



Report by the
Comptroller and
Auditor General

Department of Trade and Industry: The Alvey Programme for Advanced Information Technology

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Comptroller and Auditor General

National Audit Office
15 March 1988

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Contents

	<i>Pages</i>
Summary and conclusions	1
Part 1: Introduction	5
Part 2: Administration and Financial Control	8
Part 3: Collaboration and Participation in the Alvey Programme	12
Part 4: Exploitation of Alvey Funded Research	15
Part 5: Skills Shortages	19
Part 6: Other Information Technology Schemes	23
Glossary of Abbreviations	25
Appendices	
1. Definition of the Alvey Committee's enabling technologies	27
2. Summary and recommendations of the Alvey Report	28
3. Expenditure on the Alvey Programme	29
4. External evaluators' studies	30
5. Procedures for strategy formulation and project appraisal	31
6. Framework for Intellectual Property Rights and Collaboration in the Alvey Programme	33
7. Firms participation in the Alvey Programme	38
8. The Large-Scale Demonstrators	39
9. Examples of Government schemes aimed at promoting technology in education	40
10. Information Technology Skills Agency: terms of reference	43
11. Recommendations of the Bide Committee	45

Summary and conclusions

1. Information Technology (IT) is concerned with collection, storage, processing, transmission and presentation of information by electronic means. It is essential to the competitiveness of virtually all manufacturing and service industries, and has a fundamental impact on society.
2. This Report records the results of an examination by the National Audit Office (NAO) of the management and attainments of the Alvey Programme for Advanced Information Technology, which was intended to increase the competitiveness of the United Kingdom IT industry in world markets, by doubling the level of IT research in the United Kingdom over five years, and by meeting a series of detailed technical targets.
3. The Programme is funded jointly by Government (HMG) and industry, and is managed by a small unit – the Alvey Directorate (AD) – within the Department of Trade and Industry (DTI) but the Ministry of Defence (MOD) and the Science and Engineering Research Council (SERC) also participate mainly through staff seconded to the AD. The IT industry also second staff to the AD. Government expenditure to March 1987 amounted to £98 million.
4. The Report's main findings and conclusions are summarised below.

On administration and financial control of the Programme

5. The Government's decision that administrative responsibility for the complex collaborative projects under this major programme should be split between three Departments meant that there was a vital need for strong central administrative and financial supervision to hold the programme on course. External evaluations of the Programme's effectiveness, commissioned by the AD and running parallel with the Programme itself, were expected to help identify improvements. The NAO found that there had been material weaknesses in administrative areas. The main ones were:
 - (a) The involvement of three Departments gave rise to problems in contracting, financial control and funding of projects (paragraphs 2.8, 2.12, 2.19, 2.20, and 2.26).
 - (b) The AD did not initially establish central management and financial information systems so that provision of Programme data was slower, more labour intensive and less comprehensive and reliable than it should have been for complex Programme of this sort. An integrated computerised system was not introduced until mid 1987 – four years after expenditure on the Programme started (paragraphs 2.7 – 2.9).
 - (c) External evaluations had some influence on the direction of the Programme but this was limited mainly because they arrived late in

the Programme's life. The AD stated that they had not expected evaluations to influence the present Programme much but they would influence decisions on any future IT programme (paragraph 2.6).

(d) Project appraisals were thorough but the appraisal process caused delays. In 8 of the 42 cases examined 9 months or more elapsed between receipt of the final proposals and issue of offers to the contractors (paragraphs 2.17 - 2.18).

(e) Departmental monitoring of projects varied in standard and approach. But it was necessary, in the AD's view, to strike a balance between standardisation and giving reasonable autonomy to technology directors (paragraphs 2.20 - 2.23).

6. However, in spite of these weaknesses - which may have been partly caused by a lack of resources - the Programme succeeded in drawing up detailed strategies within 14 months and in getting 300 projects underway by March 1987.

On collaboration and participation

7. The Alvey Committee (paragraphs 1.3 to 1.6) regarded collaboration involving industry, academics and research organisations as fundamental to securing the best use of the nation's scarce resources. It also considered that there should be maximum access to the Programme, which was seen as particularly relevant to small firms. The NAO found that the Programme had generated a substantial amount of co-operation. The 187 full collaborative projects extant in 1986 had on average four partners, typically two or three firms and one or two universities. 72 per cent of academic groups and 58 per cent of the industrial firms had not previously worked with their Alvey partners (paragraph 3.8). However, NAO also noted that:

(a) Difficulties in establishing collaborative agreements had caused significant delays as well as withdrawals from the Programme, and most project managements considered that the AD should have done more to help (paragraphs 3.9 and 3.12 - 3.14).

(b) Participation in projects was dominated by large firms: five such firms accounted for 209 of a total of 428 industrial "participations" and the 35 small firms, who were participating, had only 51 "participations" between them (paragraph 3.19).

(c) The Alvey Board decided to spend more on academic research and on Programme administration and infrastructure than was originally intended. As a result, some £35 million less will be spent by Government and, under matching arrangements, also by industry on industry's research work under collaborative projects (paragraphs 2.13 - 2.15 and 3.18).

On exploitation of the Alvey-funded research

8. The Alvey Programme is designed to give UK industry the technological base to meet the needs of the world IT market in the 1990s, but the Alvey Committee considered that exploitation of research would start at an early stage and continue throughout the Programme and beyond. They saw Software Engineering (SE) as providing the greatest exploitation expectations, and dissemination of the results of the research

as the key to exploitation. The AD established arrangements aimed at maximising such dissemination and at encouraging commercial exploitation. The Programme is not yet complete but the NAO found that:

(a) A 1987 achievements paper by the AD showed that ten out of approximately 200 industrial projects in the Programme had put products on the market or had improved existing production processes and a further 77 projects had products at the prototype stage. The products already being exploited were predominantly in the Very Large Scale Integration (VLSI)/ Computer Aided Design (CAD) area from which the Alvey Committee had not expected many early exploitable products. In SE, however, there were no products yet being marketed although 16 were at the prototype stage. The AD consider that evidence of exploitable results emerging from nearly half the 200 industrial projects at this stage in the Programme was highly encouraging. (Paragraphs 4.26 - 4.29).

(b) Under the framework which governed Intellectual Property Rights (IPR), participants are allowed three years to exploit the Alvey results before they are required to make them available under licence for exploitation. This is in line with practice on other DTI programmes but the AD has recognised that any worthwhile exploitation in IT areas should take place within a year (paragraphs 4.6 and 4.7).

On skills shortages

9. The Alvey Committee considered that the then current output of IT graduates was wholly inadequate and recognised the need for a detailed and wide-ranging programme of action. It thought that there was sufficient manpower to launch the Programme but that more would be needed to carry it through and exploit the results. The NAO found that:

(a) There was considerable evidence of continuing IT skills shortages generally and for the Alvey Programme. The NAO's case examination revealed that manpower and staffing difficulties had been reported in over 50 per cent of the projects examined. This had contributed to delays (some substantial) or the need for extensions on nine projects; to withdrawal of partners on five projects; and the need to employ foreign experts or an overseas university on three other projects (paragraphs 5.17 - 5.19).

(b) The Government had instituted two major measures to increase the supply of graduates in IT and other engineering and technology disciplines. The first - the IT in Higher Education Initiative of December 1982 - roughly maintained the level of IT graduate output from universities in the face of reductions in university funding in 1981 - 82. It also helped to increase graduate output from the polytechnic sector. It was too early to judge the success of the second initiative - the Engineering and Technology Programme of March 1985 - but its targets for graduate output were less than DTI and MSC suggested in initial discussions and were determined with resource consequences and relevant demographic factors in mind (paragraphs 5.7 - 5.9).

(c) The Government have decided not to establish a national body to monitor manpower demand and supply but the DTI have set up a

new section to collect data on demand and supply for skilled IT manpower and the AD has also contributed substantially to the formulation and execution of central initiatives in this field (paragraphs 5.13 - 5.16).

On other information technology schemes

10. In addition to the Alvey Programme there are national and European funded IT schemes which could duplicate or overlap it and which might enable participants to be funded from more than one source. And the "IT 1986 Committee" recommended a successor to the Alvey Programme. The NAO found that:

(a) The organisational arrangements and the controls over Alvey Programme applications were such that it was unlikely that there would be duplication of work between Alvey and other IT Programmes or double funding from two of these sources (paragraphs 6.2 - 6.4).

(b) The Government's recent White Paper "DTI - the department for Enterprise" (CM 278) includes the Government response to the IT86 Committee recommendations. The White Paper indicates that collaborative research programmes are to play an increasingly important part in the Government's future policies for research and development. But for IT most of the funds available will be channelled towards European programmes - mainly ESPRIT - with more limited DTI and SERC resources devoted to a national initiative complementary to ESPRIT within the framework of the overall national collaborative research programme. There will be no specific national programme of support for applications in IT (paragraph 6.8).

General

11. It will probably be some years before it is possible to make a measured judgement of the impact of the Alvey Programme on the UK's competitiveness in the field of IT. It is clear that a substantial amount has been achieved in terms of new research commissioned and projects supported and of closer co-operation within and between industry and academic institutions.

12. However, in the NAO's view, the rate of exploitation of Alvey funded research appears lower than the Alvey Committee expected. And there have been other indications that the Programme might have been more effective given more staff and better management information systems at the outset and if the balance of programme expenditure between work in industry and SERC funded work in universities and higher education institutions had been closer to that originally envisaged by the Alvey Committee. The AD could also have taken a more positive role in securing more prompt and effective collaboration; and the framework which governed exploitation of IPR by participants could have recognised the special nature of IT development and required results to be made available under licence earlier than for other DTI programmes. It will clearly be important for Departments to bear these points in mind in the new collaborative programmes (see paragraph 10 (b)) which will also have to cope with the continuing effects of skill shortages in IT.

Part 1: Introduction

Background

1.1 Information Technology (IT) covers a wide range of activities and impinges on all sectors of the economy. It is concerned with the collection, storage, processing, transmission and presentation of information by electronic means. Throughout the industrial world IT is seen as a necessity to economic success and since the early 1970s it has been a major growth industry. Between 1970 and 1982 average growth of the UK IT industry was some 12 per cent a year but this was lower than that of our main overseas competitors (Figure 1). In 1981, the UK captured only 4 per cent of the world market (Figure 2) and the UK's adverse balance of trade in IT products, which had remained fairly constant at some £100 million during the 1970s, began to increase rapidly (Figure 3) and it was forecast that it could reach £1 billion by 1990.

1.2 In October 1981, Japan announced a programme of research into "Fifth Generation Computer" technology. "Fifth Generation Computer" is a term applied to a computer system that encompasses the goals of Advanced IT (AIT); the aim is to develop computers which can work at very high speeds, undertake many functions in parallel, and handle speech and image processing. Such machines would go beyond the processing of assembled data into the field of using inference to apply empirical knowledge of rules to the performance of a task.

The Alvey Committee

1.3 The Japanese and other actual or potential national computer programmes were seen as a major competitive threat to UK industry. In March 1982, the then Minister for Information Technology set-up a Committee under the Chairmanship of Mr John Alvey, to advise on the scope for a collaborative research programme in IT and to make recommendations. The formation of the Committee, which was mainly comprised of senior industrialists, was announced in the House of Commons on 12 July 1982.

1.4 The Alvey Committee reported in September 1982 and recommended a £350 million, five year, pre-competitive research programme into AIT to which the Government would contribute two thirds of the direct costs. Industry would provide the

remainder, and the much larger sums needed to translate the results of the research programme into marketable products.

1.5 The Committee recommended a programme of research into four basic enabling technologies; i.e. Software Engineering (SE), Very Large Scale Integration (VLSI), Man Machine Interface (MMI) and Intelligent Knowledge Based Systems (IKBS) – a description of these technologies is given at Appendix 1. Other important proposals were:

- (a) The programme should involve collaboration between industry, the academic sector and other research organisation to harness technical strengths and allow the widest possible involvement and exploitation;
- (b) The Government should fund all of the academic research and training, 90 per cent of industrialists' costs where wide dissemination of results was required and 50 per cent of other industrial costs;
- (c) The programme should be run by a compact directorate set-up within the Department of Industry and reporting to a Board which would act as a steering Committee and supervise strategy and management. But the Science and Engineering Research Council (SERC) and the Ministry of Defence (MOD) were to be involved in management and control and should provide some of the Government funding.

1.6 In addition to specific proposals for education, for which provision had been made within the total programme costs, the Committee referred to the need for an increase in higher education in order to provide the manpower for the technical programme and for the results of the programme to be exploited and used. The Committee's Summary of Recommendations are reproduced at Appendix 2.

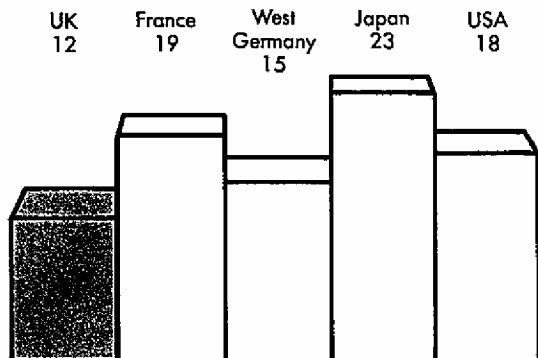
The Government's response

1.7 On 28 April 1983, after detailed consultation with industry, the Secretary of State for Industry announced that the Government stood ready to support a programme of research costing £350 million over five years to which the Government would contribute £200 million. The extent of the Government's contribution, however, depended upon industry making its contribution and upon the

UK IT Industry in world context - pre ALVEY

Figure 1

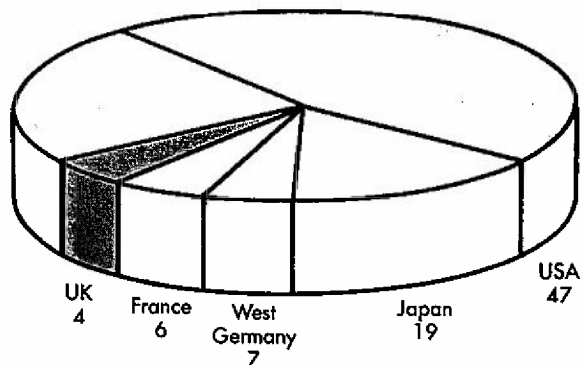
Average annual growth rate 1970-82 (percentage)



Software is excluded to maintain rough comparability of Figures. Based on exchange of time of shipment. The Japanese average growth rate figure is for 1970-81.

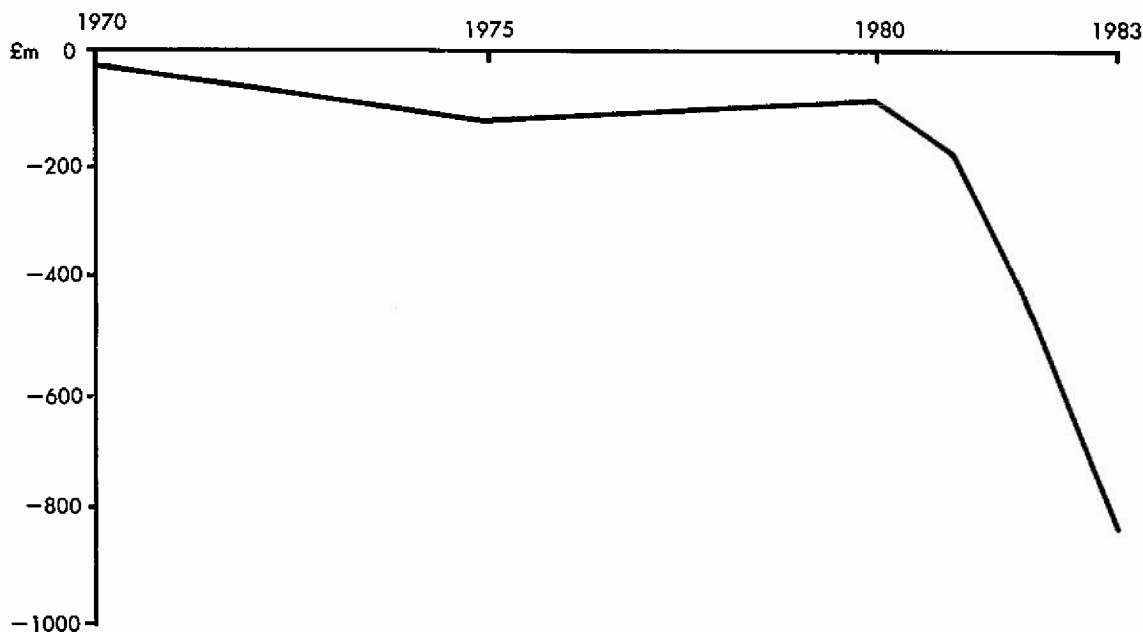
Figure 2

Share of world IT market (percentage) 1981



UK balance of trade in IT products 1970-1983

Figure 3



Source (all figures) - NEDO - "Crisis Facing Information Technology" (August 1984)

programme's technical progress. The central purpose was to pave the way for IT products, processes and services that could be sold in the market in competition with the rest of the world. The Government would fund all work carried out in academic institutions but had decided that all industrial work would be funded at 50 per cent. The cost of the programme would therefore be borne:

	Funding Level	£m
Government contribution		
Academic research	— 100%	50
Industrial research	— 50%	150
		200
Industrial contribution	— 50%	150
Total programme cost		350

1.8 The Government's contribution was to be financed out of existing allocations by the Department of Education and Science (DES), through SERC; MOD; and the Department of Industry which became the Department of Trade and Industry (DTI). The latter would carry overall responsibility for the management of the programme. It was stated that the need for skilled manpower had already been recognised and measures to meet it had been announced to the House of Commons by the Secretary of State for Education and Science.

Administration of the programme

1.9 The principal Alvey Committee proposals for managing the programme were accepted by the Government but a separate Steering Committee of Industrialists was added to provide external advice and guidance. The Directorate (the "Alvey Directorate" (AD)) comprises the Director of the Programme, five technical directors (of whom three are seconded and paid by industrial firms) and an administrative director, all supported by some 60 technical and clerical staff drawn from the DTI, MOD and SERC. The directors collectively form the Alvey Board. The Programme Director reports to the Steering Committee, headed by Sir Robert Telford.

1.10 The activity of the Programme consists essentially of establishing collaborative projects to

achieve the strategies agreed for each of the enabling technologies; monitoring these and ensuring that the results are disseminated as effectively and widely as possible within the UK. At the time of NAO's examination there were 187 fully collaborative projects and 116 long-range academic projects mainly run by single university teams.

Costs to date

1.11 HMG expenditure to April 1987 amounted to £98 million. £53 million of this was spent by DTI, £27 million by SERC on grants and £18 million by MOD. An analysis of HMG expenditure to date and forecast expenditure is at Appendix 3. Alvey grants to industry generally cover 50 per cent of industry's eligible costs, so industry's contribution to the Programme matches the grant they receive. Industry's gross expenditure on which grant had been claimed and paid by April 1987 totalled about £105 million so its net expenditure would have been about £52.5 million making total Programme expenditure by HMG and industry about £150 million. Industry may, however, have incurred extra expenditure on their own account of which DTI would not be aware (but see paragraphs 2.14 and 2.15).

Scope of the NAO enquiry

1.12 The NAO examined the administration and financial control of the Programme (Part 2); collaboration and participation in research (Part 3); exploitation of Alvey funded research (Part 4); the effect of skills shortages on the Programme (Part 5) and the relationship of Alvey research with other publicly funded schemes including European schemes (Part 6). Part 6 also looks at the proposals made for a Programme to follow Alvey by the Committee chaired by Sir Austin Bide.

1.13 The NAO's findings are based on an examination of departmental papers; review of external evaluations of the Programme and of Internal Audit and other Management Services' Reports; and interviews with senior staff of the AD. To obtain evidence of the adequacy of management and control and the extent of collaboration and exploitation, the NAO examined 42 collaborative research projects agreed with the AD as giving a representative view of project activity although biased towards the higher value projects. They also included all four Large-Scale Demonstrator (LD) projects (see paragraphs 4.13-4.17). In all they represented some 15 per cent of projects by number or 45 per cent by value.

Part 2: Administration and Financial Control

2.1 The NAO sought to assess whether the staffing and structure of the Directorate and its procedures have enabled it to maintain sound administrative and financial control over the Programme as a whole and whether the procedures for securing, controlling and monitoring individual projects have ensured that they proceeded satisfactorily.

Administering the overall Alvey Programme

Administration tasks and structure

2.2 The Alvey Committee stressed that the Programme Director should have under his own control all the resources and expertise needed to run the Programme. While his central staff unit should be slim and compact, it should include at least 15 professional staff and contracts, finance and patent specialists, and office support.

2.3 The AD was established in June 1983. Four of the five technical directors (see paragraph 1.9) were made responsible for enabling technologies with the fifth having responsibility for communications and infrastructure. They were given considerable autonomy in the development of their strategy and in dealing with projects but subject always to oversight by the Alvey Board and overall guidance by the Steering Committee. While administration of most of the projects rested with the AD, MOD staff administered contracts with industry in the VLSI area and SERC staff had responsibility for all grants to academic institutions.

2.4 When established in June 1983, the AD had only 10 staff and even at April 1984, when the first project was approved, there were only 28 staff although there has since been a build up to the level of 66 in 1987. Staff were drawn from all three sponsoring departments but also from industry, who normally met their cost, and from academic institutions.

Evaluation of the Programme

2.5 The need for a comprehensive evaluation of the Alvey Programme was recognised. Because of the unusual nature of the Programme and the possibly wider significance of the mechanism early evaluation results were felt to be important and a process of evaluation in parallel with the Programme – “real

time evaluations” – was chosen. This had the added advantage of promising feedback which could itself influence the development of the Programme. Three groups were commissioned to conduct the work. They were:

Manchester University's Programme of Policy Research in Engineering Science and Technology (PREST)	Assessed the structure and organisation of the Alvey Programme
Sussex University's Science Policy Research Unit (SPRU)	Assessed the Programme effectiveness in the context of the UK economy
London Graduate School of Business Studies' Centre for Business Strategy (CBS)	Examined Alvey's effect on the UK software industry (withdrew 1986)

A full list of the studies undertaken by the evaluation teams is at Appendix 4.

2.6 A review of the evaluation process carried out for the Directorate by the DTT's Economics Division in 1986 pointed out that evaluation work had only had a limited influence on the development of the Programme but noted that this was in accordance with expectation. The NAO noted that reports in the main had come relatively late in the life of the Programme and that reviews of important areas such as project monitoring and the functions of consortia and Alvey clubs were still awaited in the Summer of 1987 in year four of what was intended to be a five year Programme, although in practice expenditure will continue well beyond the fifth year. The AD agreed that the evaluation reports only had limited impact on the development of the Programme. But it maintained that this was expected and the evaluators have produced information and guidance of value to future collaborative programmes.

Financial information

2.7 An adequate financial information system was particularly necessary for the Alvey Programme because of its diversity of funding and the large number of individual grant-aided projects each with several participants and often with different levels of HMG funding.

2.8 The NAO found that there had been no central financial information systems within the AD, so that monitoring of budget and spend was inefficient and incomplete, and financial reporting irregular. In the absence of a central system, individual directors had established their own, to some extent incompatible, programme management systems. Where produced, financial information had generally to be assembled by aggregating spend on individual project files. The NAO had difficulty in obtaining information on commitment and spend by enabling technology and on industry's contribution to the Alvey Programme. Internal Audit, PREST and staff inspection had all commented on inadequacies in the financial information systems.

2.9 The AD acknowledged that there were deficiencies and has periodically tried and, largely through lack of resources to carry it through, has failed to implement an effective financial information system. In mid 1987 - nearly four years after the start of expenditure on the Programme - a new computerised system was introduced but the NAO has not yet reviewed this.

Funding

2.10 When approving the Alvey Programme, the Government announced an overall funding (£350 million) similar to the figure that appeared in the Alvey Committee Report (£352 million). But, in rejecting 90 per cent funding for any research work by industry, it increased the share of finance it expected industry to make from £117 million to £150 million and stated that funds would only be provided if industry met its share of the Programme costs.

2.11 The three Departments were required to find the required funds from within their existing expenditure allocations. And neither the Alvey Committee nor HMG, in approving the Programme, specifically recognised the cost of its administration and infrastructure in their calculations. In practice, these costs, which were expected to be small, have been substantial and have been treated differently within the Programme by DTI and MOD on the one hand and SERC on the other hand. DTI and MOD have borne the administration costs outside their £150 million contribution to the Programme: SERC have charged them to their contribution above the £50 million proposed. Infrastructure costs, which are much more substantial than administration costs, have been borne within the overall Government contributions.

2.12 A number of problems have arisen from these funding arrangements. Firstly, SERC found difficulty in finding the necessary funds to meet their share of the Programme in view of other pressing (non-IT)

demands on both the Council's funds and those of the Science Budget, administered by DES. This was exacerbated by their being required to meet an increased share of the Programme resulting from the higher than predicted involvement of academic institutions in the collaborative work and from increased expenditure on infrastructure costs. Expenditure also tended to occur at an earlier stage of the Programme than expected. Although DTI and MOD provided SERC with some funds and SERC eventually found an additional £7 million itself, its available funds in financial years 1985-86 and 1986-87 fell significantly short of what were required. As a result SERC grants to many academic partners in collaborative projects were held up and at least 22 projects were seriously delayed.

2.13 In addition to infrastructure expenditure, the AD has found it necessary to spend substantial sums on non-project expenditure including consultancies and costs of such items as the Alvey Club organisation, conferences etc. It also decided to meet, in full, the costs of managing the LD projects. All this has reduced the HMG funds available for joint-funded industrial research work and has resulted in a reduction in industry's financial contribution to the Programme. The Directorate, however, pointed out that the great bulk of the infrastructure expenditure funded under the Programme was directly related to collaborative project work. It was designed to take advantage of the collaborative nature of the Programme by increasing the overall effectiveness of the project funding by, for instance, providing appropriate common computing infrastructure, software etc throughout the Alvey community.

2.14 The eventual distribution of expenditure on the Programme, including industry's contribution, cannot yet be forecast with exactness since the Directorate agreed at an early stage in the Programme to a degree of calculated over-commitment on project expenditure in anticipation of some degree of underspend and the premature termination of some projects. The amounts that will actually be spent on each part of the programme will thus not be clear until later, but the Government's total spend is unlikely to be significantly higher than the amount originally allocated. As things currently stand, however, the pattern of commitment, as compared to original expectations, is as set out on page 10.

2.15 The above indicates that industry's contribution - to match the Government's expenditure on research by industry - seems unlikely to be higher than £115 million, some £35 million less than intended. Taking account of the increased spend on academic research (say £10 million), total expenditure by the Government and industry on Alvey research

	Original allocation	Commitment at the time of the study	
	£m	£m	£m
HMG funded at 100% level			
SERC: academic research	50	61.4	
Infrastructure	—	11.8	
administration	—	2.0	
DTI: LD management	—	3.8	
Infrastructure	—	7.4	
Consultancies etc	—	<u>8.1</u>	94.5
HMG funded at 50% level			
DTI: industrial research	110	72.9	
MOD: industrial research	40	<u>43.6</u>	116.5
	200		211.0

projects is likely to be some £60 million less than intended when the Programme was announced. The AD considered that the implications of this in terms of the amount of work actually likely to be done in the collaborative research programme were probably not as great as the numbers above might indicate. In particular they pointed out that costs per man-year for SERC funded research were very much lower than for research in industrial laboratories and it was not clear that the total amount of research eventually funded, in terms of man-years of effort overall, would actually be less than was originally expected. The Directorate also pointed out that the pattern of spending, both as regards infrastructure support, etc and as regards the balance between the industrial and the academic contribution to the collaborative programme, represented positive decisions by the Alvey Board on the most appropriate way of achieving Programme objectives.

Management of individual projects

Dealing with Alvey projects

2.16 The procedures for inviting and appraising projects are set out in Appendix 5. In seeking to examine their effectiveness in application, the NAO had difficulty in establishing some basic facts on project administration, especially about the first years of the Programme, because filing of documentation had often been haphazard and some important documents could not be found. Nevertheless, it was apparent that much had been done to attract projects which would achieve the objectives of the strategies

set. And, while the NAO did not seek to examine the technical content of projects, the AD's appraisals appeared to have been thorough. Thus, in 30 of the 42 projects the NAO examined the original proposals were revised in the course of appraisal in material ways to make them more relevant and/or viable.

2.17 The approval process, however, was perceived generally as being slow and causing delays. In a number of cases examined by the NAO the offer letter to contractors was issued nine months or more after the final proposal had been received. The Directorate agreed that there had been such delays. To some extent they reflected difficulties with contractors unfamiliar with collaborative programmes or unable to finalise detailed plans. They also reflected a continuing process of getting projects right before finally agreeing them, but there were certainly delays because of administrative overload, especially in the early part of the life of the Directorate. The AD pointed out that where participants were prepared to do so they were often willing to let projects start before the formal issuing of an offer or contract under a letter of intent, and that this had happened in a number of cases the NAO had cited.

Contracts

2.18 The division of project responsibility (paragraph 2.3) meant that participants had differing contract and grant conditions and were financed from separate sources where projects involved industrial and academic collaborators. And industrial collaborators who were engaged in both VLSI projects and on other technology might find themselves subject to different contract conditions on each.

2.19 The NAO examination showed that each Department were basically following their own standard contract or grant procedures. These provided adequate protection of the Government's interests. However, PREST found that the varying contract procedures had occasionally caused some confusion to industrial applicants, especially those with projects in different research areas. Not all contract staff were committed to Alvey and some were not involved until the technical details of a project were settled. PREST concluded that the inter-departmental interface was inadequate and that in the absence of dedicated contract staff there was a need for better liaison and procedures at an early stage. The AD stated that had a new directorate tried to establish an entirely new contractual regime all its own delays could have been worse!

Monitoring of projects

2.20 The AD and MOD monitor industrial projects in the technologies for which they let contracts. SERC are not involved in the monitoring of industrial

projects and in academic-only projects, in accordance with standard research grant conditions, they do not monitor technical progress against budget. MOD apply their standard procedures whereby a monitoring officer (MO) is appointed to monitor technical progress; financial progress is monitored separately at six-monthly meetings between project officials and the contractors.

2.21 Although the AD laid down broad central guidelines on project monitoring there was no common approach to monitoring across the different technologies. In part this was because the monitoring role was fundamentally different under MOD and DTI contracts, in part because of the different approaches of individual technical directors, from different backgrounds, to programme management. The central guidelines referred to above, which formed part of the contracts of external monitoring offices, were based on the detailed requirements of a monitoring scheme designed for the Directorate by consultants and introduced for the SE programme in mid 1984, being extended later to the MMI programme in mid 1986. At about that time, since the great bulk of Alvey projects and monitoring officers were in place, the Directorate arranged a seminar for monitoring officers on the basis of which further, expanded, guidance was issued. PREST were, in 1987, carrying out a review of monitoring.

2.22 The NAO's non-technical examination of projects showed that MOs generally commented fully on technical matters identifying future problems as they emerged and making positive suggestions for action. They were less informative on management and financial matters and the NAO noted that there was often inadequate comment on progress in relation to plan. It was observed, too, that MOs' reports tended to be submitted after the due date and in two of the cases there was no file evidence to show that some of the quarterly reports had been received. Internal Audit also reported in September 1986, that a number of cases contained no workplans; monitoring reports were not produced on a regular or timely basis; and MOs were not always submitting progress reports with certified grant claims.

2.23 The AD acknowledged to the NAO that monitoring performance had been variable and that it

had not always been able to get the monitoring staff it would have liked. This was inevitable in a field where skilled manpower was in short supply. It accepted that it would have been better if it had gone beyond the issue of broad guidelines and imposed a uniform system of monitoring but it had sought to strike a balance between standardisation and giving reasonable autonomy to technology directors.

Achievements

2.24 Despite the small staff, the enabling technology Directorates, in extensive discussions with industry, drew up detailed strategies for their areas between August 1983 and August 1984 (see Appendix 5). Having appraised numerous solicited and unsolicited proposals for projects, the AD approved 100 in 1984-85, 90 in 1985-86 and 110 in 1986-87. Other parts of this Report refer to its achievements in securing collaboration and exploitation, addressing skill shortages and co-ordinating Alvey work with that of the European IT Programmes.

2.25 Strategies must be flexible to respond to unexpected developments and assessing overall progress against such a moving target is extremely difficult. And the IT 1986 Committee (see paragraph 6.5) reported in November 1986 that it was then too early to assess the Programme's technical achievement.

2.26 The problems in administration referred to in other sections of this Part and in other Parts of this Report may be partly attributable to the staff constraints placed upon the Programme and to the division of responsibility between the three sponsoring departments for managing projects. PREST considered that staff numbers had not corresponded with workload especially in the first year of the Programme when the peak load in devising strategy coincided with the peak in processing applications. They drew attention to the inefficient use of technical staff who, because of inadequate numbers of support staff, had had to devote too much time to such mundane functions as typing and filing. Internal Audit also noted staff difficulties and a staff inspection in 1985-86, that they instigated, concluded that the administration was seriously under-staffed.

Part 3: Collaboration and Participation in the Alvey Programme

3.1 The NAO sought to assess whether the Programme was achieving the advances in collaboration that the Alvey Report recognised as necessary; and whether participation in the Programme was sufficiently wide and balanced to achieve its objectives and especially whether small firms had been well represented.

Collaboration

The need for collaboration

3.2 The Alvey Committee recognised that while there were considerable technical strengths in the UK collectively, these were widely scattered in industry, the academic sector and research organisations. No organisation had the know-how to make sufficient progress on its own or resources to tackle independently the high risk and long lead-times of the type of projects that were involved. Compared with the opposition, the UK's overall effort was badly fragmented. Collaboration between the three groups was seen as a means to secure the best use of UK's scarce IT manpower and expertise and was clearly regarded as a fundamental and vital ingredient of any Government Programme.

Structure for collaboration

3.3 The Alvey Programme is based on collaboration: only in very exceptional circumstances will support be awarded to a single organisation. This collaborative element carries implications for the organisation of the work and for the relationship between the Government and the firms and academic and other research organisations carrying out the research.

3.4 The long range academic projects do not normally involve full collaboration, but an industrialist is involved with the academic team, steering the work towards issues of industrial and commercial interest, and alerting the AD to the need for full industrial collaboration when necessary. Because of the industrialist oversight, these projects are known as "Uncle" projects. They take up only about £11 million (or 6 per cent) of the Programme's public funding.

3.5 The full collaborative projects are carried out by consortia of firms, academics and, occasionally,

research establishments and other non-profit distributing bodies. The AD uses the extent and likely benefits of collaboration as one of the main criteria for judging project proposals, and once the proposal has been approved, it requires that collaboration in the "industrial" projects is formally enshrined in a collaboration agreement.

Collaboration agreements

3.6 Collaboration agreements detail the project objectives, the division and management of work and the arrangement for the dissemination of research information. The AD has left the specific details of collaboration agreements to consortium partners to negotiate between themselves. But it seeks to obtain an assurance that collaboration is soundly based and that there will be effective sharing of information between the partners through rules which govern participation in the Programme and set the constraints within which individual collaboration agreements are drawn up by the partners. The rules were published in February 1984 as a "Framework for Intellectual Property Rights and Collaboration in the Alvey Programme" (Appendix 6) and are mostly concerned with arrangements for sharing information and securing exploitation, subjects dealt with more fully in Part 4 of this Report. The Agreement normally also establishes a project co-ordinator to ensure that the work is properly planned and co-ordinated.

3.7 The AD examines all proposed collaboration agreements and any failing to incorporate the intention and principles of the framework are rejected. For the IKBS, MMI and SE enabling technologies, where contracts and grants are administered by DTI and SERC, collaboration agreements must be signed before grant will be paid. Initially for VLSI, where MOD is the contracting authority, only an "agreement in principle" (a draft agreement) was required. But, in June 1986, MOD fell into line with other enabling technologies, and suspended grant payments to partners until a final collaboration agreement was signed. This change in policy followed an MOD review of VLSI projects in April 1986 which found that 56 per cent of projects had not converted the draft agreements into valid, binding agreements although at that date many projects were well advanced, some nearing completion.

Progress in securing collaboration

3.8 In the 187 full collaborative projects there were on average 4 partners involved – typically two or three firms and one or two universities. PREST, in a 1985 evaluation, found that the Programme had initiated many new practical collaborations; 72 per cent of the academic groups and 58 per cent of the industrial firms had not previously worked with their Alvey partners.

3.9 The NAO found, however, that individual consortia often had difficulty securing collaboration agreements, with consequent delays to some projects. A significant number of the 42 projects the NAO examined did not appear to have collaboration agreements in place, and in many of these and also some where agreement had been secured there was evidence of significant disputes within the consortia. In 11 cases partners withdrew from projects. They generally gave a variety of reasons but difficulty with achieving collaboration was often prominent among these. The NAO also found that where projects did have agreements in place many had only been signed after long delays. For nine of the 27 projects with agreements that the NAO examined there was a delay greater than nine months between the AD's offer of grant and securing of the agreement itself. A PREST 1986 study had found a similar situation. The Directorate pointed out that the Director of the Programme was able to announce to the Alvey Conference in Manchester in July 1987 that by then virtually every project needing collaboration agreements had them in place.

3.10 The AD told the NAO that there had undoubtedly been difficulties in securing collaboration agreements and that, especially because of its policy of requiring firm agreements before grant payment commenced, this had caused delays. But it considered that it would have been wrong to drop the requirement for agreements because they settled management issues and disputes over IPR, and their worth would be shown in the speeding up of the exploitation of research results.

3.11 The NAO project examination and PREST work show that the main difficulties were in negotiating IPR. But delays in obtaining SERC funds, referred to in paragraph 2.12, also caused stress between partners and added to the difficulty of securing agreement. There was a general lack of experience of such agreements, especially in universities, but also, and surprisingly, among many of the participating industrial concerns. Many also had difficulty finding the time to negotiate these novel agreements.

Action to expedite collaboration agreements

3.12 As noted in paragraph 3.6, the AD has adopted a largely hands-off approach to collaboration

agreements. It did arrange conferences in 1984 and again in 1986 where problems of collaboration was the main subject. And it was available for consultation on an *ad hoc* basis and gave advice on collaboration in the "Alvey News" publication. PREST, in a 1986 survey of project co-ordinators, found that 73 per cent considered that the AD should have done more to assist in overcoming the problems that caused delays in reaching agreements. The co-ordinators cited standard agreements, better advice and guidelines and active AD involvement in agreement negotiations among the forms of assistance that would have been welcomed.

3.13 The Alvey Director has recorded that the time and effort taken to complete collaboration agreements was entirely underestimated and that, in retrospect, the AD should have deployed more effort to help firms and academics reach agreements. The Director told the NAO that if staffing levels had permitted more help would have been given. However, the process of securing collaboration had to be learnt and he was doubtful about the extent to which the Directorate could, in practice, have speeded up completion of collaboration agreements.

3.14 In 1986 the AD commissioned a new study from consultants experienced in the IPR field to identify the main areas of complexity in the agreement process, and to prepare a guide to agreements and a model agreement. However, the main outputs were not expected until mid 1987 when the Programme would have only about another year to run, and few new projects would be beginning. The study will therefore be of little use to the Alvey Programme although it should benefit future collaborative programmes which the Government has outlined in the White Paper on DTI (CM 278).

Participation

Proposals relating to participation

3.15 The Alvey Committee (which included many leading industrialists, mainly from large companies), recommended that the Government should fund 90 per cent of expenditure on projects where wide dissemination of results was required. They considered this necessary to give maximum access to the Programme. They considered this vital and particularly relevant to the small business sector which lacked the resources to do adequate research but could benefit enormously from joint research activities and play an important role in exploiting the results.

3.16 In a subsequent paper, DTI explained that the 90 per cent level was needed because of the nature of the parts of the Programme to which it was intended

to relate - basically SE and IKBS. Both were fragmented with many small companies and a few larger equipment manufacturers. Small companies would not be prepared to contribute 50 per cent to the cost of work whose benefits would be long-term and widely-spread.

3.17 The Government imposed a maximum grant level of 50 per cent for industrial research work because they considered a 90 per cent contribution would not secure a sufficient industrial commitment and could lead to the programme becoming divorced from industry's needs. The main effect recognised by DTI of this reduction was that it was much more difficult to involve small firms in the Programme.

Actual participation

3.18 The NAO's review showed - as recorded at paragraphs 2.13 to 2.15 - that expenditure on research at universities and other academic establishments has been much higher than originally intended. This increase in expenditure at academic establishments - which is 100 per cent Government funded - and additional expenditure on infrastructure and administration has, as paragraph 2.15 indicates, also had the effect of reducing substantially the funds available for other aspects of the Programme. Thus there has been less available to finance work by industrial firms - of whatever size - who might have been prepared to participate on a 50 per cent funding basis.

3.19 The NAO case examination also suggested that the Programme was dominated by the large electronics firms which regularly contract with Government. The AD has analysed participation from time to time. An analysis at June 1986 (Appendix 7) showed that 110 firms were participating in the 187 industrial projects then extant. Each industrial project may involve on average two or three firms and altogether there were 428 "participations" in the 187 projects. Further analysis, shown below, reveals that the top five firms in the programme, ranked by the number of projects in which they participate, accounted for 209 or nearly 50 per cent of the participations.

Participations in the Alvey Programme

Firm	Number of Project "Participations"	Percentage of total "Participations"
GEC	59	13.8
ICL	49	11.4
BT	37	8.6
Plessey	35	8.2
STC	29	6.8
	209	48.8

An earlier analysis, in late 1985, had revealed that there were 35 genuine small firms with 51 project participations - rather less than GEC had attracted on its own.

3.20 The AD acknowledged that small firm involvement, in terms of project participations, was relatively small, but argued that it was never expected to be substantial. It maintained that the large electronics firms represented the bulk of the UK's industrial activity in IT and, particularly, the bulk of UK long term industrial R&D. There was nothing to show that the large firm participation in Alvey was disproportionate to their importance to the sector as a whole. It was these firms, which were not large compared to their US and Japanese competitors, which would have to raise the funds to develop Alvey technology and sell products in the world markets. The Directorate accepted that a higher funding rate than 50 per cent might have helped small firms to participate - but little long term research was done by many such firms on their own account. They considered that while a higher funding level might have been a useful option to encourage particular areas of research, which were especially manpower intensive or especially long term, the Programme had not been seriously inhibited by a 50 per cent funding ceiling.

Part 4: Exploitation of Alvey Funded Research

4.1 The NAO sought to assess whether provisions for ownership, sharing and dissemination of results facilitate maximum exploitation (essentially the responsibility of the industrial partners); whether large-scale demonstrators have been effective in bringing together the results of the Programme to demonstrate their exploitation potential; and whether exploitation to date has been as high as could reasonably be expected.

Contractual arrangements and organisation for dissemination and exploitation

Alvey Committee proposals

4.2 The Alvey Committee saw the scope for dissemination as dependent upon the level of Government funding for the Programme: the proposed 90 per cent funding would have obliged participants to make results from their research freely available to other UK companies. Fifty per cent funding was intended to apply to areas of work where dissemination of research results was less relevant: companies holding IPRs would make the results available on licence only if they did not intend to exploit commercially themselves in which case the rights would become transferable to Government.

The framework for IPR and collaboration

4.3 A Joint Working Party was set up with industry to advise the Alvey Directorate generally on collaboration, IPR and information exchange under the Programme as then established. It resulted in the February 1984 publication of the framework reported at paragraph 3.6 and detailed at Appendix 6. This effectively determined both the legal conditions for exploitation applied to participants under collaborative agreements and also the arrangements for disseminating Alvey results.

Dissemination and exploitation through the Alvey Club organisation

4.4 The Alvey Club structure is a key element of the Programme and is aimed at providing effective sharing of information between collaborative contributors and at speeding up technology transfer in the various research communities. Participation in Alvey projects confers membership of a three-tiered club organisation i.e. project, Category Club and

Alvey Club, and sets rights and duties on disclosure and licensing which are written into the letter of grant or contract. Members of consortia working on projects that are associated with each other within a single Alvey enabling technology (or a sub-set of these) will constitute an Alvey Category Club. All members of Category Clubs together comprise the Alvey Club. The AD can, with the agreement of club members, invite parties who can make a significant contribution or have a bona fide interest to join in club activities.

4.5 Project participants are required to make regular progress reports to their Alvey Category Club and must also grant free licences to the other members, where necessary, for the purposes of their Alvey projects. Alvey Club members may also request information on project results from other enabling technologies and this should not be withheld unreasonably although a confidentiality agreement may be required.

4.6 Each contributor is expected to exploit the results of his research within three years. To do so he may require other project participants to grant a licence, on fair and reasonable terms, to use their results or seek licences from other Category Club members on commercial terms. In the event of failure to exploit within three years, the contributor must co-operate with the Secretary of State to secure exploitation. Licences under this requirement are offered first to other project participants, then to members of the appropriate Category Club and then to Alvey Club members. Licences are granted on fair and reasonable terms for the use of results and commercial terms for use of background.

4.7 The Alvey three year interval was based on existing practice in other Government supported programmes but the AD has since recognised that any worthwhile exploitation should take place within a year. While as yet it has no post-completion procedures to ensure that exploitation takes place it has indicated its intention to introduce these and to record progress on exploitation.

Directorate involvement in the dissemination process

4.8 An official Alvey newsletter "Alvey News" was introduced in September 1983 and is published, bi-monthly. Alvey News has a reported circulation of

about 6,000 and is the main public information channel for the Alvey Programme. It provides information on the activities and progress of the Programme including the annual Alvey Conferences, seminars and Alvey Clubs and promotes and makes available all published Alvey material. Conferences and seminars, which have covered a number of subjects of interest to Alvey participants, are themselves an additional means of disseminating information.

4.9 An electronic infrastructure and communications network also exists, one feature of which allows geographically distant project participants to exchange information. No system has yet been implemented to record and control the dissemination of research papers generated by the Programme. However, this need has been recognised and is currently being pursued.

Large-scale Demonstrators (LDs)

Background

4.10 The Alvey Committee expected the funded Programme to include "capability demonstrators to test the emerging technology and assist its potential commercial application". Under the IKBS Programme proposals, these demonstrators, by applying research findings to particular applications, would provide a focus, time-scale and motivation for various research activities; assist in technology transfer; and the education of users. Early, small and short-term demonstrator projects were envisaged to allow follow-up demonstrators to apply research results incrementally.

4.11 In response to criticism that the Alvey Committee had suggested no mechanisms to ensure a proper market orientation to the research and the vigorous exploitation of results, the AD decided to support a number of LD projects. It intended these to produce prototype products at the end of five years and to provide a user influence on the Programme by setting exploitation-led goals and by pulling together developments in the different enabling technologies. It was considered essential to take a rapid start on the LD Programme, independent from the research programme, in order to get feed-back to individual strategies before they became "set in concrete". £36 million was provisionally allocated for this, representing approximately 10 per cent of the total Alvey spend. Because of their complexity, it was decided that there should be commercial management of these projects which, exceptionally, was to be 100 per cent funded by HMG.

4.12 Out of 22 proposals seven proceeded to a three month project definition stage from which the following were chosen:

LD 001	DHSS Decision Support
LD 002	Mobile Information Systems
LD 004	Design to Product
LD 006	Speech Input Wordprocessor and Workstation

Details of the projects are at Appendix 8.

The decisive factor in selection was a designated user with perceived project management capability an important consideration.

The NAO examination of LD projects

4.13 the NAO reviewed all four LD projects because of their significant cost and perceived singular importance to the Alvey Programme.

4.14 The NAO found that all LD projects were subject to substantial delay in finalising collaboration agreements. In the case of LD 006 one participant refused to sign for 2 years and the Directorate were on the point of terminating the project but in all the other cases too delay exceeded nine months. Delay occurred because company lawyers were inexperienced in drafting such agreements and universities were uncertain as to their IPR position following the abolition of NRDC's right of first refusal to exploit Research Council funded work.

4.15 The AD was not wholly satisfied with the management of LDs and considered that better control would have been exercised had they been directly managed. This was, however, precluded by shortage of manpower resources.

4.16 The setting-up of LD projects before research elsewhere in the Alvey Programme was far advanced meant that it was not possible for LDs to incorporate much Alvey-based research at the start. But it was expected that Alvey results would increasingly be introduced. The NAO examination of project files suggested that the degree to which this happened varied greatly with different LDs. LD 001, for instance, was reported to have "little contact" and LD 004 a "low level of interaction" with the Alvey enabling technology research. For LD 006, necessary revised proposals resulted in use of existing technology because results expected from an Alvey project were not available. Only in LD 002 did the use of Alvey technology appear to be substantial.

4.17 The AD acknowledged that LDs may not have exploited Alvey technology to the full extent possible and that this had varied according to the different enabling technologies. They considered that LDs had

been effective in pulling IKBS results together but accepted that SE had had their own goals and that there had perhaps been too little pressure to make them change direction. LDs had had little influence on VLSI work but this was expected. None of the LDs could have fulfilled their objectives without the application of some Alvey-based technology. They also pointed out that there were smaller-scale demonstrator-type projects in most of the enabling technology programmes.

Exploitation to date

4.18 The Alvey Committee expected early, continuous and significant exploitation of the technology emerging from the Programme. They stated specifically that there was no question of having to wait. The AD also recognised the importance of exploitation and placed great emphasis on it in project selection and monitoring. The NAO recognise that the Programme is only part-way through, few projects are completed and the process of exploitation of pre-competitive research is itself long-term, so that commercial exploitation at this stage cannot be the most persuasive evidence of achievement. Nonetheless given the eventual importance of exploitation NAO have attempted in the following paragraphs to review the current position.

Exploitation expectations in the individual enabling technologies

4.19 For each of the four main enabling technologies the Alvey Committee provided, in some detail, the technical content and targets of proposed individual development and exploitation programmes. They saw exploitation occurring mainly in the SE area but they also expected a limited number of exploitable products from IKBS and VLSI.

4.20 The enabling technology strategies subsequently developed for the Alvey Programme also saw SE as providing the greatest exploitation expectations. The SE strategy envisaged encouraging the widespread use of SE tools currently available in the more "leading edge" environment. Integrated Project Support Environment (IPSEs), using a variety of such tools, were identified as a priority need and three generation IPSEs were projected:

- the 1st generation to be completed and demonstrated in Software Production Centre(s) (SPCs) to be established during year two;
- a 2nd generation prototype to be developed in year three and demonstrated in SPCs in year four; and

- work on the 3rd generation IPSE beginning in year four and continuing throughout year five.

Relative attainments in the SE field

4.21 The NAO sought to review attainments against the SE strategy adopted. The 1st generation IPSEs in the AD strategy were not in the event established. The simple tools then available had not proved satisfactory in all applications or for use in IPSEs. Similarly the 3rd generation IPSE, with its applications of IKBS techniques, is now seen as a much longer-term proposition.

4.22 The AD explained that the SE Programme had perhaps moved in the means whereby it sought to achieve its objectives from tools to methods. Also in the SE field, new techniques were in use by firms as a result of Alvey research and demonstrators and prototypes, still some distance from the market place, were being considered as exploitable results of Alvey research. The AD maintained that there had been real progress with tools and IPSEs, with exploitation currently being demonstrated in product development, the issue of prototypes and the forging of links with potential ESPRIT partners.

Representative project sample examination

4.23 The NAO also reviewed evidence of exploitation in all the projects selected for their detailed examination. This confirmed that the Alvey Board fully considered all aspects of exploitation in their project selection and approval process. Examples were noted of the Directorate's efforts to involve specific participants in particular projects to ensure that worthwhile research would lead to exploitable products. Some projects were not given the go-ahead until a fully collaborative user had joined the project or more partners were involved for wider technology transfer.

4.24 To obtain full exploitation benefits and provide timely opportunities for a Programme such as Alvey, much depends on the programme and projects progressing to schedule and the satisfactory achievement of planned research objectives. Various delays in getting the Programme underway and late project starts, caused, inter alia, by problems with collaboration, have been noted in previous parts of this Report. The NAO review suggested that where projects had high expectations of exploitation, problems over IPRs were often correspondingly more protracted and difficult and these projects were among the ones to have been most delayed.

4.25 The NAO's examination of project files was non-technical and took place towards the latter half of 1986. Three projects in the representative sample

of 42 appeared to have results being exploited; that is three projects had put products on the market or had improved existing production processes. The AD has since produced a detailed achievements paper dealing with exploitation and there has been an interim evaluation conducted by all the Programme's evaluators working together. The NAO has sought to summarise the comments in these relating to exploitation.

Alvey Directorate's achievements paper and the interim evaluation report

4.26 The AD's paper, supplementing the June 1986 monitoring officer exercise on planning for exploitation, drew on a project by project review. The results were submitted in February 1987 to Ministers and set out the progress and achievements of the Programme, including exploitation.

4.27 Out of nearly 200 industrial projects in the Programme at various stages in their lives, the achievements paper describes some 86 projects where exploitable results had already been identified. Ten projects had put products on the market or improved existing production processes, and a further 77 had taken exploitation as far as the development of prototype products. Of these, eleven projects appeared to have firm marketing plans. The NAO noted that the projects that have put products on the market or improved existing production processes are predominantly VLSI/CAD related and this suggests that in this area products of Alvey work may be being exploited in excess and/or in advance of the Alvey Committee's expectations. On the other hand in software engineering, the shift of the emphasis from tools to methods, where the Alvey Programme has made significant progress, has contributed to the Alvey Committee's forecast of early exploitation of SE

tools not being fulfilled. Nonetheless the sixteen SE pre-competitive research projects included in the 87 with exploitable results have all developed prototype products.

4.28 The Interim Evaluation Report records that most projects are still in progress and that any commercial products at this stage should be regarded as spin-offs. Also, the Report states that the benefits of many projects are only realised in a derived manner through improvements in other products or processes, while other projects seek to establish standards. The evaluators appear generally satisfied with exploitation at this stage, but they draw attention to a worrying tendency in the MMI and SE technologies for exploitation progress to be lagging in the larger industrial projects.

4.29 The AD accepted that the major criterion of the eventual success of the Alvey Programme would be the effectiveness with which the work was exploited by United Kingdom industry. But it agreed with the interim evaluators that such exploitation would take various forms: much of the work will be developed into eventual software or hardware products; other parts, through the collaborative structure of the Programme, would contribute to the pool of available enabling technology and thus to the success of other products and processes, whether developed under the Programme or not. The AD considered that commercial exploitation, whether in terms of development work or products, would be relatively rare at this stage of the programme and notable where it did occur. It thus considered that the evidence of exploitable results identified in its achievements paper as emerging from nearly half of the 200 collaborative projects at this stage in the Programme is highly encouraging.

Part 5: Skills Shortages

5.1 The Alvey Committee considers that the then current output of IT graduates was wholly inadequate and recognised the need for a detailed and wide-ranging programme of action. It thought that there was sufficient skilled manpower to launch the Programme but that more would be needed to carry it through and translate the research into marketable products. NAO sought to assess whether measures taken to relieve skills shortages have been effective and whether skills shortages have had an adverse effect on the Alvey Programme itself.

Evidence of general IT skills shortages

5.2 Severe skills shortages in IT and related technologies were recognised and documented by a number of authorities prior to the Alvey Committee Report including the "Finniston" Committee of Inquiry into the Engineering Profession which reported in 1980 (Cmnd 7794) and the Government's Advisory Council for Applied R&D (ACARD) in its 1979 Report on "Technological change: Threats and Opportunities for the UK".

5.3 Since the Alvey Report, however, concern about IT skills and shortages has not abated. Thus, the House of Lords Select Committee on Science and Technology in its December 1984 Report on "Education and Training for New Technologies" commented that identifiable shortages of skilled manpower threatened to be a serious constraint on the development and application of new technologies and, although the need had been apparent for five or even ten years, little concerted effort had been devoted to solving the problem. The IT Skills Shortages Committee, chaired by Mr John Butcher (Parliamentary U/S of State, DOI) found, in July 1984, no agreed basis for defining IT skills shortages but an accumulation of evidence all suggesting that additional IT graduate manpower to that projected would be required during the rest of the decade and possibly beyond. In January 1985, it concluded that at the technician level, below graduate, there was a need both for greater numbers of technicians to have particular IT skills and for higher levels of general IT skills in the existing technician workforce. In its response to the Select Committee Report (Cmnd 9653, November 1985), the Government endorsed the Committee's view about the threat posed by IT skill shortages and went on to set out the initiatives taken across the further and higher education sectors to increase provision in science and technology. It

added that, in taking action, it had given full weight to advice on actual and potential skills shortages offered by, among others, the IT Skills Shortages Committee.

5.4 More recently, in 1986, the National Computer Centre reported that more than 20 per cent of IT users and 25 per cent of software suppliers stated they were "crippled" or had their "survival threatened" by shortages of skilled staff. The Institute of Manpower Studies (IMS) concluded, in a 1986 Report commissioned by the Government, that skills shortages were a continuing constraint on the development of IT. The Bide Committee 1986 Report on an "after Alvey" programme (see Part 6) concluded that, despite the measures taken, the skills shortages problem had not been solved.

Measures taken to tackle skills shortages

5.5 The Alvey Committee identified specific and immediate additional manpower needs in respect of three of the enabling technologies: IKBS, SE and MMI. It made provision within the proposed programme for the setting up of studentships, research fellowships and teaching posts in these disciplines. Funding was to be through SERC in respect of the post-graduate elements, and by earmarking through the established UGC and NAB channels for the remainder. It identified a requirement for at least 30 new posts to be for research and teaching specifically related to the AIT programme. It highlighted features of the educational system at all levels where it considered action was needed.

5.6 There have been two major Government measures to increase the supply of graduates in engineering and technology;

- An initiative of December 1982, part of a £100 million 3-year programme intended to boost IT student places (IT in HE initiative) and to bring "new blood" into university research.
- The £43 million three-year Engineering and Technology Programme (ETP) of March 1985 intended to provide additional engineering and technology places within higher education institutions.

5.7 Although the December 1982 initiative preceded a final decision on the Alvey Programme it was

meant to meet national IT training needs including those identified by the Alvey Committee. The intention of the IT in HE scheme was to provide by 1985-86 5,000 additional student places in higher education, at both under- and post-graduate levels in electronic engineering and computer science; 400 additional staff in universities and polytechnics; and 145 extra research fellowships. The "new blood" scheme - to maintain the vitality of university research - provided for an additional 700 university researchers and lecturers in natural science, technology and arts by 1985-86. The IT in HE scheme was to be funded wholly by DES from additional resources and not from Alvey Programme funds, as envisaged by the Alvey Committee. In practice, however, it did no more than maintain the level of IT graduate output from universities in the face of reductions in university funding in 1981-82, although it did help to increase graduate output from the polytechnic sector. On the postgraduate side, by contrast, the number of new awards increased from 397 in 1982 to 1,674 in 1985.

5.8 The ETP represented the culmination of a long debate within Government Departments. DTI, supported by the MSC had proposed a saturation (over-supply) approach which aimed, by 1990, to increase the annual output of engineering and IT graduates by 3,000. Having regard to resource factors, and to the logistics of teacher and student supply, DES finally concluded agreement with other departments and agencies on a more modest - but as they saw it more realistic - programme over the same period to give an increased output of 1,500 graduates per year.

5.9 The ETP, when announced, covered only the three years to 1987-88 and was split into two phases. The first phase was to provide 475 extra under-graduate and 104 post-graduate places for each of the three years in universities with existing facilities and courses. The second phase would require new capital expenditure on buildings and would provide places (1,000 under-graduate and 120 post-graduate per year) only in the second and third years. Phase II would also extend the programme to the polytechnic sector and to Cranfield IT Institute. Phase I and II would together achieve the aim of the ETP of an extra 5,000 places in engineering and technology disciplines by 1990, of which four-fifths or more will be in the fields of computer science and electronic engineering. This equates approximately to an increased graduate output in these fields of 1,500 per year. The cost to the Government was to be £43 million and this was to be found from within existing expenditure allocations including DES grant for the Universities. Other Departments, including DTI and the Departments of Employment and Energy, were to

contribute. The then Secretary of State for Education and Science announced in the House of Commons on 12 November 1985 that he had made provision within his programme for continuation of ETP in 1988-89 and later years.

5.10 The Government also made it clear that it looked to industry to offer concrete support to the institutions included in the Programme; so far as Phase II institutions were concerned industrial support was a necessary condition of Government funding. In the event some 200 companies contributed assistance valued at some £24 million during 1985-86 alone. Assistance included gifts of equipment, lending staff for part-time teaching, helping with course design, providing more training places with firms and in sponsoring students.

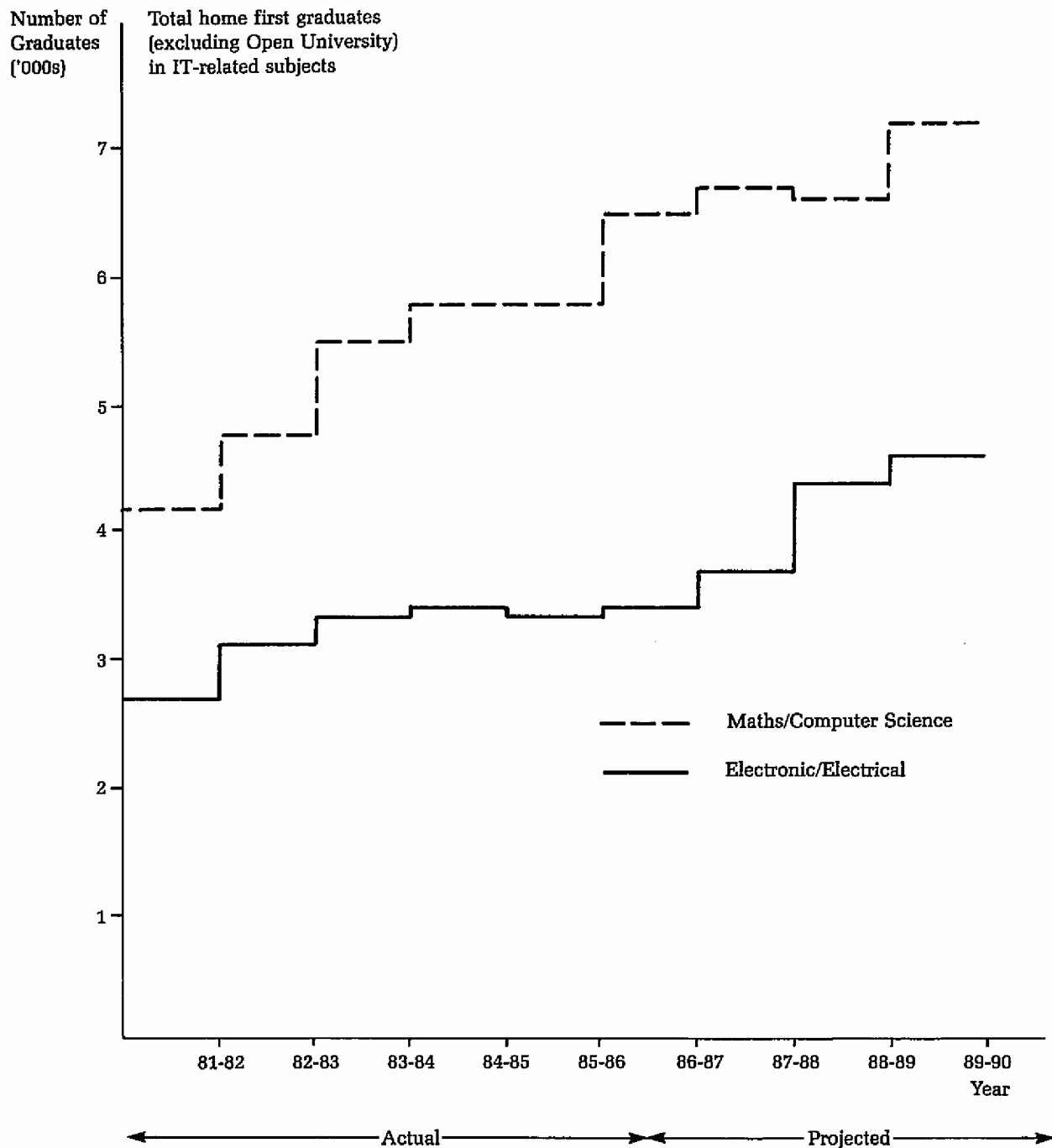
5.11 Where the IT in HE initiative and the ETP are used to increase current course places as opposed to funding completely new courses, it cannot be said which graduates from the course are due to the extra funding and which are "ordinary" students. All that can be done is to monitor the total number of graduates each year. The overall trends in graduate output in IT-related subjects are set out in Figure 4.

5.12 In addition to the major higher education initiatives, there have been a considerable number of measures to promote IT throughout education. A brief description of the more important is given at Appendix 9. Probably of greatest relevance to the Alvey Programme are the post-graduate initiatives such as the Teaching Company Scheme (DTI/SERC) and the Integrated Graduate Development Scheme (SERC). Lower down the educational scale, initiatives such as the Information Technology Centres (DTI/MS), the Technical and Vocational Education Initiative (MS/DES/SO/WO), PICKUP (DES), Interactive Video (DTI), Micros in Schools (DTI), Microelectronics in Education (DES) have all made a contribution to a widening of the skill base.

Monitoring IT skill needs

5.13 As indicated in previous paragraphs, there have been numerous enquiries into IT skills shortages. Most have sought - but generally failed - to quantify the problem. Many of the subsequent reports had called for a national body to monitor manpower demand and supply. But the Government has so far rejected the setting up of such a central body on the grounds that a new body specially charged with improving the prediction of future manpower needs is unlikely to be able to add significantly to the evidence already available. The White Paper "Higher Education - Meeting the Challenge" (Cmnd 114)

Figure 4
Trends in IT graduate figures



Source: DES July 1987

does, however, promise a major inter-departmental review of prospective need for highly qualified manpower generally by industry, commerce and the public services and to commission further research if necessary. It also states that, if the evidence of student or employer demand suggests that graduate output will not be in line with the economy's needs, the Government will consider whether the planning framework should be adjusted.

5.14 In the meantime, there have been some initiatives which should improve monitoring. First, DTI have recently set up a new section to collect and assess evidence on industry's changing patterns of demand for skilled manpower, working closely with the MSC's Skills Unit and others, and focussing particularly on IT and related technologies. And the CBI has established the Information Technology Skills Agency (ITSA). This has the specific remit of working for the advancement of education to ensure that the development of the UK economy and the creation of employment opportunities are not limited by shortages of technology skills. It will both monitor the position on skills shortages and make recommendations to Government on means of remedying them at all levels of education and training. The full terms of reference of ITSA are at Appendix 10.

The Alvey Directorate's role in ensuring adequate IT skills supply

5.15 The Alvey Committee had recommended a specific role for the AD in monitoring IT manpower requirements for the Programme and in initiating action to meet these. The Government, in approving the Programme, did not give the AD this educational remit. It has nevertheless taken a considerable interest in the problem and undertaken initiatives where this appeared necessary. These have included developing distance learning courses in collaboration with the National Computing Centre and the IKBS Journeyman scheme, under which small numbers of industrial staff are able to train for six month periods at designated centres of excellence in IKBS. They also encouraged SERC's support for distance learning courses in IKBS and SE in collaboration with the Open University.

5.16 The AD has also contributed to the debate on skills shortages by giving evidence to various committees and participating in inter-departmental reviews. It has been closely involved in the allocation of teaching and research posts arising from the ITI and ETP measures. The Director was a member of the Butcher Committee and is now an observer at ITSA. DTI also consider that the Programme has itself

generated large numbers of trained personnel and has induced several UK experts to return from abroad.

The effect of skills shortages on the Alvey Programme

5.17 Skills shortages have affected all areas of the Alvey Programme, but have been most acute in IKBS. As early as November 1984, the AD estimated that virtually all the available IKBS expertise in the UK was already involved in Alvey projects. As a result, companies wishing to submit collaborative proposals were finding it impossible to involve researchers with experience in Artificial Intelligence, and a number of deserving projects were having to be rejected for this reason. Later the AD identified skills shortages as the major determinant of the future development of IKBS, and found that it was proving difficult to get proposal from industry through the advisory committee due to the inexperience of many of the teams. A few IKBS projects have, in fact, been funded in the knowledge that teams lack the necessary experience, but in the hope that they will pick up the skills required during their participation in the project.

5.18 The shortage of skilled manpower, particularly within the industrial community, has also affected the rate of progress of the Alvey Programme in SE and MMI. The AD consider that it took a full two years to build up the required level of industrial involvement in the SE Programme. In MMI, too, the build-up of industrial teams and the commitment of Alvey funds was slower than anticipated, due to the lack of specialist expertise in the field.

5.19 The NAO's own case examination concentrated on continuing projects and was not designed to pick up projects which had been rejected for inadequate skills. Problems on projects were generally attributable to several causes and it was often difficult to associate the resulting damage specifically with skill shortage. Nevertheless, the NAO's review revealed that manpower and staffing difficulties had been reported in over 50 per cent of the 42 cases examined. The major problem was the recruitment and retention of staff of sufficient calibre to participate in an advanced research programme. In a number of projects, programme objectives had been adversely affected by this. Thus delays (some substantial) and the need for extensions (nine projects) will have clearly been detrimental in an integrated programme; withdrawal of partners (five projects) reduces the degree of collaboration and dissemination; use of foreign experts (two projects) and use of an overseas university (one project) affects the intention of developing a UK AIT capability.

Part 6: Other Information Technology Schemes

6.1 In addition to the Alvey Programme there are national and European funded schemes which, wholly or in part, support research and/or development of IT. The Government has also given its response to the proposals of the "IT 1986 Committee", chaired by Sir Austin Bide, which proposed a programme of continuing IT research and development after the Alvey Programme has been completed. This part of the report considers whether there is any duplication or conflict between the Alvey Programme and these other schemes; and looks at the "After Alvey" proposals in the light of the present study.

Existing IT schemes

6.2 DTI, through Investment Support for Microelectronics, the Software Engineering Programme, and other small schemes, promote awareness and applications by industry in electronics generally. The European Research Co-ordination Agency manage the collaborative programme, EUREKA, which is concerned with enhancing European competitiveness in high technology by collaboration between firms and research institutes and includes IT aspects. United Kingdom participants in EUREKA may apply for DTI financial assistance. The above schemes differ from the Alvey Programme in that they support initiatives that have advanced beyond the basic research stage and are thus nearer the market.

6.3 The European Strategic Programme for Research and Development in IT (ESPRIT), however, is a European Community Programme that is designed to provide Europe with the technological base to make it competitive in IT. It therefore has similarities with the Alvey Programme. In 1985, the House of Lords Select Committee on the European Communities considered the scheme, including its relationship to the Alvey Programme. In their 8th Report, Session 1984-85 the Committee noted that the Alvey Director assessed the potential overlap between the two schemes at some 25-30 per cent. The NAO noted, however, that the Alvey Director is a member of the ESPRIT Management Committee and his Directorate examine copies of all United Kingdom applications with the aim of avoiding duplication of Alvey work.

6.4 This vetting actively helped to ensure that no research activity could be funded from the two sources and that the Directorate were aware where Alvey themes were being pursued in ESPRIT projects or vice-versa. The NAO case examination also showed that applications from potential participants in the Alvey Programme had to declare whether they were receiving support under any other national or international programme, which facilitated checks on duplication of work. Furthermore, Alvey contracts provide specific conditions as to payment of grant. Claims paid by the AD were supported by certificates from independent auditors and payments by MOD and SERC were made in accordance with their long-standing payment procedures.

After Alvey

6.5 The Alvey Committee foresaw a need for further collaborative research beyond the five-year programme it had recommended and such a programme was considered by the "IT 1986 Committee". The Committee reported in November 1986, recommending that there should be a Plan of Action for IT founded on:

- (a) a Scheme of collaborative IT Applications;
- (b) a focussed collaborative Research Effort to support application needs; and
- (c) measures to promote technology transfer, widespread adoption of IT, and the development of IT skills.

6.6 The Committee proposed that industry should play a major part in the organisation and management of the programmes. It was therefore recommended that the Board, which would determine strategy, and the supporting Executive Group within DTI should have representatives from the user and supplier IT industries and from Government Departments.

6.7 The Committee proposed that the Government should contribute £125 million to the Applications Scheme, with variable funding rates according to the assessed risks of each project. It was stated that the

Scheme should be planned so as to stimulate a much larger investment by industry and thus generate a total programme of £500 million or more. In addition, it was proposed that Government should contribute £300 million to a five year Research Effort programme within a total cost of £550 million; funding 100 per cent of academic costs (£50 million) and 50 per cent of industrialist costs (£250 million). Full details of the Committee's recommendations are at Appendix 11.

6.8 The Government welcomed the report of the IT86 Committee. At the Alvey Conference in Manchester in July 1987 the Chancellor of the Duchy of Lancaster said that its recommendations were being considered as part of the review of DTI priorities. The results of the review of the DTI priorities were announced on 12 January 1988 in the White Paper "DTI - the department for Enterprise" (Cm 278). The proposals listed in the White Paper

included a new initiative in the field of information technology to follow from the Alvey Programme. DTI has provided £29 million for this over the next three years and SERC £55 million over a five year planning horizon. The initiative is to be managed by a new unit, based on the Alvey Directorate, which will be responsible for the whole range of the Department's research programmes in the field of electronics and advanced IT. DTI will encourage and finance further collaborative research through:

- (a) ESPRIT II - an EEC collaborative programme specifically in IT - for which there will be a United Kingdom contribution of the order of £200 million;
- (b) the United Kingdom-only LINK programme and the European EUREKA programme which both encourage companies to undertake joint research with education institutions and Research Councils but are not restricted to IT.

Glossary of Abbreviations

ACARD	Advisory Council for Applied Research and Development
AD	Alvey Directorate
AIT	Advanced Information Technology
BT	British Telecom
CAD	Computer Aided Design
CBI	Confederation of British Industry
CBS	Centre for Business Strategy (London Business School)
DES	Department of Education and Science
DTI	Department of Trade and Industry
ESPRIT	European Strategic Programme for Research and Development in IT
ETP	Engineering and Technology Programme
EUREKA	European Research Co-ordination Agency
GEC	General Electric Company plc
ICL	International Computers Limited
IKBS	Intelligent Knowledge Based Systems
IMS	Institute of Management Studies
IPR	Intellectual Property Rights
IPSE	Integrated Project Support Environment
IT	Information Technology
ITI	Information Technology Initiative
ITSA	Information Technology Skills Agency
LD	Large-Scale Demonstrator
LDP	Large-Scale Demonstrator Programme
MMI	Man Machine Interface
MO	Monitoring Officer
MOD	Ministry of Defence
MSC	Manpower Services Commission

NAB	National Advisory Body (for Public Sector Higher Education)
NAO	National Audit Office
PREST	Policy Reserach Engineering, Science and Technology (University of Manchester)
SE	Software Engineering
SERC	Science and Engineering Research Council
SO	Scottish Office
SPC	Software Production Centre
SPRU	Science Policy Research Unit (University of Sussex)
STC	Standard Telephones and Cables plc
STDC	Software Tools Demonstrator Centre
UGC	University Grants Committee
VLSI	Very Large Scale Integration

Appendix 1

Definition of the Alvey Committee's enabling technologies

Software Engineering (SE)

Software, the operating instruction for computers, is a fundamental component of IT systems and accounts for an increasing proportion of their cost. Today it is common practice to construct even large and application-specific systems using ad hoc techniques but as systems become more complex this approach is becoming untenable. In order to meet the requirements of the efficient production and operation and improved reliability and performance an engineered approach to software production is required. Software Engineering will provide for specification and prototyping, leading to automatic software production; programming support; computer aided design for VLSI; and a knowledge base of available and re-usable hardware and software components.

Man/machine Interface (MMI)

Critical to the development of IKBS are: the identification of the needs, conventions and skills in successful human communications; analysis of human problem solving behaviour and expertise transfer and the application of these to information systems. Additionally, the development of speech and image processing to improve communication between untrained, non-expert users and the machine by methods that are natural for humans is

fundamental to the commercial success of advanced systems.

Very Large Scale Integration (VLSI)

This involves the design, manufacture and testing of silicon chips of approximately 1 cm square which contain about 1 million logic gates each capable of switching delays down to one nano second. These, and development of novel computer architectures, to avoid the limitations of single processor sequential machines, are the means of achieving high speed processing of information.

Intelligent Knowledge Based Systems (IKBS)

An intelligent knowledge based system is one which uses inference to apply knowledge to perform a task. Developing IKBS is seen as the best way of applying IT to areas that present computer technologies cannot meet and it is envisaged that such systems will eventually be used to handle information in many areas of human activity, i.e. medical diagnosis, citizens' advice, engineering design, agriculture, military strategy etc. The research programme overlaps with those of MMI and VLSI and the production of IKBS will be dependent on progress in these areas and on the development of Software Engineering.

Appendix 2

The Alvey Committee Report

Summary of recommendations

1. Government should launch a national programme for Advanced Information Technology. This should be a collaborative effort between industry, the academic sector and other organisations, with Government backing.

2. The programme should cover basic research and design tools in four key enabling technologies: software engineering, VLSI, man-machine interfaces and intelligent knowledge based systems. The programme should also include the provision of a communications infrastructure.

3. Education and training measures are required to provide the manpower for the technical programme and for the results of this programme to be exploited and used.

4. Government should provide 100 per cent funding for academic research and education, and for infrastructure components of the programme; and should provide some 60 per cent of the total funds for industrial work, the exact amount varying from 90 per cent to 50 per cent depending upon the particular activity. Industry should provide the balance of funds needed for the programme, and should finance commercial exploitation, supported by existing Government schemes.

5. Property rights arising from any industrial research 90 per cent Government funded should belong to the companies conducting the research, but they should be required to make the results available to other UK companies. Property rights arising from work 50 per cent Government funded should belong to the companies involved in these projects. If they

do not intend to exploit commercially they should be required to transfer these rights to Government.

6. The programme should be managed as a coherent entity by a new Directorate, which should be set up in DOI for this purpose. The Directorate should be supervised by, and be accountable to, the EARB, which should be restructured for this task. The Directorate should be given the mandate to implement the programme and have the necessary powers and resources to achieve this. It should operate chiefly by placing prime contracts on other organisations.

7. Government funding for the programme should be made by DOI, MoD and SERC. Arrangements should be made for these departments to be involved in the management and supervision of our programme.

8. The programme should be viewed as lasting 5-10 years. However, there should be detailed annual targets and regular reviews of performance and requirements. The decision to continue should be taken in the light of these.

9. The Directorate should encourage early and widespread commercial exploitation of the results of the programme not least by the small business sector. Exploitation should not be restricted to companies participating in the programme.

10. The programme should be implemented immediately to safeguard the future competitiveness of the UK IT industry. The first step is to set up the Directorate so that detailed planning and the letting of contracts can commence. The programme should go "live" in April 1983.

Appendix 3

Expenditure on the Alvey Programme

	Actuals (000's)					Estimates (000's)					
	1983-4	1984-5	1985-6	1986-7	Total	1987-8	1988-9	1989-90	1990-1	1991-2	Total
Project spend by enabling technology											
VLSI	—	2,990	14,294	16,022	33,306	19,631	13,486	5,731	1,641	—	73,795
SE	—	1,752	3,961	8,583	14,296	8,758	4,942	1,107	190	—	29,293
IKBS	—	1,725	6,402	7,661	15,788	7,363	5,119	1,824	116	15	30,225
MMI	—	204	2,255	4,699	7,158	9,186	5,396	1,847	183	5	23,775
LD	—	1,049	3,017	3,426	7,492	4,842	4,810	3,018	297	40	20,499
Total	—	7,720	29,929	40,391	78,040	49,780	33,753	13,527	2,427	60	177,587
Non-project spend											
DTI Infrastructure and Communications	1,965	1,189	1,902	3,070	8,126	2,294	825	316	—	—	11,561
DTI Consultancy	—	989	1,214	1,602	3,805	2,000	1,064	600	—	—	7,469
DTI Awareness & Publicity	—	—	80	144	224	197	148	59	—	—	628
SERC Infrastructure, Co-ordination & Support	—	979	2,619	3,176	6,774	3,361	1,670	—	—	—	11,805
SERC Administration	—	350	400	400	1,150	400	400	—	—	—	1,950
Total	1,965	3,507	6,215	8,392	20,079	8,252	4,107	975	—	—	33,413
Total of project and non-project spend	1,965	11,227	36,144	48,783	98,119	58,032	37,860	14,502	2,427	60	211,000

Source: The Alvey Directorate

Appendix 4

External evaluators studies

The Programme of Policy Research in Engineering Science and Technology (PREST) at the University of Manchester:

The establishment and early operation of the Alvey Directorate (January 1986).

The structure and organisation of the Japanese Fifth Generation Computer Project (February 1986).

Telephone survey of Alvey project coordinators (March 1986).

Collaboration agreements of the Alvey Programme (July 1986).

The structure and organisation of the Alvey Programme for advanced IT (OECD paper) (January 1986).

Centre for Business Strategy at the London Graduate School of Business Studies (CBS) and Templeton College, Oxford:

The UK software industry — and overview (January 1986).

The Science Policy Research Unit (SPRU) at the University of Sussex:

Assessing the technological performance of the UK electronics industry using patent data: notes on method and an illustration (January 1985).

Evaluating Alvey: notes on the evaluation of the Alvey Programme (March 1985).

A preliminary comparison of IT programmes (March 1985).

VLSI: a personal appraisal (August 1985).

Lessons from abroad: what the UK can learn from foreign IT policies (December 1985).

The evaluation of the Alvey Programme: the SPRU workplan 1984-90 (January 1986).

Source: Alvey Programme Annual Report, 1986.

Appendix 5

Procedures for strategy formulation and project appraisal

Strategy formulation

Directors of enabling technologies were required to devise strategies in accordance with the following guidelines:

- interested parties should have sufficient opportunity to comment at an early stage;
- as well as general comment from industry, detailed comment should be taken from a group including industry, academia and defence;
- industrial members should cover the range of interests, including users;
- the best individuals should be selected but excessive representation for particular firms should be avoided;
- where possible, existing advisory groups should be used, modified if necessary to include representatives of MOD, DTI and SERC.

Therefore, for each technology the process started with consultation between the Director and the research communities. Draft strategies were devised by the Directors and Working Parties and considered by Advisory Committees before submission through the Alvey Board to the Steering Committee for approval.

Project appraisal

Proposals for research projects within strategies were sought by the Alvey Directorate through "Announcements of Opportunity" in its publication, "Alvey News". The Directorate also made approaches to uninvolved companies with relevant expertise and assisted applicants with inappropriate proposals to amend them or to enter into collaboration with another party. Additionally, numerous unsolicited bids were received.

Guidance Notes for the Applicants, published in February 1984, listed the criteria against which bids would be evaluated. These included:

- (a) relevance to the objectives of the Alvey Programme;
- (b) the extent of collaboration and its possible benefits;
- (c) the quality of the participating teams and of the background knowledge and experience they would bring to the task;
- (d) the realism of the proposed workplan;
- (e) the ability of the participants to exploit the work;
- (f) the cost to the Directorate in relation to the work proposed;
- (g) likelihood and timeliness of successful achievement of the stated objectives;
- (h) conformity to standards approved by the Directorate.

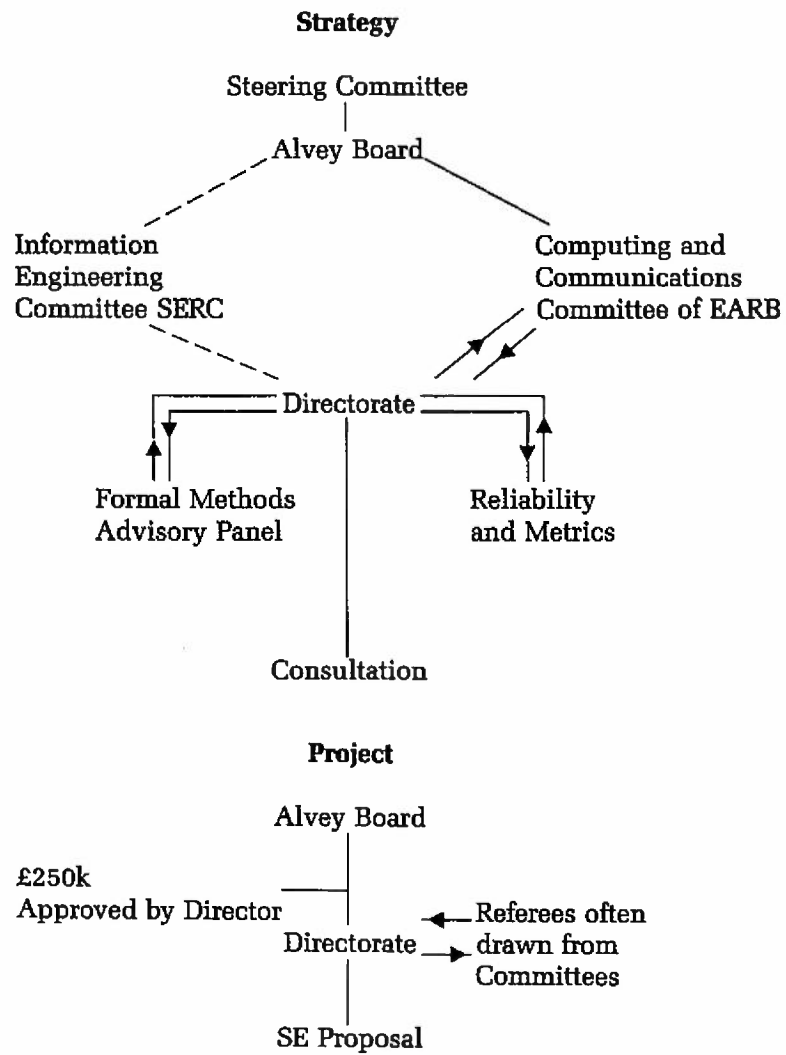
After consideration within the enabling technology Directorate and by independent experts, proposals were further considered by advisory committees before submission to the Alvey Board for approval.

Committee structure

Committees involved in strategy formulation and project appraisal involved 192 people. These were drawn from:

	No	%
Government Departments	74	39
Industry	58	30
SERC and University	41	21
Other	5	3
Directorate	14	7
	192	100

Below Board level each enabling technology had its own committee structure. That for SE is shown overleaf



Appendix 6

Framework for IPR and collaboration in the Alvey Programme

1. Introduction

The Alvey Programme is collaborative and only in very exceptional circumstances will support be awarded to a single organisation. This collaborative element carries certain implications for the organisation of the work and the relationship between the government and the firms and academic and other research organisations carrying out the research as well as between individual members of any Consortium. The specific details of the collaboration are for the individual members of a Consortium to negotiate between themselves, but the Alvey Directorate does need to be assured that the collaboration is soundly based and that there will be effective sharing of information between the contributors. For this reason there will be some rules which will be a condition of participation in the Alvey Programme.

The rules are set out below in a framework which will be incorporated in the letter of grant/contract and will set the constraints within which individual collaboration agreements will be negotiated by the members of a Consortium. This framework is comparable with that developed for the ESPRIT programme and will apply to all support under the Alvey Programme whether in the form of letters of grant from the DTI or contacts from MOD. It will also apply as appropriate to academic participation in the Alvey Programme. While the framework contains the rules applicable to the whole of the Alvey Programme, individual Projects may have additional conditions reflecting specific requirements of the Directorate. These might involve particular obligations with respect to IPR or a requirement that the Project works to, or incorporates, defined standards. Any such requirements will be made known in advance.

2. Definitions

- (i) *Alvey Programme*: all work carried out with support from the Alvey Directorate and extending to the exploitation of that work.
- (ii) *Contributor*: any firm, academic or other research organisation in receipt of financial support from the Alvey Directorate.
- (iii) *Project*: specific work undertaken by a Consortium or individual Contributor with

financial support from the Alvey Directorate.

(iv) *Consortium*: Contributors working on any Project in collaboration and under the terms of a formal collaboration agreement. For the purposes of this framework the term "Consortium" shall include the case of a single organisation working alone on a Project.

(v) *Category Club*: those Contributors working on any Project in a single Alvey enabling technology (eg VLSI or Software Engineering) or a smaller subset of these. The Directorate reserves the right to vary the membership of these Clubs in the interests of the Programme.

(vi) *Alvey Club*: all members of Category Clubs.

(vii) *Background*: any inventions, designs, computer software, reports, drawings and other works and information made available by a contributor for use in the Project or necessary to exploit the Results but not generated under the Project and belonging to the Contributor or to which the Contributor has the necessary rights for the purposes of the Alvey Programme.

References to Background in this framework cover any such material as above which is made available before the end of the Project as necessary for the exploitation of the Results of that Project.

(viii) *Results*: any inventions, designs, computer software, reports, drawings or other works and information generated under the Project by the Contributor or under any subcontract.

(ix) *Dissemination*: the passing of a report prepared by a Contributor to any other Contributor(s) which contains:

- (a) a statement on the Results and/or progress of work done under the Project;
- (b) a statement of the performance, form, fit and function of items resulting from the work.

(x) *Disclosure*: the passing to any party by the contributor of information which contains:

- (a) data relating to capability, technology, techniques, process know-how and the like;

(b) any data which is deemed by the disclosing party to be of a commercially sensitive nature.

3. Organisation of Programme

The receipt of support confers membership of a limited community of industrial and academic and other research institutions who have rights and duties at three levels:

- (i) *Project*;
- (ii) *Category Club*;
- (iii) *Alvey Club*.

4. Structure of Collaboration

- (i) Each Contributor will be entitled to choose its partners in any Consortium.
- (ii) Members of a Consortium will submit a joint proposal to the Alvey Directorate.
- (iii) A formal collaboration agreement will be included in a joint proposal setting out, *inter alia*:
 - (a) the terms of the collaboration between the intending Contributors and the mechanisms for managing the Project;
 - (b) ownership and licensing of IPR;
 - (c) provisions for confidentiality including any mechanisms for agreeing disclosure of information to Category Clubs, the Alvey Club, or third parties.

5. Management/Organisation of a Consortium

The collaboration agreement relating to a Project will cover the management and organisation of the Consortium. It will set out the details of how the work by the different Contributors will be coordinated; how information relating to the Project will be collected and assessed; and the mechanism for reviewing progress and reporting the results of these reviews to the Alvey Directorate at agreed regular intervals which shall be no more than six months. The management of the project must be agreed with the Alvey Directorate. The following conditions shall apply:

- (i) Where there is a prime contractor, he will be responsible for documentation of IPR, communication of management information and submission of regular progress reports to the Directorate;
- (ii) Where there is no prime contractor each Consortium will appoint an employee of one of its industrial Contributors as the formal contact

point with the Directorate for the communication of management information and submission or forwarding of regular progress reports;

(iii) Where there is no prime contractor the collaboration agreement will set out the respective responsibilities and liabilities of the Contributors;

(iv) The Alvey Directorate will appoint a project assessor who will undertake the technical monitoring required by the relevant Alvey Director. The Contributors will co-operate with this assessor and make available such information (both financial and technical) as he considers necessary for the effective monitoring of the Project.

6. Intellectual Property

(i) Contributors are required to make all reasonable enquiries concerning the availability of IPR needed for the Project. They must make clear to the Directorate the dependence of the Project on, and availability of, any licensed-in IPR.

(ii) Participation in the Alvey Programme shall not of itself affect the ownership of Background.

(iii) Background necessary for the purposes of the Project shall be made freely available within each Consortium for such purposes for the duration of the Project.

(iv) When a Contributor sub contracts work under a Project, he shall take such steps as are necessary to ensure that his obligations under the Alvey Programme can be met.

(v) Results of the Project shall be vested in the non academic partners as set out in the collaboration agreement which will also contain the terms for recompensing academic research institutions for their involvement.

(vi) Results will be made freely available within each Consortium for the purposes and the duration of that Project.

(vii) If a Contributor is requested to disclose commercially sensitive information included within either Results or Background to a member of the Category Club or of the Alvey Club:

- (a) The Contributor owning the information may require the recipients to enter into an appropriate confidentiality agreement;
- (b) Where Results are to be provided to anyone not collaborating in the Project concerned, agreement by the other

Contributors to the Consortium may be required for the conditions of disclosure.

7. Dissemination and Disclosure

(i) Each Consortium will furnish regular reports describing progress and Results for dissemination confined to the appropriate Category Club(s). It is intended that these should be informative but may exclude commercially sensitive information.

(ii) Contributors should not withhold unreasonably, information relating to a Project requested by Alvey Club members who are not collaborators on that Project. The owner of the information may require the recipients to enter into an appropriate confidentiality agreement which may be subject to the prior approval of the other members of the Consortium.

(iii) Contributors are free to take into account their commercial interests when deciding whether and how material stemming from a Project should be made public. Within the constraints that this may impose, Contributors are able to publish material as they think appropriate and other Contributors should not seek unreasonable restrictions on their doing so.

8. Further Research

As a general rule, the conditions in this framework covering dissemination and disclosure should provide a satisfactory vehicle for collaboration between Contributors involved on different Projects. However where disclosure of information about one Project is necessary for the purpose and implementation of another Project, and the conditions set out in para 7 and elsewhere do not provide a means of ensuring this, the Alvey Directorate may call a meeting of the interested parties with a view to determining what information should be made available for the purposes of that Project and on what terms.

9. Exploitation

(i) Industrial Contributors to a Project shall ensure, as far as possible the exploitation of their own Results and shall in consequence be entitled to:

(a) A licence to use the Background of other Contributors to the Project to the extent necessary to exploit their own Results. Such licence will be on normal commercial terms;

(b) A licence to use the Results of other Contributors to the Project to the extent

necessary to exploit the Contributor's own Results. Such a licence will be on fair and reasonable terms;

(c) Request a licence to use those Results and relevant Background of a member of the same category Club which derive from a different Project but which are necessary to exploit the Contributors own Results. Such a licence shall be on normal commercial terms.

All such licences shall be on a non-exclusive basis and may be non-transferable.

(ii) An entitlement to a licence under this paragraph need not exist if the Contributors agree in their collaboration agreement that the requirement can be satisfied by supply of the necessary goods or services for which a licence would otherwise be required.

10. Failure to Exploit

If a Contributor fails to exploit its Results within 3 years after the completion of the Project or such longer period as may be agreed with the Directorate, and is unable to demonstrate that it will exploit those Results in a period which appears to the Secretary of State to be reasonable, it shall co-operate with the Secretary of State in securing their exploitation. In consequence it will license those Results on fair and reasonable terms, and any necessary Background on commercial terms, to another company at the request of the Secretary of State. In offering these licences preference shall be given first to members of the same Consortium, second to the appropriate Category Club and then to the Alvey Club.

11. Termination for Default

(i) If a Contributor to a Project defaults on its obligations so as to jeopardise the objectives of the Project then the defaulting Contributor's right to continue participating in the Project may be terminated, whereupon:

(a) Rights granted to other Contributors in respect of the defaulting Contributor's Background shall continue for the duration of the Project; to the extent that exploitation of the Results of other Contributors is dependent on the defaulting Contributor's Background, this shall be licensed on normal commercial terms;

(b) The defaulting Contributor shall provide other Contributors with a free licence to use any of its Results necessary

for the implementation of the Project. It shall also provide other Contributors with a free licence to use its Results to the extent necessary for them to exploit their own Results;

(c) All rights acquired by the defaulting Contributor under the Project to Background and Results of other Contributors shall cease immediately;

(d) Any rights granted to and by the defaulting Contributor may be extended on the same terms to a third party where its involvement is necessary for the satisfactory completion of the Project.

(ii) The collaboration agreement may provide for change of ownership of one of the Contributors to be treated as default on the part of that Contributor.

12. Termination for Convenience

Withdrawal from a Project without penalty shall require the unanimous consent of the other Contributors and unless otherwise agreed shall be treated as default with the conditions set out in para 11(i) of these rules having effect.

13. Crown Use

(i) Without prejudice to National Security, when a Government Establishment is a Contributor, the Crown shall have, in addition to the rights set out in sub paragraph (ii) below, the same rights and obligations as those prescribed herein for any other Contributor.

(ii) Without prejudice to the rights acquired by the Crown if a Government Establishment is a Contributor:

(a) In relation to any patented invention forming part of the Results of a Contributor, the respective rights of the Crown and that Contributor shall be as prescribed by Section 55 of the Patents Act 1977 save that the Contributor shall not be entitled to any payment in respect of any Crown Use of that patented invention other than in exceptional circumstances and at the sole discretion of the Secretary of State. The foregoing shall be without prejudice to any claim that the Contributor might have in respect of a patent forming part of his Background.

(b) The Crown shall have the right, free of payment, to use the Results for information and research purposes only, within Government Departments and Establishments, provided that any

information not in the public domain relating to such Results shall not be communicated outside such Government Departments and Establishments without the prior written permission of the Contributor to whom the Results are proprietary. For the purpose of this provision, a Royal Ordnance Factory shall be deemed not to be a Government Department or Establishment.

(c) Where a contributor is unable or unwilling to meet a requirement for the manufacture, supply or further development of items embodying or utilising that Contributor's Results (other than as provided under paragraph (a) above) for the services of the Crown on fair and reasonable terms, then the Crown may require the Contributor to make those Results and any relevant Background available for use by a third party nominated by the Crown, after consultation with, and having due regard to any representations made by the Contributor, to the extent necessary to enable that requirement to be met. In nominating such third party, preference shall be given first to another Contributor in the same Consortium, second to another Contributor in the same Category Club, and third another Contributor in the Alvey Club.

(d) Subject to paragraph (a) above use for the services of the Crown under paragraph (c) above shall, in respect of Results, be on fair and reasonable terms and in respect of Background on normal commercial terms. In each case the terms of use may be determined before or after the use commences taking into account the Crown's financial and technical contribution to such Results and Background under the Alvey Programme or otherwise.

14. Relations with Academic Participants

(i) In general, Contributors from academic research institutions should be full members of any Consortium with the same rights and obligations as non-academic Contributors, including any rights to use Results for further research. The ownership of any Background made available for the purposes of a Project will be unchanged. Results of a project involving collaboration between academic Contributors will be vested in the non-academic Contributors who will pay for any patent or like protection thought necessary.

(ii) In return for ownership of the Results, the non-academic Contributors should recompense

the academic Contributors on a basis which represents a fair and reasonable return for their contribution and its relation to the contributions of the other Contributors. It is not possible to say in advance what will constitute a fair and reasonable return nor is it desirable that a single means of payment should be specified.

Contributors may, however, find the basis for calculating the return suggested in the SERC Co-operative Research Grant Scheme provides a helpful model.

(iii) Where a Project involves only academic Contributors, the ownership of IPR will be treated as for normal SERC funded work, but

such Contributors as members of the relevant Category Club will have the standard obligations of a Contributor relating to the dissemination and disclosure of information and the granting of licences.

15. In those cases where agreement of any Contributor is required under this framework (including agreement to license following requests under paragraph 9 above and elsewhere), such agreement shall not be withheld unreasonably. However Contributors shall be entitled to full and sympathetic consideration of any safeguard necessary to protect their commercial interests.

Appendix 7

Alvey firms participation, June 1986 — firms in more than one project

Firm	Order	VLSI Techno- logy	VLSI Arch.	VLSI CAD	Software Eng	IKBS	MMI	Large Dem.	Comms	Total
GEC	1	22	4	6	5	13	7	1	1	59
ICL	2	—	2	8	14	20	4	1	—	49
BT	3	16	1	4	3	7	5	—	1	37
Plessey	4	18	2	6	2	3	3	1	—	35
STC	5	10	—	4	8	—	7	—	—	29
Ferranti	6	10	—	3	1	—	2	—	—	16
Logica	7	—	—	—	3	9	3	1	—	16
SDL	8	—	—	—	4	8	1	—	—	13
SSL	9	—	—	—	4	4	1	—	—	9
Thorn-EMI	10	1	—	3	—	1	2	—	—	7
BAe	11 =	1	—	—	1	1	2	—	—	5
Smiths	11 =	—	—	1	—	1	3	—	—	5
Racal	11 =	1	—	2	1	—	—	1	—	5
Plasma Technology	14 =	4	—	—	—	—	—	—	—	4
Philips	14 =	4	—	—	—	—	—	—	—	4
High Level Hardware	14 =	—	—	—	—	4	—	—	—	4
BSI	14 =	—	—	—	4	—	—	—	—	4
Yard	18 =	—	—	—	1	1	1	—	—	3
LDRA	18 =	—	—	—	3	—	—	—	—	3
NCC	18 =	—	—	—	3	—	—	—	—	3
NCSR	18 =	—	—	—	3	—	—	—	—	3
Scicon	18 =	—	—	—	1	2	—	—	—	3
Acorn	18 =	—	—	—	—	2	—	—	1	3
Unilever	18 =	—	—	—	—	2	1	—	—	3
Turing Institute	18 =	—	—	—	—	2	1	—	—	3
Vacuum Generators	26 =	2	—	—	—	—	—	—	—	2
Schlumberger	26 =	—	—	—	—	2	—	—	—	2
MARI	26 =	—	—	—	2	—	—	—	—	2
CAP	26 =	—	—	—	2	—	—	—	—	2
NAG	26 =	—	—	—	—	1	1	—	—	2
Stonefield	26 =	—	—	—	—	—	2	—	—	2
CRS	26 =	—	—	—	—	—	2	—	—	2
B Drug Houses	26 =	—	—	—	—	—	2	—	—	2
Imperial Software	26 =	—	—	—	2	—	—	—	—	2
Logica Programming	26 =	—	—	—	—	2	—	—	—	2
Helix Expert Systems	26 =	—	—	—	—	2	—	—	—	2
Shell	26 =	—	—	—	—	2	—	—	—	2
Visual Machines	26 =	—	—	—	—	—	2	—	—	2
ICI	26 =	—	—	—	—	1	—	—	—	1
Expert Systems Int	26 =	—	—	—	—	4	—	—	—	4
M Jackson Systems	26 =	—	—	—	2	—	—	—	—	2
BOC	26 =	2	—	—	—	—	—	—	—	2
BIS	26 =	—	—	—	1	—	1	—	—	2
Total: Above		91	9	37	70	94	53	5	3	362
Total: One Entry		7	1	3	13	27	16	—	—	66
Overall Total		98	10	40	83	121	69	5	3	428
Number of Firms (Above)	43	12	4	9	24	24	18	5	3	
Number of Firms (One Entry)	67	7	1	3	13	27	16	—	—	
Total Number of Firms	110	19	5	12	37	51	34	5	3	

← 25 →

Source: The Alvey Directorate

Appendix 8

The large-scale demonstrators

Project Title	Objective	(2) Participants at 4/86	Cost	Start	Expected duration at start
The DHSS large demonstrator LD 001	The Project aims to provide decision support systems to assist in a variety of tasks arising in large legislation based organisations.	ICL, Logica, Lancaster University, Surrey University, Imperial College, DHSS.	(1) £6,750,000	4/84	5 years
Mobile information systems LD 002	To bring the benefits of information technology to the mobile user. (Mobile Electronic Office, Traffic Information Collator etc).	Racal Research Ltd, Racal Operating Companies, Plessey Controls Ltd, Cambridge University, Electricity Council, Ferranti Electronics Ltd, HUSAT at Loughborough University, Sussex University, Thames Polytechnic, (BL Technology Ltd, Cambridge University, Transport and Road Research Laboratory, Acorn Computers, RAC Motoring Services).	(1) £7,500,000	9/84	5 years
Design to product LD 004	The aim of the project is to demonstrate the use of Artificial Intelligence in Computer Integrated Manufacture, culminating in a Full Demonstrator at a Manufacturing factory.	GEC Electrical Projects, GEC Research, GEC Avionics, Lucas CAV, National Engineering Laboratory, Edinburgh University, Leeds University, HUSAT at Loughborough University.	(1) £8,900,000	2/85	5 years
Speech input word processor and work station LD 006	To demonstrate a large vocabulary general purpose English Language speech input workstation.	Edinburgh University, HUSAT at Loughborough University, Imperial College. (Shell (UK) Ltd, Plessey UK Ltd).	(1) £7,500,000	10/84	5 years

Sources: Alvey Programme Annual Report 1986 Poster Supplement; Alvey Directorate Records.

(1) Estimated project cost at 4/86 (Total of Industrial and Public Funding).

(2) Participants who have withdrawn are bracketed.

Appendix 9

Examples of Government schemes aimed at promoting technology in education

Title of scheme	Start date	Dept	Description
1. Schools			
<u>Micros in Schools Scheme</u>			
Secondary	1980	DTI	Pound for Pound aid to secondary schools buying a microcomputer. Scheme now closed. 6,500 installed by close.
Primary	1983	DTI	As above, but in primary schools. Scheme now closed.
<u>Microelectronics in Education Programme (MEP)</u>			
	1980	DES	Resources allocated to development of educational software, courses of teacher training, development of a network of centres serving groups of LEAs to exchange and disseminate software. Provided teacher training for DTI "Micros in School" Scheme. Programme superseded by Microelectronics Education Support Unit (MESU) with a remit to consolidate MEP achievements.
<u>Support for Educational Software</u>	1985	DTI	Grants to purchase educational software for use in classroom.
<u>Mini-Enterprise Scheme</u>	1986	DTI	Designed to encourage every secondary school to set up at least one mini-company run by children in Industry Year 1986.
<u>British School Technology Centres (ITECS)</u>	1986	DTI	Aims to have technology introduced as an examination subject in every LEA by the end of 1986.
2. 16-17 year olds			
<u>Information Technology Centres (ITECS)</u>	1981	DTI/MSc	Established in inner city areas to train 16-17 year olds in electronics, computing and IT. Running of ITEC is by a LEA, or other sponsor. 175 centres set up by 1986 handling 6,000 trainees a year.
<u>Technical and Vocational Education Initiative</u>	1982	DE/MSc/DES/	An initiative designed to develop technical and vocational education for all 14-18 year olds in full-time education. Interests of industry and commerce taken into account through a National Steering Group £250m devoted to the pilot scheme and £900m to the extension. All LEAs are already participating, or have applied to join the scheme which will run until 1997.
FIRST PROJECT	1983	WO/SO	

Title of scheme	Start date	Dept	Description
<u>City Technology Colleges</u>	First School planned to open in 1988	DES	Independent schools, with a broad curriculum though with an emphasis on science and technology, in urban areas for 11-18 year olds. To be established by sponsors drawn largely from industry, with the running costs met by the DES. Expected to cost Government £30-40m a year.
3. Further/higher education			
<u>PICKUP</u>	1982	DES	Aims to increase volume of updating work in polytechnics, universities and colleges, to encourage them to investigate the updating needs of local employers and mount provision to meet their demands. Regional development agents appointed to assist in the development of PICKUP activity.
<u>Computer Numerically Controlled Machine Tools in Further Education</u>	1983	DTI/DES	Aims to familiarise engineering students with up-to-date equipment by providing grants to FE colleges to purchase advanced UK-made machinery.
<u>Polycad scheme</u>	1986	DTI/UGC	Aims to give all undergraduates in electrical and electronic engineering hands-on experience in the use of CAD for silicon circuit design. Direct grants to each participating college towards purchase of electronic CAD equipment. 94 institutions are participating.
4. Post-graduate			
<u>Teaching Company Scheme</u>	1974	DTI/SERC	Aims to develop active partnership between univs/polys and industry. Graduates are appointed for 2 years as Teaching Company Associates. They are based full-time at a company which is involved in a programme of updating in collaboration with academic staff from univ/poly. More than 190 programmes to date, involving 60 academic institutions and 200 companies.
<u>Integrated Graduate Development Scheme</u>	1979	SERC	Collaboration between a group of firms and a univ/poly. Graduate entrants to a firm attend over a 2-year period a series of courses to broaden their technical knowledge. Univ/poly cost are part-funded by SERC.
<u>Cooperation Awards in Science and Engineering (CASE)</u>		SERC	Research studentships where a company joins with a univ/poly in defining a project and supervising the student's progress. CASE awards represent approx $\frac{1}{3}$ of all SERC studentships.

Title of scheme	Start date	Dept	Description
5. Continuing education			
<u>Microelectronics Application Project (MAP)</u>	1978	DTI	Grants for short training courses in microelectronics at colleges, univs, polys, companies. Available to Industrial Engineers and Technicians. Similar project recently started in AMT.
<u>Training Opportunities Programme (TOPS)</u>		MSC	MSC's main provision for adult training in new technology. Courses are run at craft, technician and postgraduate levels.
<u>Opentech</u>	1982	MSC	Open learning projects run by outside bodies are provided funds on a pump-priming basis but must be self-sufficient in 3 years. Available to technician and supervisory staff.
<u>Interactive video</u>	1985	DTI	Provision of grants to develop distance learning video courses in subjects related to micro-electronics.

Appendix 10

Information Technology Skills Agency (Terms of Reference for the Policy Committee)

Objective

1. In keeping with the objects defined in the Memorandum of Association of the CBI Education Foundation, the Agency will work for the advancement of education to ensure that the development of the UK economy and the creation of employment opportunities are not limited by shortages of technological skills.

Strategy

The Agency will:

2. Monitor and make recommendations as appropriate to Government, education, industry and commerce, designed to ensure that:

- (a) adequate numbers of young people are qualifying sufficiently in key subjects (currently maths, physics and computer studies) at 16 and 18 years of age, in preparation for further/higher education;
- (b) adequate numbers of suitably qualified students and university/polytechnic places are available for key subjects (currently computer sciences, electronic, systems and software engineering and related subjects);
- (c) the costs of the nation's technological and industrial education and training requirements are adequately and equitably funded;
- (d) while these strategies are being developed other measures, like conversion and up-dating courses — including the use of distance learning techniques — are introduced and extended;
- (e) specific initiatives are promoted by or on behalf of industry/commerce in partnership with the education system. These could include:
 - Supplying key executives as Visiting Professors and helping with the supply of lecturers.
 - Providing consultancy and employment opportunities for academics to enhance dialogue at local level and increase the earnings of key individuals.

- Providing equipment on loan or as gifts and giving access to very expensive leading edge equipment which universities and polytechnics could not possess.
- Commissioning universities and polytechnics to supply contract education, eg conversion courses, development courses, updating programmes, etc.
- Making key people available to help coordinate activities to tackle shortages.
- Entering into training partnerships with academic bodies.
- Establishing "IT Training Companies" with equity participation by companies, academic institutions and Government.
- Increasing sponsorship of students on relevant undergraduate and post-graduate courses.
- Providing greater opportunities for students to obtain industrial experience within academic programmes.
- Encouraging greater interchange of views between industry and education.

- 3. Work in close collaboration with other appropriate bodies, in particular the University Grants Committee, the National Advisory Board and the Engineering Council, in advising Government in regard to the provision and allocation of resources for relevant areas of Higher Education.
- 4. Invite and, where appropriate, support initiatives from academic bodies to launch new programmes of research and education in the Information Technology field (or other vital areas) in partnership with industry.
- 5. Keep under regular review available information about those activities of business and education relevant to the demand for and adequate supply of skills related to Information Technology and other areas of skill supply which it regards as vital to the interests of the United Kingdom.
- 6. Follow a similar approach to partnership with the Further Education system and the schools, in

collaboration with the Foundation's "Understanding British Industry" project and other relevant organisations. In particular, keep under review the relevance, mode of attendance and extent of FE facilities, and access thereto, for existing and potential employees in IT related fields.

7. The composition of the Agency's Policy Committee, its strategic and operating plans, annual budget and individual projects involving substantial expenditure, require the approval of the Foundation's Council of Management, which will also require regular reports on the Committee's activities.

Appendix 11

Recommendations of the Bide Committee

1. A major collaborative programme be launched to encourage more effective application of IT in user industries, and to generate new and improved technologies for the benefit of both users and suppliers. The programme, the prime objective of which is to enhance the competitiveness of UK industry in world markets, in order to benefit the industry and the nation, should be linked to European programmes such as Esprit, Race and Eureka;
 2. The overall programme should be in three parts:
 - Collaboration between IT users, suppliers and academic institutions in projects in a Scheme of Applications which are judged likely to stimulate exploitation of IT research as well as being intrinsically worthwhile in contributing to improvement of the UK economy;
 - An academic/industrial Research Effort designed to meet the specific needs of the Schemes of Applications and to enlarge and refine the technology base from which IT systems generally can be successfully developed;
 - A technology transfer programme stimulating the wide adoption of IT and providing the necessary training.
 3. The Government fund the programme over a five year period to the extent of: — £125 million toward the Scheme of Applications and the technology transfer programme, £300 million towards the Research Effort. The £300 million for research would include the Government's contribution to the research element of the European Commission's proposed Esprit IT Programme as well as some £50 million to be spent on a fully funded basis by the UK universities. It would be expected that some part of the research expenditure in university departments (including some not directly associated with IT such as law, economics, languages and business studies) would be used directly or indirectly (for example by consultancy) to assist the progress of IT application by suppliers and users generally;
 4. Industry's financial support of the Research Effort should bring the total support of the Effort to £550 million, and its support of the Scheme of Applications should bring the total support of the Scheme to a figure in excess of £500 million;
 5. Government funding should be derived not simply from those Agencies of Government (DTI, MOD and SERC) that supported the Alvey Programme, but in addition from Departments actively involved in relevant applications projects; either as users or sponsors;
 6. Responsibility on behalf of Government for strategic and precedental decisions as well as for the promotion and supervision of the total programme should lie with a Board chaired by a senior industrialist. The Board should be within the ambit of the DTI and be supported by an Executive Group. Both the Board and its Executive Group should be made up of industrialists and of civil servants from the relevant Government Departments;
 7. The Board should encourage the development and use by all collaborators in the UK and Europe of a system of communications based on international standards;
 8. Further emphasis should be laid on introducing education and training measures designed to overcome shortages of the IT skills needed at all levels to fortify the economy and to create genuine work;
 9. Government, industry and academia urgently consider further how best to deal with IPR and contractual issues arising from the Plan of Action; and
 10. The experience and methods generated within the Alvey Directorate should be utilised to the fullest extent in optimising UK participation in European programmes.
- Source:** "Information Technology — A Plan for Concerted Action". The Report of the IT86 Committee. HMSO 1986.