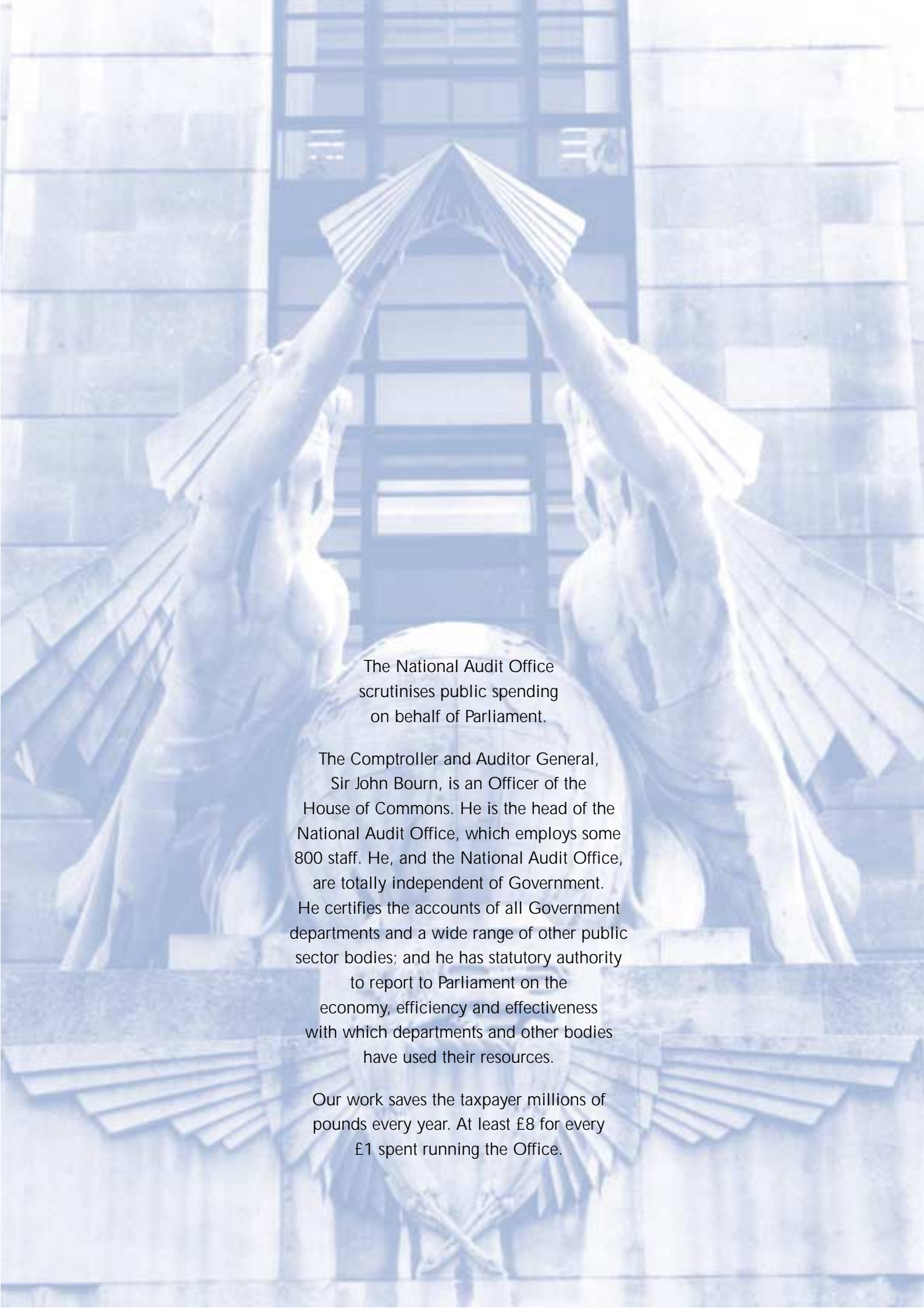


Cambridge-MIT Institute

REPORT BY THE COMPTROLLER AND AUDITOR GENERAL
HC 362 Session 2003-2004: 17 March 2004





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Cambridge-MIT Institute



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This report has been prepared under Section 6 of the National Audit Act 1983 for presentation to the House of Commons in accordance with Section 9 of the Act.

John Bourn
Comptroller and Auditor General

National Audit Office
9 March 2004

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Preface

Cambridge-MIT Institute (CMI) is a pioneering partnership between Cambridge University and the Massachusetts Institute of Technology (MIT). It was set up in June 2000 to enhance the competitiveness, productivity and entrepreneurship of the UK economy. In committing funding of up to £68 million, the Treasury made it clear that CMI's task was to "think the unthinkable" in generating ideas for applying scientific research to business and industry in ways that might have substantial economic benefits to the UK over the long term.

This report is in response to a request from the Committee of Public Accounts that we investigate CMI. We examine how CMI was set up; CMI's current and likely achievements; and the role of the Department of Trade and Industry (the Department) in monitoring the progress and management of CMI's programme. We set our findings in the context of the challenge presented by public sector investment in an experimental initiative which, by its nature, will have outcomes that cannot be confidently predicted. In these circumstances, the goal for the public sector is to define appropriate levels of controls and risk management that are consistent with innovation. The Treasury and the Department were right not to try to follow the usual arrangements for setting up initiatives, but aspects of CMI's establishment could have been managed better. Very ambitious expectations for the first two years added to the difficulty of getting a true picture of whether the progress being made was reasonable. Over the course of the initiative, the management within CMI has developed to become more systematic.

Many of CMI's key outcomes are complex and intrinsically difficult to measure, and will not be realised for some time, though there have been some early successes. One of our aims in undertaking this study was to draw the lessons from the CMI experience for others in the public sector who have to manage innovative projects and initiatives. These lessons need to be applied and adjusted intelligently to match the requirements of each project, and we therefore make no specific recommendations. Instead on page 11 we provide a questionnaire for departments to use as a guide when considering funding innovative projects. The questionnaire is intended as a straightforward tool for departments to check that their project arrangements meet reasonable requirements for care and transparency, whilst also providing an environment that encourages new thinking and ideas.

Glossary

Gateway Process	Introduced (after CMI was established) to appraise all programmes and projects whether high, medium or low risk. For medium and high risk procurement projects the Gateway process is mandatory. The process examines a project at critical stages to provide assurance that it can progress successfully to the next stage. It is intended primarily for procurement projects, but can also be used for management, policy and change initiatives.
Intellectual property	Property (such as patents, trademarks and copyright material) which is the product of invention or creativity and does not exist in a tangible, physical form.
Knowledge exchange	Information sharing, particularly between organisations with different cultures, for example universities and industry.
Knowledge integration community	Community of academics, representatives from industry, business and public bodies working together on research with a commercial aim.
National Competitiveness Network	This network incorporates the Department's Science Enterprise Centres, which have a membership of more than 60 universities.
Spin-off company	New legal entity or enterprise created by a higher education institution or its employees to enable commercial exploitation of knowledge gained through academic research.
Technology transfer	Applying technology and expertise to novel situations. May lead to commercialisation of a product.

executive summary

- 1 Cambridge-MIT Institute Ltd (CMI) is a limited company jointly owned and controlled by Cambridge University and the Massachusetts Institute of Technology (MIT). It brings together the expertise of these two leading research universities to undertake collaborative educational and research initiatives directed at improving entrepreneurship, productivity and competitiveness in the UK. The underlying philosophy is that innovation is most likely to occur when researchers in leading institutions work collaboratively, exchanging and building on ideas, towards marketable products. CMI's mission is shown at **Figure 1**.

1 CMI Mission

To enhance the competitiveness, productivity and entrepreneurship of the UK economy...
by improving the effectiveness of knowledge exchange between university and industry, educating leaders, creating new ideas and developing programmes for change in universities, industry and government...
using a partnership of Cambridge University and Massachusetts Institute of Technology, and an extended network of participants.

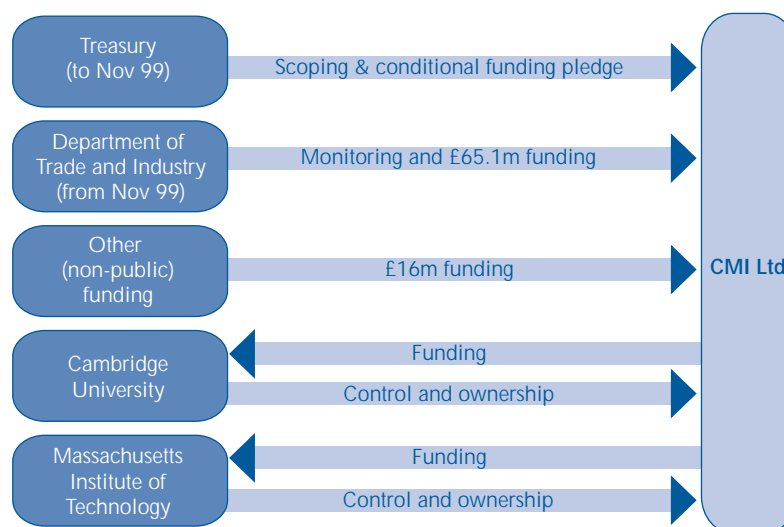
Source: CMI Strategy, April 2003

- 2 The Treasury announced its decision to establish CMI in November 1999, and conferred departmental responsibility for the initiative on the Department of Trade and Industry (the Department). The Department's overall targets include a commitment to improve the exploitation of science. Its Office of Science and Technology promotes excellence in science, engineering and technology, and transfer of knowledge from higher education institutions and the research councils to the wider economy. The Department is responsible for ensuring CMI's accountability for the proper expenditure of grant, monitoring progress and evaluating its impact. **Figure 2 overleaf** illustrates the four main parties involved in CMI - the Treasury, the Department, Cambridge University and MIT.
- 3 CMI's seven-member Board of Directors (Appendix 1 on page 32) is responsible for approving its programme of work. CMI is being publicly funded over a period of six years¹ by a grant of £65.1 million out of the Department's science budget, currently some £2.4 billion per annum, which includes funding for the seven Research Councils.² All CMI projects are jointly undertaken by Cambridge University and MIT, and each university receives roughly half the public funding.

¹ Originally five years, but formally extended to six in 2003. The amount of grant stayed the same.

² Biotechnology and Biological Sciences Research Council; Council for the Central Laboratory of the Research Councils; Economic and Social Research Council; Engineering and Physical Sciences Research Council; Medical Research Council; Natural Environment Research Council; Particle Physics and Astronomy Research Council.

2 Overview of parties involved in CMI



Source: National Audit Office

- 4 CMI is expected to take risks by funding imaginative, experimental projects. Some projects may not realise direct benefits but will still have value because they provide lessons for developing future projects.
- 5 A process known as "knowledge exchange" or "knowledge transfer" underpins many of CMI's activities. This process seeks to promote the sharing of good ideas, research results and skills between universities, other research organisations, business and the wider community, to enable innovative new products and services to be developed. It involves entrepreneurs and investors in helping to translate innovation into a commercial use. CMI's activities include research projects and educational programmes focused on how best to ensure effective knowledge exchange.
- 6 This report examines:
 - **how CMI was set up** (Part 1), focusing on the involvement of the Treasury and the Department;
 - **CMI's current and likely future achievements** (Part 2), with some examples of early successes; and
 - **how CMI has been managed** (Part 3), including the role of the Department, CMI's early experience, and changes it has made in its approach to its programmes, building on the experience.
- 7 **Figure 3** summarises the chronology of events leading to the establishment of CMI and progress over the first three years of the initiative.

Establishing CMI

- 8 The application of research in business and industry is widely accepted as an area in which the UK needs to do better. The concept for CMI was to secure for the UK economy some of the benefits that MIT was achieving for the United States - up to March 1997, MIT graduates or faculties had founded over 4,000 companies, many of the type that use high technology to bring disproportionately large benefits to the economy.

3 Chronology of events

July 1998	Chancellor of the Exchequer visits MIT. Expresses interest in United States/UK collaboration.
September 1998	Discussions between MIT and the Treasury start.
November 1999	Framework agreement and funding of up to £68 million announced, conditional on detailed proposals being agreed. Transfer of responsibility from the Treasury to the Department of Trade and Industry. Acting UK Executive Director appointed.
December 1999	United States Executive Director appointed.
June 2000	Cambridge University, MIT and the Department of Trade and Industry agreed terms of an offer letter. CMI formally incorporated.
July 2000	Formal offer of £65.1 million. Funding started.
Year 1 (July 2000-July 2001)	Strategy developed, staff recruited, systems for project and financial management set up, project applications sought, research groups formed, first activities chosen, National Competitiveness Network set up. UK Executive Director appointed, December 2000. Department concerned that CMI would not meet continued funding conditions. The Department commissioned review by Arthur Andersen.
End of Year 1	CMI did not meet all conditions for continued funding. Continued funding agreed subject to implementation of recommendations in Arthur Andersen report of July 2001.
Year 2 (August 2001-July 2002)	Work started in response to Arthur Andersen report. Second Arthur Andersen report December 2001 found CMI had made significant progress in addressing the previous report's recommendations. Department agreed to continue funding subject to CMI continuing to meet terms and conditions of the grant offer. More projects selected. 41 projects active at end of year 2.
Year 3 (August 2002-July 2003)	New Executive Directors appointed in January 2003. Strategy redefined. More projects selected: after end of year 3, 62 publicly-funded projects active/completed. Department agreed one-year no-cost funding extension to allow time for new projects to deliver.
Years 3-4	CMI commenced systematic review of existing projects to reassess suitability for funding.

9 The idea for CMI originated in the Treasury. It was an unusual initiative that was set up in an unorthodox way:

- Negotiations for CMI were handled in two stages. The Treasury handled all the first-stage negotiations with Cambridge University and MIT, to the point of publicly announcing a commitment of up to £68 million, subject to a formal agreement of detailed proposals. Other relevant government departments were not involved in the first-stage negotiations.
- The Treasury accepted MIT's selection of Cambridge University as its UK partner - this was a key condition for going ahead as far as MIT was concerned. The Treasury considered opening up the opportunity to other universities, but recognised that pursuing this option would deter MIT, because it could be perceived as undermining the Treasury's commitment to MIT as a partner.
- CMI's innovative nature made it difficult to apply standard financial and economic appraisal to the proposal for CMI and in our view, the Treasury was right not to follow the usual arrangements. It considered alternatives to CMI, but we found no documentary evidence as to whether further appraisal options, other than the two-stage process, were considered - we would have expected to see some evidence that elements of the standard appraisal process were considered or adapted for use.

- 10 It took time for the Department of Trade and Industry to satisfy itself on the robustness of the proposal for CMI, and to develop relationships with key people at Cambridge University and MIT, because the Department had not been involved in the first-stage negotiations. At the same time, intensive negotiations continued between partners and their lawyers on either side of the Atlantic. The expectations of the officials and the universities were initially far apart - the former placed an emphasis on the need for accountability, whereas the latter believed that a formal agreement on funding should be relatively straightforward.
- 11 Over the eight months that followed the announcement, the Department negotiated an offer letter with Cambridge University and MIT. The Department was concerned to give a clear indication of what was expected. On the other hand, the two universities, and in particular MIT, firmly resisted a high level of specification, because they considered there would be a risk of reducing the scope for genuine entrepreneurship and innovation. The second-stage negotiation took much longer than Cambridge University or MIT expected. However, a large public investment was being proposed and needed to be set on a workable footing. The Department did well to negotiate an offer letter that all parties could accept.

CMI's current and likely future achievements

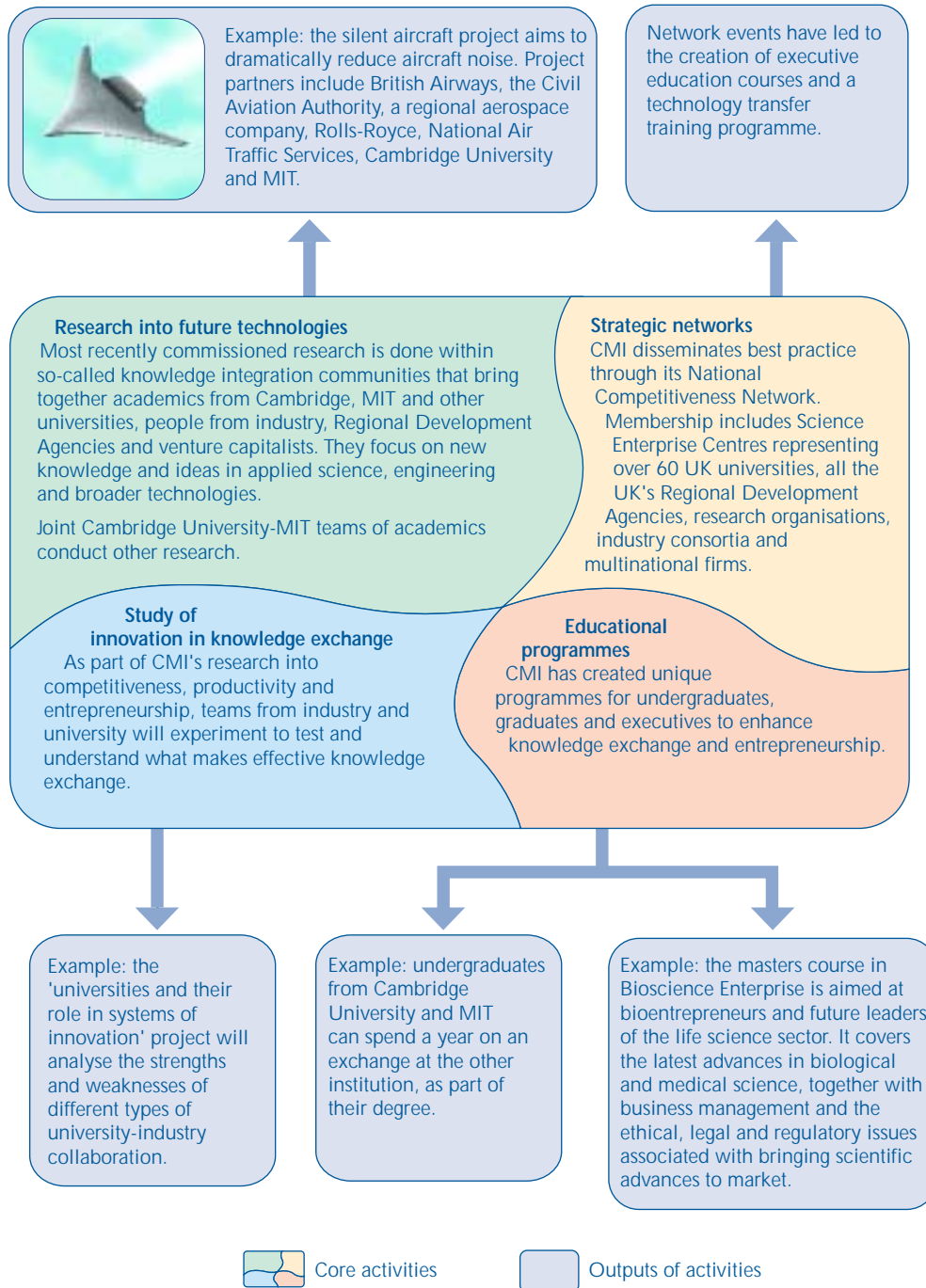
- 12 CMI is testing ways of creating and maintaining a climate for innovation. It currently has over 60 projects under way or completed. The Department recognises that some projects may not meet their objectives, but will still contribute to learning by showing which frameworks are the most successful for developing entrepreneurship.
- 13 The nature of CMI's activities means that many of its impacts will not be clearly known or felt for some time after the six-year public funding period is complete, because there can be large time lags in identifying outcomes. Some outcomes, particularly those relating to effects on the economy, are intrinsically difficult to measure. Nevertheless, there is potential for considerable success. **Figure 4** illustrates the main types of activity that CMI undertakes and some promising projects and programmes that are under way.
- 14 CMI and the Department are producing models for evaluating innovative projects. For example, CMI has started to develop measures of its success in terms of benefits to main stakeholders. The Department is in the process of appointing consultants to assess all its knowledge exchange initiatives,³ including CMI, and to compare their findings with earlier evaluations of other similar programmes funded by the Department.

How CMI has been managed

- 15 There were high expectations of what CMI might do in its first two years. These were very ambitious for a number of reasons, including the experimental nature of the initiative, and the need to set up a whole new infrastructure (effectively a start-up company) to develop the strategy and operate the day-to-day business of CMI. The time required to set up the infrastructure was not explicitly recognised, and there were expectations that CMI's activities would gather momentum quickly.

3 The five other initiatives are listed at figure 13 on page 22.

4 CMI undertakes four main types of activity



Source: National Audit Office analysis of CMI's information

- 16** The Department and the universities both concluded that it was difficult to set specific, measurable objectives at the outset. Instead, in the first year, they agreed an operating plan comprising a list of planned activities and high-level anticipated outcomes. The lack of specific objectives, combined with low levels of expenditure and delivery, meant that the Department could not rely on the usual monitoring mechanisms - reports against objectives, expenditure and activity profiles - to monitor CMI for some time. In practice, the Department had to monitor CMI directly. This was time consuming but had the advantage of helping to develop relationships between officials and university staff.
- 17** The Department commissioned an external review of CMI, which reported in July 2001 that emerging concerns that CMI would not meet continued funding conditions were justified. A second review, reporting in December 2001, found that CMI had made significant progress in addressing the earlier review's recommendations. The Department has worked with CMI's Executive Directors to improve and make its plans more explicit, and to develop better processes in other areas such as cash flow forecasting. With the improvements that have been implemented since the reviews, the Department is now able to assume a more "arm's length" role.
- 18** From January 2003, CMI's new Executive Directors embarked on an extensive mid-term review of all CMI's programmes. They called for new research proposals in April 2003, and subjected the proposals they received to new procedures for review and approval that are designed to streamline the bidding and approval process. They are overseeing the development of improved processes for monitoring projects, and for planning and evaluating outcomes.

Overall conclusions

- 19** CMI is an unusual initiative and was set up in an unorthodox way. The Treasury and the Department were right not to try to follow the usual arrangements for setting up initiatives, and the two-stage process was a sensible approach, but aspects of CMI's establishment could have been managed better. For example, in our view, it would have been helpful to involve departments other than the Treasury earlier.
- 20** Many of CMI's key outcomes are complex and intrinsically difficult to measure, and will not be realised for some time, though there have been some early successes. The CMI experience will itself help to produce models for evaluating innovative projects.
- 21** Setting up CMI proved to be a much bigger task than anticipated, and very ambitious expectations initially added to the difficulty of getting a true picture of whether the progress being made was reasonable. Lack of sufficient, relevant monitoring information meant that the Department initially took a "hands on" approach to management, but over the course of the initiative, the management within CMI has developed to become more systematic.

Lessons and self assessment questionnaire

- 22** At the end of each main section of our report, we draw the lessons from the CMI experience for others in the public sector who have to manage innovative projects and initiatives. On the following page we also provide a questionnaire for departments to use as a non-mandatory guide when funding an innovative project to check that their project arrangements meet reasonable requirements for care and transparency, without constraining new thinking and ideas.

Self assessment questionnaire for departments to use in funding and managing innovative projects

This questionnaire is a tool for assisting departments in appraising and managing projects. The guidance is not mandatory, but arises from the important lessons learned from the appraisal and management of CMI.

The Office of Government Commerce's Gateway Process provides comprehensive reviews of delivery programmes and procurement projects at key decision points. It is currently producing high level guidance for policy, project and procurement staff on how to source, appraise and manage innovative solutions to government procurement projects.

Consultation and advice

- Have key experts in other government departments been identified?
- Have these experts been contacted for advice and their role in the project (if any) fully considered and discussed with them?
- Have key parties outside of government been identified and consulted?
- Have the lessons from previous initiatives been identified, considered and applied?

Appraisal

- Has all relevant guidance, including the need to use the Gateway Process, been reviewed in relation to the initiative?
- Where a decision is made not to follow guidance:
 - are the reasons for not following the guidance clear, justifiable and recorded?
 - is the alternative approach that has been adopted to the appraisal clear, justifiable, and is the justification recorded?

Setting up the initiative

- Has the time required to build key relationships been considered at a high level and provided for?
- Have non-government (particularly overseas) parties been given briefing and help in understanding the requirements of government projects?
- Is there a project plan for setting up the initiative?
- Does the plan provide for sufficient time and resources to set up the infrastructure required to support the initiative?
- Does the plan provide for appropriate influence of the funder over key organisational aspects of the initiative (such as the skills and experience of people taking up senior appointments)?
- Have responsibilities for monitoring progress against the plan been agreed and allocated to designated individuals?
- Have risks associated with the initiative itself, and with setting up the initiative, been identified and assessed?
- Have the responsibilities for monitoring risks and actions to mitigate them been assigned to designated individuals?
- Is good progress being made in developing expected or indicative objectives, milestones and performance indicators?
- Has work started to develop a strategy, and a deadline agreed for completing it?
- Is there a realistic operating plan for the first 1-2 years of the initiative?
- Does the planned funding profile match the operating plan?
- Are there plans to review the funding profile at frequent, regular intervals?
- Have good processes for appraising and managing the initiative's activities and projects been developed?
- Have all important aspects of the initiative, especially any controversial aspects, been fully communicated to interested parties?

Managing, monitoring and evaluating the initiative

- Have expected or indicative objectives, milestones and performance indicators been set?
- Has a programme for monitoring the initiative's progress been agreed?
- Does the programme provide for sufficiently comprehensive reports and monitoring?
- Does the programme allocate monitoring responsibilities to designated individuals?
- Does the programme provide for periodic review of objectives, milestones and performance indicators (whether or not they were indicative)?
- Are the costs and benefits of projects being assessed as far and as early as possible?
- Does ongoing project appraisal include a requirement to assess project risks?
- Has an appropriate date been set for one or more comprehensive reviews of the strategy, objectives, milestones, monitoring mechanisms and achievements of the initiative during its expected life?
- Has a long-term evaluation process been developed (or an acceptable deadline set for developing a process)?
- Does the process provide for unexpected as well as expected outcomes to be identified and evaluated?

CMI CONNECTIONS · 2003 · STRATHCLYDE



Part 1

Establishing Cambridge-MIT Institute

1.1 This part examines:

- the rationale for establishing CMI;
- how the Treasury handled the proposal for CMI; and
- how the Department of Trade and Industry (the Department) took forward the negotiation of a formal agreement for the set up.

The application of research in business and industry is widely accepted as an area in which the UK needs to do better

1.2 The importance of innovation to maintaining and improving the nation's productivity is well recognised.⁴ To achieve benefits for economic growth through research requires several key elements:

- sustained investment in a wide range of research - both speculative and focused on potential products;
- highly educated people to carry it out; and
- excellent links between the researchers and research institutions, and business and industry, to help to identify when and how research results can be developed into specific products and solutions.

The UK needs to improve its record of investment in research, and the effectiveness of collaboration between business and the research community

1.3 Many authoritative reports and studies, including most recently the Lambert Review⁵, have concluded that UK businesses have had an unimpressive record of investment in research and development in recent years - with UK business research concentrated in a narrow range of sectors and a small number of large companies. At the same time, public spending on scientific research is increasing, and the UK science base is strong.

1.4 The Lambert Review concluded that there have been recent positive developments in university and business collaboration on research, but that more needs to be done, particularly to ensure that business learns to exploit innovative ideas that are being developed in universities. It saw university-business collaboration as an important current area of public policy.

CMI was set up to develop and test experimental and innovative approaches to more effective business-university collaboration

1.5 The concept for CMI was to secure for the UK economy some of the benefits that the Massachusetts Institute of Technology (MIT) was achieving for the United States. The Treasury was aware that MIT's graduates and faculties had started 4,000 firms, employing 1.1 million people and generating \$232 billion in annual sales (Figure 5 overleaf). Links between universities and industry were not unusual in the UK, but research around that time⁶ had identified the need for closer links if the development and exploitation of new ideas was to be improved.

1.6 In July 1998, the Treasury identified an opportunity for UK collaboration with MIT, which at the time was looking for a European partner. The Chancellor discussed with MIT the concept of an initiative involving MIT and a UK institution. The collaboration was not intended to replicate MIT's success directly, but to apply the lessons learned from the success to the UK environment, and to take forward new ideas jointly with experts from MIT.

⁴ For example: *Investing In Innovation - A Strategy For Science Engineering and Technology*, July 2002, HM Treasury, Department of Trade and Industry, Department for Education and Skills.

⁵ *Lambert Review of Business-University Collaboration*, December 2003, HM Treasury.

⁶ *Driving Productivity and Growth in the UK Economy*, McKinsey, October 1998; *Bank of England reports in October 1996 and thereafter*.

5 MIT has made a substantial positive impact on the US economy

If the companies founded by MIT graduates and faculties formed an independent nation, their combined revenues would make that nation the 24th largest economy in the world (all data as at March 1997).

- MIT graduates or faculties founded over 4,000 companies.
- 150 new MIT-related companies created each year, over half within 15 years of the time the founder graduated from MIT, and one in six within five years of graduation.
- The companies employ 1.1 million people across the US - a relatively few large companies account for much of the employment with 106 companies each employing over 1,000 people.
- The companies are commonly in the knowledge-based fields of software, manufacturing, and consulting.
- They tend to bring disproportionately large benefits to the economy, as they are often high-technology and can sell across the US and to world markets.
- They have annual world sales of \$232 billion.
- Companies founded by MIT graduates or faculties include Intel, 3Com, Bose, and Texas Instruments.

Sources: Bank of Boston report: MIT: The Impact of Innovation, March 1997 and <http://entrepreneurship.mit.edu>

MIT selected Cambridge University as its partner in the initiative

- 1.7 MIT specified three conditions for its agreement to pursue the initiative:
- the collaboration had to be with a sister institution in the UK;
 - MIT would want to select the institution; and
 - the scale of resources would need to match the effort it considered was necessary to do it properly - a collaboration that was under way in Singapore costing \$100 million provided a benchmark.
- 1.8 MIT wanted to collaborate with a sister university which it perceived as a comparable world leader. It chose Cambridge University as a well-established, world class institution. The Treasury and MIT agreed that Cambridge University would be a good choice for a number of reasons. It would add to the range of courses at MIT. The University had existing involvement in technology transfer that was well supported by its location among research, finance and other support services that together formed the biggest cluster of high-technology businesses in Europe. MIT saw the collaboration as beneficial to both parties - Cambridge University could learn from MIT's excellence in entrepreneurship, and MIT could learn from Cambridge's excellence in science and engineering.

1.9 MIT did not investigate other universities in the UK. MIT's negotiators were clear that the choice of partner was vital, because success would rely on the time and commitment of their MIT research colleagues to the collaboration - and there was a strongly held view among colleagues that any UK collaboration should be with Cambridge University as the partner.

1.10 The Treasury, on the other hand, considered opening up the opportunity of a similar collaboration to other UK universities. It considered establishing a challenge fund, but recognised that pursuing this option would deter MIT because it could be perceived as undermining the Treasury's commitment to MIT as a partner. Following discussions on the scale and cost of the project, the Treasury accepted MIT's three conditions, including the choice of Cambridge as its UK university partner. The Treasury made one important related condition, which was that part of the funding should be spent on CMI sharing its lessons with other UK universities. This led later to CMI setting up the National Competitiveness Network (Figure 4 on page 9 - strategic networks).

1.11 In our view, there was a clear rationale for the MIT/Cambridge partnership. But the choice of Cambridge University created some concerns among other UK universities. However, the Treasury feels it could have done little more to alleviate their concerns.

CMI was an unusual initiative set up in an unorthodox way

- 1.12 There were a number of unusual features of the initiative that influenced the way in which Treasury officials took forward the negotiations leading to a framework agreement:
- they were concerned that the UK would lose the opportunity to collaborate with MIT if they did not act quickly;
 - they were also concerned that the project might be put at risk because of competition from other countries; and
 - the novel nature of the initiative meant that assessing it was very challenging.

Treasury officials were concerned that the UK would lose the opportunity to collaborate with MIT if they did not act quickly

- 1.13 MIT wanted to have only one major presence in Europe, and the UK was not its only option. In addition, both MIT and Cambridge University expressed unwillingness to devote time and effort to producing detailed proposals before gaining a commitment from the Treasury to fund an initiative. In April 1999, MIT indicated that it would look to other countries if the Treasury did not strike a deal soon.
- 1.14 The Treasury decided to take forward CMI in two stages, firstly with the Treasury setting the parameters for the project and secondly, with the Department negotiating the detailed funding conditions. Funding of up to £68 million was announced in November 1999, subject to detailed proposals being agreed at the second stage. It was also conditional on agreeing a satisfactory programme of activities and securing private sector sponsorship of £16 million.
- 1.15 Even within the Treasury, the negotiations were handled at a very high level (Second Permanent Secretary). Officials were concerned that involving other departments at the first stage of negotiations would cause delay, and this might put the project at risk, because of possible competition from other European countries. They therefore decided not to involve other departments until after announcement.

The novel nature of the initiative meant that assessing it was very challenging

- 1.16 The announcement in November 1999 set out high level aims, but there were no formal objectives, targets, or contract. Treasury officials considered that it was not possible to set meaningful objectives and performance indicators because the proposals were at an early stage, were innovative and there were no existing initiatives to use as benchmarks.
- 1.17 Treasury officials considered that the two-stage approval process (paragraph 1.14) was sufficient to ensure value for money, especially given the requirement for detailed review at the second stage of the proposed programme of activities and private sector investment. They did not formally appraise the proposal using the guidance that the Treasury provides to departments to follow, where practicable, in appraising projects. In our view, following the usual arrangements for setting up initiatives would not have worked for CMI because of its innovative nature.

- 1.18 The Treasury identified two key risks in the proposal: that the UK would miss the opportunity to collaborate with MIT, and that other UK universities would not benefit if it did go ahead. The work on the second of these risks eventually resulted in CMI setting up the National Competitiveness Network (paragraph 1.10 and Figure 4 on page 9). The Treasury did not undertake a systematic assessment of all the risks, since it expected this work to form part of the agreement of detailed proposals at the second stage.
- 1.19 Treasury officials discussed with ministers the broad objectives and options, the pros and cons of the initiative, and its optimal size. The rationale for a commitment of up to £68 million came from MIT, and was based on the "market value" set by the Singaporean government's investment in an earlier MIT collaboration. Both MIT and Cambridge University regarded roughly the amount of activity being developed in Singapore as the minimum necessary to secure their commitment to the initiative. This level of activity carried a price tag of around £68 million (equivalent to \$100 million at the time). It represented a 'bottom line' for MIT's involvement, having started with a bid for around double that amount, which the Treasury brought down through the negotiations.
- 1.20 The Treasury considers that its assessment of the proposal at the first stage used a sufficiently wide variety of information to provide advice to Ministers, and that detailed negotiations, including specific objectives, costs and delivery outcomes would be dealt with at the second stage. As indicated in paragraph 1.17, a full, formal appraisal would not have been appropriate. However, in our view, it would have been possible and valuable to have undertaken some more formal appraisal of the initiative at this first stage. That appraisal might have valuably drawn on best practice in the private sector for assessing innovative projects, which relies on business plans containing indicative objectives, costs and delivery outcomes that will be subject to frequent review and amendment. It would have helped to prepare the way and set more realistic expectations for the second stage of negotiations for the main parties that would be undertaking them - MIT, Cambridge University and the Department of Trade and Industry.

LESSONS LEARNED FROM THE FIRST STAGE OF SETTING UP CMI

- Initiatives of this kind will often involve controversial choices (such as the selection of Cambridge University as partner to MIT). These choices should be fully explained to interested parties as early as practicable.
- Initiatives such as CMI are complex. Where possible, without risk to the project, they are best considered from the outset by a range of people with expertise from across relevant parts of government. A mechanism needs to be developed to achieve this, while also maintaining the pace and confidentiality of negotiations.
- Standard appraisal procedures are unlikely to be easily applicable to innovative projects. On each occasion, officials should review current best practice, decide the process they consider the most appropriate to follow, and document the reasons for their decision.
- Assessment of future initiatives like CMI should meet the requirements of the Gateway Process (which has been introduced since CMI was established) to appraise high-risk projects. The process guides the examination of a project at critical stages in its lifecycle to provide assurance that it can progress successfully to the next stage. It is intended primarily for procurement projects, but is recommended for other high-risk, high-value initiatives.

The Department of Trade and Industry started negotiations without the benefit of prior involvement in developing the proposal

1.21 The Department of Trade and Industry (the Department) took over the negotiations in November 1999. As an important first step, the officials needed to develop their knowledge and understanding of MIT, and forge new relationships with the key people in the UK and the United States involved in the negotiation.

1.22 As indicated above, the Department had not been involved in the earlier negotiations, though the Treasury briefed officials at the handover. The Treasury had been concerned to act quickly to avoid the risk of losing the opportunity of a UK collaboration with MIT. Officials felt that involving other departments at the first stage of negotiations would cause delay and that it would be most effective to involve the Department at the point of agreeing the details, when it might be best able to help secure the outcomes and benefits of CMI. While we understand the Treasury's concerns, we consider that selective, well managed involvement of key officials from other departments could have been achieved without causing undue delay. Involving key officials from the Department of Trade and Industry in particular would have had a number of benefits both for the first-stage negotiations and for a smooth start to the second phase:

- certain of the Department's senior officials have extensive, direct experience in negotiating initiatives involving experimental research. Whilst the Treasury has its own experts, it could also usefully have drawn on the Department's experience in the first stage of negotiations without substantially increasing the numbers of people involved;
- senior officials from the Department could have used the period of first-stage negotiations to build their knowledge of MIT and the nature of the proposed initiative; and
- they could also have started developing relationships sooner with people in MIT and Cambridge University, and building realistic expectations for the negotiation of the second stage of the proposal.

The second-stage negotiations took much longer than Cambridge University or MIT expected

1.23 From Cambridge University's and MIT's perspectives, negotiations with the Treasury had already taken some time (Figure 3 - chronology of events - on page 7). MIT in particular expected, based on experience in the United States and the first-stage agreement negotiated with senior Treasury officials, that the negotiations with the Department would be completed relatively quickly.

1.24 The Department's officials were aware of the risks to innovation from introducing undue bureaucracy. They were, nevertheless, conscious of the need to set the initiative up in a managed way, paying due regard to the need to secure value for money from the substantial sum to be expended on CMI.

1.25 The parties therefore found themselves with differing perspectives that they needed to understand and come to terms with before the negotiations could get properly under way. An important feature of both the first and second stages was the separate discussions under way within each university - at the same time that they were negotiating with the Treasury and then the Department, the negotiators from Cambridge University and MIT also had to ensure academic staff in their respective universities would see CMI as valuable, and be prepared to commit time and energy to making it work.

1.26 People in both CMI and the Department have since suggested that, while the initial second-stage discussions were frustrating, the issues were handled professionally and constructively by all those involved, and important, long-term relationships began to be developed.

The Department did well to negotiate an offer letter that all parties could accept

Cambridge University and MIT expected to receive £68 million

1.27 The Treasury's commitment of up to £68 million for CMI was contingent on the Department and CMI successfully agreeing more detailed plans. In practice, Cambridge University and MIT fully expected to receive about this amount. One of MIT's three conditions of the collaboration (paragraph 1.7 on page 14) was that the scale of resources should match the effort it considered was necessary to do it properly. The Department's negotiations on the funding of CMI were therefore very challenging, and were constrained by the firm expectations of Cambridge University and MIT.

1.28 Eight months later, in July 2000, the Department ultimately offered £65.1 million towards CMI. It allocated the balance of £2.9 million to the Cambridge Entrepreneurship Centre, part of the Department's Science Enterprise Challenge (Figure 13 on page 22).

MIT was initially reluctant to meet the Department's conditions which it saw as bureaucratic and unrealistic

1.29 In its announcement of the framework agreement, the Treasury had proposed the following aims for CMI:

- to undertake education and research designed to improve the UK's entrepreneurship, productivity and competitiveness;
- to develop a research programme in fields likely to have a substantial impact on the future evolution of technology;
- to stimulate the development of technology-based business out of the academic base;
- to adapt MIT's business executive programmes to the UK;
- to develop common courses in science, technology, engineering and management for third year degree students; and
- to form a national network open to the Enterprise Centres at UK universities to offer courses and co-ordinate research activities in areas related to competitiveness, entrepreneurship and productivity.

1.30 The Department's task in the second-stage negotiations was to agree in more detail what CMI would deliver in return for the funding, and to balance a degree of management control with the need to leave room for experiment and innovation. In January 2000, Cambridge University and MIT put forward a written proposal for the collaboration. Although the proposal developed the framework agreement a little further, it contained no details of planned activities, budgets, delivery outcomes or targets. It also contained no justification or link to the planned costs, and the Department rejected the proposal.

1.31 MIT was, however, reluctant to agree to a precise specification, since it considered that a lot would change over the course of the initiative, and was concerned that over-specification would constrain CMI's ability to experiment and innovate. In contrast, the Department wanted to agree conditions designed to gain assurance about the value for money of the initiative and to ensure that the UK would benefit.

1.32 In order to agree detailed proposals, the parties had to be flexible and proceed pragmatically. By June 2000, when the final agreement was reached, the Department broadly accepted MIT's view that it could not realistically set detailed objectives, performance measures and targets at the outset without unduly inhibiting the initiative. For the same reasons, the Department felt unable to agree at the outset indicative objectives and measures with CMI, which would have been subject to regular review and alteration, and instead agreed an operating plan for the first year (paragraph 3.20). In our view, setting indicative objectives, which are used to help manage some innovative projects in the private sector, would have had a number of advantages:

- such an approach would have further clarified and drawn together the Department's and CMI's respective expectations; and
- the indicative objectives and measures would have provided a good basis for managing and monitoring the initiative. (This matter is further considered in Part 3 of our report).

1.33 The Department built substantial controls into the offer letter to mitigate risks to the value for money and good management of the initiative (Figure 6).

6 Controls that the offer letter specified

- Funding beyond the first year dependent on CMI's progress at the end of its first year of operations.
- Funding for each year conditional on the Department receiving satisfactory operating plans.
- CMI accountable to the Department for the proper expenditure of grant. CMI's Board of Directors, with an independent Chairman, responsible for the operation of CMI.
- Grant paid in arrears, against expenditure incurred, based on audited claims from CMI. Payments linked to progress achieved, thereby minimising the risks of payment without delivery. Right of the Department to refuse payment under certain specified conditions.
- Payments conditional on claims being consistent with CMI's operating plan.
- CMI required to underwrite the recovery of any grant due to fraud: legal guarantees from Cambridge University and MIT.
- Government representatives: observers at the CMI Board of Directors and members of CMI's advisory committee.

Source: Department of Trade and Industry

LESSONS LEARNED FROM THE SECOND STAGE OF SETTING UP CMI

- It is sometimes necessary to review and adapt standard practices and approaches to get commitment from people and organisations outside of government.
- People outside of government will usually have very different expectations - considerable time and effort may be required to ensure these are understood and that they, in turn, understand the requirements of government. In particular, international collaborations will need to balance the expectations of differing national cultures and processes.
- Departments need to balance firm management against the need to leave room for experiment and innovation.
- Objectives and measures should not be set in stone - it is reasonable to set them indicatively at the outset and treat their subsequent review and alteration as an integral part of managing the initiative.

Part 2

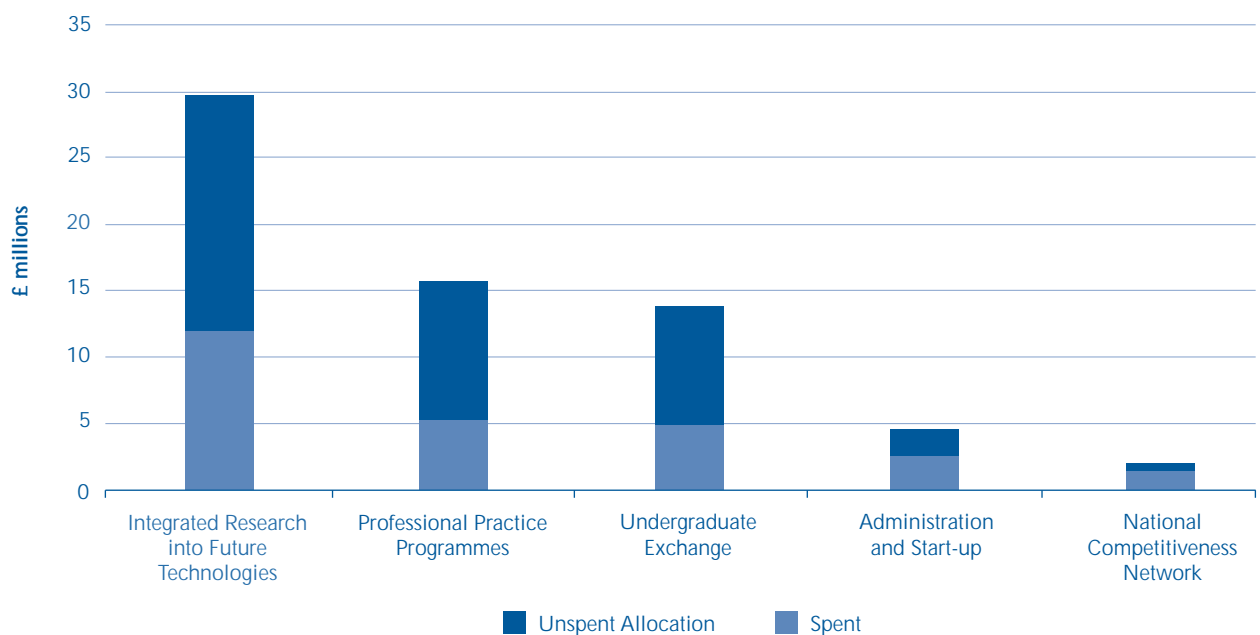
Cambridge-MIT Institute's current and likely future achievements

- 2.1 This part considers what CMI has achieved and what it is looking to achieve. It examines how the Department and CMI are seeking to measure the overall effectiveness of the initiative.
- 2.2 **Figure 7** illustrates the amount of funding that CMI has spent and committed in respect of its main types of activity. In addition, of the required £16 million private sector sponsorship (paragraph 1.14 on page 15), CMI has so far received £5.3 million and has secured a further £5.0 million.

CMI is testing ways of creating a climate for innovation

- 2.3 As an experimental initiative, the Department has mandated CMI to take risks in order to generate imaginative scientific and technological solutions. The Department recognises that some projects may not realise direct benefits but will still have value because they provide lessons for developing future projects. CMI is expected to use its resources to undertake those activities that, due to its particular collaboration and funding arrangements (see paragraph 2.10), CMI is best placed to take on. Its activities fit different frameworks for encouraging innovation (**Figures 8 and 9 overleaf**), and the results will be used to identify which are the most successful for developing entrepreneurship.

7 Research receives most public funding



NOTE

At November 2003, £27 million of public funds had been spent.

Source: Cambridge-MIT Institute, November 2003

8 Frameworks for encouraging innovation

Framework	Examples
■ teaching entrepreneurship	■ CMI sponsors new MPhil courses at Cambridge University in bioscience enterprise, technology policy, engineering for sustainable development and chemical engineering practice. It is currently developing courses in computational biology and nano - and micro-technology enterprise. All these courses have about two-thirds technical content and one-third business and entrepreneurship skills.
■ broadening student experience	■ Up to 100 undergraduate students per year, from twelve MIT departments and eight Cambridge University departments, spend a year in the other institution. The year at Cambridge University or MIT counts towards their degree.
■ training university professionals	■ CMI sponsors courses in technology transfer, creating spin-off companies and licensing intellectual property.
■ facilitating collaboration between research and industry	■ CMI has set up four knowledge integration communities (Figure 9) comprising academics, representatives from industry, business and public bodies working together on research with a commercial aim.
■ encouraging entrepreneurial networking	■ CMI brought together 70 undergraduates from five UK universities and MIT, to learn about entrepreneurship, in a week-long "Connections" course. Connections has now been run four times and another is planned. Graduates who have already set up businesses have come back to brief students.
■ sharing lessons with other universities	■ The National Competitiveness Network involving some 60 universities meets quarterly and holds an annual competitiveness conference.

Source: National Audit Office

Many of CMI's key outcomes will not be realised for some time

2.4 CMI is operating in an area of investment where many outcomes are long term. Many of CMI's activities are catalysts for long-term impacts on the economy (**Figure 10**) to be achieved through improving the way UK universities work with industry, and by influencing government policy on knowledge exchange programmes. The majority of CMI's impacts will not be evident until long after public funding ends in 2006. It will not be possible to evaluate fully the value for money of CMI for some years.

Many outcomes are complex and intrinsically difficult to measure

2.5 Many of CMI's outcomes are also difficult to attribute and measure. For example, the silent aircraft project (**Figure 11**) is a good example of pioneering work by CMI that is expected eventually to have large impacts for the economy and the environment. However, there may be many reasons for any future changes in volume of airport traffic and the resultant impact on the economy. Separating out and measuring CMI's contribution through this one project will be challenging, let alone any measure of its overall impact on the UK economy in terms of competitiveness, productivity and entrepreneurship.

There have been some early successes

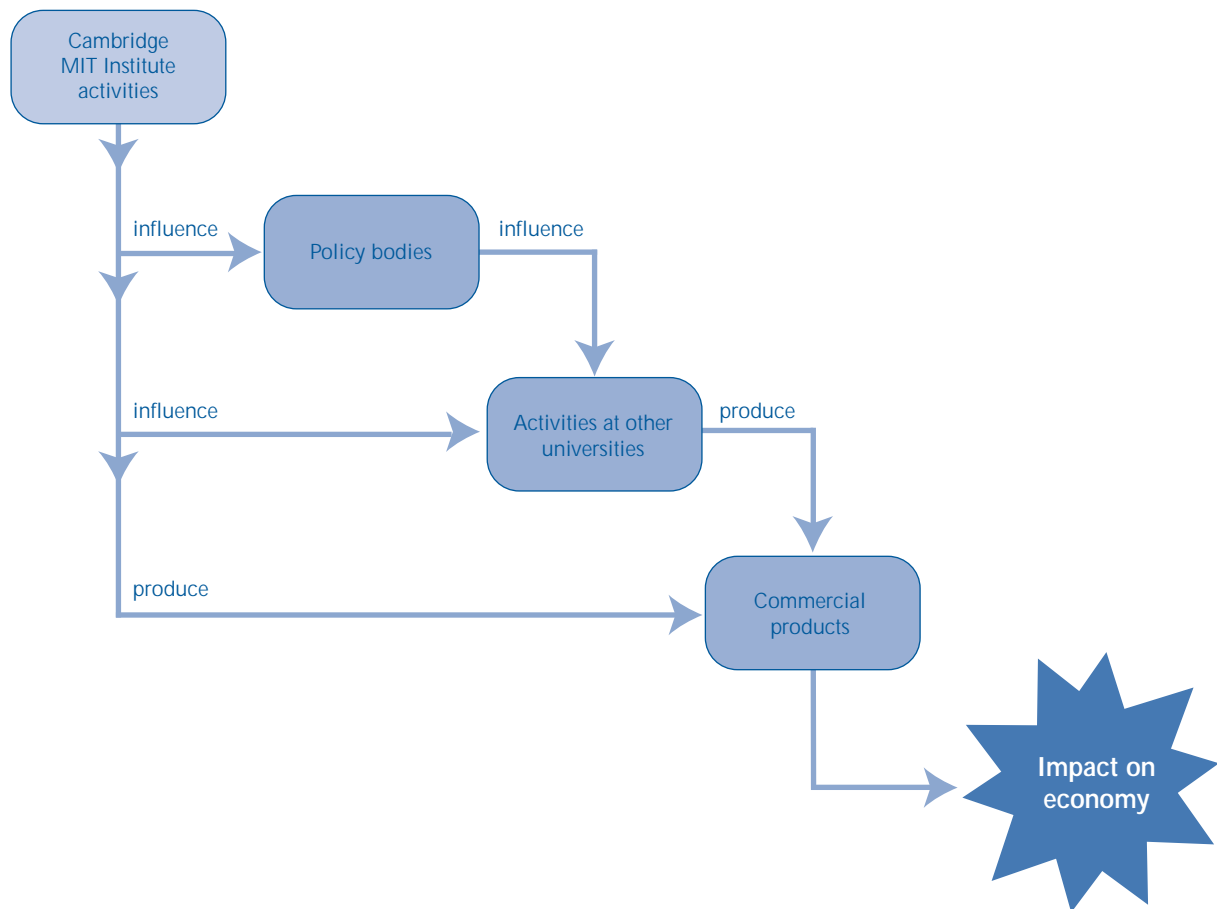
2.6 CMI's early successes have been mainly in education, entrepreneurship and knowledge exchange. For example, it has established communities of academics, representatives from industry, business and public bodies, to work together on research towards a commercial product. CMI is seeking to involve venture capitalists at an early stage, to ensure viability for funding. These knowledge integration communities (**Figure 9**) are designed to contain all the elements of the industrial supply chain required to bring about a transition from research to a product or impact on the economy.

9 Knowledge integration communities

Silent aircraft (Figure 11)	£2.4 million
Systems biology (a step on the road to towards personalised medicine)	£2.5 million
Connected worlds (including major programmes on communications innovations, disruptive technologies (those that fundamentally change the way we do things), and the management of innovation and competitiveness)	£6.1 million (including £1.75 million private funding)
Pervasive computing (mobile computing with novel devices)	£2.2 million

Source: Cambridge-MIT Institute

10 CMI's activities are catalysts for long-term impacts on the economy



Source: National Audit Office

11 The silent aircraft project

The silent aircraft project, in which CMI is investing £2.4 million, aims to discover ways to reduce aircraft noise to a level that could be virtually unnoticeable to people outside an airport's perimeter.

CMI has created a community of leading academics from Cambridge University and MIT, and representatives from the civil aerospace and aviation industry. These include British Airways, Rolls-Royce plc, the Civil Aviation Authority, regional aerospace company Marshall of Cambridge, and National Air Traffic Services. This unique community (one of CMI's knowledge integration communities - Figure 9) works together on the project, sharing knowledge and developing aircraft design.

The ultimate output of the three-year project will be the design of a 'silent' aircraft. The anticipated long-term outcome is the adoption of the design for production of commercial aircraft. These silent aircraft would help meet passenger demand for more flights, by creating opportunities for new airports, and allowing increased operations at existing airports. The effects on local and wider economies may not be felt for some time after the CMI initiative ends.

Source: Cambridge-MIT Institute

- 2.7 CMI has developed and runs courses on technology transfer - which is the application of technology and expertise to novel situations, leading to the commercialisation of a product (Figure 12 overleaf). 233 people from 110 organisations have attended these courses across the UK, and course feedback indicates that they have helped participants to learn from the experiences of other professionals in the field.
- 2.8 CMI has developed and launched post-graduate programmes in Bioscience Enterprise, Engineering for Sustainable Development, and Technology Policy. Also, students from five UK universities and MIT have attended networking events for would-be entrepreneurs. Students have reported that the courses and events gave them skills to undertake entrepreneurial projects as well as the confidence and contacts to do so.

12 Praxis technology transfer courses

Technology transfer is increasingly recognised as a discipline in its own right, requiring trained and experienced professionals to help increase the chances of technology being transferred successfully to commercial purposes. CMI runs courses under the name Praxis for staff in industry, research institutions, and universities' technology transfer offices. They are generally professionals who give advice on patents, copyright and contracts. They also facilitate the commercial development of intellectual property (research findings) by newly set up and established companies.

CMI's courses cover the legal issues around patents and copyright, negotiating and licensing skills, marketing and creating spin-off companies.

Praxis recently bid in open competition for funding from the Higher Education Innovation Fund (Figure 13). Funding of £1million was awarded to a partnership involving Praxis, the Association for University Research and Industry Links, and University Companies Association to further develop training programmes to meet identified national demand.

Source: Cambridge-MIT Institute

2.9 CMI shares its research findings, educational material and emerging best practice in the promotion of competitiveness, productivity and entrepreneurship at quarterly meetings of its National Competitiveness Network. CMI set up the network in response to a Treasury requirement to disseminate its findings. The network incorporates the Department's thirteen Science Enterprise Centres, which have a membership of over 60 universities. Network members also include Regional Development Agencies, research organisations, business and industry. The network was the originator of the idea for executive education courses, such as the Praxis course on technology transfer (Figure 12).

2.10 CMI operates alongside the Department's four other streams of funding for knowledge exchange, which aim to increase collaboration between scientific research and industry (Figure 13). However, its focus on ongoing, concentrated collaboration between two leading research universities in the United States and the UK is unique. A large part of CMI's achievements appears to derive from the mixing of two different cultures over a long period of collaboration, allowing time to consider how the best elements of each can be applied to good effect in a different environment and country. Funding CMI as an entity rather than on a project basis also enables it to work flexibly across all areas of knowledge exchange, including collaboration with industry.

13 Other knowledge exchange initiatives funded by the Department

Programme	Total funding (£ millions)	Funding period	Aims
Science Enterprise Challenge Rounds 1 and 2 (UK-wide)	44.5	1999-2004	To foster the commercialisation of research and new ideas. To stimulate scientific entrepreneurship. To incorporate the teaching of enterprise into the science and engineering curricula. To support centres of excellence for the transfer and exploitation of scientific knowledge and expertise. The scheme is based on 13 Science Enterprise Centres involving around 60 universities.
University Challenge Rounds 1 and 2 (UK-wide)	45	1999-2004	Provides seed funds to help transform good research into good business.
Public Sector Research Establishment Fund (UK-wide)	15	2001-2004	As for the Higher Education Innovation Fund and University Challenge, but for Public Sector Research Establishments.
Higher Education Innovation Fund 1 (England only)	80	2001-2004	To help universities build their capacity to collaborate with business.
Higher Education Innovation Fund 2 (England only)	131	2004-2006	To help universities build their capacity to collaborate with business and to commercialise their research, incorporating activities previously funded under Higher Education Innovation Fund 1, Science Enterprise Challenge, and University Challenge.

NOTE

A further £60 million and £56 million are provided by the Department for Education and Skills for Higher Education Innovation Funds 1 and 2 respectively.

Source: Department of Trade and Industry

CMI and the Department are producing models for evaluating innovative projects

2.11 One of CMI's key activities is to develop models to evaluate knowledge exchange initiatives. As part of this, it is currently developing proxy measures to evaluate its own achievements. For example, it is seeking to measure success in terms of benefits to CMI's stakeholders (Figure 14), compared to the benefits from other similar initiatives.

2.12 The Department is working separately to develop ways to measure the value for money of its knowledge exchange initiatives. It is in the process of appointing consultants to assess CMI as part of an evaluation of all five initiatives (CMI plus the five listed in Figure 13) during 2004. The consultants will assess the effectiveness of expenditure on knowledge exchange, and identify gaps in capabilities and good practice lessons that might be transferable between institutions and between initiatives.

14 Anticipated benefits to stakeholders

Students	Confidence to work across disciplinary and geographic boundaries, empowerment and skills to enable knowledge exchange.
Academic staff	Stimulating interaction, sources of support, greater potential impact of their work, associated recognition.
Universities	Enhancement of role, demonstration of economic impact, associated public and private support.
Entrepreneurial community	More rapid and robust uptake of knowledge into competitive impact.
Industry	Better exchange and uptake of knowledge, with associated competitiveness benefit.
Regions, Government	Universities engaged as engines of economic growth, creation of companies and jobs linked to high-value knowledge-driven innovation.
UK population	Stable and meaningful jobs, and a higher standard of living.

Source: Cambridge-MIT Institute

LESSONS LEARNED ON ACHIEVEMENTS

- Some of what made CMI a difficult initiative to get established is also leading to good results - for example, the culture differences that initially affected the relationships between the universities and the Department are providing lessons for new approaches to university/industry collaboration.
- Impacts of this kind of initiative are likely to extend well into the future.
- CMI may have still further impacts that were not anticipated and are not yet known.
- Because of the likelihood of long-term impacts, there needs to be a long-term programme for evaluation.

The Cambridge-MIT Institute
Regional Studies
Rethinking the Regions and Regional Competitiveness

Examples

- Industry support associations (San Diego BIOCOM, MassMedic)
- Small business support organizations (North Carolina Center for Entrepreneurial Development, Mass Biomedical Initiatives, WPI Venture Forum)
- Institutions focusing on commercialization of technology (MIT Technology Licensing Office)
- Real estate development organizations (Worcester Business Development Corporation)



Part 3

How Cambridge-MIT Institute has been managed

3.1 This part considers the way the Department has monitored CMI, and how CMI itself has been managed.

Setting up CMI proved to be a much bigger task than anticipated

- 3.2 There was no precedent for the work involved in setting up CMI and it proved a larger task than anticipated. A new infrastructure had to be developed to provide ongoing management, and to complete a strategy and work programme. In effect, the Executive Directors established a start-up company, with the complication of being controlled and owned by two universities, operating within two different legal systems.
- 3.3 A large amount of time and effort was required to recruit and train suitable staff - including world-class academics - to devise organisational strategies and policies, and to set up new systems. This reduced the time available to start feasibility work on actual projects and activities.
- 3.4 The feasibility work involved holding workshops to help determine the kind of activities that CMI might undertake. Research and other groups needed to be formed to help develop relations between experts and managers. Some projects and activities had to be deferred where the academic staff in Cambridge University and MIT needed to lead the projects had already made other commitments for the 2000-01 academic year.
- 3.5 Setting up CMI involved a substantial amount of work. Officials from the Department and the Treasury were observers on CMI's Board, to ensure that it was being managed appropriately and that progress was being made.

Limited usefulness of standard monitoring mechanisms and overoptimistic expectations made it difficult to assess whether progress was reasonable

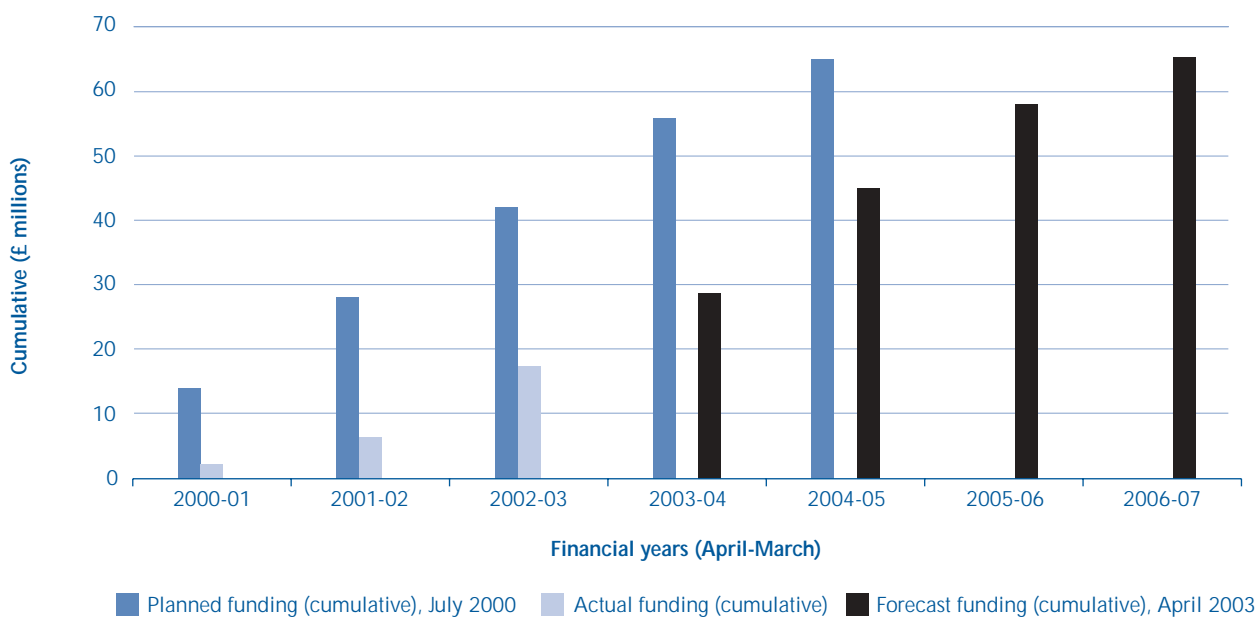
- 3.6 Innovative research by its nature requires freedom to explore different avenues. At the same time, where such research is funded by government, it has to operate within public sector accountability requirements. The Department and CMI agreed broad aims for CMI, but MIT and Cambridge University were unable at the start of the project to provide the kind of detailed, testable objectives and specific output measures that would allow value for money to be readily assessed. CMI agreed its first operating plan with the Department in June 2000 and was required to provide a more detailed operating plan by 31 October 2000. The Department expected that CMI would then set clear objectives for the whole initiative during the first year. However, CMI's Executive Directors did not feel able to do so because they considered that setting objectives at the time would constrain CMI's potential for innovation.
- 3.7 The Department had ongoing discussions with CMI's Executive Directors and Board on the importance of developing performance indicators to objectively measure progress against plans and longer-term objectives. For its other knowledge exchange initiatives (Figure 13 on page 22), the Department usually measures progress by reviewing annual reports for evidence of outputs against pre-set milestones towards agreed objectives. This was not possible for CMI in the absence of such milestones, and the Department's close, "hands on" approach to monitoring was essential.

- 3.8 Because there were no detailed objectives or milestones, the Department and CMI agreed a funding profile based on limited information. The profile reflected high expectations that activity would gather momentum quickly, but it proved overoptimistic. The Department had explicitly made payment of grant conditional on progress, to minimise the risk of payment without delivery, and actual expenditure was well below the profile (Figure 15). At July 2003, three years on from the agreement of the offer letter, CMI had spent only one-third (£21 million) of the £65 million five-year total. Expenditure in the first two years was very low.
- 3.9 In October 2002, CMI asked the Department for an extension to its programme, which was originally intended to operate from the year 2000 for five years, to allow its next set of projects to run for up to three years. The Department agreed the extension in principle, conditional on improved cash flow forecasting and, in June 2003, formally agreed a one-year extension. It will now run for a total of just over six years (spanning seven financial years) but the funding commitment will remain the same, at £65.1 million.

The Department worked with CMI to address concerns about the development of the initiative and is now able to assume a more "arm's length" monitoring role

- 3.10 The Department was committed to CMI's success and actively followed its activities. Departmental (ongoing) and Treasury (until September 2003) officials have been observers on the CMI's Board of Directors and members of its advisory board from the outset (Appendix 1 on page 32 shows the current membership of these boards and the audit committee). In addition, the Department's officials have maintained regular, informal contact with CMI staff, and held frequent meetings with CMI's two Executive Directors - one from Cambridge University and one from MIT - and CMI's other staff. The regular contact helped forge good working relationships, but has taken more departmental time and resources than originally envisaged.
- 3.11 By January 2001, the Department had become seriously concerned about CMI's slowness to spend and to develop effective systems for approving projects, and about its financial accountability and expertise. It commissioned the former auditing firm, Arthur Andersen, to review decision-making systems and expenditure controls, and CMI's processes for ensuring it delivered agreed outputs. It also asked the firm to make value-added recommendations for improving CMI's performance.

15 Use of funding has been much slower than planned



NOTES

- 1 A one-year no-cost extension of CMI's funding covers the financial years 2005-06 and 2006-07.
- 2 The amount funded by the Department does not equal the amount spent by CMI (Figure 17 on page 28) at any given time, because the Department funds CMI retrospectively.

Source: Department of Trade and Industry data, as at April 2003

- 3.12 Reporting in July 2001, the review led the Department to conclude that CMI would not have met the terms of the offer letter by the end of its first year - it had not delivered the activities set out in its first year operating plan, and did not appear to be in a position to deliver the activities in its second year operating plan.
- 3.13 The Department had to judge whether to continue to provide funding to CMI or withdraw the grant for subsequent years. It decided to take a positive approach to continuing to work with the two Executive Directors, because of the start-up difficulties that CMI had encountered and the fact that little of the grant had been used. To underpin the joint efforts, the Department made continued funding dependent on CMI taking remedial action and committing to implement the review's recommendations. Following a further review by the auditing firm, Arthur Andersen, in December 2001, the Department agreed to continue funding subject to CMI continuing to meet the conditions set out in the offer of grant. **Figure 16** outlines some of the first review's recommendations and when they were implemented.
- 3.14 With improved management systems in place, the Department is able to assume more of an "arm's length" monitoring role. CMI's audit committee (Appendix 1) is now responsible for ensuring the adequacy of internal controls and for managing risk.
- 3.15 The Department is working closely with CMI to identify, assess, and regularly review common and individual risks. A key risk identified is that CMI, or parts of the initiative, may not be sustainable when public funding ends. The Department has therefore extended CMI's flexibility to negotiate partnership agreements to take its work forward in the future, and CMI's two Executive Directors are looking into a range of options for continuing CMI's various activities.

CMI provides lessons about the skills and experience required to manage an innovative and complex initiative

- 3.16 Cambridge University and MIT appointed CMI's Executive Directors using standard procedures for appointing to academic posts. The Department had no role in helping to set the selection criteria for these posts when CMI was first established.
- 3.17 The job requirements for CMI's Executive Directors differ substantially from those for most academic posts. They involve skills in setting up and managing a start-up company, including recruiting staff, arranging accommodation and setting up IT and other systems.
- 3.18 The first two Executive Directors were senior academic staff who undertook their new and demanding roles in addition to retaining some academic commitments. All concerned underestimated the time and commitment that would be needed from them to set up and manage CMI. The posts were part-time, although the post holders needed to work almost full-time on the challenging day-to-day job of setting up CMI.
- 3.19 The difficulty with these arrangements was acknowledged with the Executive Director appointments in January 2003. As well as being effectively full-time, the posts have clearly defined responsibilities. Also on this occasion, the Department gave advice to the universities on the skills and expertise required for the posts. We observed that there continues to be frequent contact and a high level of openness between the Executive Directors and departmental officials.

16 Progress on recommendations arising from external review of CMI

CMI should set operational milestones for individual projects and programmes of activity. Milestones should be reported together with the relevant financial information.	Implemented between late 2001 and May 2002.
CMI should finalise its procedures for approving project funding.	Implemented between October 2001 and April 2003.
CMI should establish accounting procedures to allow strong controls over the commitment and expenditure of funds.	Implemented between August 2001 and May 2002.
CMI should adopt commercial style accruals accounting for reporting purposes, when accounting processes moved out of the University system and into CMI's stand-alone system.	Implemented between August 2001 and August 2002.
A finance officer should be installed at Board level.	Since May 2002, the Audit Committee includes the financial officers of both universities.
The Board should regularly review the developing research portfolio to ensure consistency with CMI objectives.	Implemented between September 2001 and February 2002.

Source: Arthur Andersen and Cambridge-MIT Institute

Management of CMI has developed to become more systematic over the course of the initiative

There have been year-on-year improvements in the quality of operating plans, reports on progress and forecasting of cash flow

3.20 The Department has helped CMI to develop meaningful operating plans. The first year's operating plan consisted of a list of planned activities, with high-level anticipated outcomes. In contrast, the fourth year operating plan contains quarterly milestones towards pre-determined objectives for all projects receiving funding.

3.21 The Department has also worked with CMI to improve its quarterly progress reports. They now include details of activities and spend against forecasts, and explanations of variances. The reports are equally useful to CMI's own managers as for the Department's officials.

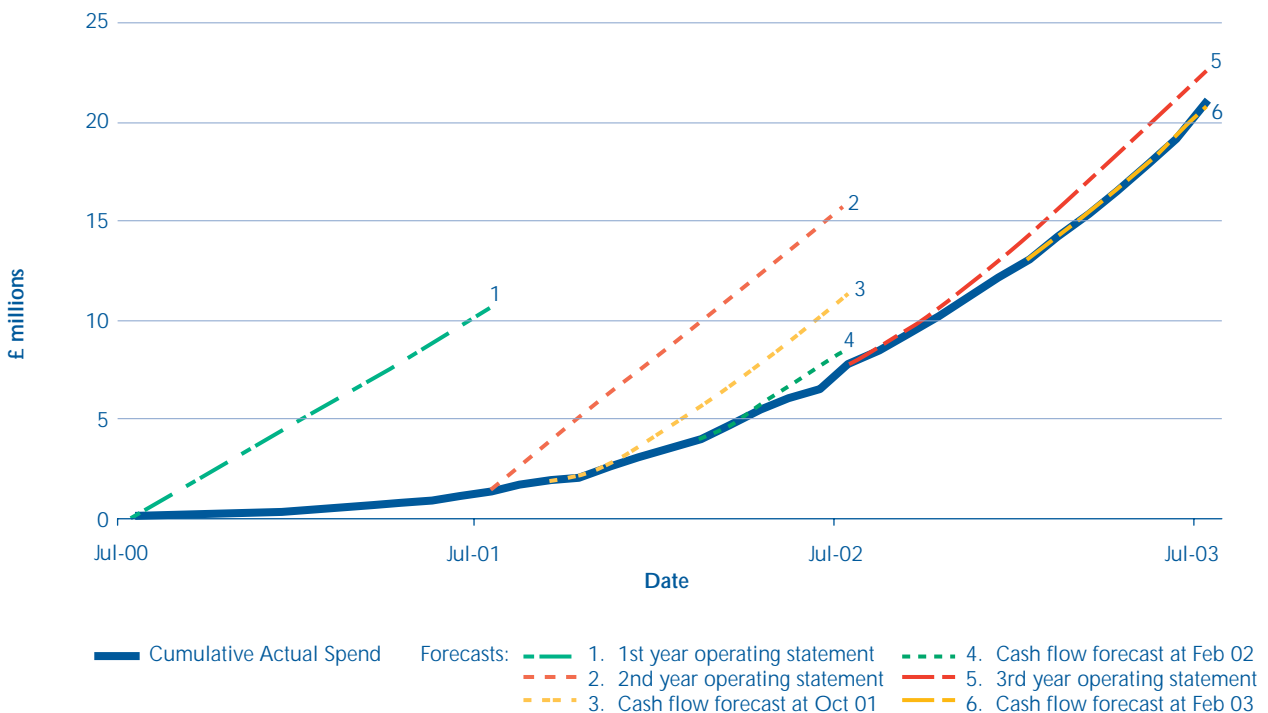
3.22 An area of particular emphasis for the Department has been the need for CMI to improve the accuracy of its cash flow forecasting, which has been unrealistically high (Figure 17). Prior to 2003, the monthly spend was routinely less than half the forecast. More recently, forecasting has improved - in the period August to October 2003 spend of public funds was 7 per cent higher than the forecast.

A mid-term review has put CMI in a good position to make progress

3.23 On taking up post in January 2003, the Executive Directors decided to undertake a thorough review of CMI. The review involved:

- looking afresh at CMI's goals;
- an extensive consultation of stakeholders, including the Department, the Treasury, Cambridge University, MIT, other universities, and people from industry and business; and
- redesigning CMI's mission and producing, in April 2003, a detailed new strategy.

17 CMI's cash flow forecasts have been unrealistically high



Source: National Audit Office analysis of Cambridge-MIT Institute annual reports and operating statements

3.24 CMI's overall aims are unchanged, but the new strategy focuses on CMI's work in three key areas - educational programmes, research projects, and innovation in university-industry collaboration. It sets some measurable objectives, which link CMI's activities to its overall aims. Using this strategy as a starting point, CMI is developing metrics for overall evaluation of the initiative.

Project appraisal and project monitoring by CMI has improved

3.25 In April 2003, CMI issued a call for project proposals to fit with its strategy. It received 167 proposals, and selected 18 for further consideration as potential knowledge integration community projects. Unusually, CMI asked the leaders of related proposed projects to work together to develop single proposals. The rationale for its request was to bring different teams together to take advantage of their shared knowledge and expertise. The further work resulted in four knowledge integration communities. CMI also took forward 15 proposals for joint Cambridge University-MIT research, and awarded funding to seven.

3.26 As part of the April 2003 call for project proposals, CMI devised new selection criteria and a formal project appraisal and evaluation process. The process is largely based on the process used by research councils to decide funding for academic research projects, which focuses on the research achievements of the project leader, the quality and scope of the proposed research, and its fit with the research council's objectives.

3.27 We analysed the extent to which CMI's old and new procedures for evaluating proposals accord with good practice by comparing them with those identified in Treasury guidance and previous National Audit Office reports. We reviewed 16 CMI projects, of which nine were awarded using the new appraisal process. Although all had been subject to some appraisal, we found that for those appraised prior to the call for new proposals in April 2003, there was little documentary evidence that the approach had been followed systematically. In contrast, records demonstrated that the more recent proposals had been appraised against pre-defined criteria. They were subject to internal and independent external reviews to assess their value and the reasons for the project (example provided at Case Study A). The new process also includes a check that a proposed project will demonstrably contribute towards CMI's overall aims and strategy (example provided at Case Study B overleaf).

3.28 CMI's assessment of projects includes a check to ensure that alternative ways to meet CMI's aims are fully explored and pursued (example at Case Study C overleaf).

3.29 In view of the substantial public investment in CMI and its goal to innovate, it is important that the activities it undertakes are unique and that it does not replicate work that is or could be done by other organisations. Although at first sight one of its flagship projects, which provides technology transfer courses (Praxis - details in Figure 12 on page 22), appears to replicate other organisations' activities, we found that Praxis has unique aspects in its depth of coverage, teaching style and target audience.

CASE STUDY A

Reasons for funding a project

CMI asked independent, external referees to assess the **silent aircraft** project in terms of its high-level goal of enhancing the productivity, entrepreneurship and competitiveness of the economy. The initiative aims to discover ways to reduce aircraft noise to be virtually unnoticeable to people outside the airport perimeter.

The referees considered that the silent aircraft initiative was of enormous commercial importance and welcomed the involvement of industry and public agencies.

Internal CMI reviewers also rated the proposal highly, judging it to be "what CMI is all about". They praised the project's specific research deliverables and milestones, and its potential to have a major impact on the aeronautical industry.

Source: National Audit Office analysis of Cambridge-MIT Institute evidence

CASE STUDY B

Ensuring that a project fits CMI objectives

Three independent referees assessed the proposal for a research project on **Universities and Their Role in Systems of Innovation** against CMI's mission and strategy. The project will evaluate the effectiveness of different mechanisms for university-industry exchange and research the impact of location in a global economy.

Specifically, the referees judged that the project would achieve results that could not be achieved on a comparable timescale by the universities acting alone. They also considered that it would contribute to a better understanding of innovation and entrepreneurship in both Cambridge University and MIT.

Source: National Audit Office analysis of Cambridge-MIT Institute evidence

CASE STUDY C

Considering alternative ways to meet CMI goals

Several different research teams asked CMI to fund proposals relating to biology and biological innovation.

CMI picked the best five proposals and asked the relevant research teams to work together to develop a single proposal for one over-arching, wide-reaching project, with clear commercial collaboration. CMI agreed to fund the resultant **Systems Biology** project covering tissue regeneration and reaction to drugs, and treatments for cancer and diabetes.

Source: National Audit Office analysis of Cambridge-MIT Institute evidence

Though CMI operates in a research environment, it could usefully draw on some general good practice in appraising projects

3.30 CMI's appraisal process is designed to be appropriate to the research environment it operates in. The process needs to take account of the real risk that the best academic staff and researchers may be deterred from making proposals if they perceive the process for appraising them to be unduly bureaucratic.

3.31 In our view, there are nevertheless other settings from which CMI could usefully draw good practice in appraising projects. For example, although the academic reviewers consider the likely scientific benefits of proposed projects, their review does not quantify the likely costs and benefits to CMI. We believe it would be possible for CMI to assess short term, direct outcomes for some of its projects. For others, it should be possible to define broader likely outcomes, and to envisage a time by which costs and benefits, and the likely value for money of the project, could usefully be reviewed.

3.32 CMI's audit committee (Appendix 1) reviews ongoing organisational risks. Until recently, CMI did not assess or monitor the risks of individual projects during their funding periods, because it is not standard practice for research councils to do so. However, CMI's projects are, by design, innovative, experimental and high-risk and, reflecting this, there is a case for explicitly managing project risks as part of CMI's routine review of ongoing projects. As part of the mid-term review (paragraph 3.23), CMI has assessed risks to each of its projects and is taking steps to address them.

3.33 CMI has systems in place to evaluate projects and apply lessons learned (**Case Study D**). As a further part of the mid-term review, CMI is considering the achievements of each live project, assessing whether funding should continue, and whether to change any of the project's planned activities.

CASE STUDY D

Evaluating a project and applying the lessons learned

CMI asked an independent consultant to evaluate the first year of its **MPhil in Biosciences/Biomedical Enterprise**, for consistency with its aim to promote entrepreneurship and innovation. The course seeks to provide students with the business understanding and skills to enable them to become entrepreneurs.

Survey results showed that, because of the course, students considered they had more potential to act as innovators, and had more networking contact with high-tech companies. Other universities were also picking up elements of the course. The consultant took the view that the course would contribute to UK competitiveness in the long term.

The consultant made recommendations to improve the planning, structure, management and value for money of the course. CMI is taking these recommendations forward.

Source: National Audit Office analysis of Cambridge-MIT Institute evidence

LESSONS LEARNED FROM MONITORING AND MANAGING CMI

- Key relationships take time to build, especially in an experimental environment where expectations may vary widely.
- Realistic plans need to be made for the time and skills required to set up the infrastructure - staff, systems and material resources - for challenging and complex initiatives like CMI.
- Those responsible for the initiative should formally monitor progress against the plans for the set up.
- Innovative, unusual initiatives require substantially more departmental resources for monitoring, because some of the monitoring is likely to need to be direct and personal rather than based on standard, periodic reports.
- The Department/funder should be involved in deciding the skills requirements of the people running the initiative.
- The CMI experience provides a good source for the Department to develop guidance on setting up a start-up company in the field of experimental innovation.
- Innovative and unusual initiatives may require non-standard funding profiles, and the initial profile will need to be regularly reviewed.
- A clear strategy drawing on consultation with stakeholders should be required of all initiatives within the first year, and should be reviewed at an agreed point in the life of the initiative.
- A mid-term review (of strategy, progress, achievements etc.) should be standard for assessing the progress of initiatives that require a relatively un-measurable, formative start-up period and need to be able to exploit both expected and unexpected impacts.
- Whilst a period of experiment and learning is essential, initiatives like CMI should move quickly to develop and adopt good processes for appraising and managing their activities.
- High-risk initiatives and projects should be managed using processes for assessing costs and benefits, and for identifying and managing risks.

Appendix 1

CMI's Board of Directors, advisory board and audit committee

Board of Directors

Name	Position	Organisation
Lord Trotman of Osmotherley	Chairman	Chairman, ICI UK
Professor Michael Kelly	Executive Director	Prince Philip Professor of Technology, Cambridge University
Professor Edward F. Crawley	Executive Director	Professor of Aeronautics and Astronautics, MIT
Professor Phillip Clay	Non-executive Director	Chancellor of MIT and Professor of City Planning, MIT
Professor Ann Dowling	Non-executive Director	Professor of Mechanical Engineering, Cambridge University
Professor Alison Richard	Non-executive Director	Vice Chancellor, Cambridge University (from 1 October 2003, previously Professor Sir Alec Broers)
Dr Charles Vest	Non-executive Director	President, MIT

Board observers are:

- Sir John Taylor, Director General of the Research Councils, Department of Trade and Industry (until January 2004).
- Sir Keith O'Nions, Director General of the Research Councils, Department of Trade and Industry (from January 2004).
- Mr James Sassoon, Managing Director, Finance, Regulation and Industry, HM Treasury. (Stepped down from observer role in September 2003; the Treasury no longer observes Board meetings).

Advisory board

Name	Position	Organisation
Professor Neil Alford	Senior Adviser	The Gatsby Charitable Foundation
Mr Nick Butler	Group Policy Adviser (alternate)	BP plc
Professor Edward F. Crawley	MIT Executive Director	CMI
Professor Gordon Edge (Chairman)	Executive Chairman	Scientific Generics
Dr Dougal Goodman (Advisory Board Associate)	Director	Foundation for Science & Technology
Mr Stephen Heal	Senior Manager	The Boston Consulting Group
Dr Chris Henshall	Group Director, Science and Engineering Base	Office of Science and Technology (Department of Trade and Industry)
Professor Michael Kelly	Cambridge University Executive Director	CMI
Dr Jean-Louis Lievin	Head, Brand and Communication	BT Exact Technologies
Mr Tony Meggs	Group VP of Technology (alternate)	BP plc
Lord Ron Oxburgh	Department of Earth Sciences	University of Cambridge
Ms Ruth Thomas	Director for Higher Education Strategy and Implementation Group	Department for Education and Skills

Audit committee

Name	Position
Professor Ann Dowling (Chair)	Professor of Mechanical Engineering, Cambridge University
Professor Phillip Clay	Chancellor of MIT and Professor of City Planning, MIT
Jim Morgan	Financial Controller, MIT
Andrew Reid	Director of Finance, Cambridge University

Appendix 2

Methodology

Interviews

We interviewed key personnel from the Treasury who helped commence the initiative, and from the Treasury and the Department of Trade and Industry who are involved in on-going management and monitoring of CMI.

Interviewees included the current CMI Executive Directors, Professors Michael Kelly (Cambridge University) and Edward Crawley (MIT), as well as previous Chief Executives Dr David Livesey (Cambridge University) and Professor John Vander Sands (MIT). We also spoke to Dr Daniel Roos (MIT), who helped to set up the initiative and to Lynne Mansfield, CMI's Finance Manager.

We spoke to personnel in the Department's Office of Government Commerce.

We contacted the Association for University Research and Industry Links, and took advice from a highly experienced entrepreneur, Sir David Cooksey, on how innovative projects should be appraised and managed.

Document examination

We examined the Treasury's and the Department's documents on setting up CMI, and the Department's documents on managing and monitoring CMI.

We reviewed reports on CMI by Arthur Andersen, and CMI's and the Department's internal auditors.

We reviewed documents at CMI's premises in Cambridge, including reports sent to the Department for monitoring purposes. In particular, we examined documents relating to 16 CMI projects. We reviewed the 16 projects in the light of good practice in project appraisal monitoring and (where applicable) evaluation, based on guidance from the Treasury (Green Book: Appraisal and Evaluation in Central Government), the Office of Government Commerce (Management of Risk and Gateway Review documents), the Higher Education Funding Council for England and previous National Audit Office reports.

Our sample included projects that had been appraised under each of the new and the old arrangements. We chose some projects that were new, and others that had been completed and evaluated.

The CMI projects reviewed were:

- Quantum information
- MPhil in environmental engineering
- Praxis
- Supply chains under stress
- Universities and their role in systems of innovation
- Security of crypto APIs (use of cryptographic processing for design of security interfaces between computer applications)
- Biosciences/biomedical enterprise phase 1
- TPP phase 1 (joint curriculum development between MIT's Technology and Policy Programme and Cambridge University)
- Preparatory study of new ultra-light metallic sheet material
- Silent aircraft
- Building the golden chain (toolsets and educational programmes for business advice supporting technology enterprises)
- Fostering student enterprise
- Entrepreneurial activities
- Development, deployment and use of D-space (a digital information repository)
- Pervasive computing
- Systems biology