversity of agricultural systems, in support of the null hypotheses.*

- *To ensure that deliverables (reports to the Steering Committee, database and scientific papers) are timely and to appropriate quality.*
- *To ensure impartiality, quality and transparency of the project.*
- *To ensure the health, safety and security of the staff involved in the project.*
- *To ensure the effective presentation of the project to participants and the wider community.*

110. Actions from the meetings were translated onto a spreadsheet that was available to all on the project website. Minutes were also available on the project website shortly after meetings.

111. In addition to helping manage the project with its complicated logistics, these meetings were very successful in building a strong project culture that transcended institute boundaries and ensured full dissemination of information. The need for this management forum was reinforced during the life of the project by the need for secrecy over results and the constant external pressures.

112. Another key communication facility was a web-based forum for communication and problem solving among staff. Our discussions with staff suggest that this was considered more useful by some than others, perhaps depending on the time individuals devoted to using it.

113. **Les Firbank should be congratulated on the way in which he managed the situation to achieve such dedicated input to the project from such a large number of dispersed staff. We particularly commend the effectiveness of the Project Management meetings, which he chaired, the use of a project website for communication and his inclusive, participative management style generally**.

Managerial challenges

114. The dispersed nature of the consortium created managerial challenges. Interactions between the project and its host institutes and sites varied somewhat, especially in the early days. In particular, meshing the project's financial and human resource management needs, such as recruitment of staff, with local procedures created difficulties, initially acute, at some sites. Part of the problem may have been the different footprint of the FSEs on each site. For some it was a relatively minor addition to their portfolio of contract research and monitoring activities. For others the impact was qualitatively and quantitatively much greater. Another difficulty, at least initially, was that the scale and nature of the FSEs was beyond the experience of some of the newly appointed project staff.

115. At RRes it is our impression that the tensions inherent in the project/institute interface were not fully overcome until the Director, alerted by an internal audit report, created an Institute [FSEs] Project Board in 2000 to oversee delivery of the contributions to the FSEs from the RRes sites. The Board, chaired by the Institute Director, provided a sufficiently high level forum to resolve resource issues, mainly staffing and finance matters. It also enabled a synoptic view to be taken of risk. Researchers we talked to agreed that the RRes Board helped overcome initial delivery problems.

116. We stop short of recommending institute project boards as an essential structure for managing the tensions inherent in all big multi-institute projects. Such collaborations are increasingly common these days and institutes generally have the necessary experience to work

together and deliver the required outcome. **We suggest, however that for big, complex research collaborations focussed on a single project, as distinct from, for example, a collaboration within a much broader EU programme, funders might ask participating members of consortia to describe how they plan to manage the institute/project interface.** This could be especially important where an institute's contribution to a multi-institute project is modest in relation to the scale and nature of the institute's overall level of research activity, yet that contribution is mission critical to the project in question.

117. We have a related concern that the three institute directors do not appear to have been sufficiently engaged throughout the FSEs. One consideration is that two of the Directors, Professors Ian Crute and Pat Nuttall, were appointed in spring 1999 and mid –2001 respectively, after the FSEs project had been conceived. Moreover, the consortium was very ably co-ordinated by Les Firbank. And the SSC provided much of the oversight, steer and mentoring that might otherwise be provided by a director, or a senior institute scientist. **Nevertheless, it is our view that a greater degree of sharing of ownership and oversight from institute directors would have been beneficial at certain key stages during the FSEs**.

118. We have considered whether there would have been merit in one of the three Directors acting as the 'lead Director', with a synoptic view of the entire project, to provide the consortium with senior leadership and clout to support the Project Co-ordinator and to embed the project more securely into institute structures and procedures. We conclude that this was probably not appropriate in the particular case of the FSEs, where the SSC chose to play a strong ownership role and project co-ordination was effective, but might be considered as one managerial option in any future projects with a similar mix of institutional, logistical and geographical complexity.

119. At the operational level, institutional differences created some tension and irritation, though these seem to have been resolved, as far as was possible, by the Project Management meetings. Examples are different IT strategies and infrastructure, which meant that the data could be accessed and analysed only at CEH sites. The writing-up stage exposed differences in authorship policies of the three institutes. **We conclude that the consortium could have paid more attention to identifying in advance irritating issues of this sort and, where possible, to trying to harmonise them.**

Staffing

Best practice benchmarks

- *HR procedures and timing sensitive to needs of project.*
- *Ensure competence of staff appointed.*
- *A contented, motivated project team.*

120. Much of the success of the FSEs was down to the choice of appropriate staff, both core and specially recruited, at both national and local level. Most of the project planning and the initial development of protocols and the power analysis were done by experienced, core staff. The breadth of available expertise and relevant experience was critical to the success of this phase of the work.

121. The next key phase was the appointment of four full time post-docs as the crop coordinators. Matt Heard, Cathy Hawes and Alison Haughton were recruited; Gill Champion

was appointed internally. All four appointments were successful and each made a major contribution to the delivery of the FSEs. The way they bonded together and took ownership of the project was critical to success.

122. Rod Scott was appointed to support the project data manager, John Watkins (CEH), but was soon given full responsibility. Despite his relative inexperience for such a key position, Rod Scott made a major contribution to the project.

123. Overall staff turnover was low. The advantages of working on a high profile project seems to have outweighed the disadvantages of being locked in to a study for four years with no publication opportunity until the end.

124. Several institute sites were under-staffed in 2000, the first full monitoring year. This created considerable pressure on field staff who were still finding their feet. It appears to be the result of a lack of foresight, perhaps due to a failure to appreciate the needs of a project of this nature where growing crops dictate the timescale. In some cases, institute HR procedures probably exacerbated the problem.

125. Some institute sites were able to employ junior field staff for longer periods than others, depending how the work was organised. Some looked to a local university as a source of seasonal staff; other sites had to recruit more widely. There were considerable benefits for those who could use staff for more than one season in terms of ease of management, reduced training and fewer quality problems.

126. The project management style, reinforced by the web-based communication forum, helped bring everyone up to speed and instil a sense of common purpose. Indeed, the empowerment of relatively junior and inexperienced staff turned out to be a major factor in the success of the project. The experience gained should be of lasting benefit to them, and in some cases to their institute, as a number have gone on to be employed on other projects.

127. **The choice and motivation of all the staff working on the FSEs was, in the view of its senior managers, the single most important factor contributing to the success of the project. We concur. We believe that better planning, faster recruitment and longer retention would have eased some of the operational problems encountered with field and laboratory work, especially in the first full year.**

Financial management

Best practice benchmarks

- *Sound budgeting and financial control procedures at overall project level.*
- *Clarity in the delegation of financial powers to sites and individuals.*
- *Project financial requirements compatible with established local financial systems and procedures.*
- *Clear financial audit trail.*

128. The initial consortium bids were revised upwards following the changes in the nature and scale of the work to be done agreed during planning and design discussions with the SSC during

1999. In particular the number of sites per crop was increased. The SSC worked on the assumption that the consortium would be able to recover any cost increase arising from their deliberations. Additionally, Defra agreed in early-2000 to cover the cost of the beet work.

129. Defra were able to increase the project budget to meet these increased costs and SCIMAC similarly accepted the increases in the costs falling to them. The budget was then re-fixed for the life of the project.

130. Project costing carried out by the consortium was not as comprehensive as it could have been. The original travel time assumption was far too low and the costs of management, power analysis, statistical design and central data processing were under-estimated. And there is uncertainty whether the time of senior management was fully costed in the first estimates. Consequently, some sites did not achieve full cost recovery on the project.

131. The award of four separate contracts, one for each crop, turned out to be unhelpful in terms of financial management, particularly when each site was involved in part of the delivery of the results for each crop. The consortium wisely centralised the contract finances at CEH, Monks Wood, where Mark Hill in effect managed a single contract budget. He developed a series of spreadsheets and, once the work was firmed up in early 2000, he allocated monies to institutes against their agreed programme, including any responsibility for central activities such as data management and seedbank assessments. He ran a transparent process, which kept everyone informed of the project finances. It seemed to work well and without disagreement.

132. Defra did not require annual financial reports, so the consortium was able to be flexible in their spending over the life of the project. This helped project financial management.

133. The level of financial delegation varied between sites. At one extreme the non-overhead portion of the institute's annual allocation was fully delegated to the senior scientist responsible for the FSEs. At the other extreme, staff had to go through their normal central administrative procedures for each item of expenditure. This caused delays, particularly in the first full monitoring year. The speed of authorisation was improved in later years.

134. We think it inevitable that at a tactical level these sorts of differences will always occur and it would be unrealistic for a site to change established procedures that meet its needs for each big project that comes along. The trick, which seems to have been mastered in the light of experience of the first year, is to anticipate tensions between local resource management procedures and the needs of the project and to manage potential conflicts before they create mission critical problems. Once it had been established, the Institute Project Board at RRes fulfilled this strategic function for that institute.

135. Financial management would have been easier if the consortium had carried out a more thorough initial costing of the project. Defra not requiring annual accounts removed one incentive to put in place more rigorous procedures to monitor in-year spending. Nevertheless, we have no reason to believe there was any waste of money or that the project provided poor value for money (in any case these matters are beyond our remit). **But we believe that financial management would have been more routine and efficient if a single contract had been awarded to one institute, which would then have sub-contracted with the others.**

Confidentiality

Best practice benchmarks

- *Ensure appropriate levels of confidentiality.*

136. The SSC recognised that the extreme public interest in the evaluation, including the desire of some to undermine it, required a special communication strategy that dealt with these unusual circumstances and maximised the likelihood of successful completion and promulgation of results. This resulted in an approach that went beyond normal confidentiality. Open discussion took place on the methodology used, and this was published in two early papers. But SSC required absolute secrecy on discussion of the results until they appeared in a peer-reviewed publication.

137. Results were shared on a need-to-know basis within the consortium and with SSC members. Assessors were excluded from these SSC discussions. At the consortium institutes, research colleagues not directly involved in the study and other staff, including Directors, were excluded. A 'Chinese wall' was agreed and operated between the SSC and Defra/SEERAD. During the period when the results were being discussed, one Defra member of staff, Nick Brickle, was seconded to the Committee as Secretary. The Royal Society editorial board and their reviewers naturally had to be involved in the final phase leading up to publication, but again only on a need–to–know basis.

138. But this degree of confidentiality was achieved at a cost. Some normal institute procedures were suspended as a result of the strategy. Institute directors were not able to fulfil their responsibility for the papers produced by their institute. While one of the consortium institute directors was entirely content to be outside the ring of confidentiality, two others were uncomfortable to some degree. The SCRI were not able to discuss the FSEs with their external Visiting Group in 2003, though we agree that this was probably unavoidable.

139. **There is no doubt that the SSC's rather extreme strategy on confidentiality achieved its purpose.** Because they did not have access to early or interim results, neither funder (Government or SCIMAC) had the opportunity to change its attitude to the FSEs. No interim or final results got into the media until a leak just before the launch. And that particular leak (to *The Guardian*) a fortnight before publication did not reduce the impact of the launch. The important end result was that the independence of the science was generally accepted.

140. **More generally, we believe that the approach to confidentiality helped the SSC to balance its overall responsibility to advise and reassure Ministers with its role of overseeing the FSEs. We consider, however, that some of the internal disadvantages discussed above (Para. 138) could have been reduced to the benefit of both the FSEs and the consortium institutes if institute directors had been considered as consortium staff, and involved as appropriate**.

External influences

Best practice benchmarks

- *Assess foreseeable external influences.*
- *Agree actions to mitigate these influences.*

Intimidation/vandalism

141. Consortium staff, particularly those working on the farm sites, had to cope with the irregular attention of members of the public who opposed the FSEs in particular and GM crops in general. Staff never knew when they would encounter intimidation or find their field site had been vandalised. While consortium staff were under pressure when at work in the field, host farmers, and their staff and families, got no relief from the constant risk of intimidation and vandalism on their farm. Overall, the impact of vandalism on the evaluation was small, not least due to the large plot areas.

142. Institute staff spoke at public meetings along with staff from Defra and SEERAD to try and explain the FSEs. These meetings were often hostile.

143. Several consortium staff told us that the combination of hostile conditions led to early and sustained staff commitment to the project from staff at all levels. 'We will succeed' and 'failure is not an option' were often quoted to describe the spirit of the researchers.

144. **While no one involved in the FSEs was physically hurt, we admire the commitment shown by all the staff living, as they were, under constant threat.**

145. Several farmers and others involved in the FSEs have suggested that more should have been done to protect those involved. Some have suggested that Government should have spoken out more strongly on the benefits of the evaluation that it had initiated and was funding. Better site protection has been proposed, but, in our view, a farm site on MoD land, which was vandalised while under 24-hour surveillance, illustrates the difficulty of achieving this.

146. In our interviews, there was widespread condemnation of the Government's chosen approach to transparency by providing six figure grid references. This undoubtedly provided pressure groups with immediate access to FSEs field site locations. However, we recognise that EU and UK Government policy on transparency for field experiments with GMOs pre-dated the FSEs. And we doubt that dangers to staff, or jeopardy to the successful outcome of the scientific investigation, were any greater than might have resulted from more secrecy, or a less direct approach to publicising the locations.

147. **Nevertheless, we believe that in future situations, where publicly-funded research in a controversial area is contemplated, more thought should be given by funders and providers to the level and nature of public support that may be required, who should express it and when.**

Foot and mouth disease

148. Restrictions due to the foot and mouth disease outbreak in 2001 could have resulted in a decision by Government to halt work on the FSEs in that season. But the work continued due to its policy importance and the limited number of sites on livestock farms. Sites were managed subject to local access restrictions where they were located within affected areas. This resulted in the loss of a few assessments while access was banned and sometimes the need to change access routes to sites. This all required extra work by consortium team leaders to ensure that the work was done subject to the prevailing limitations. It also required regular advice from local MAFF veterinary staff.

149. **We note that this is an example of an unexpected added managerial burden and extra costs not directly attributed to the FSEs. It illustrates our comments about the need for more rigorous risk assessment (Paras. 172-176).**

3. Communication strategy

Preparation of publications

Best practice benchmarks

- *Determine publication route early.*
- *Plan project to meet publication requirements.*
- *Ensure appropriate internal and peer scrutiny.*
- *Allow adequate time for preparing publications.*

150. From the first meeting of the SSC it had been agreed that the main output of the evaluation would be peer-reviewed papers for publication rather than the more normal report to Government funders. The results would only be reported after completion of the trials; there were to be no interim results based on one or two year's results. All the field work and data analysis worked towards this goal. It imposed a level of confidentiality on the consortium, but increased the scientific and political impact of the results. It also helped to ensure that, once the contract was awarded, Ministers could not influence the project or use non-peer reviewed interim and/or incomplete results for political ends.

151. Two early, peer-reviewed papers published in The *Journal of Applied Ecology*, gave details of the scientific approach being used in the FSEs. Their publication was approved by the SSC. The first paper, *An introduction to the Farm-scale Evaluations of genetically modified herbicide-tolerant crops*, gave details of general approach and range of measurements being taken in the FSEs. The second, *Design, analysis and statistical power of the Farm-Scale Evaluations of genetically modified herbicide-tolerant crops*, described the considerations that went into the overall design of the FSEs, including the statistical power analysis. It also set out the proposed methodology for analysing the results.

152. The main results for the spring-sown crops were prepared from late-2002 onwards when the consortium worked with the SSC on the production of a series of papers. The SSC allocated oversight of the papers to individual members but, in practice, some members were involved with several papers. This interaction covered the whole process from overall structure to detailed editing. In due course, nine papers were submitted to the journal editors.

153. Consortium institutes varied in their approach as to who should appear on the author lists. Some were inclusive; others less so. These differences were not resolved so some papers appeared with more authors than others (one paper had 33 joint authors). Some junior staff felt let down on being excluded, especially when their saw their peers included in papers led by other institutes.

154. In November 2002 it became clear that the Journal originally approached to accept the series of manuscripts for simultaneous review was not in a position to commit themselves to publish a special issue within the time frame desired by Defra. Defra, the SSC and the consortium then agreed that the papers would be submitted to The Royal Society for consideration as a themed issue of *Philosophical Transactions of The Royal Society, Biological Sciences*. The editors were 'happy to consider' the papers, but gave no commitment to

publication. The papers would follow the normal peer review process and the editor's decision was final.

155. The Royal Society's journals are at arm's length of the Society itself, which has a public policy position on GM crops. *The Guardian* questioned this independence, which reinforced the need for the editors to avoid any possible claim of bias in the reviewing procedures for the submitted papers. The Editorial Board, therefore, put in place a special, one-off Advisory Board to assist the reviewing process. The Advisory Board oversaw the peer-review process and advised on the choice of three to five referees for each paper. The selection of Advisory Board members and all the referees excluded 'any scientists who are, or may have been, affiliated with companies or institutions that may have, actually or potentially, a vested interest in swinging the debate (regarding GM crops) one way or another'.

156. In September 2003 one over-arching paper was rejected by the Journal on grounds of not meeting its required standard. This decision caused concern to both the SSC and the consortium, as it was the only paper that presented the full results on a crop-by-crop basis. The problem was that the terms of the original research contracts required results on a crop basis to inform public policy on the environment and GM crop consents. Perhaps earlier discussion could have mitigated this unfortunate outcome, either by ruling out such a review paper and allowing the consortium to explore alternative publication routes, or by persuading the Society of the merits of including a paper presenting the results on a crop analysis.

157. **We commend all concerned – research consortium, the SSC and the Royal Society, for getting the papers published quickly in a prestigious journal.**

Communication of results

Best practice benchmarks

- *Plan ahead.*
- *Engage professional help in public and media relations.*
- *Develop clear and consistent message.*
- *Staff commitment to the process of wider communication.*

Press briefing

158. Once the eight papers were accepted, a publication date was agreed and preparations for the launch of the results were put in place. At the SSC's request, the SMC organised the press launch for national news journalists in the morning of 16 October 2003 at The Royal Institution offices in London. Preparations were guided by the SMC's professional advice that requirements for a successful launch to the news media are:

- Planning ahead and having a strategy for dealing with leaks (the SSC asked for this) and the unexpected.
- Clarity of objectives and the main messages; also anticipating the questions, e.g. on the use in the trials of the subsequently banned herbicide, atrazine.
- Rehearsing the event thoroughly (the day before in the case of FSEs).
- Concentrating on news journalists.

- Recognising that news journalists want just one concise, informative release; they are not interested in longer supplementary material.
- Having key scientists available throughout the day for interviews, not just at the briefing.

159. About 70 national press, radio and television journalists and camera staff attended, several for the whole day. Journalists were given 30 minutes to read the press releases and papers. Two press releases were produced, one by the SSC highlighting the key findings and one by The Royal Society on the launch of their themed *Phil. Trans*. publication. This was followed by 60 minutes presentation and questions by Les Firbank, Chris Pollock, David Gibbons and Joe Perry. They and other SSC and consortium scientists were available for interviews throughout the day.

160. A combination of involving professional communicators and good preparation helped contribute to a highly successful press briefing, as measured by the standard criteria of amount of coverage and the degree to which the intended message was put across without distortion. The research consortium greatly welcomed the advice and contribution generally by Fiona Fox (SMC) and her colleagues. From its perspective, the SMC considered this to be one of the highest profile science news stories ever in the UK.

161. **We believe that clarity of purpose, bringing in professional communicators and paying attention to detail contributed to a successful press briefing.**

Public launch

162. A wider public launch for stakeholders, industry, NGOs etc, was arranged by a commercial media agency, Lewis Live Ltd, after the press launch on 16 October. The entire proceedings of this launch are available on video at a Defra website[12].

163. The Royal Society synchronised on-line publication of the themed issue of *Phil. Trans*. with the submission of results to the Secretary of State for Environment, Food and Rural Affairs and the press briefing and public launch, all on 16 October. Because of the great interest, the Society exceptionally extended by two months free access to the themed issue on its website.

164. Once published, the results of the farm-scale evaluations were immediately forwarded to ACRE, the Government's statutory advisory body on the release of GMOs, for their advice on the implications of the results for any existing, pending or future releases of GM crops. Stakeholders had an opportunity to make their comments to ACRE on the results. All these comments were considered and the Committee invited stakeholders to provide further evidence at two open meetings held in London and Edinburgh in November 2003.

Documentation

165. In addition to the press release describing the publications, the crop-based analysis that *Phil. Trans*. would not publish was revised and made available at the press briefing and the public launch. Although it had been edited following careful review by the SSC, it is not a peer-reviewed publication. A glossy summary publication of the FSEs results, *GM crops – effects on farmland wildlife*, more suitable for lay audiences, was produced by the SSC and the consortium.

[12] https://www.livegroup.co.uk/sscfarmscaleevaluations/SSL/index2.php

166. **While we understand the compelling reasons for producing the crop-based account of the results, we have some minor concerns over the status of this paper. Its release at the launch might have jeopardised its chances of future publication in a peer-reviewed journal. The lesson seems to be that more thought should have been given earlier to alternative ways of producing a crop-based paper rather than waiting until the *Phil. Trans*. editorial board rejected the paper a few weeks before the public launch of the findings. More attention to risk assessment (see paras. 172-176 below) might have flagged this as a critical issue somewhat earlier.**

Reaction to the briefings

167. Most people we have talked to think that the SSC and the consortium prepared well for the launch day and did a good job in testing circumstances. Some felt that a more strategic approach might have been achieved if institute directors had been included in the discussions and preparations.

168. Members of SCIMAC have expressed their strong disappointment that, despite their original partner status and commitment of resources to the project, they did not get any advance notice of the results and were excluded from the press briefing. These concerns were compounded by the press coverage, which they consider stemmed from limited coverage at the press briefing on the agricultural significance of the results - for example the potential agronomic and environmental benefits of GMHT beet.

169. In reality, SCIMAC's disenchantment runs deeper than simply dissatisfaction with the processes and messages of the FSEs press briefing and public launch. They believe that Government has not shown sufficient commitment to carrying through its side of the voluntary agreement of autumn 1998 with the industry. These are matters well beyond our remit**.**

170. **On the specific matter of lack of involvement in the press and public launches, however, we have some sympathy with SCIMAC, though we accept that the research consortium were the sole 'owners' of the results. The problem was that SCIMAC were not only collaborators (and funders) of the FSEs, but also a vested commercial interest. Nevertheless, we conclude that, in the spirit of the original partnership, the SSC and consortium might have done more to lower any unrealistic expectations that SCIMAC nurtured about early access to the results and to avoid SCIMAC being unsighted when approached by the press immediately after the briefing.**

171. **Overall, we support the use of professional agencies to maximise the positive impact of the FSEs results. The events of 16 October 2003 were planned and handled well, but could not be expected to please everyone.**

4. Risk assessment and management

172. The research consortium recognised three risks in their tender documents:

1. *The null hypothesis is accepted, even though it is false.*
   This was judged to be a possibility if quite large effects on biodiversity were not detected by the trials.

2. *Longer-term and indirect impacts are not well determined.*
   Longer-term impacts would need longer-term experiments. Several rotations might be needed before they became apparent.

3. *Sites may become damaged or lost.*
   This recognised the sensitive nature of the trials and the consortium's lack of control of sites on farmers' land.

173. Only the third relates to the practical execution of the evaluation. It seems to us that, several other risks should have been explicitly identified and managed, including:

- Failure to manage a complex project spanning three autonomous organisations and, initially, seven separate sites, leading to delay and/or non-delivery.
- Failure to develop the critical automated data analysis, which depended on innovative interfacing of statistical packages and an Oracle database.
- Dependence on key senior leaders (Drs Firbank, Perry & Rothery), and no apparent succession/replacement strategy.
- Inability of SCIMAC to nominate enough of the right sort of field sites.
- SCIMAC prematurely withdrawing from the project.
- Reliance on inexperienced field teams working under pressure.
- Sabotage of experiments or data from within consortium (many new & casual staff).
- Public opposition causing Ministers to halt the project before completion of three year's fieldwork.
- Adverse impact of natural hazards: weather, FMD.
- Failure to publish results in peer-reviewed journal.

174. We acknowledge that the Project Management meetings were effective in anticipating risks and problems and mitigating operational problems as they arose. As Les Firbank said to us, 'these procedures had been pretty much internalised by all senior project staff'. Moreover, when the project started in 1999 risk was not so strongly embedded in research planning and management processes and culture as it is today. Nevertheless, we are still surprised that there is little evidence of a strategic and systematic approach to the assessment and management of risk by the SSC or Project Management meetings. W**e consider that more comprehensive risk assessment at the planning stage could have helped limit some of the problems that arose later.**

175. Since risk assessment is an integral part of project planning and management, it should be the responsibility of the research contractors. In the case of the FSEs, where the SSC played a proactive role, the Committee might have asked for the latest project risk map to be reported routinely to SSC meetings as part of the consortium's report.

176. **We conclude that future projects of a similar scale and organisational complexity should include formal procedures for assessing, quantifying, monitoring and mitigating risk.**

5. Operation of the Scientific Steering Committee

177. The SSC was charged with providing scientific review of the progress, quality and outcomes of the FSEs and reporting this to Ministers. It was required to ensure that the approaches for monitoring the biodiversity in each crop were consistent and were producing data of the appropriate quality.

178. Its membership comprised scientists with expertise that reflected key features of the FSEs and a Chairman with knowledge of applying science to illuminate problems of agriculture and farmland biodiversity, as well as awareness of the social and political dimensions of research in these areas. There were also observers from SCIMAC, Government departments and statutory environmental advisory bodies. Scientists of the research consortium attended according to the requirements of each meeting's agenda. In the interests of transparency of process, minutes of SSC meetings were posted on a special Defra website.

179. The SSC was given a broad remit, but apparently left to determine how it should operate. It took an early decision that a proactive approach to the science of the FSEs, almost a quasi-executive role, was necessary if it was to fulfil its responsibility for assuring Ministers. This required the Committee getting into the detail of the statistical basis of the FSEs and the protocols and other experimental design, as well as reviewing draft publications before submission. It led to sometimes robust discussions between the researchers and SSC members, collectively and individually, at the design stage and again when the results were being written up. A few consortium scientists found these exchanges uncomfortable, but on the whole the Committee's role was welcomed by the researchers. Chris Pollock told us that the SSC's strong, uncompromising position helped to 'pressure test the project'.

180. While the SSC looked in detail at the science and statistics, it did not address finance, the overall project, or data management regimes that were critical to the successful delivery of the FSEs. And, as we have just noted, there is little evidence that it carried out formal risk assessment, or asked the consortium to do this.

181. At the design stage, significant scientific improvements were made on the advice of the SSC. Although the consortium took all these recommendations on board, it is not clear that the project budget was adjusted upwards sufficiently to take account of all the extra costs they created. This might partly be due to SSC not concerning itself with finance, partly to the fixed contract approach and partly to the Chinese wall between the SSC and the officials in Defra responsible for commissioning the project.

182. Because of the growing public and media interest in GM crops generally, the SSC insisted at the outset that there should be no reporting of interim or incomplete results of the trials, which might be misused to support one lobby group or another. They also argued strongly that the results should be published in respected peer-review journals to verify their integrity. These were to be touchstones throughout the project.

183. Given its responsibilities for overseeing design, methodology and statistics, as well as the publication of results, it is not surprising that SSC was most active during the design phase early in the project and in reviewing draft publications prior to submission for formal peer review in

2003, towards the end of the project. Overall it met 13 times between June 1999 and January 2003. Its final report to Ministers on 16 October 2003 was a positive one, as follows:

Box 1: SSC advice to Ministers on publication of the spring crop trial results

> *The publication of these papers, [in Phil. Trans. B] following full peer-review, provides independent endorsement of the SSC's view that the farm scale evaluations were designed and executed to a high standard. The SSC is content that these eight papers collectively have adequately addressed the null hypothesis under test.*

184. A consistent message from our interviews is that the SSC worked well as a group and that it formed a constructive partnership with the research consortium, built on a foundation of mutual respect. The Committee also quickly gained the confidence of the Government officials responsible for the FSEs.

185. We are less convinced that the SSC established such good communication links with SCIMAC, other than on matters directly concerning site selection and crop management. This partly reflected Government's strong desire that the research should not be influenced by commercial considerations. But we conclude that more could have been done by the SSC, and perhaps by SCIMAC itself, to maintain a legitimate level of communication, particularly during the latter stages of the project when SCIMAC were no longer allowed to attend the SSC as observers. Over the course of the project SCIMAC was represented by an observer at only seven of the 13 SSC meetings.

186. The SSC's detailed, hands-on interactions with the researchers on statistical power analysis, experimental design and reviewing draft publications distinguished it from the type of scientific steering committee with which most scientists are familiar. A more orthodox relationship would have struck a different balance, with the researcher team internalising more of the scientific discussion on experimental design, drawing on senior colleagues in their home institution and elsewhere. And we would expect the reviewing of draft papers normally to be carried out within the authors' institute(s).

187. We accept, however, that the requirements for confidentiality of the FSEs made more normal procedures difficult, or impossible. And, although well-equipped for its task, the consortium lacked experienced scientific leadership at the highest level, a role the SSC was well-equipped to provide. **We conclude that, in the special circumstances of intense political and public interest in the GM crop trials and, consequently, an urgent requirement to have practical arrangements in place to oversee the FSEs, the proactive role that the SSC chose to play was a wise decision.**

188. Our concerns, which are relatively minor for the FSEs, but which have some generic value for similar steering groups in future are:

- Expertise should map onto the needs of the project (the SSC was short of informatics expertise).
- There was insufficient interaction with institute directors.
- There was no obvious connection between SSC recommendations and the project budget.
- The SSC should have paid more attention to the risks associated with the FSEs.

189. **Overall, there is no doubt that the SSC did what it was asked to do extremely well. Apart from providing scientific oversight and assurance, it also acted as an important buffer between the research consortium and Ministers. Its robust policies on confidentiality and on peer-reviewed publication of results were well-judged and, as the political pressures increased, turned out to be critical to the successful completion of the project and the meaningful presentation of results**.

190. **We recognise that most research projects are successfully led and managed internally, with occasional reinforcement by a small advisory steering group. In trying to draw a generic conclusion from the experience of the FSEs SSC, we have attempted to list the considerations that would point to the need for a similar overarching steering committee for future research projects. These are:**

- **Strong public interest, requiring:**
  - **Guarantee of scientific probity.**
  - **Quality assurance of methods and data.**
  - **Buffer against political influence.**
  - **No piece-meal release of interim results.**
  - **Confidentiality.**
- **Consortium of several research institutions.**
- **Project scale and complexity.**

5. REFLECTIONS ON THE FSEs

The FSEs in context

191. In one sense there was nothing particularly special about the FSEs. Nowadays research institutes frequently engage in UK, European and international collaborations involving a dozen or more research centres in as many countries and routinely handle and exchange Megabytes of data electronically. The partners in the FSEs consortium already had experience of working together, and with others, on earlier coordinated research programmes on agriculture and the environment.

192. However, unlike many other inter-institutional collaborations, including these earlier agriculture and the environment programmes, the FSEs project was designed to test one simple hypothesis, implying much greater coherence and focus of effort. The nature and scale the FSEs also presented considerable managerial and co-ordination challenges that are not normally associated with wholly laboratory-based research. For instance, large numbers of datasheets, manually recorded out-of-doors, presented challenges in terms of site management, logistics, data handling and quality control.

193. Furthermore, the intense political and public interest (and hostility) in the FSEs made fieldwork difficult and created an unique communication situation.

194. It was the prospect of working in this hot-house environment that marked the FSEs out as special and led the SSC to play a much more proactive role than we would normally expect of a non-executive steering committee, effectively assuming ownership of the project and controlling the presentation of results.

195. Another distinctive feature was that the project was conceived as a laudable initiative by Government and industry to work in partnership to fund research in an area that had major, and potentially opposed, public and commercial interests. The availability of SCIMAC to represent and mobilise the range of commercial interests in GM crops was crucial to the project, as was the on-going dialogue between industry and Government, separate from the FSEs study itself. The complex dynamics between industry, Government and research consortium, however, added to both the task of project coordination and management and to the SSC's overseeing role.

196. Unfortunately, the initial sense of Government-industry partnership weakened as the project developed. SCIMAC played a very full role in identifying farms for site selection and in subsequent site management. At these crucial stages communication between SCIMAC and the research consortium was probably adequate, though a little haphazard. In latter stages communications between SCIMAC and the project worsened, culminating in the industry nursing a sense of grievance at their exclusion from the final stages of the project when results were emerging.

197. Several the organisations and many individuals worked hard to make the Government-industry partnership effective, but one lesson of the FSEs is that it is very difficult to accommodate public and commercial interests in a single scientific project without giving the impression that one or both of these legitimate interests has been compromised.

Critical success factors

198. Despite these challenges, the project was outstandingly successful in terms of its rigorous execution and its delivery of robust scientific results on schedule and within budget. The principal factors contributing to this were:

- An intelligent Government customer that consulted widely at the concept stage and was flexible on scientific approach and finance during the design and experimental stages of the project.
- The SSC, which exceeded a strict interpretation of its overseeing remit by effectively adopting proxy ownership of the project. By providing intellectual challenge and guidance at the design stage and when publications were in preparation, it exercised an essential review function. It also acted as the gatekeeper of confidentiality.
- The research consortium, which had considerable intrinsic strengths based on its skill base and experience of agricultural field experiments and ecological monitoring, and was embedded in institutes that could provide resource back-up.
- Effective project co-ordination and management, including:
    - An outstanding personal contribution by the project co-coordinator.
    - A policy of motivating and empowering staff.
    - Web-based document management system.
    - Web-based communications.
    - Attention to quality control.
    - Development and adoption of automated data analysis.
- A professional approach to preparing and communicating the final results.
- The commitment and dedication of all the staff involved.

Organisational tensions and weaknesses

199. However, the organisation and management of the FSEs project had some weaknesses, notably:

- The consortium and the SSC had few formal procedures for risk assessment and management, despite the project facing many uncertainties and risks.
- Patchy communication between the SSC/research consortium and SCIMAC. After initial enthusiasm and commitment, SCIMAC became progressively disenchanted with the way they were kept at arm's length. This could have been eased, but not fully overcome, by better communications with the SSC and the consortium, especially in the later stages when results were being prepared for public launch.
- Initial communication failures between the project and local site management. It took some time to manage the interface between the project and the consortium institutes.
- Uneven, and generally insufficient, engagement with the three consortium institute directors.
- Lack of detailed budgets, so financial management by the consortium was necessarily pragmatic, but nevertheless transparent and effective.

6. GENERIC LESSONS FOR RESEARCH FUNDERS AND PROVIDERS

200. The FSEs project was the largest field-based study of farm biodiversity to be conducted in Europe. In addition to its intrinsic scale and complexity, organisation and management were challenged by intense political and public interest. It is important to profit from the experience and to apply any generic lessons about organisation and management to studies with similar approaches, not necessarily involving controversial subjects. The following comments are aimed at those who fund research, particularly in the public sector, as well as those who carry out the research. They are relevant to the planning and conduct of research, especially involving collaboration between two or more research centres.

Scientific probity

201. Where there is strong public and/or political interest in the outcome of publicly funded research, experience with the FSEs has emphasised the importance of the whole research process, but particularly emerging results, being independent from the public funder, policy makers and Ministers. An arm's length relationship is likely to increase the acceptability of the results to all parties.

202. An independent steering committee is one approach to achieving this arm's length relationship. Based on experience with the FSEs SSC, the following principles should guide the setting up of similar project advisory committees:

- Clarity of remit and responsibilities, especially where advice has resource implications, and on relationships with funder(s) and research providers.
- Membership with sufficient complementary skills to cover the scientific scope of the project.
- An effective chairman, probably not an expert in the science of the study, who can take a broader view.
- Attention to any conflicts of interest when considering membership.

203. These guidelines could be helpful in managing research addressing issues in other areas of intense public interest, including environmental protection, food safety and human health.

Public interest

204. Public interest has to be recognised and managed by researchers. A communication strategy should be adopted early on. This would incorporate appropriate professional PR advice and media training for key researchers. Decisions should be taken on when and in what form results will be released. The FSEs showed the importance of a well-planned communication strategy, particularly:

- Publishing results in a high-impact peer-reviewed journal, which helped pre-empt debate about their validity or integrity.
- Keeping the results confidential until peer reviewed papers were published also helped discourage uninformed debate and speculation, and ensured that message from the project was effectively and widely communicated.
- Getting advice on managing public and media interest from independent, PR professionals.

Tendering and selection

205. The FSEs followed a sequential process that involved establishing the policy and scientific objectives, choosing the contractors by open tender and then refining the project in discussion with the contractor. For the FSEs, the pilot year helped inform this refining process. If this approach were adopted for future projects, the revised work should then be re-costed and revised contracts should be agreed, even if the research has started. Such an approach would improve the likelihood of meeting the scientific objectives, informing the policy question and delivering value for money.

Project management

206. Successful project management is crucial, but is unlikely to be achieved without initial foresight and planning and continuous monitoring throughout the project. The flexibility to accommodate necessary changes is essential. In any collaboration, the starting point is to recognise the strengths and weaknesses of the staff and organisations that are going to be working together. Any cultural differences that may inhibit communication should be identified and managed.

207. At an operational level, our evaluation of the FSEs emphasised the importance of:

- Director, or senior management, level buy-in to the project at each participating institution.
- A single project manager, sufficiently empowered across the project and resource envelopes.
- Reconciling central project management needs and local management systems at the outset.
- A human resources strategy covering staff requirements to facilitate the timely engagement of appropriately qualified staff at all levels – from established senior researchers to casual field staff.
- Reinforcing any skill and competence deficits with appropriate training.
- Empowering staff within clearly defined duties.
- Systems for quality assurance.
- Effective communication between project staff, by conventional and electronic means, especially where they are in different research centres or otherwise geographically dispersed.
- Managing project confidentiality sensitively within the community of researchers.

Financial management

208. Early attention needs to be given to designing robust and auditable financial management procedures appropriate to the degree of organisational complexity that exists on the ground. A project's central systems for budgeting and control should mesh with local systems of financial control as smoothly as possible. Degrees of delegated authority should match a project's operational requirements for resources.

Data management

209. It is important to ensure that data management and archiving systems are in place, or have been clearly planned, timetabled, costed, with appropriately qualified staff identified or marked for recruitment. Quality assurance systems are vital. This is crucial for agri-environmental and other projects that create large datasets.

Risk

210. Risk assessment and mitigation should be scoped at the outset and reviewed critically by the senior project management team at regular intervals. The process must be properly documented.

Successful research consortia

211. The key features that contributed to the success of the FSEs research consortium were the full range of complementary expertise and facilities needed for the work, experience of similar studies and a mutual respect between key senior staff. These attributes should provide a strong foundation on which to build a sense of common purpose and a successful collaboration. The FSEs also demonstrated that smooth execution of the research requires the participating institutions consciously to buy-in to the project. Potential boundary problems between the project and each institution, for instance in costing, resource allocation and local management, need to be identified and addressed at the outset, then kept under regular review.

Successful partnerships

212. The FSEs have demonstrated the importance of understanding and managing the different values, expectations and cultures of diverse stakeholder groups when they join forces to support major research endeavours carried out in the public domain. In future collaborations of this sort any restrictions, or constraints, such as not sharing interim results, that might affect one or more of the stakeholders should be discussed and understand at the outset.

Operational lessons for future studies

213. Where not already done, it is not too late for operational lessons from the FSEs to be captured and written up by appropriate lead groups within the FSEs consortium and made available on web-sites, or by other means, to guide future large scale agro-ecological field experiments. Topics that might benefit from this sort of treatment include site selection, designing protocols, conducting field work, data management and data quality assurance.

6. ACKNOWLEDGEMENTS

214. Chris Pollock and Les Firbank provided an invaluable initial briefing and were very responsive to our repeated requests for additional information as the evaluation developed. Linda Smith at Defra similarly responded helpfully to our frequent requests for documentation.

215. Finally, we must thank all those people we interviewed for the considerable time they gave us and for the helpful and frank way they answered our questions.

Brian Jamieson & Associates
November 2004

ANNEX 1

ORGANISATIONS & INDIVIDUALS INTERVIEWED

Chris Pollock	Chairman, SSC & IGER
Nicholas Aebischer	SSC & Game Conservancy Trust
Alastair Burn	SSC & English Nature
Mick Crawley	SSC & Imperial College
David Gibbons	SSC & RSPB
Jim Orson	SSC & Morley Research Centre
Nick Sotherton	SSC & Game Conservancy Trust
Bob Fiddaman	SCIMAC
Colin Merritt	SCIMAC
Roger Turner	formerly SCIMAC
Daniel Pearsall	SCIMAC
Linda Smith	Defra
Nick Brickle	Defra
Rosi Waterhouse	SEERAD
David Williamson	SEERAD
John Kerr	SEERAD
William Brigham	Farmer
Eric Cole	Farmer
Jim Dutton	Farmer
David Hill	Farmer
Frank Oldfield	Farmer
Fiona Fox	SMC
Phil Hurst	Royal Society

Bob Ward	Royal Society
Pat Nuttall	Director, CEH
Dan Osborn	Science Director, Sustainable Economies, CEH
Les Firbank	Project Co-ordinator & CEH, Lancaster
Matt Heard	CEH, Monks Wood
Mark Hill	CEH, Monks Wood
Peter Rothery	CEH, Monks Wood
Peter Roy	CEH, Monks Wood
Terry Parr	CEH, Lancaster
Martin Rossall	CEH, Lancaster
Rod Scott	CEH, Lancaster
Caroline Boffey	CEH, Dorset
Jeremy Thomas	CEH, Dorset
Roger Daniels	formerly CEH, Dorset
Alan Gray	formerly CEH, Dorset
Ian Crute	Director, RRes
Caroline Birchall[13]	RRes
David Brooks	RRes
Alison Haughton	RRes
Joe Perry	RRes
Ian Woiwod	RRes
John Pidgeon	RRes, Brooms Barn
Gill Champion	RRes, Brooms Barn
Alan Dewar	RRes, Brooms Barn
Beulah Garner	RRes, Brooms Barn
Lisa Haylock	RRes, Brooms Barn
Mike May	RRes, Brooms Barn

[13] Submitted written comments on behalf of a group of RRes field and laboratory staff.

John Hillman	Director, SCRI
Gill Banks	SCRI
Lawrie Brown	SCRI
Cathy Hawes	SCRI
Joyce McClusky	SCRI
Adele Parish	SCRI
Geoff Squire	SCRI
Mark Young	SCRI
Mike Roberts	Chief Executive, Central Science Laboratory

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