Engineering and Physical Sciences Research Council : procurement of equipment from research grants report / by the Comptroller and Auditor General.

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NATIONAL AUDIT OFFICE

Report by the
Comptroller and Auditor General

Engineering and Physical
Sciences Research Council

Procurement of Equipment from Research Grants

HC 494 Session 1998-99
23 June 1999

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John Bourn
Comptroller and Auditor General

National Audit Office
17 May 1999

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For further information about the National Audit Office please contact:

National Audit Office
Press Office
157-197 Buckingham Palace Road
Victoria
London
SW1W 9SP

Tel: 0171-798 7400

email:nao@gtnet.gov.uk

Web site address: http://www.open.gov.uk/nao/home.htm

Contents

Executive summary

1 The Engineering and Physical Sciences Research Council (the Council) are one of six Research Councils which provide grants to meet the cost of specific research projects proposed by universities and other organisations. These grants may include funding for equipment which is then purchased by universities. In 1997-98 the Council made around 1,900 grants totalling some £260 million of which around £38 million (15 per cent) was for research equipment.

2 The Council give considerable freedom and flexibility to recipients of grants to manage the resources provided. By its nature scientific research is uncertain. The Council recognise that projects may change as the research progresses, either as a consequence of discoveries by the investigator or by others. The equipment needed may then be different from that applied for initially.

3 Our examination of research grants covered the last four years. During this period there have been considerable efforts by the higher education sector and the Research Councils to improve procurement arrangements generally. In 1996 the Joint Procurement Policy and Strategy Group, made up of representatives of the higher education sector, produced a procurement strategy and has been working with the sector to implement that strategy. In September 1998 the group provided new guidance on procurement of equipment and, in October 1998, guidance on whole life costing. The Cabinet Office has also issued guidance to departments on procurement issues including "Better Quality Services" and "Efficiency in Civil Government Procurement" (both July 1998), setting out the scope for efficiency gains in procurement.

4 The purpose of our examination was to establish whether there was any scope for more effective procurement of research equipment funded by the Council and if so what the Council could do to encourage the further implementation of the recent guidance on best practice. We examined 68 grants in order to identify the scope for further improvement. Our methodology is set out in Appendix 1.

Findings

5 Our study produced findings in five areas:

- Scrutiny of grant applications;
- Equipment purchased at keen prices;
- Overestimation of costs in grant applications;
- Equipment that could have been purchased more cheaply; and
- Combining equipment requirements to increase purchasing power.

Scrutiny of grant applications

6 When researchers apply for a grant they are required to identify the resources needed. Proposals are scrutinised through a process of peer review by academic experts in the relevant field of research. When equipment is required as part of the research project, a specific element in the total research grant awarded is identified by the Council as being available for this purpose. At the end of the grant period the achievements are assessed by the Council in terms of the research quality, output and cost effectiveness. Although the Council reconciles the funds against the expenditure, it does not review whether the equipment specifically set out in the application was actually purchased and whether it was purchased at the price specified in the grant proposal.

Some equipment is purchased at keen prices

7 Against the background of the procurement initiatives launched in the higher education sector, many universities have taken steps to improve their procurement arrangements. In our study of procurement in the English higher education sector we estimated that the sector had achieved savings of around £38 million in 1994-95, £53 million in 1995-96 and a further £42 million in 1996-97 from these initiatives. In 20 of the 68 cases we examined, universities had purchased equipment at keen prices. These cases were usually where suppliers had been willing to accept lower than normal prices in order to support, or associate themselves and their equipment with, a prestigious area of research.

Overestimating costs in grant applications

8 Our examination showed that, in our selection of cases, on average the equipment purchased by the universities cost around 16 per cent less than the amount provided by the Council. Generally the universities use the funds released to purchase additional equipment for the benefit of the research being undertaken.

9 Overestimating, where it occurs, is due to various factors. First, at the grant proposal stage, it is difficult for universities to obtain best prices from suppliers when they are not in a position to place a firm order. Second, prices can fall while the Council are considering the application. Third, some estimates are based on informally obtained prices rather than through formal quotations. Fourth, sometimes a margin is added to equipment estimates to insure against the Council not awarding a grant for the full value of the equipment proposed. Fifth, universities normally include provision for VAT in their applications, even if the equipment is subsequently zero-rated for VAT and the funds are not claimed from the Council. Finally equipment needs may change or alternative solutions to the equipment needs may be identified as research progresses.

10 We found that where the initial estimates were better evidenced, such as being based on competitive quotations, the estimates proved more accurate. Of the 68 cases we examined nearly half had not been fully funded by the Council. In the year ending July 1998 the Council found that the situation had improved and grants were reduced by 6 per cent overall and by 15 per cent for the equipment element of grant. The Council would prefer to fund fewer higher quality grant applications, but in full. Better evidencing of research equipment costs would be one element of providing a better quality grant application and would help ensure applicants had a greater chance of success.

Equipment that could have been purchased more cheaply

11 In the 68 cases (total value £8.7 million) we examined, savings of around £0.6 million (7 per cent) could have, in our view, been achieved by better purchasing. This was mainly because greater use could have been made of competitive purchasing, additional discounts could have been claimed in some cases and there had been scope for more effective negotiations with suppliers.

12 We found a number of areas where other best practice was not being applied and the advice of the universities' procurement experts was not sought. In no cases were alternatives to outright purchase, such as leasing, formally considered, or whole life costing adopted. A whole life costing approach to procurement takes account of the total cost of an item, from determination of need

through acquisition, running costs and eventual disposal. The adoption of this approach enables purchasers to understand more fully the costs involved and to make more effective comparisons between different procurement options. We also found no examples of the universities benchmarking the prices they were obtaining against those obtained by other universities or departments for similar research equipment.

Combine equipment requirements to increase purchasing power

13 The Council and other Research Councils have opportunities to co-ordinate major research equipment purchases. Combining together to increase purchasing power can produce additional savings because it strengthens the purchasers' negotiating position. It improves their ability to gain enhancements to the original equipment specification and offers suppliers the opportunity to reduce manufacturing and marketing costs. Except for some computer hardware purchases, we found no evidence of the Council or the universities co-ordinating purchases of major research equipment despite the potential benefits for doing so. Depending on the opportunities arising throughout the year, we estimate that additional savings of at least two per cent overall could also be obtained by co-ordinating major equipment purchases.

Conclusions

14 Gains can be secured by improving the accuracy of equipment cost estimates and the efficiency of equipment procurement. All the deficiencies in procurement we identified can be remedied if the universities follow the basic best practice set out in the "Equipment Procurement" guidelines for the higher education sector produced in September 1998 by the Joint Procurement Policy and Strategy Group referred to in paragraph 3. This guidance was issued in response to an earlier National Audit Office study in Scotland on equipment procurement by the Scottish higher education sector. It was issued after we had examined the case studies. It provides advice on competitive tendering, the use of preferred suppliers, negotiating effectively with suppliers, co-ordinating purchasing and involving procurement specialists.

15 We consider that the findings from our selection are generally indicative of the scope for improving the estimating for, and procurement of, equipment funded through grants. The case studies were selected to illustrate the potential scope for improvement but not in a way to allow statistical inferences to be made. If our findings are indicative of the potential gains across the whole of the Council's funding of research equipment, improved procurement would equate to

£2.7 million a year. Improved estimating could yield £6 million a year for the Council to fund on approved research which might not otherwise have been funded. However, it should be noted that this is a redirection, rather than an increase, in university research expenditure.

Scope for improving estimating and procurement

Figure 1

This figure shows how improvements in estimating and procurement release funds for investment in other research projects.

Scope for improvement	(%) of total cost	Annual value (£ million)
Estimating equipment costs	16	6
Improved procurement:		
Competition/negotiations	5	}
Seeking discounts	2	} 2.7
Co-ordination of purchases	2	0.8, but dependent on opportunities arising

We recommend that the Engineering and Physical Sciences Research Council should:

Recommendation 1 Encourage universities to improve their estimating of equipment costs by requiring proposals for equipment funding to be fully evidenced, while recognising, however, the effort required in preparing such proposals.

Recommendation 2 Make applicants aware that, for research proposals of equivalent quality, those that have well supported and realistic assessments of equipment costs are more likely to be fully funded.

Recommendation 3 Encourage universities to follow best procurement practice, including that set out in the "Equipment Procurement" guidelines for the higher education sector.

Recommendation 4 Identify opportunities for co-ordinated purchasing between universities.

Recommendation 5 Work with the other Research Councils and the Higher Education Funding Councils to continue to improve procurement and seek assurance that best procurement practice is being used and measures agreed to monitor progress in equipment procurement performance.

16 The Council accept our recommendations. In conjunction with the other Research Councils and the Office of Science and Technology, they have set up a Working Group to examine the report and to determine, with representatives of the higher education sector, how best to carry forward the report's recommendations.

Part 1: Introduction

1.1 The Council are one of six Research Councils which together provide around £630 million to universities and other higher education institutions to fund research. About £115 million of this is for the purchase of research equipment. Generally they provide their funding as part of a larger grant awarded for a specific research project, although grants purely for equipment are also made.

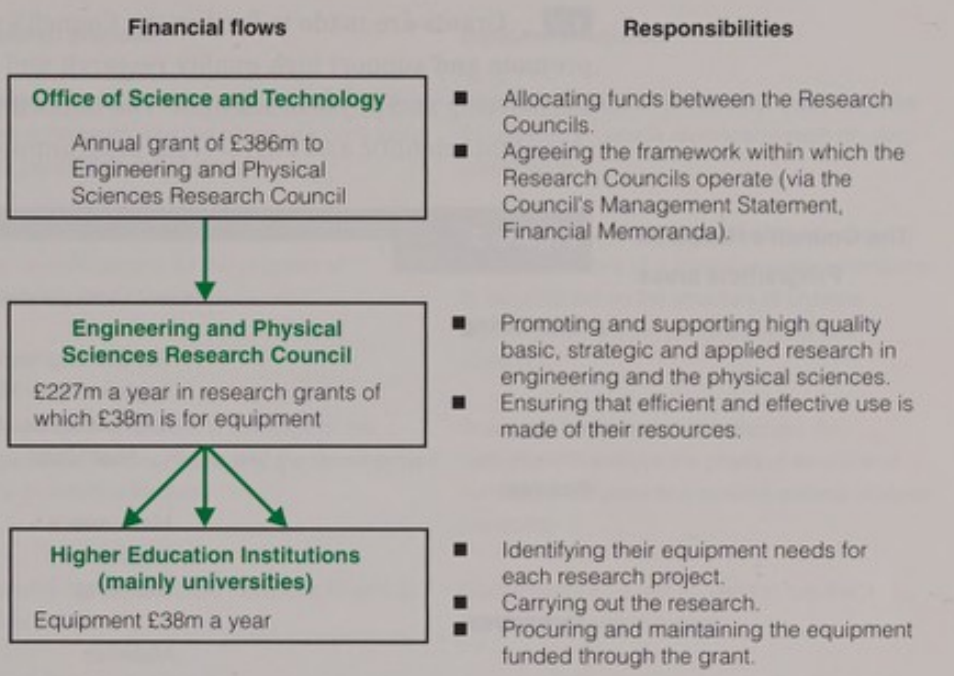
1.2 The Council are the largest provider of research grants. In 1997 they approved around 1,900 grants totalling some £260 million and, in 1997-98, incurred expenditure on research grants of £227 million of which £38 million (17 per cent) was for the procurement of research equipment. In June 1998 they were managing some 4,000 "live" grants (Appendix 1, Figure 14) valued at approximately £675 million with equipment of some £102 million.

1.3 University research equipment is funded from a variety of sources. The Research Councils between them provide 40 per cent of total funding. The other funding sources are the Higher Education Funding Councils who provide around 25 per cent, charities who provide almost 15 per cent; private industry or business providing around 10 per cent; and the European Community, government departments and donations providing around 10 per cent.

The Office of Science and Technology allocate funds between the Research Councils and agree the framework within which they operate

1.4 Research funds are provided to the Research Councils through the Office of Science and Technology which is part of the Department of Trade and Industry (Figure 2). The role of the Office of Science and Technology is to develop and co-ordinate Government policy on science and technology both nationally and internationally. Their overall objective is to ensure that science and technology expenditure is directed towards making the maximum contribution to national economic performance and quality of life. They are responsible for allocating the funds between the Research Councils and agreeing the framework within which they operate. In 1997-98 they made a grant to the Council of £386 million to cover their grant programmes and administrative costs.

Figure 2 Flows of the Council's research funding



Source: National Audit Office

The Council appraise proposals for research grant, monitor progress and review outcomes

1.5 As a Non-Departmental Public Body the Council have an obligation to ensure that the research programme resources they distribute, including grants for research equipment, are used economically, efficiently and effectively. The Council discharge their obligations by appraising, through peer review, proposals for grant, monitoring progress and reviewing outcomes. Reliance is placed on the universities' procurement procedures and controls as a means of purchasing the research equipment well. Up to now the Council have expected universities to follow the advice on procurement best practice from the Funding Councils and have not separately reviewed or monitored the usage or adequacy of the procurement arrangements in place at universities. These arrangements are examined in more detail in Part 3.

1.6 By its nature scientific research is uncertain. The Council recognise that initial intentions may change as the funded research progresses and that planned equipment purchases may need to be modified. The Council give the grant holders a high level of freedom and flexibility in the way they manage the resources provided so as not to stifle research ideas.

Grants are made to promote and support high quality research

1.7 Grants are made to further the Council's research objectives which are to promote and support high quality research and related postgraduate training in engineering and physical sciences. The Council divide their support for research into eight scientific and engineering programmes (Figure 3).

The Council's Research Programme areas

Figure 3

Engineering:	
	General Engineering
	Engineering for Manufacturing
	Engineering for infrastructure, the environment and healthcare
Science:	
	Mathematics
	Physics
	Chemistry
Technology:	
	Materials
	Information Technology & Computer Science

Source: The Engineering and Physical Sciences Research Council

1.8 The Council define equipment as items costing more than £1,000. Items costing less are classified as consumables. Examples of research projects and equipment funded by the Council are shown in Figure 4.

1.9 Grants provide the funds needed to meet the cost of specific research projects which may include equipment. Some research activity focuses on high quality blue skies research to further scientific understanding and support for the British science base. In the more applied research areas, such as engineering, the research may be tied more to the potential relevance of the results of the research to industry and commerce.

1.10 As with other Research Councils, the Council have a much greater demand for research funding than can be met within the resources available. Less than 40 per cent of the applications they receive are successful and receive funding.

Research projects funded by the Council

Figure 4

Research proposal	Equipment required
Research into the electromagnetic behaviour of future lightweight vehicles which use composite body panels instead of steel.	High quality graphic computers. Used to model the effects on vehicle electrical system of using composites.
Research into structures of single crystals using x-ray crystallography for the purpose of developing new materials.	X-ray diffractometer. The diffraction of x-rays by the atoms or ions of a crystal enables information to be obtained on the structure of crystals. Research will aid the development of new materials.
Research to promote the knowledge of the properties of solid surfaces and the development of the processes involved.	Scanning Transmission Microscope. An instrument to analyse the physical structure of surfaces It will provide a modern surface analysis capability.
Research into the unstable vibrations in vehicle brakes.	Components for a test rig used to test the vibrations in vehicle brakes.
Development of a facility for routine chemical analysis to enhance the throughput of routine samples.	Automated Mass Spectrometer. An apparatus used for separating isotopes, molecules, and molecular fragments by passing them through electric and magnetic fields. Used for analysing chemical samples.
Research into practical uses of lasers for surface processing, including the development of a laser percussion hole drilling technique.	Laser. A device that amplifies light by stimulating emission of radiation. The laser's beam of intensely pure light can cut through metal.

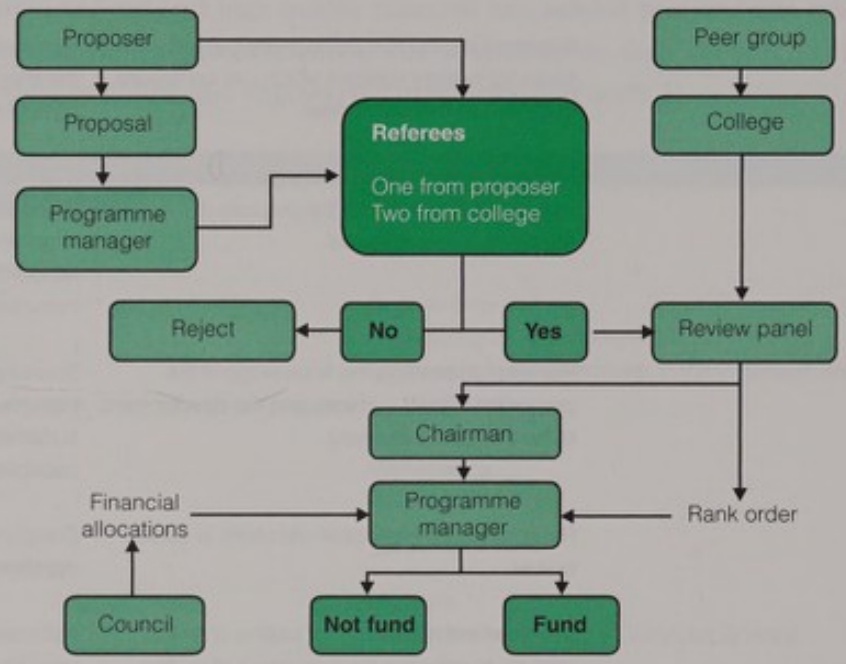
Source: National Audit Office database of live research grants

A peer review process is used to appraise grants

1.11 The award process is described in Part 3 but Figure 5 outlines how applications are handled.

How research grant proposals are handled

Figure 5



Source: The Engineering and Physical Sciences Research Council

Fifteen universities receive over half of the Council's funding

1.12 The Council provide grants for research by investigators in universities, and other similar institutions of higher education. Some 120 organisations are currently in receipt of research funding from the Council, although 15 universities receive over half of the funds for equipment (Figure 6).

Our objective was to establish whether there was scope for more effective procurement of funded equipment

1.13 We conducted this examination for a number of reasons, but mainly because:

- the equipment element of grants is a substantial (17 per cent) part of the Council's expenditure;
- the area offered potential for improvements and efficiency savings. The Council themselves were keen to make any cost effective improvements that would enhance value for money; and

Main recipients of Council funding for equipment

Figure 6

These 15 Higher Education Institutions receive around £58m of the £102m currently committed to equipment.

Source: The National Audit Office database of live grants as at March 1998

Note: * The NAO visited these universities and the University of Glasgow.

- other studies by the National Audit Office in 1993, 1996 and currently on purchasing in the higher education sector have made recommendations on ways to improve procurement. The 1996 study focused on research equipment in Scotland.

1.14 Our examination of research grants covered awards made by the Council over the last four years. During this period, the Higher Education Funding Councils in England, Scotland and Wales, the Department for Education (Northern Ireland) and the universities themselves have progressively introduced initiatives to improve procurement in universities. In 1993 the National Audit Office reported on University Purchasing in England and in 1994 the Committee of Public

Accounts subsequently reported on the progress that had been made. In 1996 representative bodies of the higher education sector established a Joint Procurement Policy and Strategy Group to co-ordinate and direct all strategic activities aimed at promoting good procurement practice in the sector. In 1996 the group produced its procurement strategy for Higher Education and has been working with the sector to implement the strategy. In February 1999 the group set out its revised procurement strategy as a consultation document. It gives increased emphasis on providing support for implementing its guidance and is supported by draft guidelines on "Effective Procurement in Higher Education" and a model procurement strategy. The Cabinet Office has also issued guidance on procurement issues including "Better Quality Services" and "Efficiency in Civil Government Procurement" (both July 1998), setting out the scope for efficiency gains in procurement.

1.15 The purpose of our examination was to establish whether there was any scope for more effective procurement of research equipment funded by the Council and, if so, to establish what the Council could do to promote the further implementation of the recent guidance on best practice. The two main issues examined were:

- whether research equipment funded by the Council could be purchased more cheaply; and

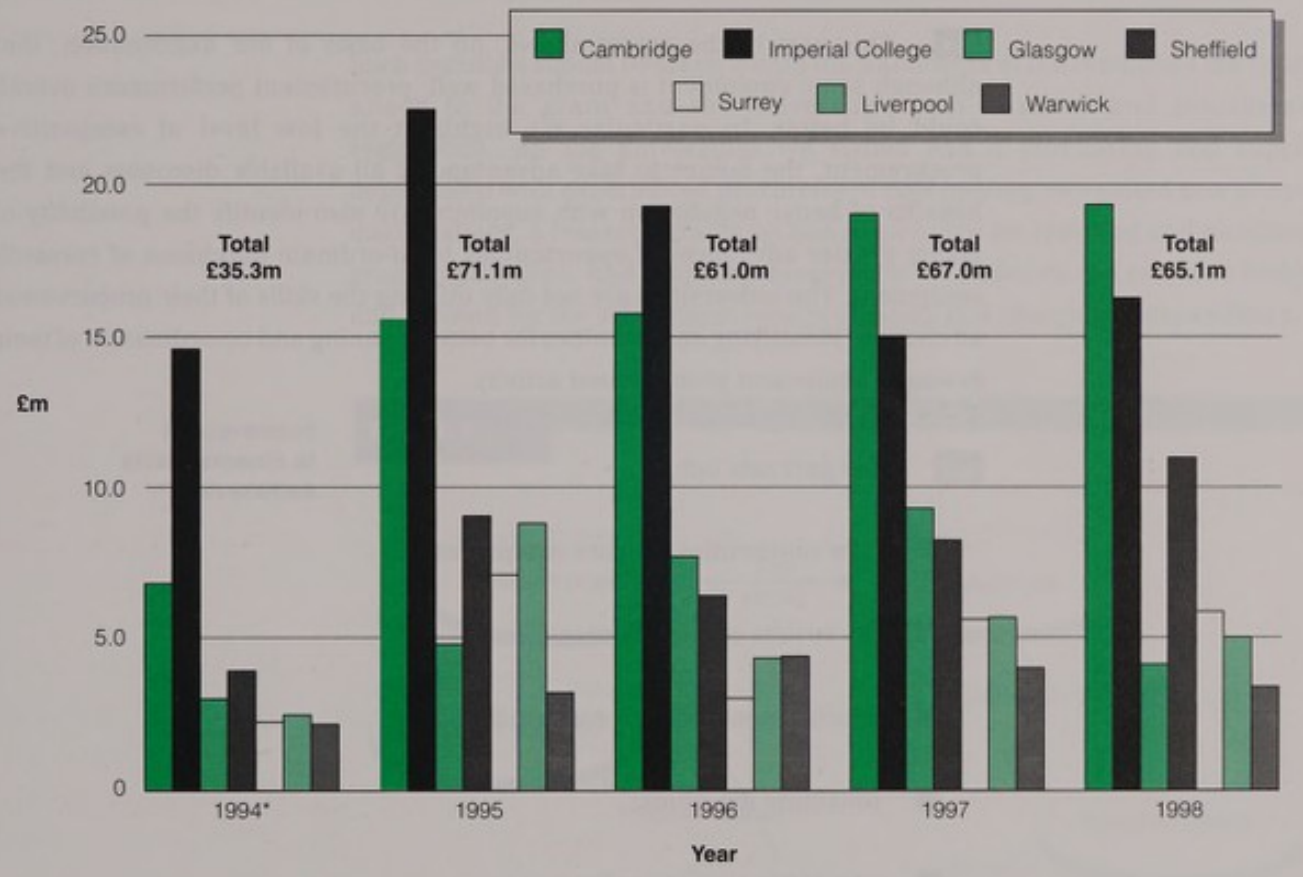
- how the Council ensure that proposed equipment resources are justified, well procured and used for the purposes intended.

1.16 Our methodology is set out in Appendix 1. In brief the National Audit Office selected six universities to visit from the 15 institutions receiving the highest proportion of their funds, plus one other university in Scotland. We selected and examined 68 grants to universities for case study, from which we selected, where possible, individual equipment purchases for price checking by our consultants. The grants were selected to cover all types of grant, different levels of equipment funding – from around £25,000 to over £1million - and a range of research equipment. The grants selected for study totalled £60 million of which £14 million was for equipment. The universities to whom the grants relate had been awarded grants from the Council totalling some £300 million over the last five years (Figure 7).

Figure 7

Value of grants awarded to universities visited by the National Audit Office

Over the last five years the Council awarded to the seven universities visited a total of £300 million in grants.



Note: * From 1st April 1994.

Source: The Engineering and Physical Sciences Research Council's research grant statistics

1.17 Another National Audit Office examination looked at the higher education sector's progress in developing and implementing improvement in procurement since the 1993 National Audit Office report on University Purchasing in England (HC 635 of 1992-93). The results of the examination are set out in Procurement in the English higher education sector, (HC 437 of 1998-99).

Part 2: Procurement of equipment funded by grant

2.1 This part of the report shows, on the basis of our examination, that although some equipment is purchased well, procurement performance overall could be better. In particular we highlight the low level of competitive procurement, the failure to take advantage of all available discounts and the benefits of better negotiation with suppliers. We also identify the possibility of taking greater advantage of opportunities to co-ordinate purchases of research equipment. The universities are not fully utilising the skills of their procurement advisors or identifying opportunities for better planning and co-ordination of their research equipment procurement activity.

2.2 This part sets out:

- how universities procure equipment;
- the results of our examination;
- procurement through competition;
- obtaining discounts;
- negotiating with suppliers;
- the use of co-ordinated procurement; and
- compliance with other aspects of best practice.

Academic researchers are mainly responsible for procuring research equipment

2.3 The procurement arrangements in operation at universities vary but broadly follow the pattern set out in Figure 8. The key procurement decisions are taken by academic researchers who normally:

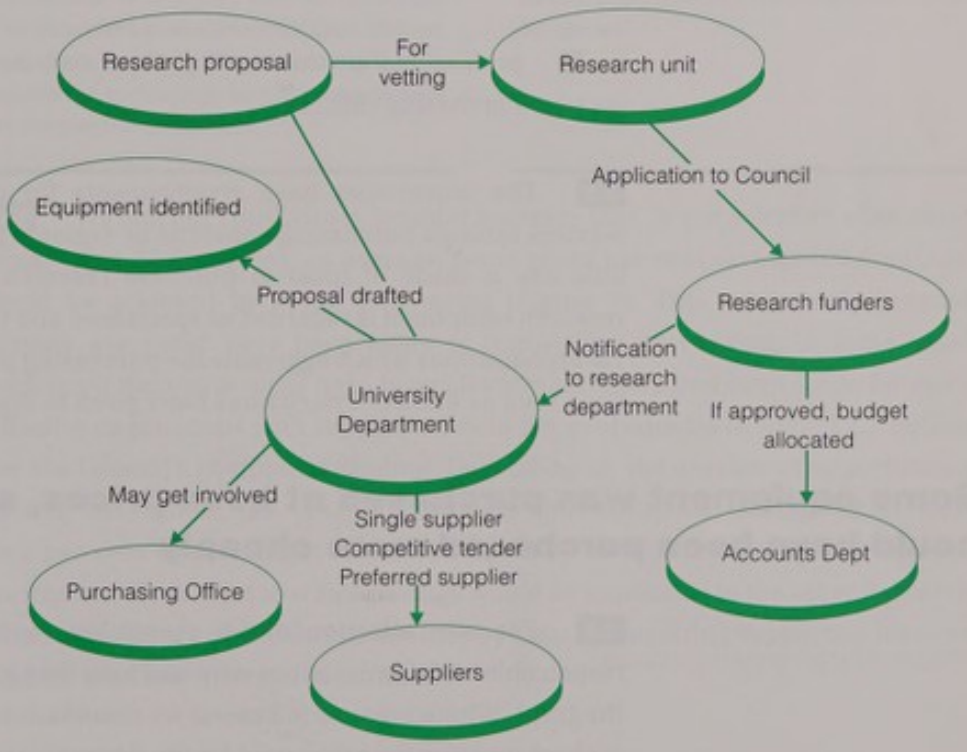
- write the research proposal;
- submit the application for grant to the Council (through the university);

- decide what equipment to purchase and how to buy it; and
- carry out any competitive procurement and/or any negotiations with suppliers.

Such decisions should be taken within the framework of the conditions the Council attach to the grant and the university's own financial and procurement regulations. All the universities we visited had a purchasing and supplies department with experienced procurement staff holding recognised procurement qualifications, a research grants section responsible for checking and monitoring grant applications, and a finance department who allocate the research budgets and account for the subsequent receipt of funds and charging of expenditure.

Procurement arrangements at universities

Figure 8



Source: National Audit Office

2.4 Within the higher education sector there are a number of inter-related organisations involved in procurement matters. They include:

- the Funding Councils for England, Wales and Scotland and the universities' Committee of Vice Chancellors and Principals, the Standing Conference of Principals and Committee of Scottish Higher Education Principals;

- a Joint Procurement Policy and Strategy Group, established by the above bodies to co-ordinate and direct all strategic activities directed towards promoting good procurement practice in higher education institutions, including the development of guidelines for the procurement of equipment;

- regional purchasing consortia and national and inter-regional working groups; and

- professional procurement groups, such as the Association of University Purchasing Officers.

2.5 The universities have arrangements for purchasing many goods and services through purchasing consortia or regional purchasing organisations. But little use is made of them to purchase research equipment. This is because research equipment is regarded as specialised and the scope for obtaining savings via organisations which aggregate the purchasing power of many universities has been seen as limited. Priority has been given to lower cost higher volume items.

Some equipment was purchased at keen prices, some equipment could have been purchased more cheaply

2.6 For our selection of 68 grants we reviewed with the researchers responsible at the universities why and how they purchased the items funded by the grant. Where possible (62 cases) we commissioned an independent consultant to check whether the prices paid for the equipment were in line with market levels. It was not possible to price check six cases mainly because the selected items were being built from a number of smaller components. In seven further cases, our consultants encountered a lack of co-operation from research equipment manufacturers.

2.7 We found that in 20 cases the universities had purchased equipment at keen prices. These were usually where manufacturers/suppliers were willing to accept lower prices in order to support, or associate themselves and their equipment with, a prestigious area of research. This applied particularly where the work involved development of equipment which could have future commercial benefit to the manufacturer. An example of effective procurement is shown in case 1.

Illustrative case 1

A keen price

Purchase of a scanning ion microscope (an electron microscope capable of forming a three-dimensional image on screen by means of a focused beam of electrons that is scanned across the object being viewed). It will be used to develop analysis, fabrication and modification of structures such as microchips. The equipment estimated to cost £385,000 was acquired for £245,000 with the aid of a substantial contribution from the manufacturer as programme collaborator.

Illustrative case 2

Selecting best prices

Preliminary estimates were obtained, at proposal stage, for the supply of computer equipment. Further quotes were obtained before the start date of the grant and a third and fourth set obtained just before purchase. The purchaser eventually saved 23 per cent by selecting best prices for individual items from all the quotes.

2.8 We and our consultants consider however that, in our selection of 68 cases (total value £8.7 million), on average, some seven per cent savings (£0.6 million) could be achieved by better purchasing (Figure 9). This was mainly because greater use could have been made of competitive purchasing, in some cases additional discounts could have been claimed and there had been scope for more effective negotiations with suppliers. Seven per cent equates to some £2.7 million for the Council's equipment funding. Depending on the number of opportunities arising throughout the year, we estimate that additional savings of at least two per cent overall might also be obtained by co-ordinating major equipment purchases. The extent to which savings would be applicable to the other Research Councils depends on the thresholds they operate for requiring supporting invoices and on whether virement is permitted.

Analysis of results by categories of potential savings

Figure 9

This analyses the results of the National Audit Office examination and their consultants price check, and shows three categories where scope for savings were identified.

Category of potential savings	Number[1]	Scope for savings identified (£)	Average % of price paid	% for items examined[3]
Items purchased at a keen price	20	-	-	-
Competition not sought/negotiation with suppliers	48	248,400	5	6.9
Discounts not sought	35	344,700	6.8	
Co-ordination of purchases not considered	2	180,000[2]	10	2
Total		**773,100**		**8.9**

Notes: 1. Potential savings for one grant can occur in more than one category.
2. Relates to two specific items within the National Audit Office selection.
3. The total cost of the items examined was £8.7 million.

There is scope for more competitive tendering

2.9 The Joint Procurement Policy and Strategy Group (paragraph 2.4) consider that the primary basis for providing evidence to the taxpayer that value for money is achieved is by procurement through competition. They believe that best value for money means accepting the best combination of cost and quality while also taking account of important criteria, such as, delivery, equipment compatibility, warranty and maintenance. This can best be achieved by competition. This view is confirmed in guidance issued by the Committee of University Chairmen, which states that, save in exceptional cases, all procurements should be undertaken on the basis of full and open competition. The Council state in their grant guidelines that, although contract procedures are a matter for the organisations to whom they award grants, they expect that contracts will be let as a result of competitive tendering.

2.10 The main argument for not adopting competitive tendering was that there was only one supplier. We and our consultants, believe, however, that this is very rarely the case. Competition appeared to be feasible in over ninety per cent of the 68 cases we examined, but we found that it had been applied in only 14 (20 per cent) of cases, representing 34 per cent by value. In only three cases, where competitive tendering had not been undertaken, were we able to accept and confirm that only one supplier existed. The benefit of competition is demonstrated by case 3 while cases 4 to 6 show that there is scope for savings through greater use of more effective competition.

Illustrative case 3

Good competition

Mass spectrometer (an apparatus used for separating isotopes, molecules, and molecular fragments by passing it through electric and magnetic fields) which will be used for developing the study of molecular structures of synthetic materials. Estimated to cost £254,000. Obtained for £198,000 after competition, involving five potential suppliers.

Illustrative case 4

No competition

Two central processing units were purchased without going to competition. According to our consultants, savings of at least 30 per cent could have been achieved by competitive tendering.

2.11 Of the 55 items price checked, our consultants concluded that, in 35 cases (64 per cent), the prices paid did not reflect normal market levels, and that additional savings averaging seven per cent could have been obtained. We and our consultants found several examples which demonstrated the benefits of effective competition and which addressed all aspects of value for money.

Illustrative case 5

Limited competition

Quotes were obtained from two suppliers for a high performance mass spectrometer (an apparatus used for separating isotopes, molecules, and molecular fragments) costing around £85,000. It will be used primarily to study biological micro-structures of things such as proteins. Quotes received were similar but one of the suppliers was rejected without being given the opportunity to improve their offer as they had asked to do in their original response.

Illustrative case 6

Separating purchases for tendering

Ordering complete systems of research equipment from the supplier of the main equipment does not necessarily guarantee good value for money because keen prices were often not given on the ancillary equipment. Our consultants advised us that savings of 25-30 per cent can be achieved by placing separate orders for the peripheral equipment.

2.12 In deciding on whether to proceed with competitive tendering it is of course important to ensure that a balance between the costs of organising competition and the benefits likely to be gained is taken into account. There may also be advantage, once it is established that a supplier is offering good quality products at competitive prices, in entering into longer term or preferred supplier arrangements in order to minimise the costs of competition.

Not all available discounts are obtained

2.13 When open competition is not possible, purchasers should take standard discounts on offer, or obtain special discounts, from suppliers. In 20 cases universities negotiated prices lower than were generally available because the equipment supplier wished to support the research or have their equipment associated with it. But in 35 cases discounts that were obtainable were not negotiated including available "university" discounts and discounts for prompt payment. Case 7 identifies a failure to achieve satisfactory discounts. But it is important to ensure that, as far as possible, the basic price, from which discounts are deducted, is real and verifiable, for example from published price lists.

Illustrative case 7

Prompt payment discount not secured

A fibre optic camera part of an instrument used for measuring diffraction, which by applying a beam of electrons can determine the structure of crystals, costing £54,000. Our consultants advise that an additional 2 per cent discount for prompt payment, worth £1,150, was available but not taken.

Negotiation with suppliers can achieve savings

2.14 There were examples where post tender or other negotiations with suppliers had achieved considerable savings or other benefits in kind from suppliers. None of the staff undertaking the negotiations were, however, trained in purchasing or contract negotiations. The staff undertaking the negotiations were the academic staff and there was no input from the universities' professional procurement staff. As a result, in the examples where a supplier was selected non-competitively, we saw no evidence of them being asked to supply breakdowns of their prices to assist in subsequent price negotiations. Case 8 identifies the additional benefits that were gained from such negotiations. Case 9 identifies a failure to negotiate effectively over price or seek a breakdown of costs.

Illustrative case 8

Good purchasing negotiations

Purchase of a laser marker (a device that generates an intense light beam). A commercial laser system was needed to develop a new method for the production of rapid prototyping/tooling processes. The department negotiated with the supplier after receiving four quotes. Following negotiations with the potential supplier a further reduction of 20 per cent was achieved realising additional savings of £10,000.

Illustrative case 9

Scope for negotiation

Purchase of a prototype detector costing £158,000. The first of 16 detectors needed to build a new gamma-ray spectrometer for radioactive beam spectroscopy necessary for the study of the properties of nuclei. The university did not seek to negotiate the price down, despite being in a good negotiating position. The prototype may lead to subsequent significant follow-on orders, possibly in excess of £2 million, although the specification and funding for these detectors has yet to be finalised. A breakdown of the cost of building the prototype was not sought either.

Combining equipment requirements to increase purchasing power

2.15 Institutions have the opportunity to aggregate their equipment requirements to yield substantial savings on the purchase cost of equipment, and associated costs such as maintenance, delivery and procurement costs. Similarly, the universities, the Council and other Research Councils have the opportunity to co-ordinate major research equipment purchases. Improved planning by the universities can help to ensure that such opportunities are identified and joint procurement approaches initiated. In addition to possible financial savings, co-ordinated purchases increase the procurement power of the institutions involved and their ability to gain enhancements to the original equipment specification and other commercial advantages. The Council is in a position to implement the procurement practice of pursuing joint procurement strategies as laid down by the Government in its Comprehensive Spending Review report (CM 4011).

2.16 Except for some computer equipment (Case 10), we found no evidence of universities co-ordinating the purchase of the same equipment. In one case (Case 11) the Council approved funding for the purchase of similar specification Electron Microscopes by three universities in a three month period. The Higher Education Funding Council for England funded another through the Joint Research Equipment Initiative. No attempt was made either by the Council or the universities involved to co-ordinate these purchases to secure best value for money. Our advisers, the Société Généralé de Surveillance, estimate that co-ordinating the purchase of the three machines may have saved an additional £242,000 (ten per cent). They informed us that, in their experience, savings of at least this level have been achieved in other major co-ordinated purchases. The

Higher Education Funding Council for England told us that they had secured substantial savings of around £3 million over two years by combining other orders under their Joint Research Equipment Initiative.

Illustrative case 10

Co-ordinated purchase

The computer requirements of two research projects were combined to increase the university's purchasing power. Subsequent negotiations with the supplier obtained a package representing a 57 per cent reduction from the list price. Our price check confirms that the university received a good deal from the supplier.

Illustrative case 11

Potential co-ordinated purchase

The Council separately funded three Electron Microscopes (instruments with high magnification and resolution employing electron beams in place of light, using electron lenses) costing between £728,000 and £1.1 million and the Higher Education Funding Council for England funded another. Each purchase was undertaken separately, by four different universities, involving detailed assessment and testing of the specifications of the available microscopes.

2.17 The Councils are in a position of knowing when grants for similar equipment are made to different universities and where there may be scope for these purchases to be co-ordinated. The Council do not maintain central records of the major research equipment items they fund. Such information would be useful to them and university procurement officers for identifying scope for co-ordinating purchases. To help universities exploit the opportunities to co-ordinate research equipment purchases, the Council need to consider how they could provide them with early notification of impending major purchases. The Council is considering disseminating such information via its website.

2.18 In view of the high value and volume of research equipment being purchased by universities with Research Councils' funds, further benefits could be gained from benchmarking prices and procurement processes to test whether they are meeting best practice. This does not have to be a complicated process. Universities could contact others who have bought similar equipment to ask them what price they had paid. We found however no evidence of procurement benchmarking being undertaken by the universities for major research equipment. During our discussions with researchers we identified a general reluctance to formally share information on prices achieved for purchasing research equipment although they claimed they were in touch with each other and with the market. Information on prices paid for similar items of research equipment was generally indicative rather than specific.

Other aspects of best practice

Guidelines on equipment procurement have been published recently

2.19 Despite the significant level of funds provided to universities by the Council for the purchase of research equipment they do not offer them comprehensive guidance on best practice and how to purchase equipment more expertly. Some of the universities we visited published their own guidance on purchasing though it varied in quality.

2.20 In their 1993 Report on University Purchasing, the National Audit Office reported on the lack of procurement guidance in universities. In another Report in 1996 the National Audit Office examined the Management of Teaching and Research Equipment in Scottish Higher Education Institutions. This was done partly in response to concerns expressed by the Scottish Higher Education Funding Council about the absence of guidance on equipment management. It concluded that institutions could do more to manage equipment in a structured way and to improve their purchasing practice.

2.21 The representative bodies for the higher education sector took steps to remedy such deficiencies when, in 1996, the Joint Procurement Policy and Strategy Group developed and published a procurement strategy for the sector (paragraph 1.14). Since then central guidance to the higher education sector has been issued – including, for example, guidance on benchmarking, whole life costing and building and engineering projects. More relevant to research equipment, the Joint Procurement Policy and Strategy Group published "Equipment Procurement" guidelines (in September 1998) and "Whole Life Costing" guidance (October 1998) for the higher education sector. This was after we had completed our fieldwork for this study. This guidance is aimed particularly at academic staff wishing to purchase specialised equipment for teaching and research and provides comprehensive and practical advice on how to achieve successful institutional equipment procurement and represents accepted best practice. The guidance sets out best practice on all the procurement issues identified in this report. We believe that, if the universities followed the basic best practices set out in Figure 10, it would help them ensure they obtain better value for money in their procurement of equipment.

Figure 10 **Procurement of equipment best practice**

These best practices represent the key issues that should be considered in purchasing equipment.

Procurement process	Best practice
Need	The users decide what is needed and when. They should plan ahead for replacement of new equipment and endeavour to take account of the procurement implications of research needed to be funded by the Council in their overall strategy.
Specification	Avoid insisting on compatibility of equipment at any price, requiring a higher specification than really needed, or specifying so narrowly that true competition is inhibited.
Value analysis	Every feasible alternative should be considered. This can include upgrading existing equipment or purchasing a second hand or ex-demonstration model.
Co-ordinated purchases	Aggregation of similar equipment needs can bring substantial savings in the item cost, maintenance charges, delivery and in ordering and processing costs.
Equipment sharing	The possibility that suitable equipment already exists in another department should be considered. Where equipment is purchased, consideration should be given to making it available for use by other departments.
Funding	Reliable estimates of the cost of the equipment should be sought. Alternative forms of funding should also be considered, such as a leasing agreement or a private purchase initiative.
Supplier appraisal	The potential suppliers should be researched and assessed and competitive tendering used.
Competitive tendering	The introduction of competitive tendering significantly increases an institution's purchasing power and negotiating position. Cases where there is a sole source of supply are very rare. The procurement office should be involved in the less technical aspect of the tender, including the requirements of the European Community procurement directives.
Negotiations	Post tender negotiation can take place to obtain an improvement in the content of the tender. Procurement officers, with appropriate purchasing negotiating skills, should be involved.
Selecting best value	The selection of the best value tender should be evidenced and records kept on how the decision was reached and justified. Costs must take full account of all whole life costing considerations.
Equipment management	The effective management of equipment involves formally monitoring usage, seeking to minimise running and maintenance costs and negotiating maintenance agreements at keen prices.

Source: National Audit Office summary of the higher education guidelines for equipment procurement

The specialist skills of purchasing co-ordinators are not always used

2.22 Most research equipment is purchased by university departments who manage budgets delegated to them. They are best placed to draw up the often highly complex user specification of the equipment they want. But little recourse is made to the specialist skills which the universities' purchasing co-ordinators can bring to the procurement of the equipment. Best practice guidance recommends that appropriate use should be made of available specialist purchasing skills in all aspects of the procurement process particularly where high value capital equipment is required.

2.23 Most of the universities we visited employ staff with special responsibility for purchasing. But we found that, in most cases, the investigators carrying out research, who also make the equipment purchases, were not obliged to consult them. In some cases they were not even obliged to notify purchasing staff of major purchasing activity. Our examination revealed that the universities used the expertise of specialist procurement skills in only nine out of the 68 cases we studied. In the majority of the cases where they were used, they were asked to provide advice on compliance with the European Community procurement directives, rather than on how to obtain the best possible price.

A whole life costing approach to equipment procurement is not used

2.24 Procurement decisions which are made on the basis of the initial cost of an item, may not yield best value for money in the long run. The Joint Procurement Policy and Strategy Group's guidance on whole life costing, recommends that it should be applied, where appropriate, so that the longer-term financial implications of various options can be fully recognised. Whole life costing takes account of the total cost of an item from determination of need right through to its eventual disposal and replacement. Its use will identify the full cost of acquiring equipment, its on-going running costs and all other significant costs. It can also enable better comparisons to be made between different equipment models and assist tender evaluations. It also encourages users to specify from the outset how the assets will be used, determine technical specification and establish what long-term support and maintenance is likely to be required. We found that none of the examples examined used the whole life costing approach either at the grant application or procurement stages. This was mainly because this costing technique is relatively new in higher education and guidance on its use was not issued until October 1998, after we had completed our fieldwork.

Alternatives to procurement are not always considered

2.25 All possible solutions relating to the perceived need for research equipment should be investigated before a decision is made to purchase new equipment. Alternatives to procurement include, sharing existing equipment already held by research departments, negotiating the loan of suitable equipment from a supplier or by purchasing good second-hand or ex-demonstration models. Alternative methods of acquiring equipment should also be considered. For high value research equipment this can include, for example, leasing agreements, outsourcing or joint ventures. We found some examples where ex-demonstration models had been obtained (Case 12) and where equipment had been loaned from suppliers. However we found no evidence of leasing being actively considered.

Illustrative case 12

Alternative option taken

Purchase of a Mass Spectrometer (an instrument used for measuring the index of defraction). The equipment was essential to the efficient identification of key structures, including the analysis of high molecular weight compounds. By purchasing an ex-demonstration model the university managed to obtain a discount of around 55 per cent off the full list price.

Ways of securing improvements

2.26 We conclude that gains can be secured by improving the efficiency of equipment procurement. This can be achieved if the universities are encouraged to use the basic best practice guidance recently set out in the "Equipment Procurement" guidelines for the higher education sector. One way of encouraging the adoption of best procurement practice would be for the Council to make adherence to the guidance a condition of grant. The Research Councils and the Funding Councils should work together to improve procedures in the light of the advice on best procurement practice that has been developed by the Government, the Funding Councils and the sector representative bodies. Ways should be sought to obtain assurance that best procurement practice is being used, and measures should be established to monitor progress in equipment procurement performance.

Part 3: Arrangements for approving and reviewing grants

3.1 This part of the report shows that the Council's arrangements for obtaining value for money for grants have, until now, been focused on reviewing the scientific case for equipment made in the grant application. Once the project is completed, the Council review the quality, output and cost effectiveness of research and reconcile the expenditure against the funds awarded. Relatively little has been done to monitor procurement outcomes specifically, such as whether the equipment funded was actually purchased, and if so at what price, and whether good procurement practices were used.

3.2 This part sets out:

- how universities identify equipment needs and sources of research funding;
- the arrangements for inviting grant applications;
- what the application for grant contains;
- how the Council review the applications, award a grant and check outcomes; and
- the monitoring of the usage of research equipment.

The universities should identify and justify their research equipment needs and the appropriate sources of funds

3.3 The seven universities that we visited did not have a reliable database of all the research equipment they possessed and did not have an overall plan setting out what their future needs might be. Most university heads of department did, however, have a clear idea of the major items of laboratory and research equipment that they would purchase if funds were available.

3.4 It is the role of the Higher Education Funding Council to provide universities with the buildings, equipment and other infrastructure to establish and maintain "well found" research laboratories. The Research Councils have

traditionally funded the additional equipment necessary to carry out particular research projects they wished to support. The individuals we visited at the universities told us however that, because of pressure on the funds provided by the Higher Education Funding Councils, they were looking to Research Council grants to provide some of the basic equipment they needed as well as equipment dedicated to specific research projects. The universities also told us that there was therefore a considerable incentive, moderated by the time and effort involved, to submit as many grant applications as possible to the Research Councils to secure this funding and to err on the generous side with their equipment estimates.

The Council invite and review applications for grant

3.5 Until 1995 the Council invited applications to be submitted by two deadlines set each year, but now they can be submitted at any time.

3.6 In 1997-98 the Council received over 5,000 research grant proposals for consideration. Standard grant proposal forms are completed by the principal investigators who should provide, among other things, a case for support of the research proposed, including justification of the resources required and a summary of the proposer's track record. Proposals should itemise all single equipment items estimated to cost more than £1,000 and identify separately equipment estimated to cost more than £250,000 as large capital items. The latter are subject to special payment arrangements, if funded. The Council provide no specific guidance as to what the justification of equipment resources should include and what supporting information should be provided.

3.7 Our examination showed that the extent and quality of justification provided in support of proposals varied. In the best cases, researchers met all the criteria for justifying equipment resources. They explained:

- why they needed the type of equipment requested;
- the performance specification they required; and
- the potential sources of supply.

They provided estimates from a representative number of suppliers, appraised the merits of supplier proposals and justified their preferred choice. In the worst cases researchers just indicated what they intended to buy without substantiating their choice of supplier or their estimate of cost.

3.8 As shown in Figure 5 the primary mechanism for assessment of proposals is peer review by experts in the proposed field of research. Referees are required to comment on the scientific merit of the proposal, whether the resources requested have been justified and whether the proposal is likely to offer good value for money. The guidance provided to them on justification of resources is however limited and, in contrast to the guidance for assessing scientific merit, provides no criteria to be applied when making these judgements.

3.9 Our examination showed that the quality of individual peer reviews in respect of the justification of resources and expected value for money was patchy and that negative comments about equipment prices were rarely substantiated by hard evidence. Sometimes, there also appeared to be a contradiction between the comments made by reviewers and decisions taken. For example we found eight cases where, despite some negative comments, the proposals were fully funded. In seven cases we found that grants had been reduced where the referees had not made negative comments. It is however the function of the assessment panel to weigh up the comments by individual referees and reach conclusions, sometimes in the face of conflicting reports, on the merit and cost effectiveness of grant proposals.

3.10 We encountered only one case where deficiencies in justification of equipment resources was pursued in a robust way. In that case the grant was restricted to 50 per cent pending receipt of information about specification, choice of equipment and supplier and pricing. This information was produced within four days and the equipment was subsequently fully funded. The Council has recently adopted the practice of sending referees' comments anonymously to applicants to give them an opportunity to respond to any issues raised. This practice should lead to better justification of the research resources sought.

Equipment typically costs 16 per cent less than the amount awarded for its purchase

3.11 We encountered only two cases where prices were obtained through formal competitive tendering at the proposal stage. The universities told us that, in most cases, it was not practicable to go to competition or demand best prices at the time of their grant application because:

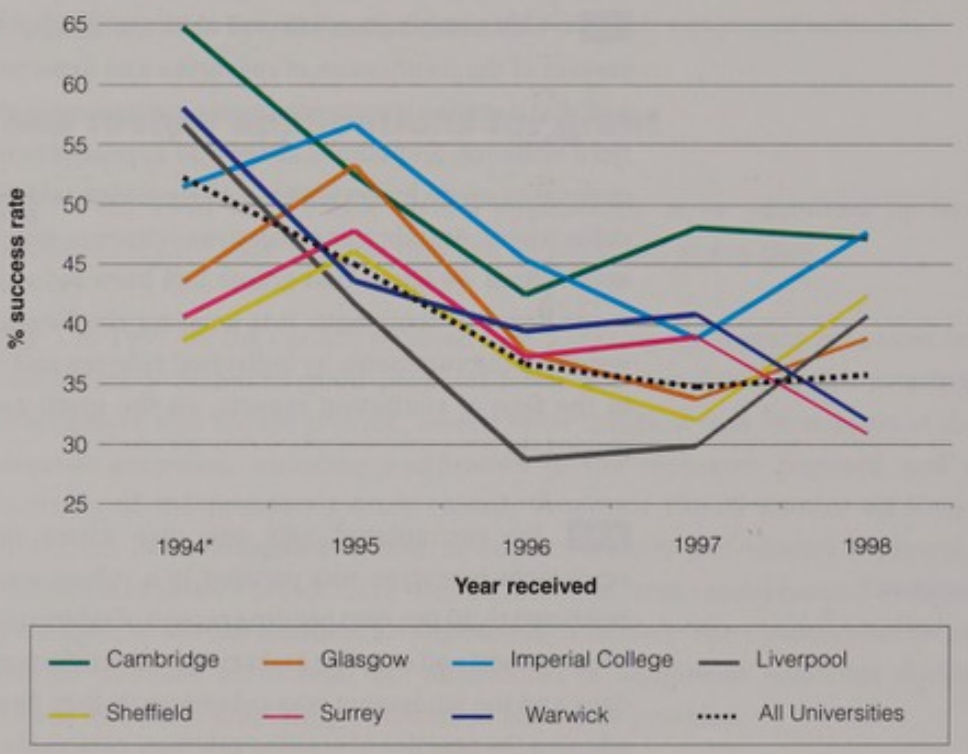
- grant approval was not assured at that stage. The actual success rates achieved by the universities visited by the National Audit Office were generally greater than the average success rates for universities overall

and the one in ten chance they believed to be the norm. Although success rates vary, the average chance of a proposal being funded by the Council is around 38 per cent overall (Figure 11)

Application success rates of universities visited

Figure 11

The success rates, at the universities visited by the National Audit Office, tended to be better than the average for all universities.



Source: The Engineering and Physical Sciences Research Council's research grant statistics

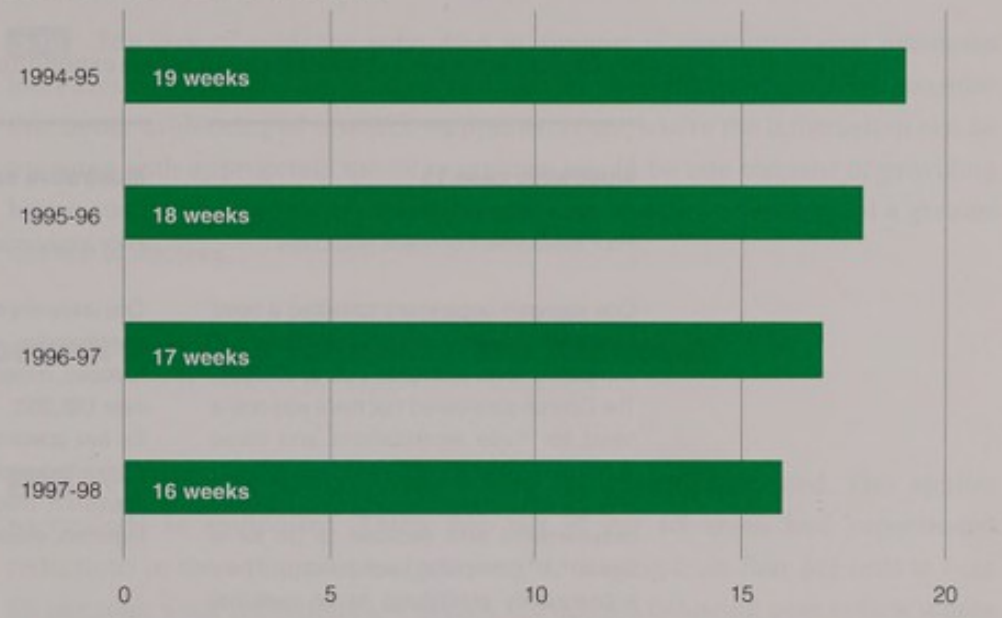
Note: *From 1st April 1994

- While the application is being appraised the price might change. Applicants told us that they anticipated that it would take at least six months between submitting the application and receiving the grant and sometimes longer. For the grants we selected, elapsed time ranged from two weeks to 62 weeks, with a average of some 24.7 weeks. For all grant applications handled by the Council the average elapsed time between receipt of grant proposals and notification of outcomes has fallen in each of the last four years, from 19 weeks to 16 weeks (Figure 12);

Elapsed time

Figure 12

The average elapsed time between receipt of grant proposals and notification of outcomes has fallen in each of the last four years.



- In addition the applicants we interviewed admitted that they sometimes inserted as high a figure as possible in the proposal. Many regarded the grant proposal as an opportunity to maximise research equipment funding. They knew that, if the project budget was approved at an inflated level, they would be able subsequently to negotiate lower prices and obtain more equipment with the money available. Sometimes they also used this device to minimise the impact of reductions in equipment budgets, which might be imposed during the grant review process. In some cases we found that Value Added Tax was included in grant applications for items which were subsequently found to be zero rated.

3.12 For our selection of 68 equipment items, we took the estimated cost in the research application, on which the grant was based and paid and compared it with the actual price. In one case the item has not yet been purchased. This showed that, on average for our selection of cases, equipment cost 16 per cent less than the estimate and that in:

- 46 cases expenditure was less than estimate by on average more than 26 per cent. For example see cases 13 and 14;

- 11 cases costs were higher (in four cases where the variation was highest it was because different equipment was purchased to that specified in the application); and

- in ten cases the estimate equalled expenditure.

Illustrative case 13

Poor assessment of needs and costs

One research department identified a need for seven workstations and six personal computers at an estimated cost of £85,000. The Council considered that there was only a need for three workstations and three personal computers and provided £67,200. The department reassessed their computing requirements and decided to go for a personal computer approach. They subsequently purchased seven personal computers for £15,000.

Illustrative case 14

Poor assessment of needs and costs

One university estimated the price of a "time of flight" spectrometer (an apparatus used for separating isotopes, molecules, and molecular fragments) at over £95,000. The final expenditure was £60,000 for two spectrometers of lower specification than originally proposed. The equipment was needed for research into biocatalysis, nanostructured materials, electrocatalysis and polymer research.

3.13 In the two cases in which the initial estimates were based on competitive quotations, the estimates proved more accurate. In these cases expenditure was within 10 per cent of the estimate, compared with the 26 per cent variance arising from non-competitive quotes.

3.14 Researchers acknowledged that the accuracy of estimating could be improved by either:

- ensuring that initial estimates were based on evidenced prices preferably obtained through competition but at least from several potential suppliers; and

- post award of grant, requiring them to resubmit prices following active negotiations with suppliers or competition.

3.15 One university purchasing officer suggested that the Council could incentivise the process by sharing with the university savings achieved through price negotiations. Nearly all the researchers we interviewed accepted that there is at present no incentive for them to be more precise in their estimating, other than ensuring that the level of the grant proposal is pitched at a level they consider will

be accepted by the Council. They also told us that the universities use the excess to fund additional equipment for the benefit of the research project being undertaken.

3.16 The lack of evidence submitted in support of equipment cost estimates increases the risk of the grant being awarded for overestimated costs. We consider that better evidencing of research equipment costs, where the information can be provided with appropriate use of resources, would be one element of providing better quality grant applications and would help ensure applicants had a greater chance of success.

A number of equipment funding requests are reduced by the Council

3.17 A number of grants are lower than the amount requested. This applies particularly to equipment. Thirty two out of our 68 cases had experienced reductions in the equipment budgets sought, ranging from four per cent to over 80 per cent. Such reductions are usually introduced following peer review where the equipment budgets are perceived to be too high or where referees consider that universities should obtain additional funding from other sources. Occasionally the Council may reduce the funds offered because of budgetary constraints. In none of those cases did we see evidence that the Council had gone back to the applicant to assess whether the additional funds could be found and, if not, what impact this would have on the research work. In those cases where the Council reduced the funding for a long list of research equipment items, it was left for the researcher to decide whether to accept or reject the reduced offer of funding and to prioritise the items he wanted to buy with the reduced budget.

3.18 The Council recognise the problems that reducing grants can introduce and are taking steps to improve the situation. In the year ending July 1998 they found that grants were reduced by 6 per cent (by value) overall and by 15 per cent (by value) for the equipment element of the grant. The Council also told us that they are taking steps to encourage higher education institutions to submit fewer, higher quality proposals, as one measure to minimise the number of grants they reject or reduce. The Council have also introduced a procedure to allow investigators to comment on referee's comments in advance of a decision which provides an opportunity to counter unjustified recommendations for reductions in equipment funding. But we consider that these various steps have not yet fed back significantly into the perceptions of grant applicants.

The Council monitor and evaluate the results of research activities

3.19 As part of their monitoring and evaluation of programmes the Council evaluate, at the end of the grant period, the outcome of the research project and its contribution to the Council's overall programme and mission objectives. They place emphasis upon the cost effectiveness of the research and the value for money obtained.

3.20 They grant reasonable freedom and flexibility to researchers to manage resources according to the needs of individual projects. Sometimes they require them to submit periodic reports, attend evaluation meetings or require their programme staff to monitor the research project. In 1997 the Council, in collaboration with the other Research Councils, introduced a programme of periodic "dip-stick testing" at universities in receipt of research grants mainly to assess the administration and accounting procedures applied to research grants. This does not currently cover testing of procurement practices and examination of individual equipment procurements.

3.21 At the end of the grant period the university is required to submit a final expenditure statement identifying all expenditure incurred against the project compared with the payments made by the Council. The Council reconciles the expenditure against the grant funded and makes a final payment of any balance due, or recoups any overpayment made. The applicants are also required to submit a scientific report setting out the results of the research activity and detailing the use of the resources, including transfers between heading and major purchases. Both the final expenditure statement and the scientific report must be sent to the Council within three months of the end of the grant. The Council applies financial penalties for late or non-submission of final expenditure and final reports.

3.22 The information that is provided by the researchers to the Council on equipment expenditure in general and on individual purchases is not compared to the equipment originally requested. The Council acknowledge that they need to correlate more closely the terms of the award with the expenditure actually incurred, the research activity and the outcome. They told us that, with effect from April 1999, they signed a Framework Agreement with individual universities, which set out the duties and responsibilities of all parties in relation to research grants.

3.23 The scientific reports produced at the end of the grant funded activity are assessed by peer review in much the same way as the original proposal. As part of this process referees are required to comment on the use of resources. Most of the applicants we interviewed in relation to our selection of grants also act as referees for other grants. They told us that they often felt unable to comment on this aspect as they do not have all the relevant grant information and financial statements at their disposal.

3.24 Our examination of a selection of grants showed that, in 16 cases (24 per cent), the equipment purchased was not what was specified in the proposal. We also noted that there was no requirement for the applicant to inform the Council if equipment needs changed. Investigators told us that they often firmed up on what equipment they wanted and its specification only after their grant was approved. This is particularly sensible for the acquisition of computer equipment, where the market is very fast moving, but we also saw it in other cases. Our examination revealed one instance where equipment was purchased in anticipation of the Council's approval (Case 15) which is permitted within the Council's grant conditions provided the researcher seeks retrospective approval. We also found another instance where both the research and the equipment was different to that proposed (Case 16), a situation that was subsequently picked up under the Councils final report review procedures.

Illustrative case 15

Purchase in anticipation of approval

The Council reduced the equipment funding requested in a rolling grant proposal in respect of the purchase of a £40,000 laser which they felt was not justified. They agreed to review their decision at the mid-term review of the grant two years later. The university exercised the flexibility permitted in their management of the grant resources and purchased the equipment from the grant. They felt it was essential for their work and intend to justify the purchase at the review stage. They are confident that retrospective approval will be granted but acknowledge that, in the unlikely event it is not, the university would be obliged to fund the purchase from their own resources.

Illustrative case 16

Unauthorised change in research

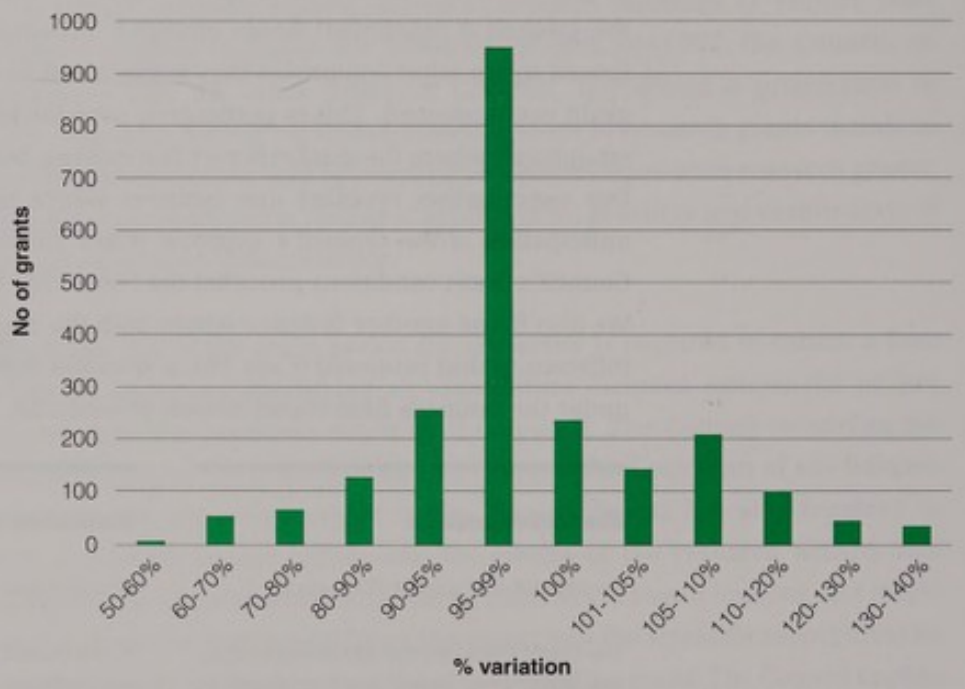
In one project, both the equipment and the research was different to that originally specified in the proposal. Computers were purchased for £31,000 instead of a stereo camera at £32,000. The Council were not informed of these changes until the project had been completed.

3.25 We analysed the 2,498 grants, completed during the two years ending 31 March 1998, which included funding for equipment. Overall, the final expenditure equalled the funding originally approved, although individual equipment grant out-turns varied considerably. Over 70 per cent of the grants were within plus or minus ten per cent of the approved equipment grant (Figure 13).

Figure 13

Outturn expenditure pattern on equipment costs for completed projects

Over 70 per cent of grants were within plus or minus ten per cent of the approved equipment budget.



Source: National Audit Office database of completed projects

Effective monitoring of equipment usage is rarely undertaken

3.26 It is important for equipment to be justified in terms of usage as well as technical performance at the application stage. We observed that, until recently, the Council had asked universities for estimates of usage to accompany proposals for equipment costing over £100,000. But this practice has now ceased. From our selection of grants, planned usage ranged from 40 hours a week with the equipment in use 40 per cent of the planned time to 150 hours a week with the equipment in use all of the time.

3.27 After the research equipment has been purchased, its effectiveness can often best be judged through an evaluation of how much and how well the equipment has been used and managed. To monitor such performance it is essential that major items of research equipment are recorded and mechanisms are in place to record and permit the monitoring of usage. From our selection of grants we found that formal recording and monitoring of usage was rarely undertaken. For those research equipment items costing over £50,000, only four cases (12 per cent) were found where effective monitoring was being undertaken, sometimes through detailed recording of real time usage data embedded in the equipment itself. In 13 cases reliance was being place on the equipment booking sheets without any use being made of the data, and in 20 cases we found that usage was not actively considered.

3.28 The Council have not taken steps to highlight the importance of maximising the usage of research equipment. We recognise that some research equipment purchased for very specific and specialised research may not be fully used even though it achieves the objectives of the project. In other circumstances there may be limited scope for sharing. But, in the majority of instances scope is likely to exist for increasing usage or at least demonstrating actual against planned usage. We found that, in the majority of cases, actual usage versus planned is not monitored by either the Council or the universities. We also found that monitoring and evaluation of completed research projects by the Council has never included reviewing the usage of the equipment funded.

Appendix 1
Selection of case studies, audit methodology and results

Our examination was intended to identify those aspects of the Council and university practice relating to the procurement of research equipment which represented a risk to value for money. We commissioned independent consultants, Société Genéralé de Surveillance, to price check 68 research equipment items. Our consultants were asked to see whether the prices paid for the equipment were in line with market levels and to identify whether there was scope for purchasing the equipment more cheaply.

This appendix sets out:

- why we focused on the Engineering and Physical Sciences Research Council rather than the other five Research Councils;
- why we selected certain universities at which to carry out our examination;
- the basis on which we selected grants for case study;
- the basis on which we selected individual items of equipment for price checking;
- what we examined;
- what we found;
- what this means for the Council; and
- how this affects the other Research Councils.

Why the Engineering and Physical Sciences Research Council?

We reviewed the systems by which all six Councils administer their research grants and found that they were very similar. We concluded therefore that an in-depth examination at one Council would be more likely to produce convincing results than a less detailed examination of all Councils. We focused our examination on the Engineering and Physical Sciences Research Council (the Council) as they are the largest single provider of grants among the six Research Councils. Their grants represented around 41 per cent by value of the total live grants for all six Councils and 56 per cent in respect of their funding of equipment (Figure 14). At the end of March 1998 the Council had around 4,000 live grants in payment valued at about £675 million of which some £100 million was intended for the procurement of research equipment.

Figure 14

Distribution of research grants at 31 March 1998

EPSRC are the largest individual funder of research grants overall and fund more research equipment than the rest of the research councils put together.

Councils	Number of grants	Value of grants: Total grants £m	Total grants %	Equipment budget £m	Equipment budget %	Number of higher education institutions receiving grant
EPSRC	4,057	674.4	41.5	101.6	56.5	123
Other five councils	4,813	952.1	58.5	77.9	43.5	105
Total	8,870	1,626.5	100	179.5	100	

Source: National Audit Office database of live grants

Why were seven universities chosen?

We found that a comparatively small number of universities receive over half of the grant provided by the Council to universities (Figure 15). So as to be able to examine a smaller number of cases in depth, we focused on those universities which had received the largest proportion of grants. We examined the procurement of research equipment at six from the top fifteen universities and at one other from the top twenty (Figure 16). We chose one from outside the top fifteen in order to ensure that the same procurement arrangements and results applied to both the larger and the smaller universities. To reduce the administrative burden on individual universities we avoided those which had been visited by the Councils as part of their own programme of grant monitoring or were planned for a visit by them.

Figure 16

Universities visited by the NAO

Cambridge
Glasgow
Imperial College
Liverpool
Sheffield
Surrey
Warwick

Distribution of EPSRC research grants between higher education institutions

Figure 15

Fifteen universities receive 55 per cent of EPSRC research grants and 57 per cent of the equipment budget funded through grants.

Institutions	Research grants			Grants with equipment budgets		
	Number	Value (£m)	%	Number	Value (£m)	%
Major	15	367.5	54.5	1,427	57.6	57
Others	108	306.9	45.5	1,504	44.0	43
Total	123	674.4	100	2,931	101.6	100

On what basis were the individual grants chosen for case study?

We considered that 8 to 12 case studies per university would allow coverage of all the characteristics listed below. Our consultants, Société Généralé de Surveillance, also advised us that this was a reasonable number of items for them to price check in the time envisaged. We chose our cases to reflect:

- where the major expenditure was being incurred. This led us to focus on higher value grants because 10 per cent of higher value grants accounted for 60 per cent of total value;
- the areas of research being supported by the Council and the university departments working in these areas;
- coverage of both mature and more recent grants;
- the whole range of equipment grant values - from less than £50,000 to more than £500,000 (Figure 18);
- the various types of grants covering for example, single grants, rolling grants and special equipment initiatives; and
- different types of equipment.

The number of cases finally selected which enabled us to meet our various criteria was 68 (Figure 17). Because the number of criteria we wished to cover was extensive we decided against selecting the cases on a random basis. The degree of

stratification (making sure enough cases with each characteristic are chosen) would have significantly increased the numbers requiring selection and thus increased the burden on the universities.

Selection of research grants for case study examination

Figure 17

We focused our selection on those universities receiving most research funding.

Institutions	Universities	Research grants	Value (£m) Grants	Value (£m) Equipment budget
Top fifteen	6	60	53.13	12.87
Others	1	8	7.13	1.15
Total	7	68	60.26	14.02

Distribution of EPSRC equipment budgets and NAO selection

Figure 18

We selected mostly from those research grants with the most significant equipment budgets and also covered the full range of grant values.

Value range	EPSRC Equipment budgets (£m)	EPSRC Equipment budgets No.	NAO selection (£m)	NAO selection No.
Less than £50,000	38.86	2,530	0.38	10
£50,000 - £100,000	16.10	236	1.72	25
£100,000 - £200,000	13.72	99	2.07	15
£200,000 - £500,000	12.12	45	2.75	10
Over £500,000	20.33	21	7.10	8
Total	101.63	2,931	14.02	68

On what basis were individual items of equipment selected for price checking?

For each grant chosen for case study examination, we selected an item of equipment purchased from the grant which we considered would be capable of independent price checking. This necessitated examining the grant and accounting records of the Council and the universities to identify items of equipment actually purchased and charged to the grant.

What did we examine?

The principal elements of our methodology for examining the grants were:

For the grant administration procedures and university procurement arrangements:

- review and analysis of the procedures used by the Council for receiving, reviewing and awarding grants for research equipment;
- review of their grant monitoring and evaluation of final results;
- comparison of their practices with those of the other Research Councils; and
- visits to the institutions to discuss their equipment purchasing and accounting procedures in general and in particular their acquisition of research equipment with Council funds.

For the case study selection:

- examination and analysis of Council documentation relating to the case studies selected at seven universities (Figure 17);
- visits to the individual researchers at universities to examine how they had justified the resources requested, what they had purchased with the grant awarded and how the purchase process had been managed; and
- an independent price check by the Société Genéralé de Surveillance of individual items purchased with the above grants to confirm the price paid or to identify those cases where scope had existed for savings to be achieved.

What did we find?

Overestimating

We found, in relation to our 68 case studies, that in 46 cases (nearly 70 per cent) the equipment funded was actually purchased for less than the estimated cost on which the grant for equipment was assessed (Figure 19). Overall the equipment was purchased for 16 per cent less than estimated.

Analysis of equipment costs against estimates

Figure 19

Overall the equipment was purchased for 16 per cent less than estimated.

Equipment expenditure	Number	% variation
Less than estimate	46	- 26
More than estimate	11	+ 11
Equal to estimate	10	0
Item not yet purchased	1	0
Total	68	-16

Scope for better procurement

We provided 68 equipment items, purchased for a total of £8.7million, to our consultants for price checking. This proved not possible in 13 of these cases. In six of the 13 cases the item was not suitable for price checking because it was part of a larger equipment built specifically for the universities and in seven other cases, our consultants encountered a lack of co-operation from suppliers.

Where a price check was concluded, our consultants confirmed that the items had been purchased well in 20 cases but identified scope for savings which had not been achieved in 35 cases. Figure 20 shows that scope for savings existed across all ranges but that the incidence of savings in relation to the numbers examined was generally greater in the higher value ranges.

Analysis of results by grant values

Figure 20

The results of our price check revealed that scope for savings arose across all the value ranges of grants.

Value range of grant	Number selected	Results of price check by consultants				
		Not possible	Purchased at keen price	Cases where savings apply Price check	Competition	Percentage savings
Less than £50,000	10	4	2	4	8	6.4
£50,000 - £100,000	25	3	10	12	22	7.2
£100,000 - £200,000	15	3	6	6	12	5.0
£200,000 - £500,000	10	1	1	8	6	5.9
Over £500,000	8	2	1	5	3	7.8
Total	68	13	20	35	51	6.9[1]

Note: 1. These potential savings exclude the estimated savings that could be obtained from co-ordinated purchases.

Figure 21 shows that the highest potential savings, in percentage terms, related to the cases where there had been failure to co-ordinate high value purchases. The largest number of potential savings arose from failure to pursue competitive purchasing and not obtaining available discounts.

Analysis of results by catagories of potential savings

Figure 21

This shows an analysis of the results of the National Audit Office examination and their consultants' price check.

Category of potential savings	Number [1]	Scope for savings identified (£)	Average % of price paid	% for items examined [3]
Price check not feasible (mainly build items)	6	-	-	-
Price check not achieved by consultants	7	-	-	-
Items purchased at keen price	20	-	-	-
Competition not sought	48	248,400	5	6.9
Prompt payment and other discounts not sought	35	344,700	6.8	
Co-ordination of purchases not considered	2	180,000[2]	10	2
Total		773,100		8.9

Notes: 1. Potential savings for one grant can occur in more than one category.
2. Relates to two specific items within the NAO selection.
3. The total cost of the items examined was £8.7 million.

The overall results indicate that savings of around nine per cent could have been achieved through better procurement.

What does it mean for the Council?

We discussed our emerging findings with a Focus Group who acknowledged that our findings were in line with their own experience. The members were:

Name	Title/Organisation	
Peter Maxwell	Director of Finance and Administration.	] Engineering and Physical
David Harman	Programme Services	] Sciences Research Council
Peter Smith	Programme Manager Materials	]
Allan Robertson	Procurement Adviser to all the Research Councils	
Steve Butcher	Principal Auditor, Higher Education Funding Council for England	
Keith Root	Director of Finance, Office of Science and Technology	
Kerry Tregonning	Procurement co-ordination, Office of Science and Technology	
Professor Roger Cowley	Clarendon Laboratory, University of Oxford	
Stephen South	Director of Procurement, University of Sheffield	

As our case studies were not selected on a random basis we cannot place statistical confidence intervals around our results. But, taken together, the results indicate potential savings could be made by the Council and the institutions. We consider the findings from our selection indicate savings of a similar size could be made across the grants awarded by the Council because:

a) our selection covered a sizeable proportion of the Council's equipment grant expenditure (£14 million out of £102 million);

b) our selection covered all types, sizes and characteristics of grant and a range of equipment. Savings were found across the whole range of procurement situations not just, for example, on one type of equipment at one university; and

c) university systems and approaches to procurement are broadly similar.

A saving of 9 per cent through better procurement would represent around £3.5 million. Improved estimating, based on the 16 per cent average overestimating we identified, would represent some £6 million.

What does it mean for the other Research Councils?

The six Councils' grant systems are very similar and the same institutions are being funded. We consider that it is very likely that similar opportunities for savings exist in their grant arrangements. The savings which we believe the Council could make may also be possible in the other Research Councils, although because of difference in the operation of their grants, it is not possible to provide an

accurate estimate of the potential savings. If our results apply to the other five councils, potential savings of some £3million could have been achieved from improved procurement. This figure is based on using the same savings level of 9 per cent, and applying it to the other research councils' expenditure on funding research equipment (some 44 per cent of the total Research Council expenditure). We note that the Research Councils and the Office of Science and Technology have formed a working group in conjunction with representatives of the higher education sector to explore how best to carry forward the recommendations of this report.

Reports by the Comptroller and Auditor General, Session 1998-99

The Comptroller and Auditor General has to date, in Session 1998-99, presented to the House of Commons the following reports under Section 9 of the National Audit Act, 1983:

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