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Policy Study No. 4

THE STRUCTURE OF RESEARCH EXPENDITURE

SCIENCE AND ENGINEERING POLICY STUDIES UNIT

THE ROYAL SOCIETY THE FELLOWSHIP OF ENGINEERING

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FOREWORD

Analysis of the structure of research expenditure leads one directly into some of the key issues in science and engineering policy, even though it may at first sight appear to be a dry, not to say arcane, subject. Particularly topical at the moment is the issue of overheads—expenditure on things other than the salaries of research staff which, if consistently miscalculated, can bankrupt a research group. Other issues include the adequacy of provision for materials and equipment, relative expenditure on support staff, the balance between capital and recurrent expenditure and the extent to which these parameters are affected by the size of the research group.

This report presents detailed data on how 30 leading research centres (from university departments to major research institutes) use their budgets. Our data are unique not only in their level of detail but also in the fact that they cover, on a directly comparable basis, research in universities, research institutes and industry. They also cover four broad disciplinary areas. The complexity of the exercise meant that we had to use a case study approach rather than attempt to construct statistically significant samples.

Our methodology, as well as our findings, will be of interest. The methodology is necessarily experimental, especially in the university sector where it involved allocating central expenditure to individual departments and dividing all expenditure between teaching and research. A simplified version could be developed for more widespread use.

We present our findings as indicative, not prescriptive: they establish ranges for the various parameters, for each sector and discipline covered, rather than laying down statistical norms. These ranges will provide a background against which individual research managers can assess their own use of resources. They will also be of value to those concerned with developing research policy at the national level, for example in connection with the future of the dual support system.

Professor B.K. Follett, Sec RS
Chairman, SEPSU Steering Group

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Vice-Chairman, SEPSU Steering Group

July 1990

SUMMARY

This report presents a quantitative analysis of how research centres in various science and engineering disciplines spend their research budgets. We have collected very detailed data on actual expenditure patterns in a single year (1986/87) from 30 research centres in four disciplines (biochemistry/pharmacology, chemistry, electrical engineering & electronics and plant science). The centres cover a wide range of size, and include university and polytechnic departments, research council and other research institutes, and industrial research centres. Our results are of special interest because they allow direct comparison to be made between the three sectors of research.

We have used the data to examine many facets of research expenditure: the division of expenditure between pay and non-pay, how pay is divided among various categories of staff, how much goes on equipment & consumables, on computers, on travel, on training, how the pattern of expenditure varies by discipline and by sector. The results are presented in relative terms, particular expenditures being expressed as a percentage of total and/or recurrent expenditure and as expenditure per researcher.

Those concerned in any way with the management of science and engineering research will be particularly interested in the following findings.

(i) *Overheads*. In universities, indirect expenditure ('overheads') on research in plant science, biochemistry/pharmacology and chemistry was at the rate of about 80% of the pay costs of departmental research and research support staff; for electrical engineering & electronics, the figure was 140%. In industry, we found rates of 240% in biochemistry/pharmacology, 190% in chemistry and 165% in electrical engineering & electronics. Rates in research institutes were somewhere between those in industry and those in universities.

(ii) *Pay expenditure*. Over all disciplines, universities spent 63% of total recurrent expenditure on pay, while research institutes and industrial research centres spent about 50%.

(iii) *Non-pay expenditure*. In universities, expenditure per researcher on non-pay items (including materials & equipment) averaged £18K for the three science disciplines and £46K for electrical engineering & electronics. In industry it averaged £93K for biochemistry/pharmacology, £75K for chemistry and £29K for electrical engineering & electronics.

(iv) *Scale effect*. We found no correlation between the size of research centres and their expenditure patterns.

(v) *Heterogeneity*. On most parameters, we found considerable variations between research centres, even within the same sector and discipline. Funding formulae based on the 'typical' research centre could therefore be misleading.

In measuring research expenditure in the university sector we had to devise methodologies for attributing central expenditure to individual departments and for allocating both central and departmental expenditure between teaching and research. The way we did this could be developed so as to provide a relatively accurate way of monitoring academic expenditure on research.

Some care is needed in interpreting our data. Addressing an issue where there was little previous quantitative work, our methodology was necessarily experimental. The complexity of the data required meant that we were restricted to a statistically small number of case studies. The disciplines we selected may not be typical of all science and engineering disciplines. Nevertheless, we have been able to generate relatively hard data on a series of important policy issues where data have generally been poor. Both our methodology and our findings contribute to an improved understanding of the financing of science and engineering research.

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Tables and figures

CHAPTER 1: INTRODUCTION

(i) Aims

Aims and coverage

This report presents the results of an investigation into the structure of research expenditure at the level of individual research centres. Our aim has been to collect and analyse detailed quantitative data on the way institutional research budgets were used in a single recent year, so as to generate understanding that might be valuable to those in research institutions and in funding agencies who have responsibilities for managing research.

We selected four disciplines with a diverse range of operational requirements (biochemistry/pharmacology, chemistry, electrical engineering & electronics and plant science). Within these disciplines we selected leading research centres in three sectors (industry; research council institutes and comparable research organizations; institutions of higher education). The complexity of the data needed for this exercise—the analysis involved over 100 separate categories of expenditure—limited the number of case studies we could complete to 30.

Our data allow us to address the following issues:

- the structure of research expenditure in each discipline/sector;
- comparisons between disciplines;
- comparisons between sectors;
- the proportion of total expenditure represented by particular items, in particular 'overheads';
- methodology, notably the separation of research from teaching expenditure in the academic sector.

Since the data cover a single year only (1986/87), we cannot address issues, such as the rate of inflation of research costs, that require trend data over a number of years. We have not attempted to relate expenditure on research to outputs (e.g. published papers) from research, since analysis of research performance was outside the remit of this study. For the university sector we collected data on the various sources of income, but we were not able systematically to relate particular sources of income to particular items of expenditure. This is nevertheless of policy interest, since it is likely that sums nominally allocated to teaching or to research are in practice used for the other function.

We have tried to analyse the ways in which different research centres spend their budgets. It has not been our aim to establish norms for any given discipline or sector. One of the main findings from this study is the extent to which expenditure patterns vary even between research centres in the same discipline and sector, so it is not clear how much value the concept of a norm has in this context. We have therefore presented our data as ranges, and interpret them as indicative rather than prescriptive.

Expenditure vs costs

This report deals with the structure of research *expenditure*: the data we collected were on actual expenditure incurred by the respondents, and reflect the particular circumstances of the respondents, including their total available budgets. Our discussion covers the expenditure of research centres rather than the slightly more abstract notion of the costs of research.

(ii) Previous studies

Clayton report

The most detailed recent attempt to examine research expenditure in institutions of higher education is the 1987 report by Professor Keith Clayton, *The measurement of research expenditure in higher education*. Clayton aimed to cover all types of cost centre and constructed a sample in which all universities and polytechnics were represented: the sample covered every cost centre in uncommon and expensive subjects, one in three in high cost areas and one in five in lower cost areas. He developed a set of five succinct questionnaires covering institutional expenditure, central expenditure on research, departmental expenditure on various items including research, sources of departmental income and measures relating to the output of departmental research. He achieved a good response rate: 85% from universities and 40% from polytechnics.

The Clayton study was both more and less ambitious than our own. With responses from 225 university cost centres, he was able to calculate averages and standard deviations for various parameters. His data on outputs allowed him to calculate, for example, average expenditure per published paper. However, the scale of the study was achieved at the cost of detail. Expenditure data were collected at a relatively high level of aggregation: for example, central recurrent expenditure was divided into just five categories. Moreover, Clayton did not attempt to develop detailed methods for separating research from teaching expenditure. Arguing that the study was aimed at developing methodology, he provided some guidelines but generally invited respondents to devise their own approaches.

The Clayton study was criticized for several reasons. The lack of a detailed methodology for separating research from teaching meant that many of his respondents resorted to guesswork, and some emphasized the unreliability of their replies. The lack of clear definitions of key terms such as 'research staff' caused problems. The use of 'pro-rating' techniques at relatively high levels of aggregation begged a number of issues, particularly in respect of the allocation of academic staff time. Clayton's data refer to 1983/84, but most respondents replied during the winter of 1985/86 by which time they had difficulty in tracing how particular items had been divided between research and teaching.

It should be said that Clayton was open about such problems and discussed them frankly in his report. He argued that the consistency of his results justified his general approach. However, given the range of activities to be found in any particular cost centre across different institutions, it is not obvious what degree of variation in expenditure structure one might expect to find even if one had perfect data from each institution.

Form 3

Extensive data on the income and expenditure of each university are collected annually by the University Grants Committee (UGC—now the Universities Funding Council); some are published by the Universities Statistical Record as volume III of *University Statistics*. The data are valuable for many purposes, and have the advantage of allowing one to track trends over time. However, the data are not close enough to the requirements of our investigation to enable us to use them instead of collecting our own.

Financial data are collected by the UGC via a document known as 'Form 3'. Form 3 is continually being developed to meet the changing needs of the UGC. For the year 1986/87, it comprised a set of seven tables, summarized below:

Table 1: General income (e.g. UGC allocations) and specific income (e.g. research grants and contracts), aggregated for the university as a whole

Table 2: Expenditure, at the level of each of the 39 disciplinary costs centres plus 6 academic services, analysed by salaries and wages costs for various categories of staff and by non-pay expenditure

Table 3: Specific income by source, and related expenditure by pay/non-pay, at cost centre level

Table 4: Catering and residence accounts, at university level

Table 5: Balances, provisions and reserves, at university level

Table 6: Maintenance of premises and capital spend met from income, at university level

Table 7: Equipment and furniture income and expenditure, at cost centre level

From 1987/88, additional tables sought data on fee income for vocational short courses, income from European research grants and contracts and payments to medical authorities for premises used.

Table 1 in Form 3 is similar to the income section of the questionnaire we sent to universities (see Annex A, heads 1–21), except that it omits capital income. Table 2, however, is less useful for our purposes. Our analysis was carried out at departmental level, which is often different from the cost centres used by the UGC. The categories used in table 2 for analysis of pay expenditure are similar to our own (heads 22—33), but neither in table 2 nor in table 3 is non-pay expenditure broken down (cf heads 34—54 of our questionnaire). Table 2 also omits departmental capital expenditure (cf heads 55—58 of our questionnaire). But the most serious difficulty, from our point of view, is that in table 2, as indeed throughout Form 3, there is no attempt to separate expenditure on research from expenditure on teaching. Form 3 was a helpful reference point for the design of our own questionnaire (and we tried to use comparable categories wherever possible), but it was not possible to use Form 3 data in lieu of our own.

Diary exercise

The 'enquiry into the use of academic staff time' was undertaken during 1969/70 and published by the CVCP in 1972. For one week at each of three different times in the year, 8000 UGC-funded academic staff kept a record of how each half hour of each day was spent. Overall, it

was found that 42% of working time went on teaching, 30% on research and 29% on 'unallocable internal time' and 'external professional time'. This is the origin of the assumption, still current, that 30% of staff time—and therefore of staff pay costs—should be ascribed to research. If the unallocable 29% is distributed *pro rata* between teaching and research, then teaching accounts for 58% of total time and research for 42%. There were some differences between disciplines: within the seven science and engineering categories, the highest teaching : research ratio was found in 'engineering' (61 : 39), and the lowest was found in agriculture & forestry (48 : 52).

The survey achieved a fair response rate: 70% completed diaries for at least two of the three weeks. The methodology did, however, attract criticism. Some respondents pointed out that the sample weeks were not typical of their normal activities. More significant was the absence of a category for administrative duties—these were subsumed under teaching, research or unallocable internal time. An exact repeat of the survey now would therefore not show whether, as is often stated, there has been an increase in the amount of time that academic staff spend on administration at the expense of teaching and/or research.

It was expected that the diary exercise would be repeated at five-year intervals, but no repeat has been carried out—because of methodological difficulties and, perhaps, because of the abandonment of quinquennial planning in the mid 1970s.

Hanham Report

In 1988 the CVCP published the Hanham report, *The costing of research and projects in universities*. This followed an interim report issued the previous year. The aim of these two reports was to establish agreed principles that universities should apply when estimating research costs; the interim report also presented some data on what research costs might actually be.

The Hanham report emphasised the importance of knowing the full costs of research projects, as a prerequisite for establishing a proper pricing policy. The price charged for a piece of research might well differ from the actual expenditure on that piece of research; but it should do so as a deliberate matter of policy, which would not be possible if the expenditure were not known to a reasonable degree of accuracy. The practice, dating from 1970, of charging indirect costs as 40% of total direct costs was said by Hanham to be inadequate either as a means of calculating full costs or as a charging policy. Moreover, in 1985/86 the actual recovery of indirect costs on contracts from outside the dual support system averaged just 10%, resulting in a shortfall of over £40M against the 40% target—i.e. a 'subsidy' of this amount from university general funds to external bodies.

In line with general industrial practice, Hanham recommended that the indirect costs of a project be related to the payroll costs of all research and support staff directly engaged on the project. The total costs of a project would then be direct payroll costs, plus a certain percentage for indirect costs, plus other direct costs such as travel, consumables and equipment purchased specially for the project. The interim report suggested that that percentage would be in the range 100%—150% of direct payroll costs; it would vary not only between institutions but also between capital-intensive and manpower-intensive projects. The final

report suggested that indirect costs were likely to be 75%—150% of direct payroll costs.

On pricing, Hanham recognised the need for sufficient flexibility to account for the nature of any given project. Short-term contract research should be charged at full cost, or higher if the university was in a strong bargaining position (e.g. through having unique expertise); it could be charged at less than full cost if the university secured a compensating right to the ensuing intellectual property or some comparable benefit. Projects of a more long-term or basic nature, where the university had greater influence over setting the objectives and timescale of the research, might be charged at less than full cost: the university might deliberately decide that the research was a legitimate object for its own funds. Full-cost pricing carried with it tougher obligations as to delivering results to time and to budget.

Sophistication factor

It is often suggested that the costs of remaining at the forefront of experimental research increase faster than the general rate of inflation. This arises in part from the escalating sophistication of the experimental equipment and techniques needed to compete at the world level—the so-called 'sophistication factor'. Substantive attempts to measure the sophistication factor are relatively rare, not least owing to the difficulty of ensuring that one is comparing like with like over intervals of several years. At one stage, we considered trying to make a quantitative investigation of the sophistication factor, but were dissuaded by the conceptual and methodological difficulties. One attempt to measure it was, however, published by the Council for Scientific Policy in 1967 as *The sophistication factor in science expenditure* (CSP Science Policy Studies No 1).

The study examined the budgets of thirteen government research institutes and three university departments over the period 1955—1965, and focused particularly on the costs of pay, buildings and equipment. Growth rates of 7%—20% above the general rate of inflation were reported for expenditure on equipment per researcher; this was to some extent balanced by lower growth rates in other parts of the budget.

Equipment costs

The Council for Scientific Policy returned to the issue of equipment costs in a report published in 1972, *An analysis of equipment costs in university science and engineering departments* (CSP Science Policy Studies No 5). This report was based on analysis of 69 departments in 14 universities over the period 1957—1968, and covered 13 science and engineering disciplines. Overall, a mean annual growth rate in the cost per scientist of teaching and research equipment of 8%—11% in real terms was reported. It was pointed out this result could reflect not only increasing sophistication per se but also management decisions on the deployment of resources and moves by some departments into new areas of research where initial unit costs were high. Indeed, equipment costs per scientist were determined as much by the amounts of money made available for research as by the inherent demands of the advance of scientific knowledge.

Canadian study

The Canadian Association of University Business Officers published in 1982 an empirical report *On the costs of university research*. This was based on data from 14 universities on expenditures in four groups of

disciplines—education, humanities & social sciences, business & law and physical & applied sciences (health sciences were excluded). The objectives of the study were to establish a methodology for analysing costs and to examine the ratio of indirect to direct costs of research.

The study was conducted at a fairly high level of aggregation. It drew on a previous 'empirical faculty activity analysis' to apportion costs such as faculty time between the three functions of teaching, research and 'community and professional service' (for all disciplines combined, faculty time was apportioned as 69 : 26 : 5 respectively). It argued that indirect costs could most usefully be specified in relation to direct payroll costs rather than total direct costs.

For research in the discipline group physical & applied sciences, the study found that indirect recurrent costs averaged 69% of direct payroll costs. Across all disciplines, capital expenditure averaged a further 36% of direct payroll costs. This gave a total of 105% as the proportion of indirect costs to direct payroll costs in physical & applied sciences. In the other discipline groups, the ratio ranged from 99% to 106%.

NSF study

A report published in 1987 by the National Science Foundation, *Future costs of research,* presented some aggregated data on likely trends in the financial requirements of research. It concluded that the USA 'will have to more than double its annual expenditures on academic R&D merely to maintain its base level'. A substantial part of this figure arose from inflation: in constant dollar terms, a person-year of senior academic R&D effort was estimated to increase from $155K in 1986 to $180K—$205K in 1996. Expenditure on equipment, facilities and overheads, all of which had been growing in real terms, were expected to continue growing though more slowly, while increasing competition for the services of the decreasing numbers of skilled scientists and engineers was expected to drive up pay costs.

CHAPTER 2: METHODOLOGY

(i) Design of the study

Scope

This study analyses the structure of research expenditure in four disciplines and three sectors. The disciplines were biochemistry/pharmacology, chemistry, electrical engineering & electronics and plant science, chosen to represent a diverse set of operational requirements. The three sectors we covered were industry, Research Council and similar institutes, and academe.

Case studies

In view of the complexity of the data required, we decided to adopt a case study approach. We invited 53 research centres to participate in the study, and 42 initially agreed to do so. The distribution of these 42 within the discipline/sector matrix is shown below.

Figure 1. Initial participants in case studies

	Biochemistry/ pharmacology	Chemistry	Electrical engineering & electronics	Plant science
Industry	3	5	4	2
Research institutes	4	–	2	3
Universities	3	4	4	3
Polytechnics	–	2	3	–

In the event, only 30 centres were able to provide useful data, though in one or two cases the data were incomplete. The final sample gave us up to four data sets in each cell of the discipline by sector matrix. We had no examples of research institutes in chemistry (none were sought) or of industrial research centres in plant science. We had only a single representative of university chemistry, and only two polytechnic respondents (both in chemistry).

Two criteria were used to select the research centres. One was that they should be recognized as among the stronger centres in their disciplines in the UK. This added a degree of coherence to the sample and ensured that our results would be of interest to those concerned with examining 'best practice' in the management of research. The second criterion was that they should be large enough to have discrete financial records and the administrative capacity to analyse them for us.

All the research centres included in the study were located in the UK. Although international comparisons would have been interesting, we thought it preferable to establish the methodology at the purely national level first.

Pragmatism

An investigation of this sort must be approached pragmatically. For example, in devising methods of separating teaching from research expenditure in universities, we had to be sensitive both to the limits of what was meaningful (in view of the sometimes close relation between the two) and to the administrative burden that our respondents might be willing and able to shoulder; but, because the separation was

carried out at the greatest feasible level of disaggregation, by methods appropriate to each individual category of expenditure, we believe the overall result is likely to be reasonably accurate.

Again, we did not attempt to develop precise definitions of the disciplines we covered: since administrative exigencies required that we operate at the level of, for example, a university department, we simply defined disciplines as co-terminous with the departments named after them.

Our necessarily small sample precludes sophisticated statistical analysis of the data. Our results must therefore be regarded as indicative of the characteristics of each discipline/sector rather than as establishing definitive norms.

(ii) General methodology

The study started, at the beginning of 1987, with a literature survey and discussions with research managers and finance officers. This enabled us to identify the components of research expenditure and to gauge what data might reasonably be expected to be available. We developed questionnaires accordingly and tested them with those whom we had consulted.

Once institutions had agreed in principle to participate in the study, we held extended discussions with the individuals who would be responsible for completing the questionnaires, to clarify what was being requested and to ensure that the questionnaires would be suited to the circumstances of each institution. Further meetings were held with respondents after they had received the questionnaires; sometimes additional consultations proved necessary to clarify particular aspects of the completed returns.

The reference year for the study was the financial year 1986/87. The questionnaires, together with the detailed guidelines, were sent out as soon as possible after the year end: the mailing was completed by the end of summer 1987. In not a few cases, respondents proved to have greater difficulty in producing the data than they had originally anticipated. Delays therefore occurred at this stage. Considerable effort was required both in liaising with respondents and in verifying the internal consistency of the completed questionnaires. It was early summer 1988 before we were able to begin analysing the aggregate data; further unavoidable delays occurred before the project could be brought to completion.

(iii) The questionnaire

Content

Two questionnaires were developed, one for the university sector and one for industry, research institutes and polytechnics. The university questionnaire had 117 main headings divided into three sections:

(a) Total income
- general recurrent income
- specific recurrent income
- capital income

(b) Departmental expenditure
- salaries and wages
- non-pay recurrent expenditure (facilities, materials, travel, buildings, other)
- capital expenditure

(c) Central expenditure

The second questionnaire was similar, but omitted central expenditure. Details of both questionnaires are given in Annex A. All respondents agreed that the questionnaires covered all relevant forms of expenditure.

Many of the headings in the questionnaires were divided into fine detail. Respondents sometimes proved unable to supply data at that level of detail, though the main headings were usually completed. The analysis in chapter 3 is therefore confined to the main headings. However, by including the fine detail in the questionnaire we ensured that respondents took account of all relevant factors when assessing total expenditure under any given heading.

Definitions

For ease of reference, definitions of some of the key terms in the questionnaire are given below. Further definitions are given in Annex C.

Researcher

In the university sector, 'researcher' meant both UGC-funded and other staff on academic or related scales; *but in this study postgraduate research assistants (PGRAs) were treated as technical support staff rather than researchers.* In the other sectors, corresponding definitions were used.

The reason for not classifying PGRAs as researchers is that many of them are, in practice, research students registered for higher degrees; as such they are formally regarded as undergoing research training. They do, however, provide valuable support to the research staff, and therefore may properly be included as support staff. On the other hand, *postgraduate students in receipt of grants are neither support staff nor researchers in the sense used here,* and their grants (unlike PGRAs' salaries) do not form part of the department's income or expenditure; we have therefore omitted them from all staff categories. This may distort our analysis of resources per member of staff in departments that have atypical concentrations of research students.

Senior administrative staff within research centres (but not those working in central university administrations) were included as 'researchers'. Such staff were often involved closely in research work.

In the university sector, the number of researchers was given in terms of full-time equivalents (FTE). Academic and academic-related staff paid from general university funds were counted in proportion to time spent on research: for example, ten staff spending on average half their time on research would count as five FTE researchers. We made the simplifying assumption that academic staff paid from other sources would generally devote all their time to research, though of course they do also take part to a certain extent in other departmental activities. In the industrial and research institute sectors, research staff were assumed to devote all their time to research; *in practice, this probably overestimates the effective numbers of researchers in those sectors.*

Support staff — Technicians, scientific officers, experimental officers, secretaries, clerical staff etc and, in the university sector, postgraduate research assistants.

Salaries and wages — Includes full costs, i.e. employer's contributions to National Insurance, pensions etc.

Materials — Includes all recurrent or revenue expenditure on equipment, clothing and other consumables, provided it was not capitalized.

Capital — Covers major and minor building works, equipment, furniture and computers. Academic respondents were not able to provide data on depreciation, *so capital expenditure in all sectors was assessed in terms of actual expenditure during the year.*

Indirect expenditure — All expenditure on research except the salary costs of those categories of departmental staff directly involved in research (i.e. researchers and support staff).

(iv) Allocation of academic expenditure between teaching and research

Research institutes and industrial research groups were assumed to be concerned solely with research, and all expenditure incurred by them was regarded as expenditure on research. Universities, however, have two functions, so it was necessary to devise ways of separating their expenditure into teaching on the one hand and research on the other. Moreover, in universities research expenditure is incurred both by the departments and, indirectly, by the central administration, so central expenditure had to be taken into account in calculating the total cost of departmental research. Our approach to dividing departmental expenditure between teaching and research is described below. Central expenditure is dealt with in Annex B.

Salary costs — Respondents were asked to apportion staff time between teaching and research. Two methods were suggested. One was that the assigning should be done by the head of department and the departmental administrator, and then passed to the staff concerned for comment. The other was that individual members of staff should be asked to identify the tasks they undertook during the year, categorize them as teaching or research, note the number of hours spent on each task and aggregate the results. Individual salary costs were then apportioned pro rata. Total staff numbers, split between teaching and research, were then calculated to the nearest tenth of a unit.

Departmental non-pay expenditure — Unless particular items of expenditure had been incurred specifically for teaching or for research, all facilities and equipment bought solely for the use of undergraduates and postgraduates on taught courses (with the exception of final year undergraduate project equipment) were allocated to teaching, along with any expenditure on teaching aids. All other expenditure was allocated to research. If there was insufficient information available to use this allocation procedure, participants were asked to estimate the amount on teaching and research as accurately as possible, and provide details of how the estimate was derived.

Buildings and premises expenditure

For buildings and premises expenditure incurred by departments, participants were asked to provide a teaching/research split on the basis of floorspace assigned to one or other function.

For both departmental and central expenditure, the approach to separating the teaching and research elements was, inevitably, approximate. In balancing the need for accuracy against the demands we were placing on respondents, we had to rely on pro-rating techniques as well as direct measurement. The method we used was developed in close consultation with university finance officers and other relevant experts. Respondents commented that our approach was 'acceptable', 'better than leaving it up to each university to design its own'. To seek absolute accuracy in these measurements under existing financial arrangements is futile: the aim must be to obtain sufficient accuracy to serve the policy purposes for which the data are collected. We believe that our approach met this latter criterion.

CHAPTER 3: RESULTS

(i) Introduction

Coverage

This chapter presents the core of our quantitative results, grouped together into sections on general income and expenditure, pay expenditure and nonpay expenditure. All data in this chapter refer to research only; other activities such as teaching have been excluded from the calculations.

Our results cover only certain disciplines within science and engineering. How far one can extrapolate from these results to the whole of science and engineering is open to discussion. It would certainly be unwise to extrapolate to social sciences and humanities, with their very different demands for expenditure on nonpay items. Where we refer to average results for the university sector, for example, we mean of course in relation only to the disciplines under discussion; and it may be that in some respects our sample is not representative even of the particular disciplines concerned.

In the figures, cells containing only one respondent are identified as such; other cells have 2 – 4 respondents. With a single respondent it is, of course impossible to know how typical a particular result might be. There were no respondents in the industry/plant science or research institute/chemistry cells. The number of respondents per cell occasionally varies from one parameter to another: respondents were not always able to provide usable data for each section of the questionnaire.

Presentation

The data are presented as ranges showing the maximum and minimum values for each parameter. The text sometimes discusses average values (i.e. total for all respondents of a particular type, divided by the number of responses), but for the most part we have restricted ourselves to describing the broad ranges found for each cell of the discipline/sector matrix. More rigorous statistical analysis would not be appropriate, because of the variable precision of the data we received and because of the small number of respondents in each cell of the matrix. It is not clear how typical our respondents are: they were selected because of their strong research reputation rather than as a representative sample from which one might extrapolate to the whole of the UK. Within the relatively homogenous university sector, our results should be of value in identifying typical ranges for certain parameters; in the other sectors, the concept of 'typical' is less useful.

All results have been normalized, according to total expenditure, total recurrent expenditure or the number of researchers as appropriate.

NOTE ON PRESENTATION OF RESULTS. Data have been presented mostly in the form of horizontal bar charts (from figure 2 onwards). In these charts, the shaded bars indicate the range of results obtained, with maximum and minimum values as marked. Each bar represents up to four results. When only one usable result was obtained, a single value is shown.

Polytechnics

We had hoped to include polytechnics in the study, on a comparable footing to universities. In the event, we obtained usable data from only two polytechnic departments. In both cases, however, the respondents reported that no academic staff time could be apportioned to research: all research was carried out by postgraduate or postdoctoral staff. While this may be formally correct, since polytechnics are funded essentially as teaching institutions, it probably does not accurately represent departmental experience. It also makes it difficult meaningfully to compare the polytechnic data with data from the other respondents. A major review of polytechnic research now being carried out by the Polytechnics and Colleges Funding Council is likely to provide a much more complete picture of polytechnic research. In order to avoid misleading comparisons, we have therefore presented our polytechnic data separately from our other data; see Annex D.

(ii) Income and expenditure: general

Income

The data we received on income (heads 1–21 of the university questionnaire, heads 1–7 for other respondents) were of mixed quality. Four of the industrial respondents, in otherwise complete returns, left the income section blank. Few of the university respondents could provide data on departmental income – especially on the amount allocated to the department from the UGC block grant – though data on income for the university as a whole were available. We did, however, obtain data on external income.

'External income' is income from sources other than the parent body (e.g. the relevant research council for research council institutes, the parent company for industrial research groups, the UGC for university departments). Some respondents had little or no external income, mainly as a matter of policy. The research institutes in plant science secured significant external funding: 12% – 22% of their total income. The highest proportion, however, occurred in electrical engineering and electronics; the industrial respondents in this field derived 21% – 51% of their total income from external sources, and one research institute derived 77%. The Alvey programme accounted for part of these sums, but overseas sources also contributed significantly to external income.

Figure 2 shows the ranges in each discipline/sector of external income per researcher. This, again, shows the relatively high external income in electrical engineering & electronics and in university departments of plant science.

Total expenditure

Our 30 respondents varied considerably in size. In the university sector, total expenditure per respondent ranged from £0.7M to £2.5M; in the research institute sector it ranged from £1M to £130M; and in industry it ranged from £3M to £130M. The university respondents had a combined total expenditure of £12M; for research institutes this figure was £210M; and for industrial respondents it was £280M.

In the academic sector, the highest *per capita* expenditure in our sample is found in electrical engineering and electronics (at an average of £90K per researcher), with plant science in second position at £50K and biochemistry/pharmacology and chemistry at a little over £40K (figure 3). Electrical engineering and electronics would appear also to be the

Figure 2. External income per researcher (£K)

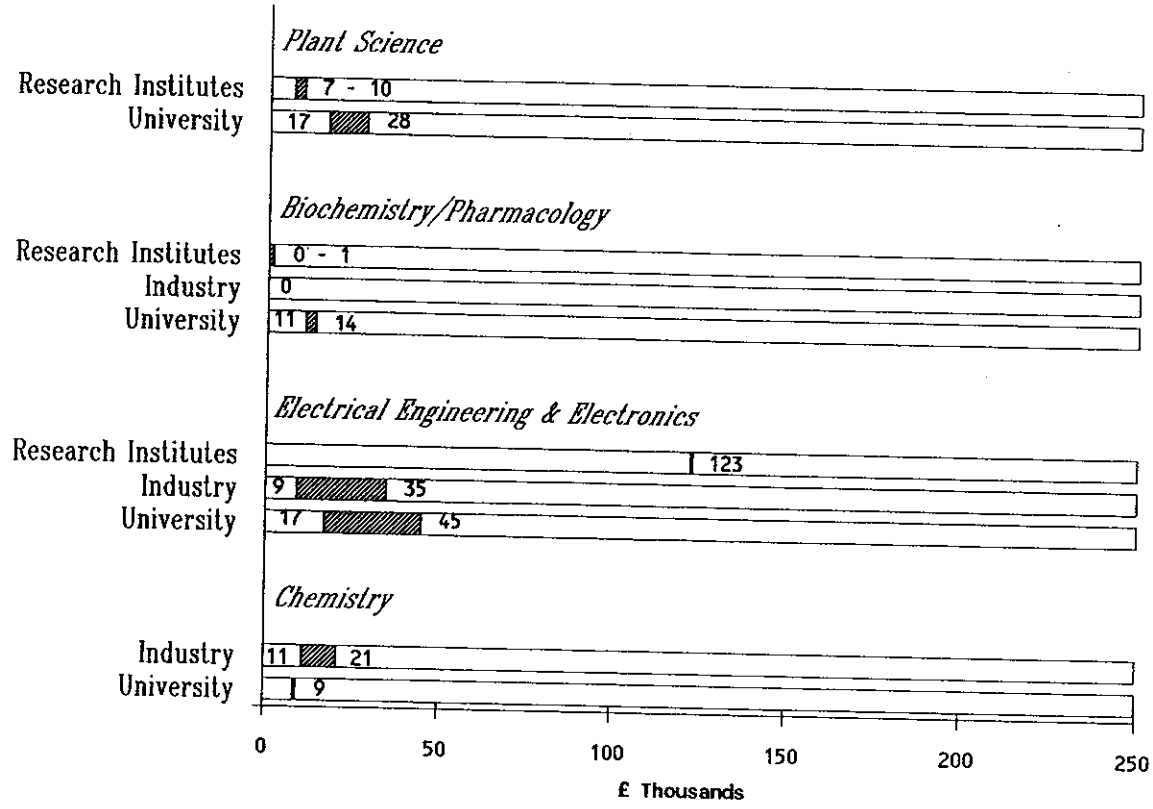
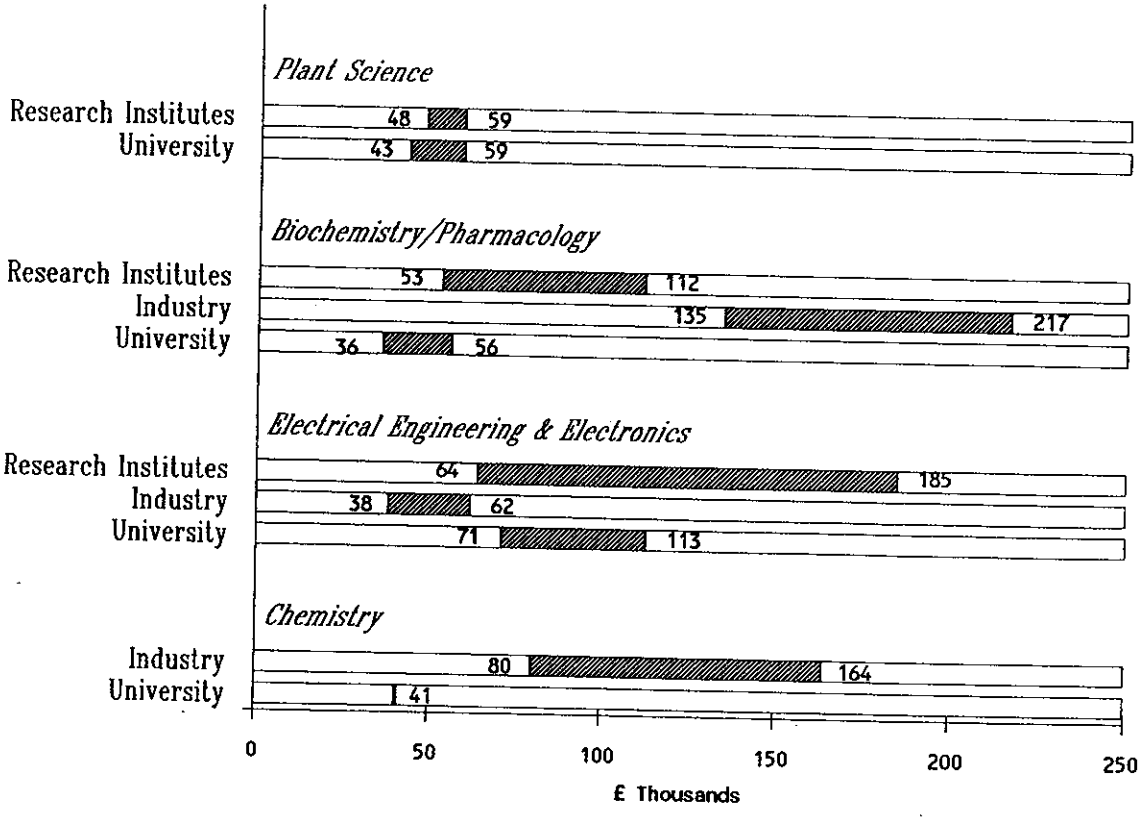


Figure 3. Total expenditure per researcher (£K)



most expensive discipline (on a *per capita* basis) in the research institute sector, though the sample may be distorted in this respect. Chemistry and biochemistry/pharmacology are the most expensive disciplines in the industrial sector.

It is more difficult to generalize across sectors: *per capita* expenditure in industry *is not always* greater than in universities, though it is greater in two out of the three disciplines where both sectors are represented in our sample.

Central vs departmental expenditure

In the academic sector, it is of some interest to see how research expenditure is divided between the department and the central administration. Our data relate to 1986/87: since then, there has been an accelerating trend towards devolution of financial responsibility to individual departments, so our data provide a baseline against which the extent of this trend may be measured at a future date.

The data are given in table 1. Except for the single respondent in chemistry, the differences between the disciplines are fairly modest. For all university respondents combined, central expenditure attributable to departments for research accounts on average for 12% of total research expenditure: i.e. 88% of research expenditure is incurred at departmental level.

Table 1. Central expenditure attributable to research, as a percentage of total research expenditure (university respondents only)

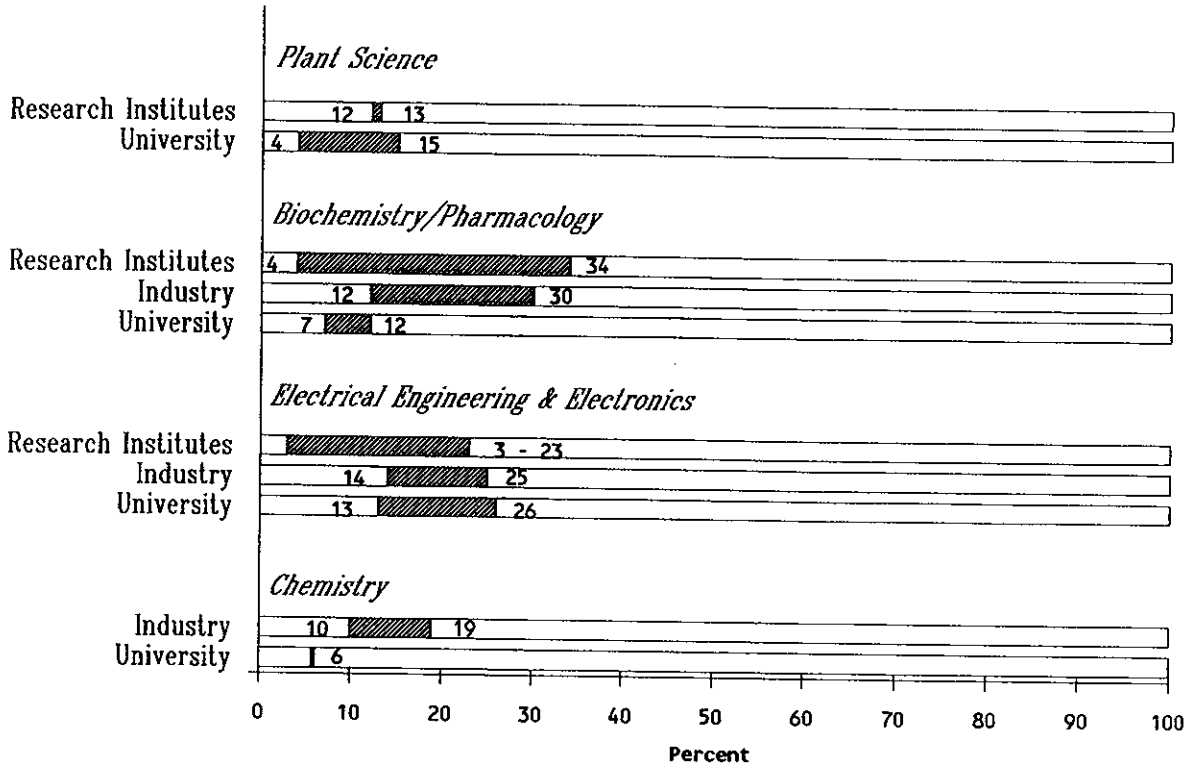
Plant science	Biochemistry/ pharmacology	Electrical engineering & electronics	Chemistry disciplines	Average all
8%–13%	9%–18%	7%–11%	21%	12%

Capital expenditure

'Capital expenditure' covers all capitalized expenditure on the construction and upkeep of buildings and on equipment, furniture and computing facilities. University respondents were unable to supply data on depreciation, so for the sake of consistency depreciation was removed from the responses in all sectors. Had it been possible to use depreciation data throughout, our analysis of capital expenditure would have been more representative of the typical situation: several respondents happened to incur unusually high capital expenditure in the year in question.

The wide range of the data on capital expenditure given in figure 4 illustrates this 'lumpy' characteristic: in five of the eleven cells of the discipline/sector matrix, the highest value for the ratio of capital to total expenditure was at least twice that of the second highest entry in the cell. The effects of the Alvey and ESPRIT Programmes may be seen in the relatively high capital : total expenditure ratio in university electrical engineering & electronics.

Figure 4. Capital expenditure, as a percentage of total expenditure



(iii) Pay expenditure and staff numbers

Definitions

The most difficult task in analysing expenditure on pay was to ensure consistency, both within and between sectors, in the types of staff included in each category. In the university sector, this involved establishing clear definitions and ensuring that they were followed. In the other, more heterogeneous, sectors there were greater difficulties in achieving commonality of definition and usage.

The key staff category is 'researcher'. In the university sector, we included in this category all staff of PhD or equivalent status on academic and related scales, irrespective of source of funds. We also included clinical staff where relevant. Postgraduate research assistants in receipt of a salary, including those registered for higher degrees, were categorized as 'technical support staff'. This latter category also included technicians, scientific officers, experimental officers, computer operators and animal attendants. Library and museum staff were included in the 'secretarial and clerical staff' category. Postgraduate research students in receipt of a grant were excluded from the analysis, since their salary costs are zero and, formally, they are undergoing research training and are not fullyfledged researchers. Senior administrators were included with 'researchers'; other administrative staff were included in a residual 'other' category, which also covered porters, security staff, cleaners and other staff not directly supporting research.

Analogous definitions were used in the non-university sectors. In the polytechnic sector, however, all academic staff were, formally, allo-

cated 100% to the teaching function and no part of their salary costs was apportioned to research by the respondents . One polytechnic respondent had ten postdoctoral research assistants and two postgraduate research staff; another had no postdoctoral research assistants but seven postgraduate research staff. In this sector only, we included postgraduate research staff as 'researchers': this to some extent offsets the time that academic staff in practice spend on research in addition to their teaching duties. But it should be borne in mind that our findings for the polytechnic sector are, therefore, not directly comparable to our findings for other sectors. See further Annex D.

Total expenditure on pay

Figure 5 shows expenditure on pay for all categories of staff. Pay costs (i.e. salaries plus the various employer's contributions) are expressed both as a percentage of total expenditure and as a percentage of total recurrent expenditure.

Some average values are given in table 2 below.

Table 2. Total expenditure on pay: summary results

	as % of total expenditure	*as % of recurrent expenditure*
All disciplines combined		
Universities	55%	63%
Research institutes	46%	52%
Industry	39%	50%
All sectors combined		
Plant science	58%	66%
Biochemistry/pharmacology	37%	51%
Electrical engineering	46%	50%
Chemistry	44%	53%

In all cases, at least half of recurrent expenditure goes on pay costs. By discipline, the highest proportion, two-thirds, is recorded in plant science; there is little to choose between the other three disciplines, which are all near one half. By sector, universities spend a higher proportion on pay costs than do research institutes or industry. As might be expected, there is less variation within the university sector than within the other sectors. Some of the differences between sectors and between disciplines arise from differences in volume of capital expenditure: these are eliminated when pay costs are compared with recurrent rather than total expenditure.

Figure 5(i). Total expenditure on pay, as a percentage of total expenditure

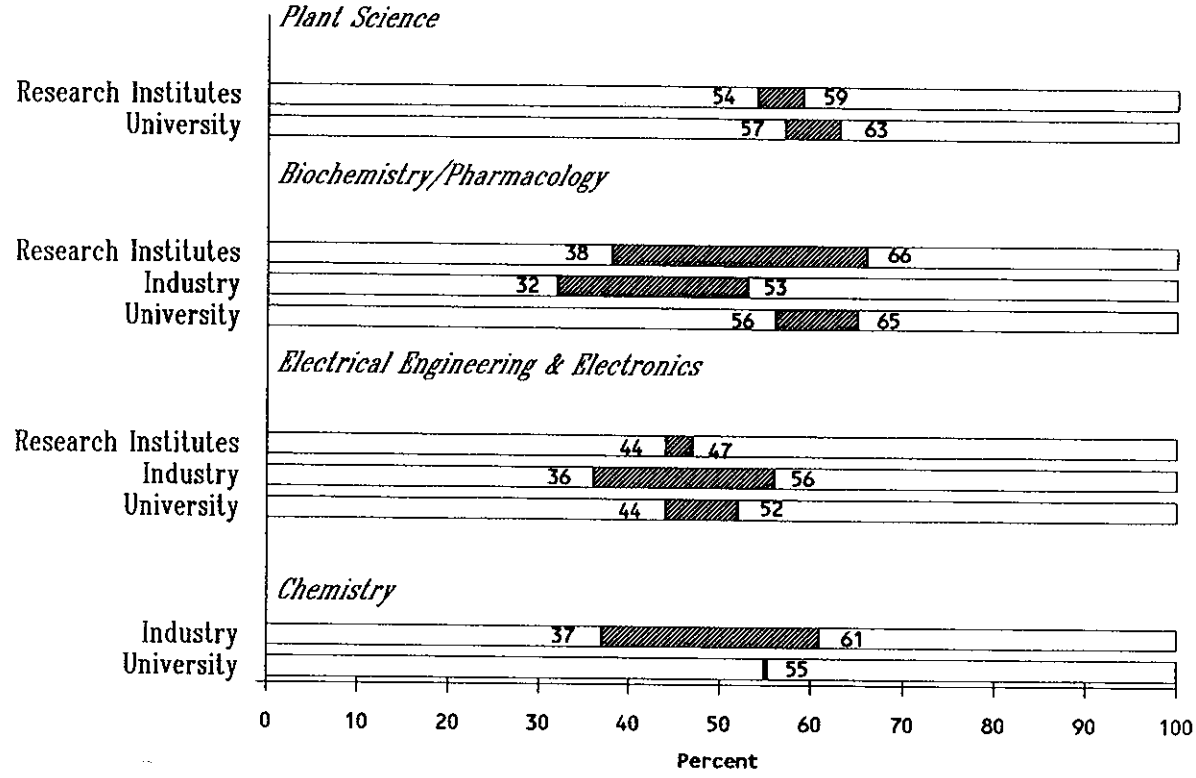
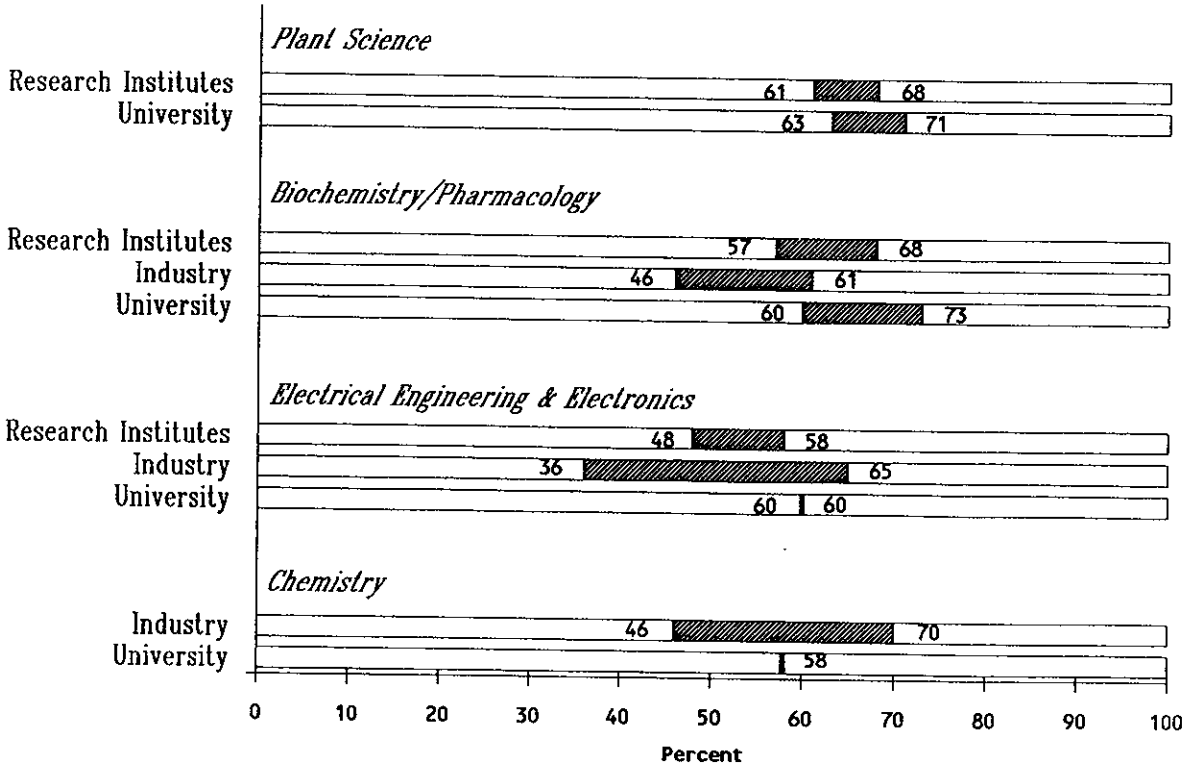


Figure 5(ii). Total expenditure on pay, as a percentage of total recurrent expenditure



Pay costs of research staff

We found considerable variation in the proportion of total pay expenditure going on researchers. 25 respondents provided usable data on this: in 7 cases researchers accounted for under 40% of pay costs, while in 11 cases they accounted for over 60% (figure 6 (i)). The lowest average proportions occurred in research institute biochemistry (39%) and industrial chemistry (40%); the highest average proportions occurred in industrial electronics (67%) and university biochemistry (66%). The differences arise from variations in staffing structure and from variations in salary differentials.

As a percentage of total recurrent expenditure (figure 6 (ii)), the pay costs of research staff were highest in the university sector (averaging 37% across all disciplines, as compared with 26% in the industry sector and 25% in the research institute sector).

The highest average pay costs of research staff, among the research centres we surveyed, are to be found in industrial biochemistry (£24K per researcher) and industrial chemistry (£23K per researcher) (figure 6 (iii)). But industrial researchers are not always the highest paid: one of the lowest average pay costs in our survey occurred in industrial electronics (£15K per researcher). In the university sector as a whole, the pay costs of research staff averaged £18K per researcher, with local variations arising from differences in the age and grade structure of individual departments. Research institutes were broadly similar to universities.

Figure 6(i). Researchers' pay costs, as a percentage of total pay expenditure

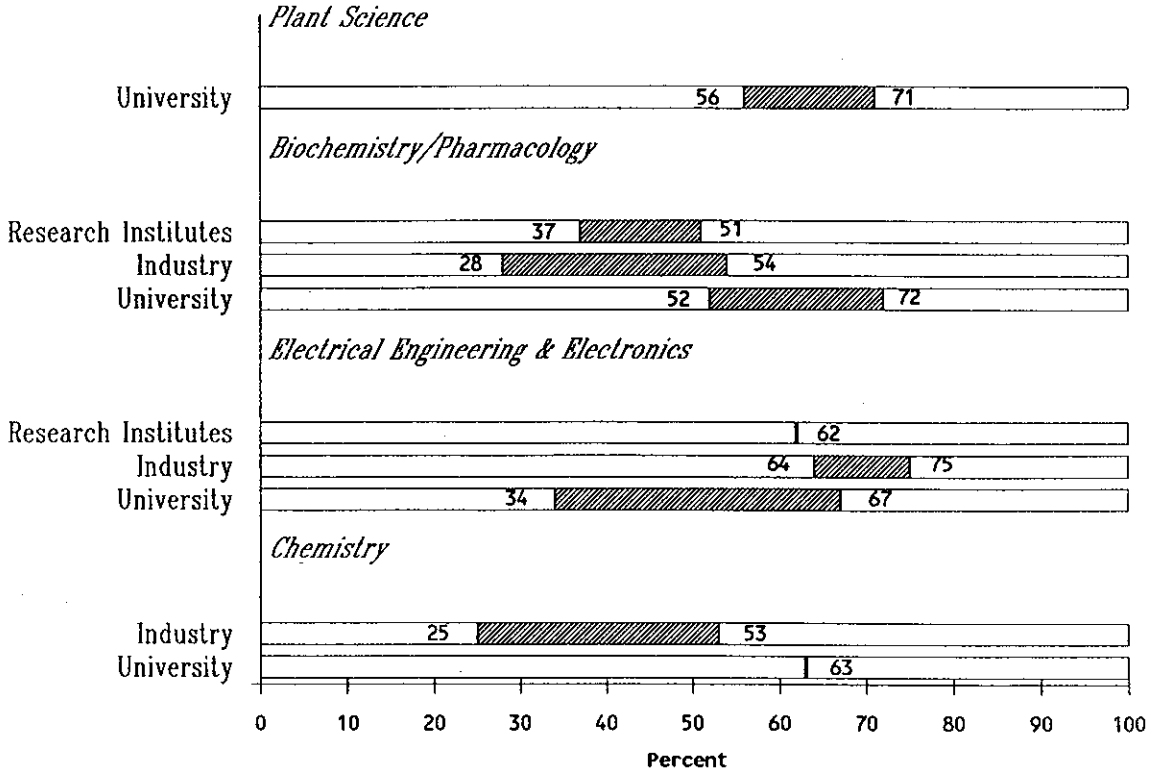


Figure 6(ii). Researchers' pay costs, as a percentage of total recurrent expenditure

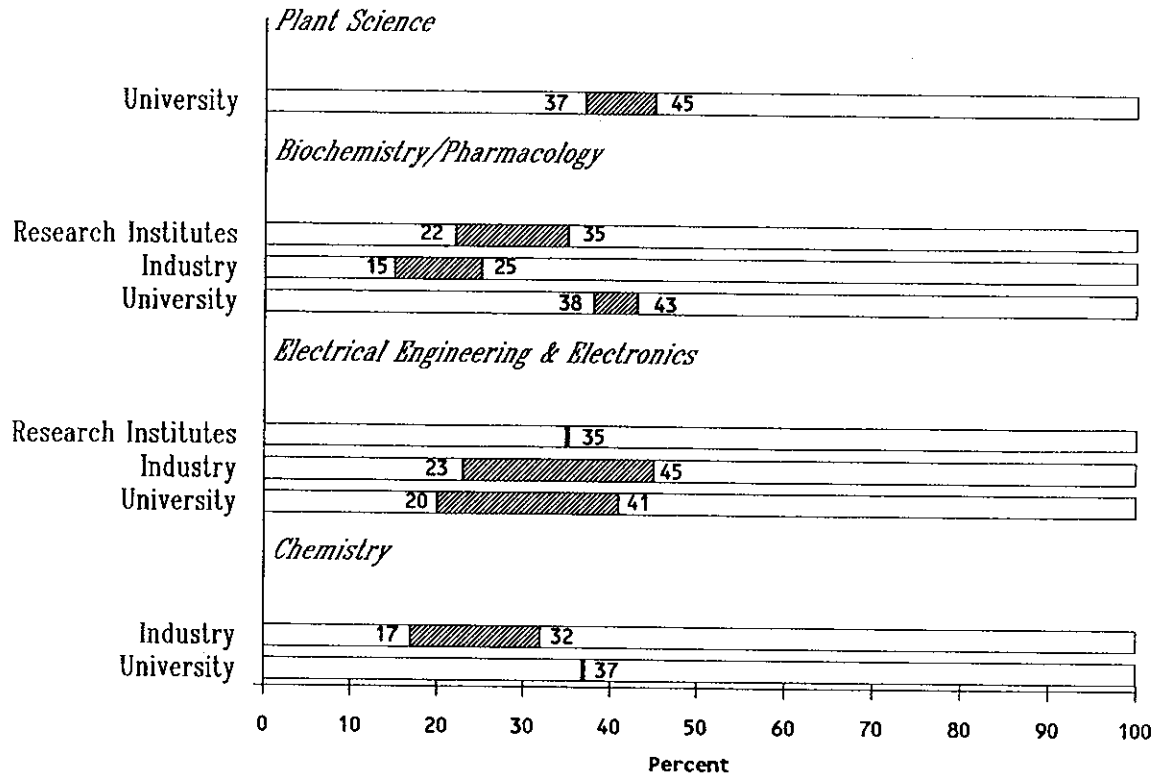
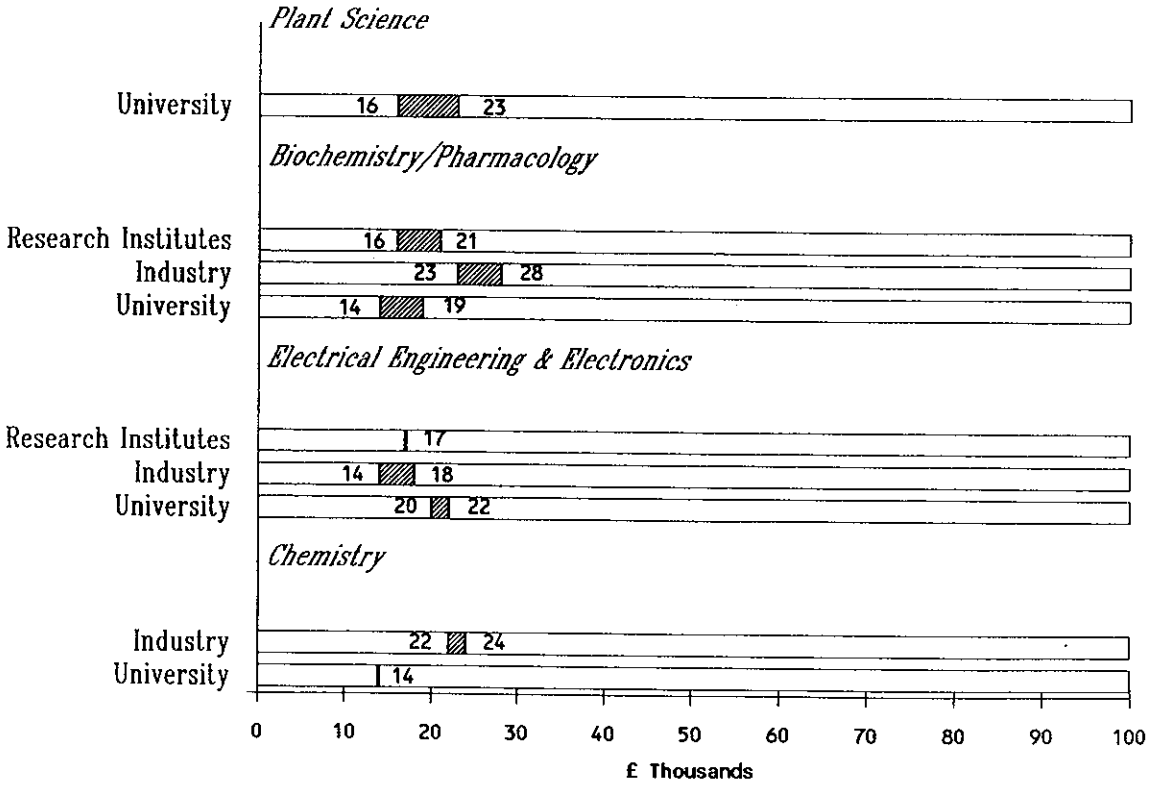


Figure 6(iii). Researchers' pay costs per researcher (£K)



Pay costs of technical support staff

We found substantial variations, both between and within individual cells of the discipline/sector matrix, in the provision of technical support staff (figure 7). Expenditure on the pay of technical support staff, as a percentage of total recurrent expenditure, was lowest in industrial electrical engineering & electronics (averaging 9%), and highest in industrial chemistry (19%) and research institute biochemistry/pharmacology (20%). Average numbers of technical support staff per researcher ranged from 0.7 in electrical engineering & electronics to 1.5 in chemistry. Because of the way we have defined the various categories of staff, these figures disregard the technical support provided by postgraduate research students: this could be significant in particular disciplines and sectors.

Pay costs of secretarial & clerical support staff

Figure 8 presents analogous data to figure 7, but for secretarial & clerical support staff rather than for technical support staff. Across the whole of our sample, the ratio of secretarial & clerical support staff to technical support staff is about 1 : 4. Provision of secretarial & clerical staff is most generous in research institutes and least generous in universities.

Figure 7(i). Technical support staff pay costs, as a percentage of research staff pay costs

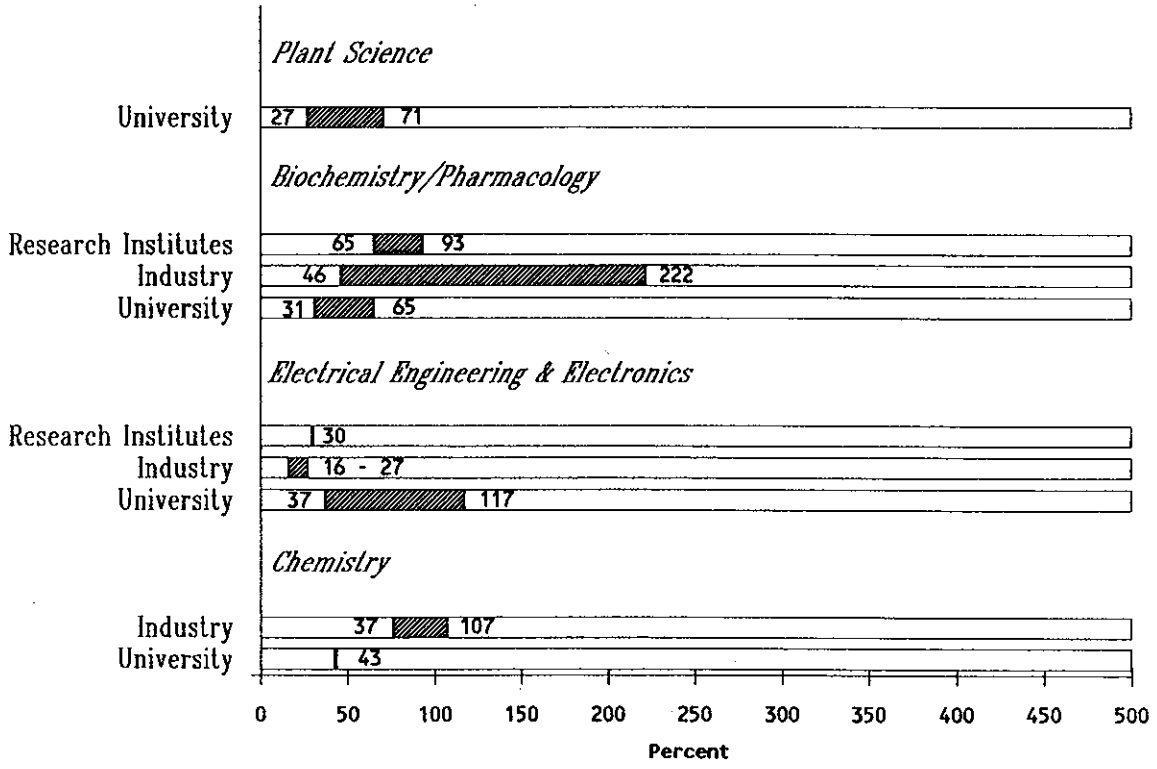


Figure 7(ii). Technical support staff pay costs, as a percentage of total recurrent expenditure

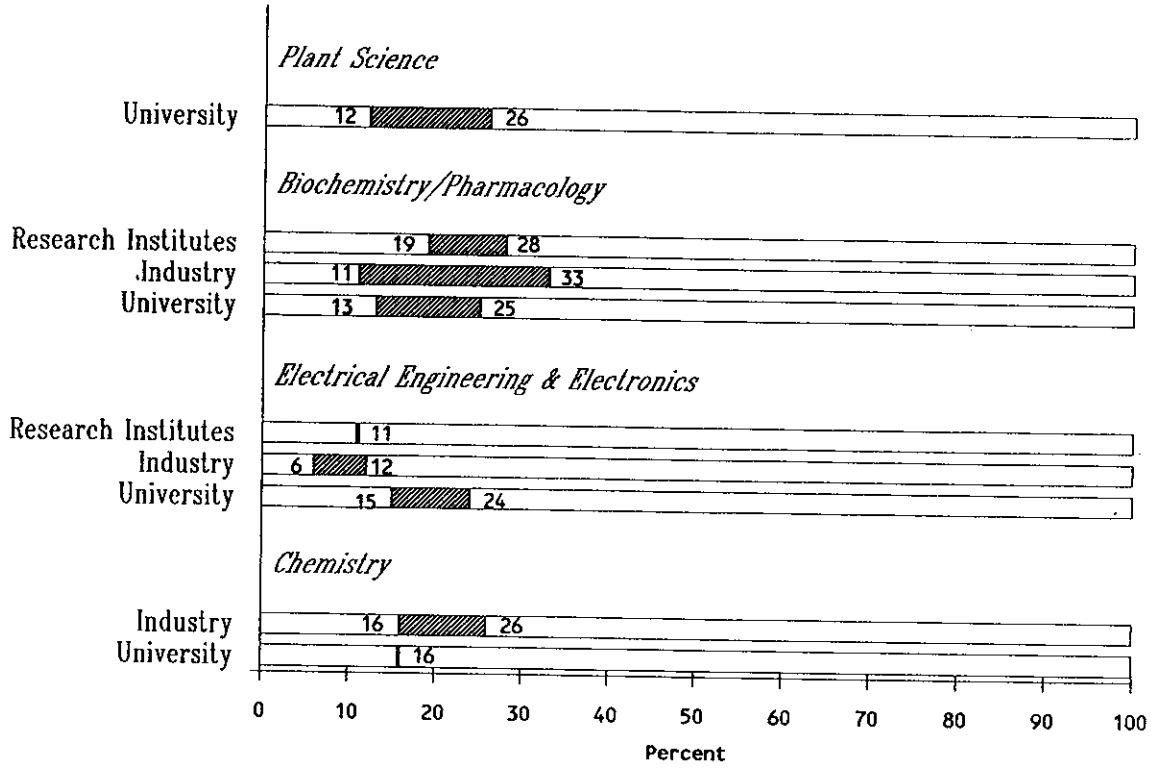


Figure 7(iii). Number of technical support staff per researcher

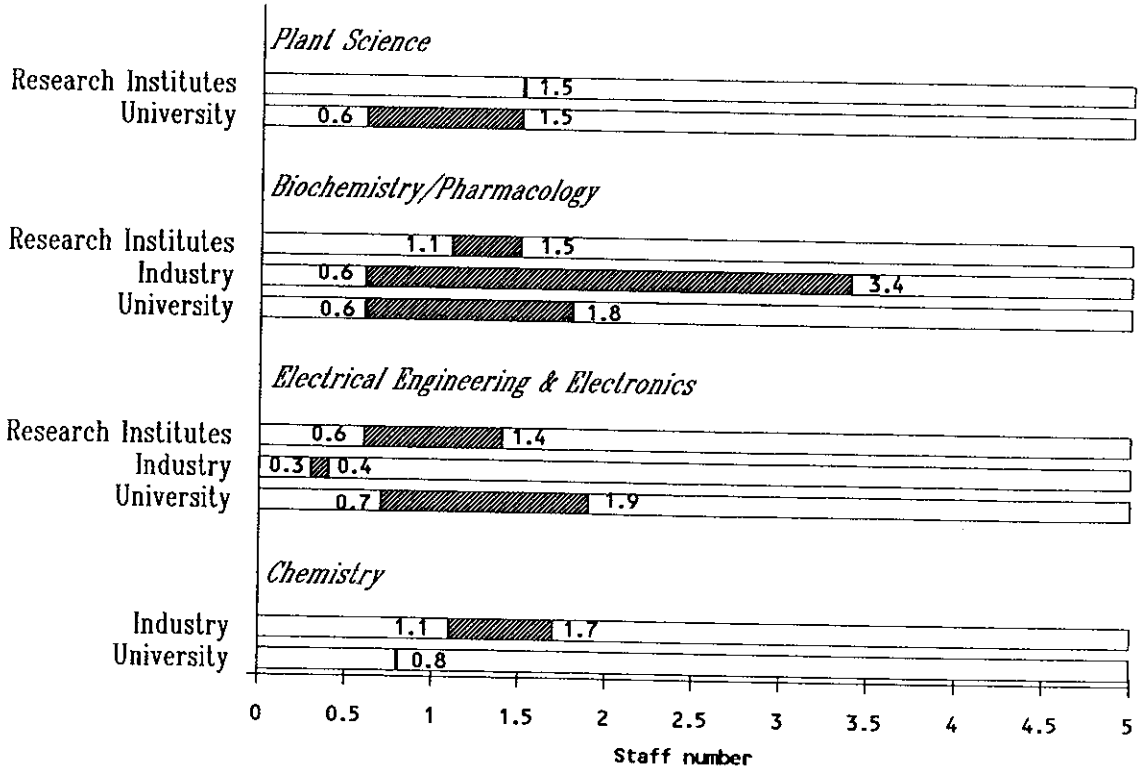


Figure 8(i). Pay costs of secretaries and clerical support staff, as a percentage of research staff pay costs

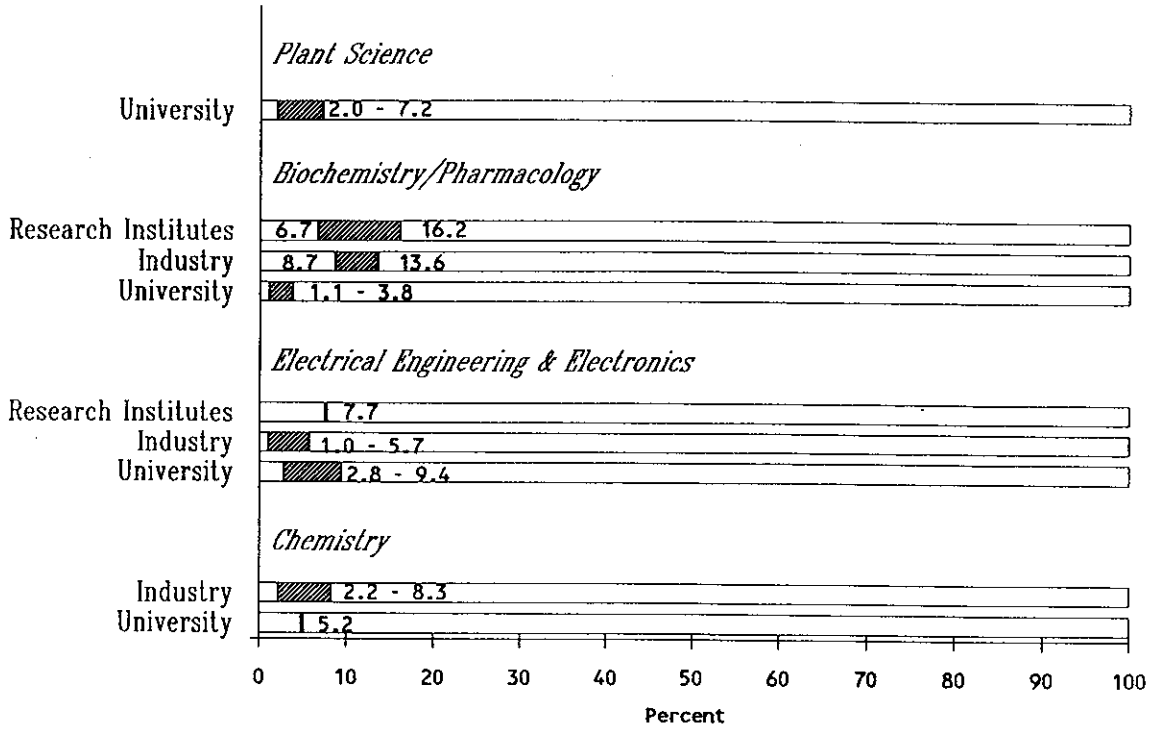


Figure 8(ii). Pay costs of secretaries and clerical support staff, as a percentage of total recurrent expenditure

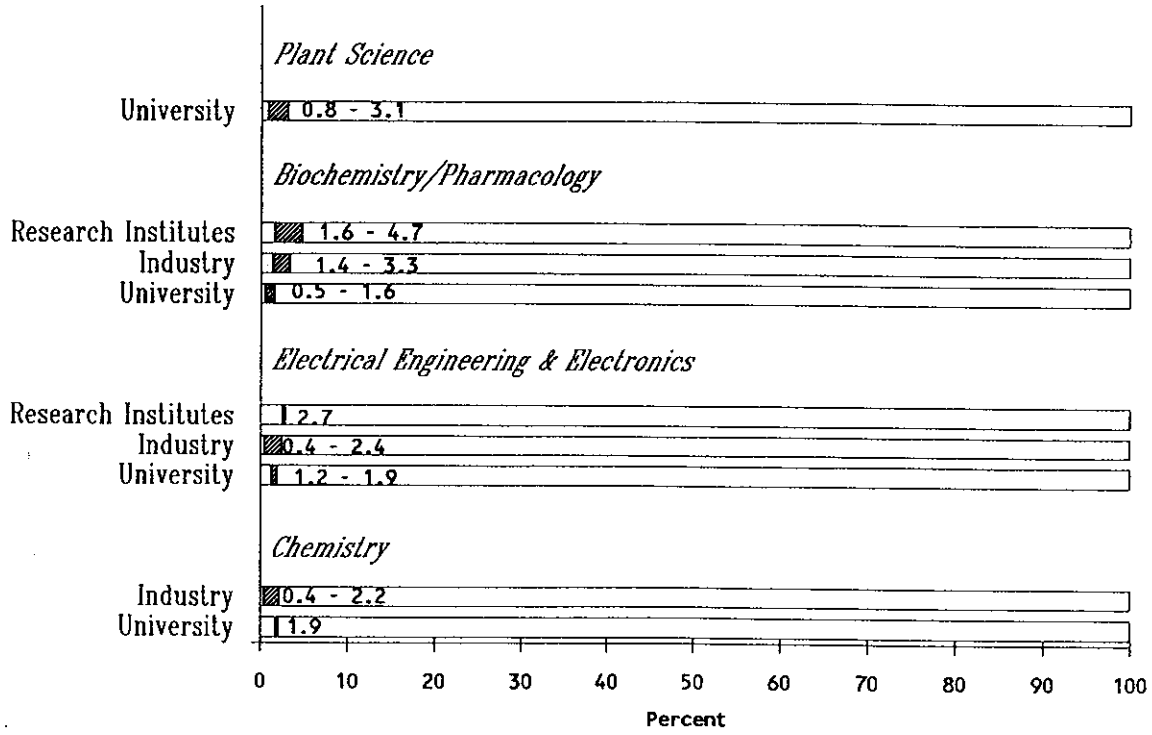
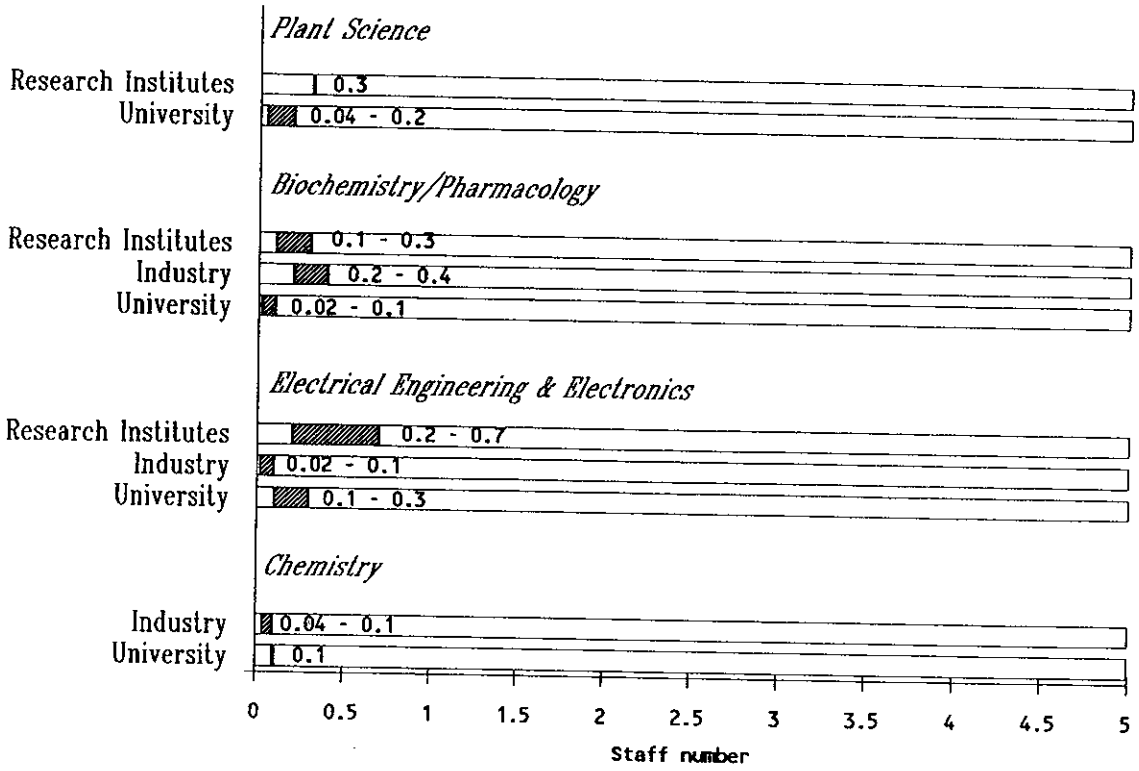


Figure 8(iii). Number of secretarial and clerical support staff per researcher



(iv) Non-pay expenditure

Indirect expenditure

The term 'overheads' is used as a shorthand to cover those items of expenditure that cannot conveniently be ascribed to a particular project or a particular cost centre. However, it is rarely defined with much precision, and it has acquired derogatory overtones (high overheads appear to imply poor management). In this report, we therefore use the term 'indirect expenditure'.

The Hanham report separates out project-specific expenditure on equipment, consumables and travel from indirect expenditure. However, our data are not in a form that allows us to distinguish expenditure on these items incurred for specific projects from expenditure incurred as part of providing a well-found laboratory, so we have included all expenditure on equipment, consumables and travel within the term 'indirect expenditure'.

In our usage, *'indirect expenditure' means all expenditure on research except the salary costs of those categories of departmental staff directly involved in research (i.e. researchers and support staff).*

Materials & equipment

Materials & equipment form the largest single category within recurrent expenditure on nonpay items, with premises expenditure second. Data on materials & equipment are given in figure 11. The differences between disciplines are fairly modest: average values across all sectors for recurrent expenditure on materials & equipment as a percentage of total recurrent expenditure are 12% in plant science and in chemistry, 14% in biochemistry/pharmacology and 16% in electrical engineering and electronics. The latter value is boosted by a figure of 27% in the industrial sector.

Total expenditure on materials & equipment as a proportion of total expenditure is generally higher, because of substantial capital expenditure on equipment. Averaged across all sectors, the proportion is 18% in biochemistry/pharmacology, 20% in plant science and 23% in chemistry and in electrical engineering and electronics. The latter value is, again, boosted by a high result in the industrial sector, where materials & equipment account for 38% of total expenditure.

Total expenditure on materials & equipment per researcher is lowest in the university sector, averaging £11K across all four disciplines. For the disciplines represented in our sample of industrial research centres, average expenditure per researcher on materials & equipment is £23K; for the research institutes, it is £20K.

Figure 11(i). Recurrent expenditure on materials and equipment, as a percentage of total recurrent expenditure

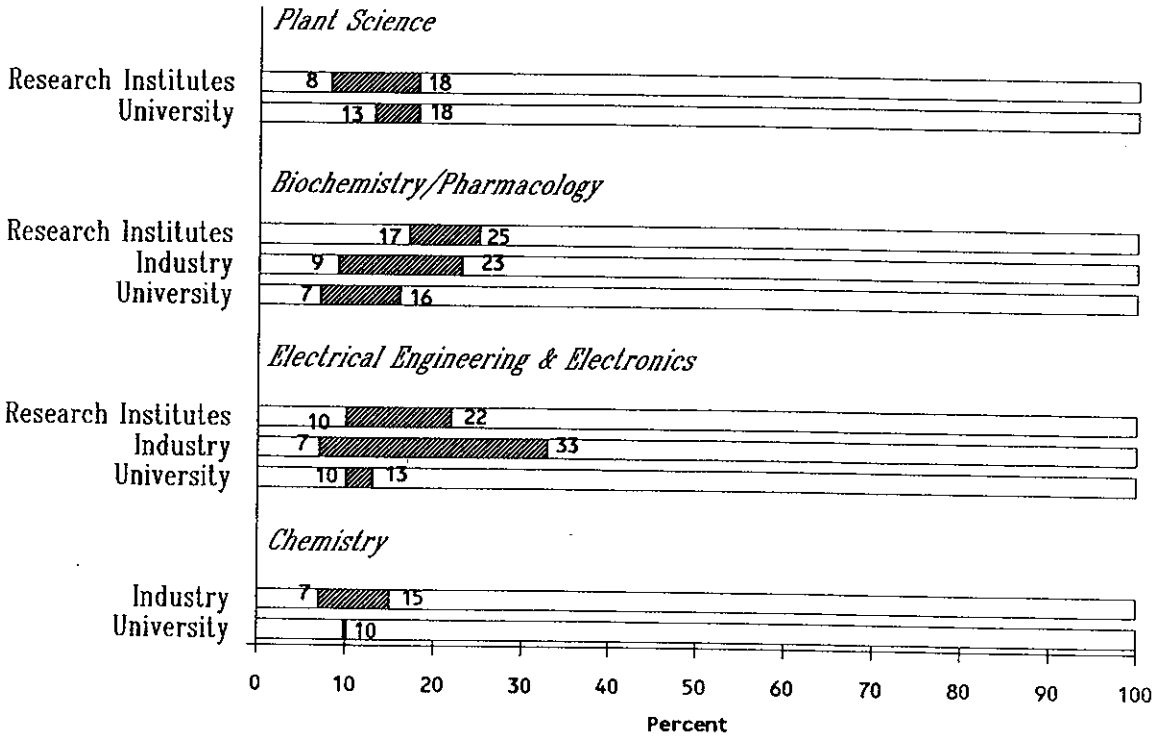


Figure 11(ii). Total expenditure on materials and equipment, as a percentage of total expenditure

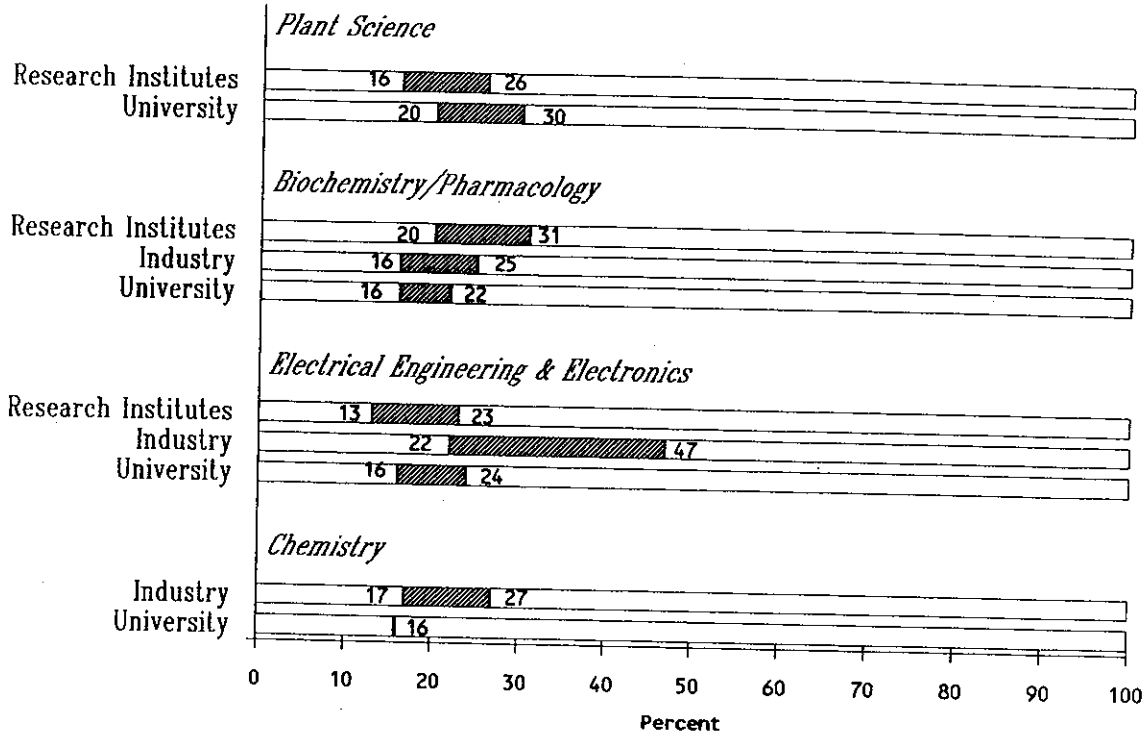
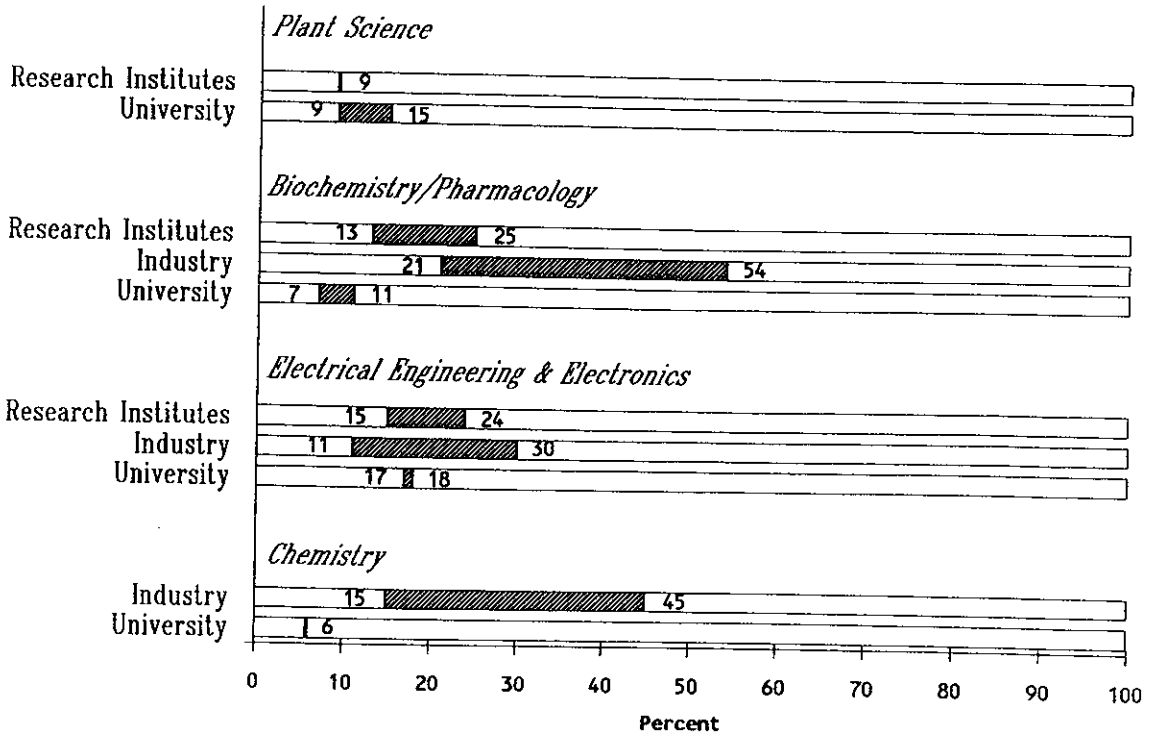


Figure 11(iii). Total expenditure on materials and equipment, per researcher (£K)



Computers

The category of materials & equipment does not include computers: computing expenditure is analysed separately in figure 12. Computing mostly appears to account for relatively small proportions of recurrent or of total expenditure, though there are exceptions with some individual respondents. The data as presented are underestimates, since some respondents in the research institute and industry sectors were unable to separate capital expenditure on computers from capital expenditure on other equipment. Insofar as the data can be interpreted, there are no clear differences between sectors or between disciplines.

Figure 12(i). Recurrent expenditure on computers, as a percentage of total recurrent expenditure

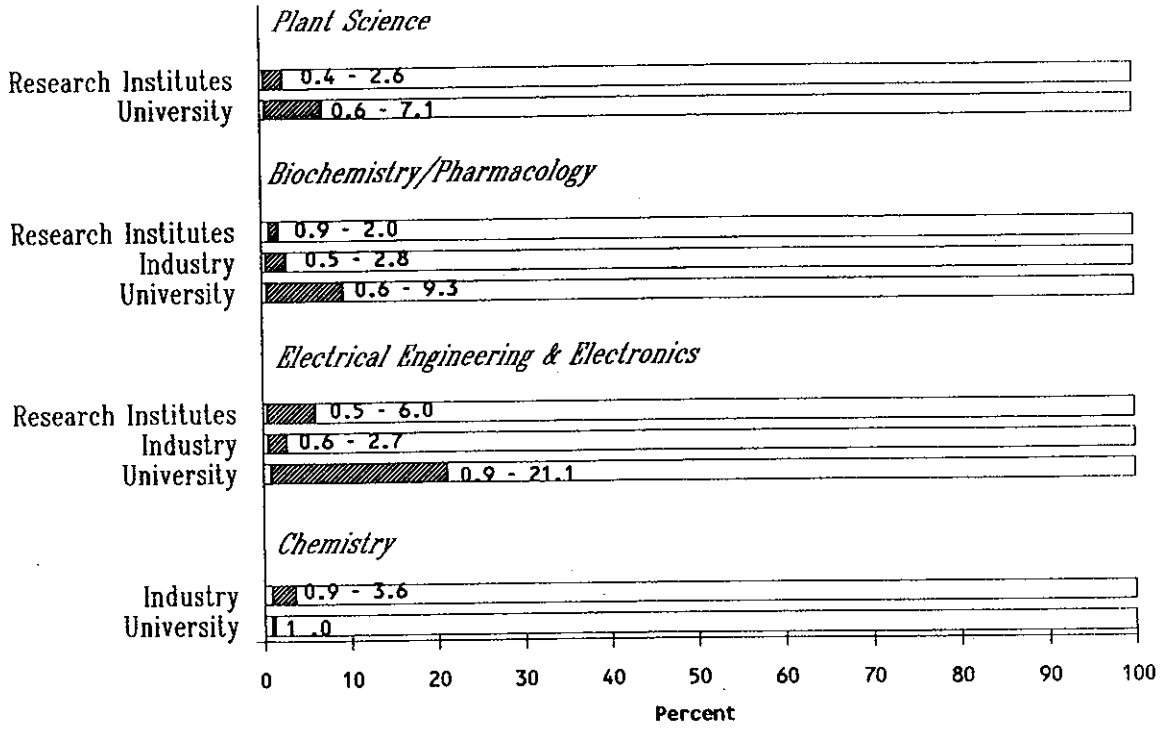


Figure 12(ii). Total expenditure on computers, as a percentage of total expenditure

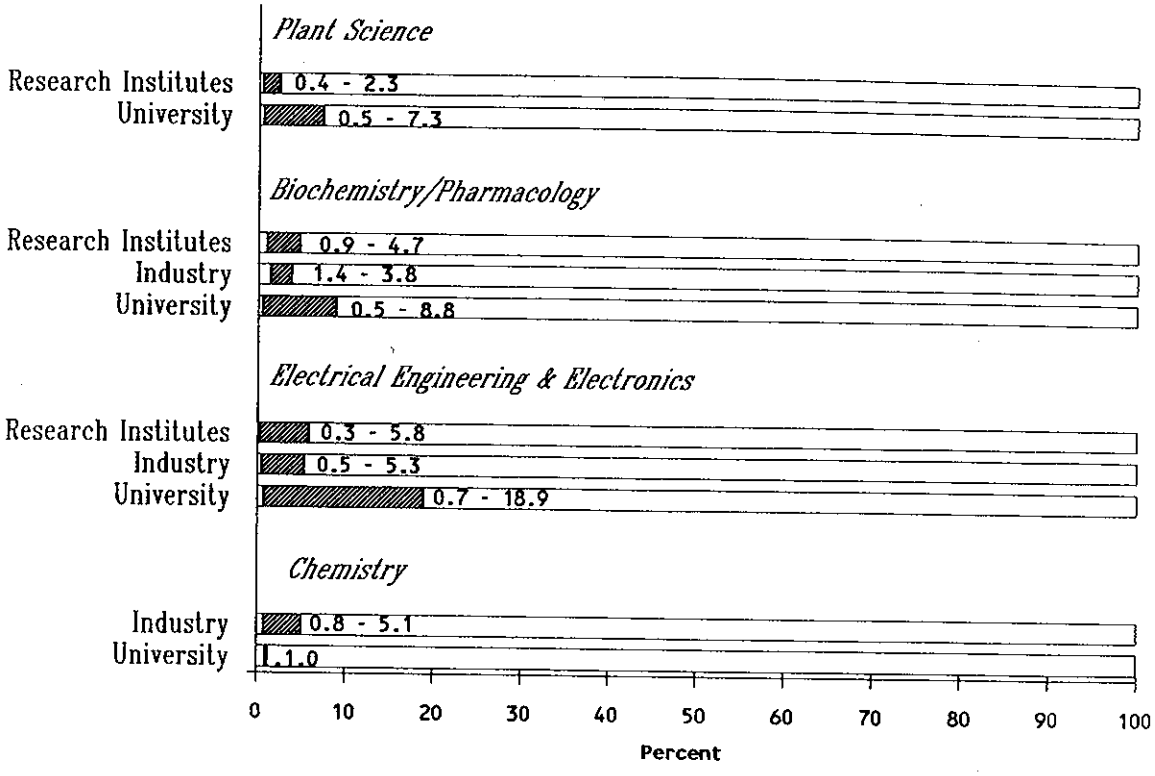
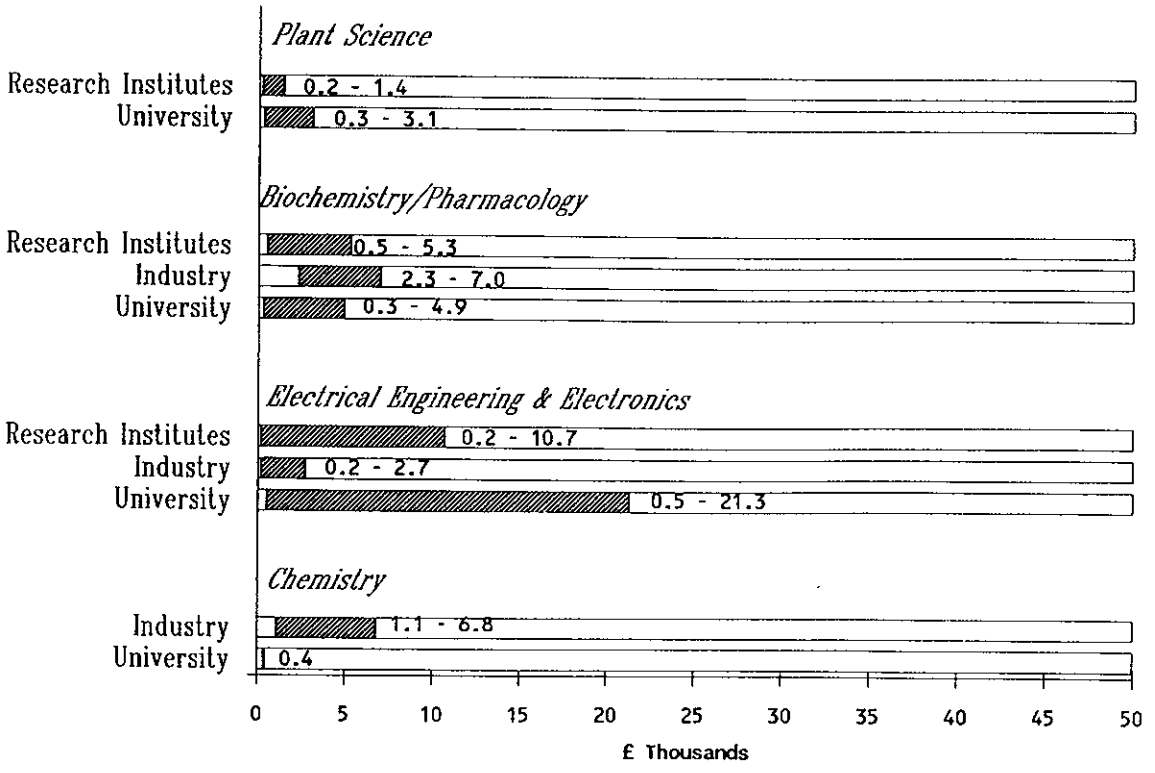


Figure 12(iii). Total expenditure on computers per researcher (£K)



Information services

Expenditure on information services per researcher (figure 13 (ii)) averages £1.7K for all disciplines in the research institute sector, £1.5K in industry and £2.0K in universities. The latter, however, includes one respondent with a copyright library; if that is excluded, the figure for universities becomes £0.9K per researcher. Analysis by discipline gives average expenditures per researcher of £1.0K in plant science, £1.2K in electrical engineering and electronics and £2.2K in biochemistry/pharmacology and in chemistry.

Travel

Figure 14 shows that universities spend less than half as much as the other sectors on travel and subsistence for conferences and other visits, including visits by outsiders to the institution. Averaged across all disciplines, universities spend £0.8K per researcher, industry £1.7K and research institutes £1.8K. A different picture emerges, however, when travel expenditure is expressed as a percentage of total recurrent expenditure: the average proportions are then 1.7% in universities, 2.4% in industry and 1.6% in research institutes.

Training

Universities appear to spend virtually nothing on formal training (figure 15). By 'formal training' we mean, for example, the costs of sending staff on training courses and payment of registration fees to allow staff to read for degrees or diplomas. The definition excludes uncosted in-house training. Industry devotes 1.2% of recurrent expenditure, or £0.8K per researcher, to education and training; research institutes spend 1.3%, or £1.4K per researcher. Research institute data, however, are strongly affected by the largest respondent in this sector, which spends £3.2K per researcher on education and training.

Patenting

Data on patenting costs proved elusive. The university questionnaire included no heading for patents. The other questionnaire did include one, but a number of respondents were unable or unwilling to complete it. Only in electrical engineering and electronics did we obtain a full set of data. The industrial respondents in this sector spent an average of 0.5% of recurrent expenditure (or £0.2K per researcher) on patenting; the research institutes spent 0.2% or £0.3K per researcher.

Figure 13(i). Recurrent expenditure on information services, as a percentage of total recurrent expenditure

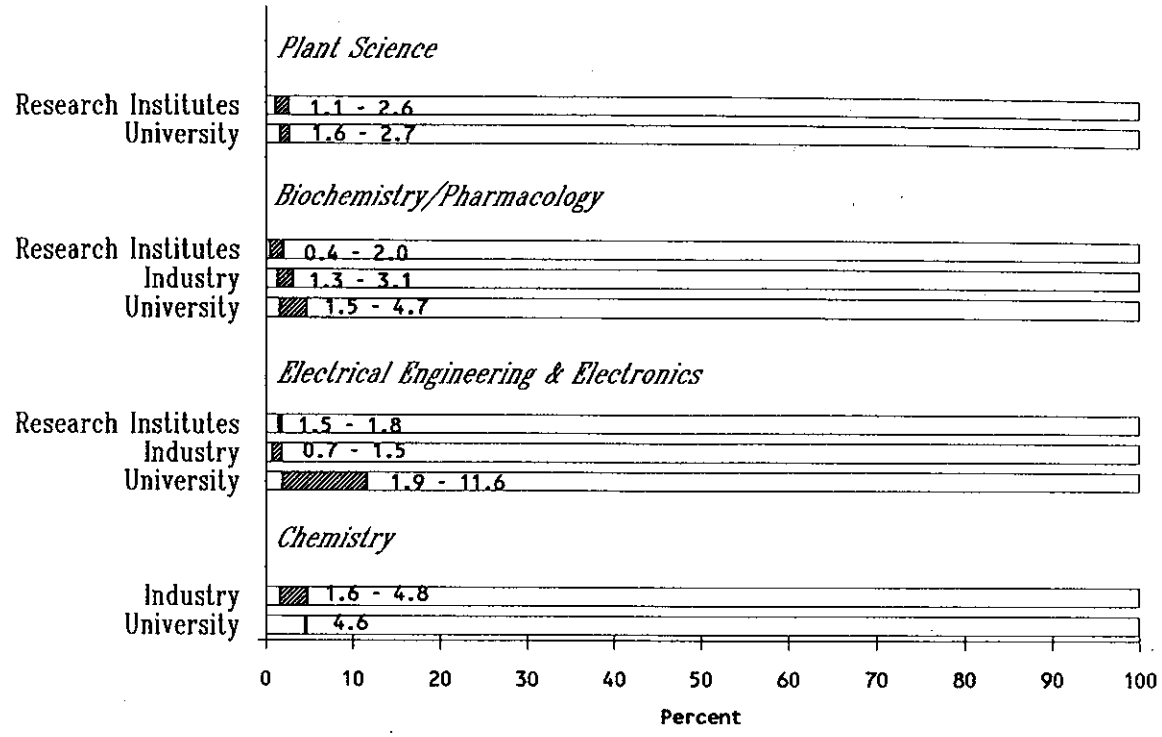


Figure 13(ii). Recurrent expenditure on information services, per researcher (£K)

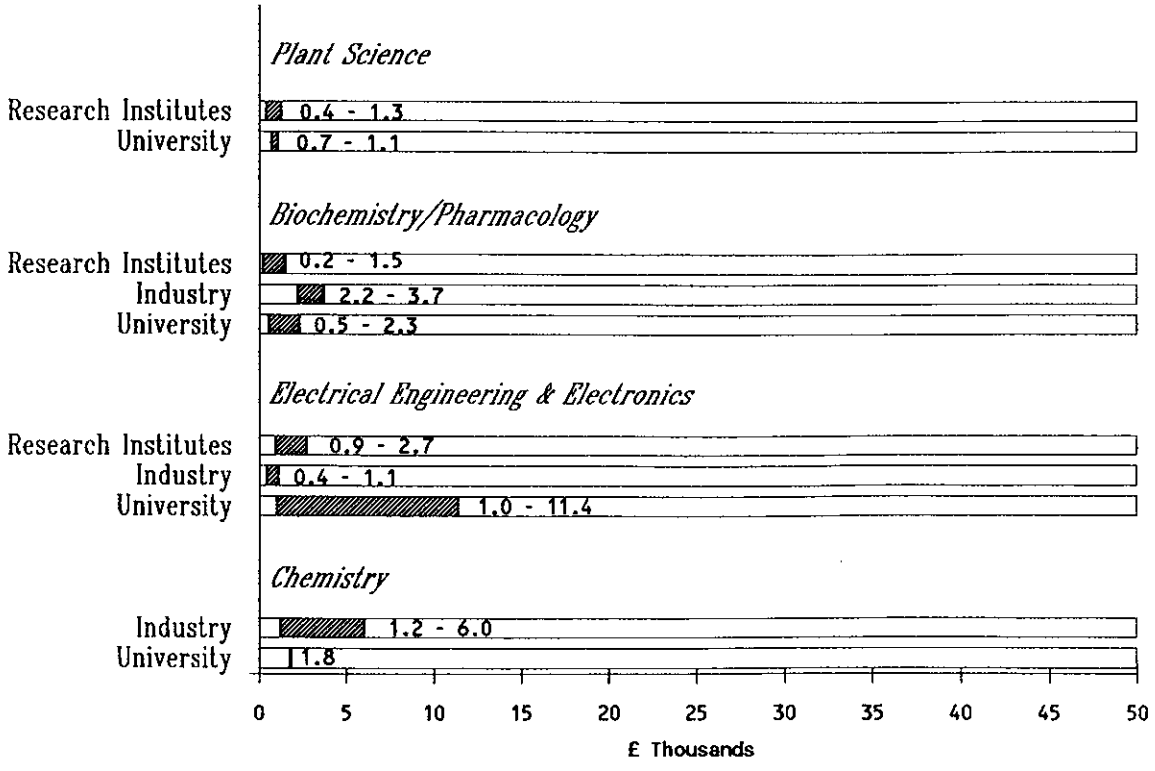


Figure 14(i). Recurrent expenditure on travel, as a percentage of total recurrent expenditure

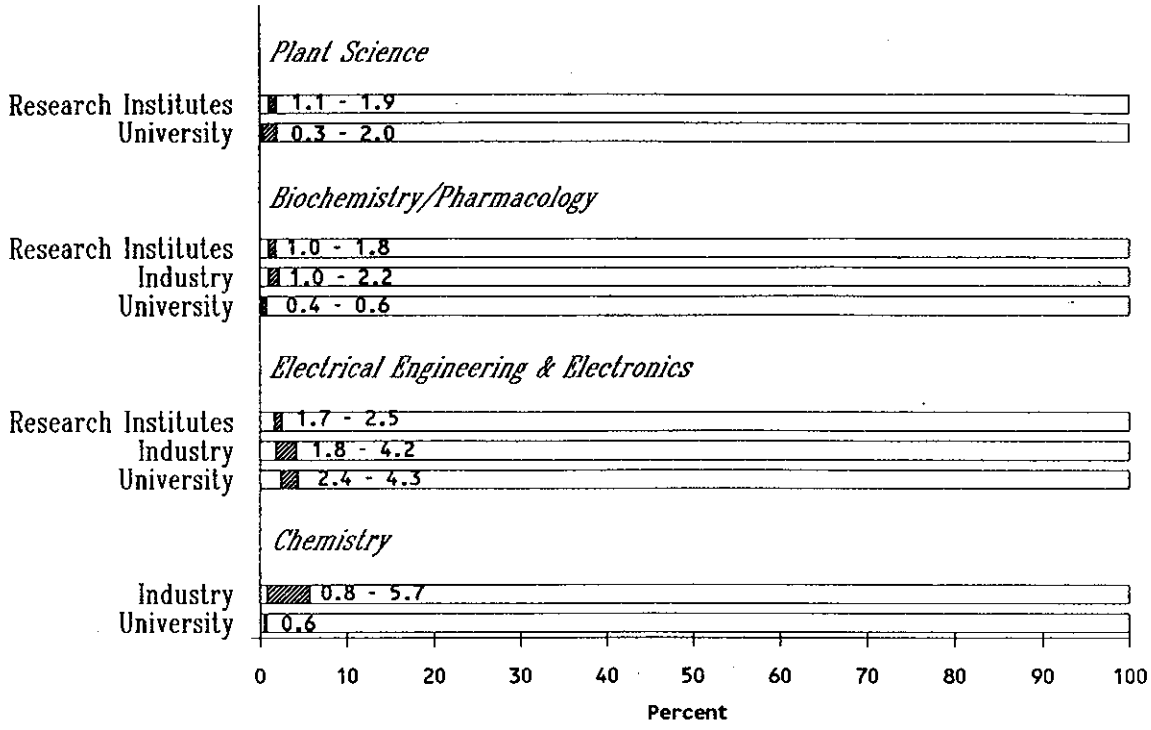


Figure 14(ii). Recurrent expenditure on travel per researcher (£K)

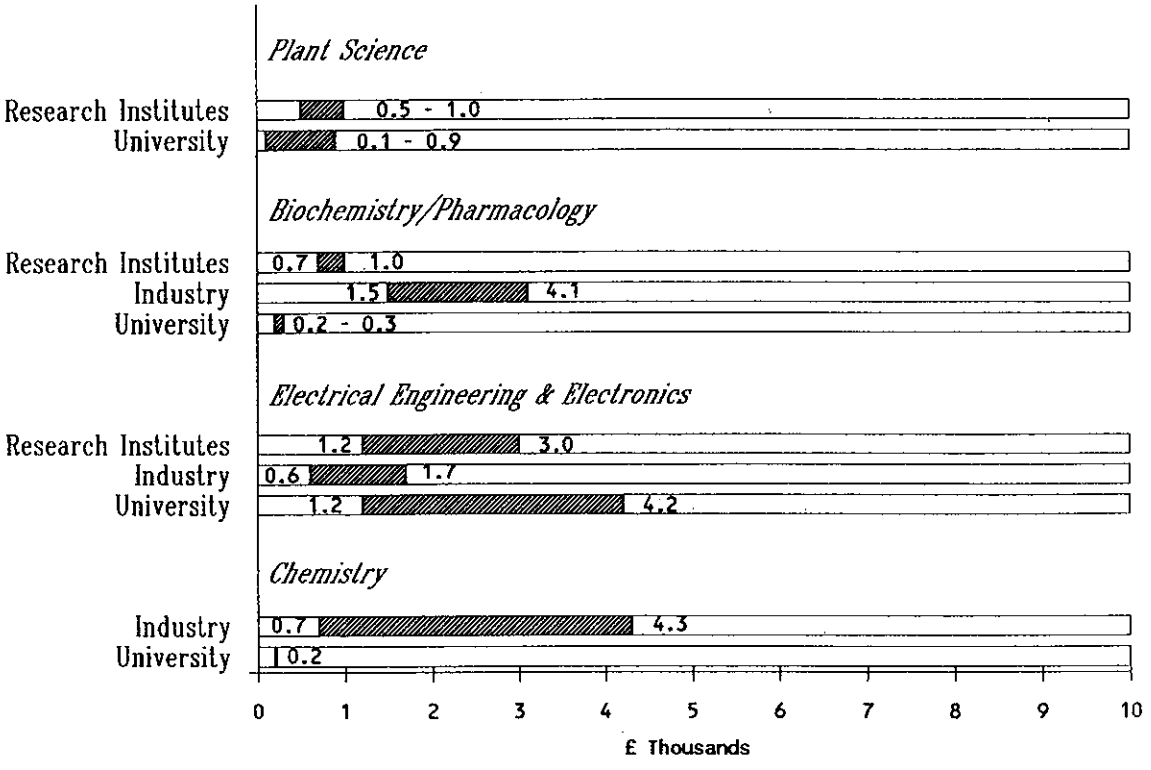


Figure 15(i). Expenditure on education and training, as a percentage of total recurrent expenditure

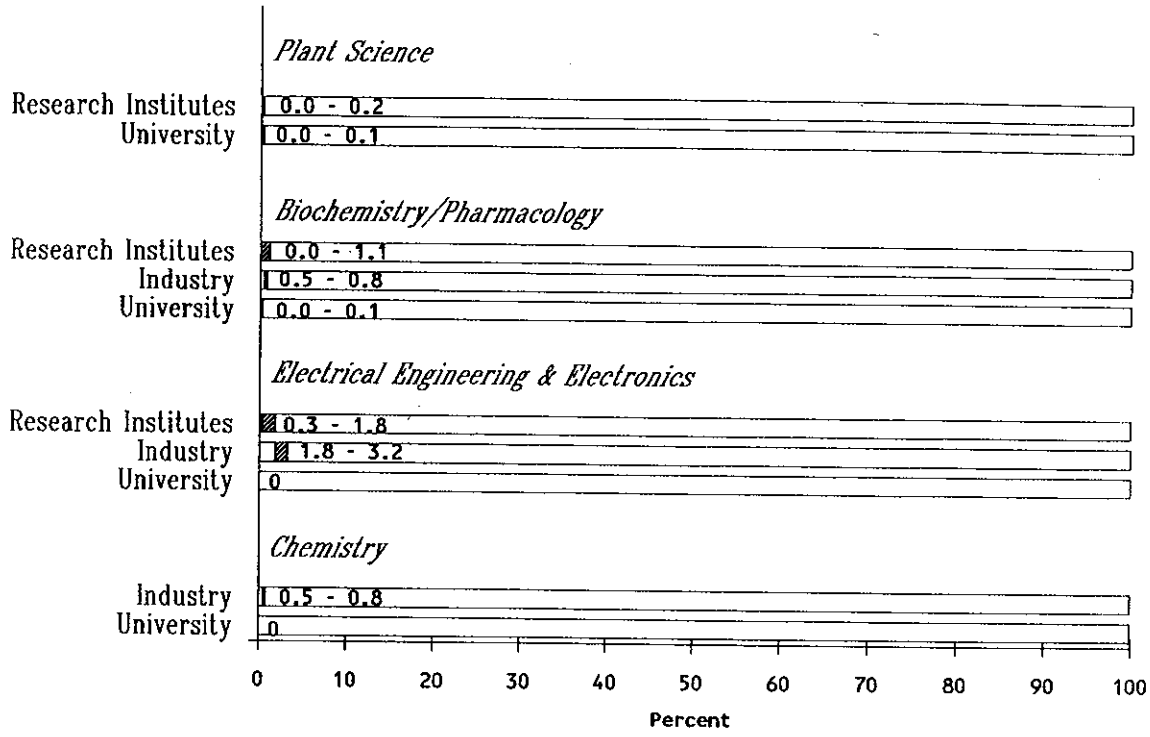
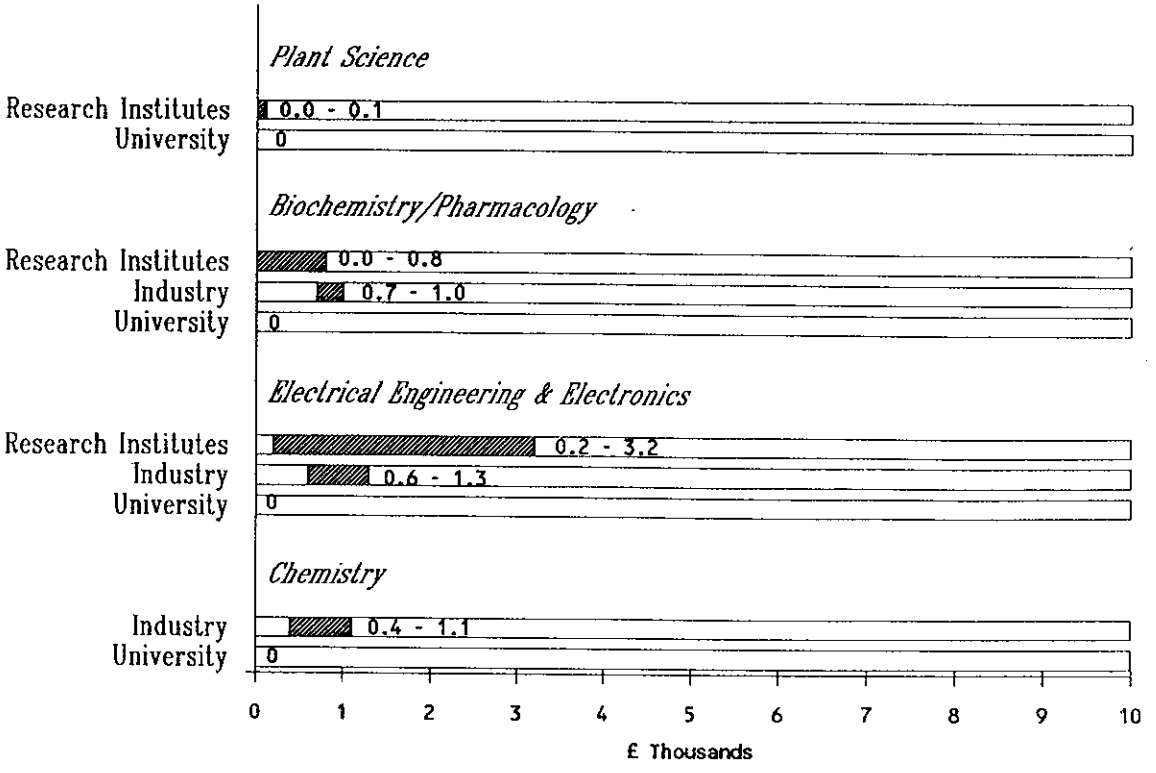


Figure 15(ii). Expenditure on education and training per researcher (£K)



Premises

After pay and materials & equipment, premises costs account for the third largest portion of recurrent expenditure. Premises costs cover such items as rates, rent, power, insurance etc, major and minor building projects and maintenance. Pay costs of maintenance staff were included in this section of the university questionnaire but excluded in the other questionnaire, so the two sets of data are not strictly comparable. Universities were unable to supply data on depreciation, so this was excluded from the calculation of premises costs for all respondents. This meant that some returns could be distorted by unusually high building costs which happened to be incurred in the year in question.

Recurrent expenditure on premises, as a proportion of total recurrent expenditure, averaged 9% in the research institute sector, 10% in industry and 15% in universities (figure 16 (i)). However, relatively high capital expenditure by one of the industrial respondents and by two research institutes meant that total expenditure on premises, as a proportion of total expenditure, averaged 19% in the industrial sector and 14% in the research institute sector. The average for our university respondents was also 14%. There may be some differences between respondents in whether particular items of expenditure are regarded as capital expenditure.

There were substantial variations in total premises expenditure per researcher (figure 16 (iii)). The university sector was relatively homogenous, averaging £6K per researcher across all disciplines. In industry, however, we found averages of £39K per researcher in biochemistry/pharmacology, £13K in chemistry and £3K in electrical engineering and electronics, while in the research institute sector we found averages of £25K per researcher in biochemistry/pharmacology, £16K in electrical engineering and electronics and £7K in plant science.

In the two university departments of biochemistry/pharmacology providing relevant data, animal houses accounted for 9–10% of recurrent premises expenditure. Glasshouses and growth houses accounted for 5–11% of recurrent premises expenditure in the university departments of plant science, and for 30–40% in the research institutes in plant science.

Figure 16(i). Recurrent expenditure on premises, as a percentage of total recurrent expenditure

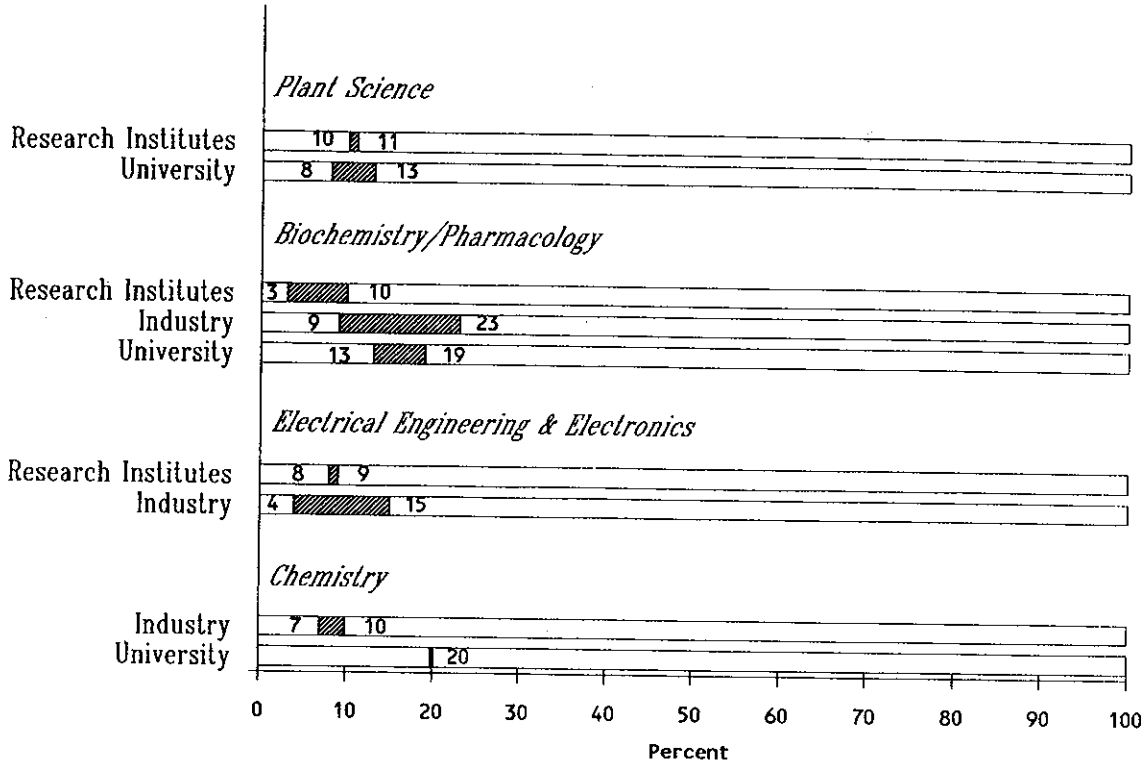


Figure 16(ii). Expenditure on premises, as a percentage of total expenditure

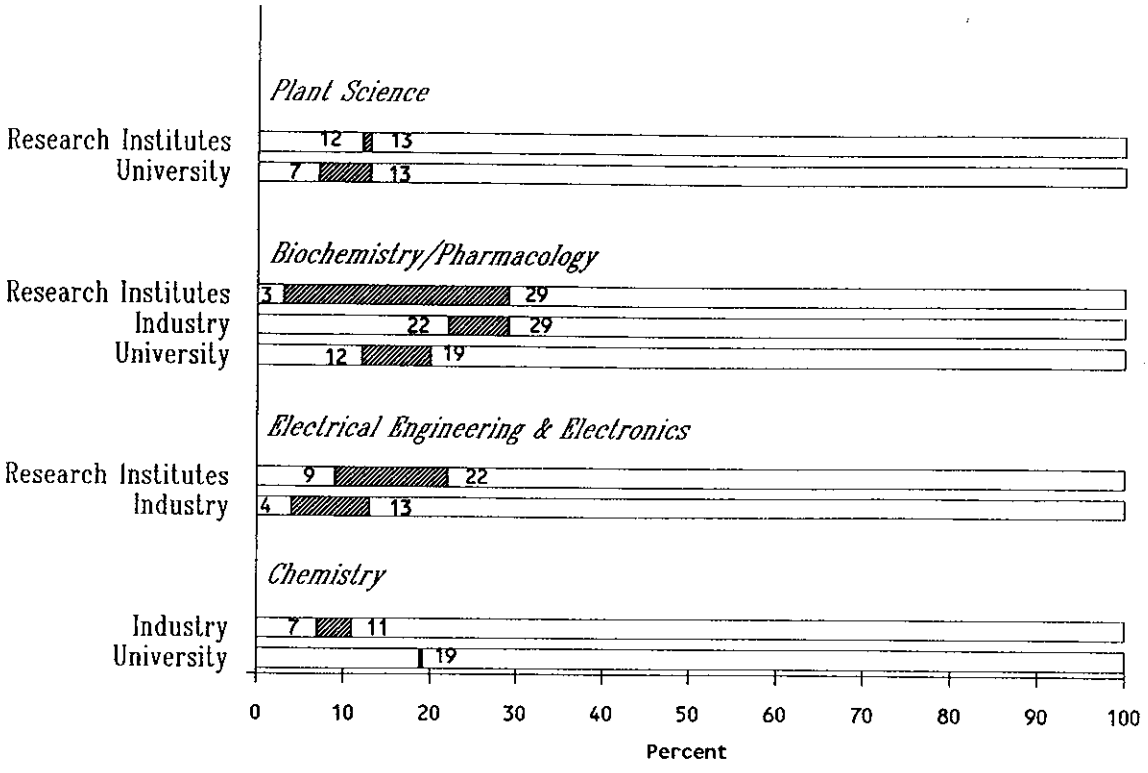
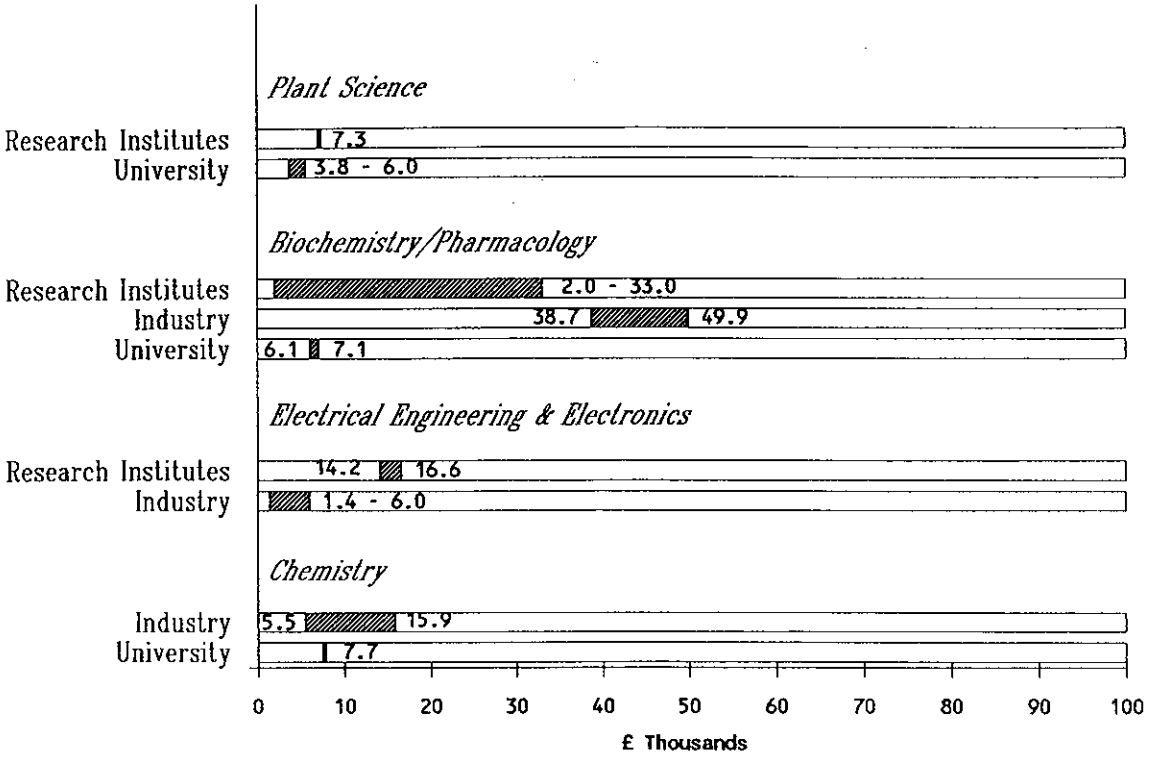


Figure 16(iii). Total expenditure on premises per researcher (£K)



CHAPTER 4: FURTHER RESULTS

(i) Introduction

In this chapter we present results of a type that cannot be analysed by the kind of figure used in chapter 3. Some of these are derived from the main body of the questionnaires; others arise from answers to a series of supplementary questions that we asked at the end of the questionnaires.

(ii) Effects of scale

The analysis in chapter 3 is based on sectors and/or disciplines. However, our data allow us to look also at the effect of scale: is the structure of research expenditure affected by the size of the research centre? To see if there were any major effects of scale, we examined how total expenditure per researcher varied with the total number of researchers (figure 17), how the number of support staff per researcher varied with the number of researchers (figure 18), how capital expenditure as a percentage of total expenditure varied with total expenditure (figure 19) and how total nonpay expenditure per researcher varied with the number of researchers (figure 20).

In no case did we find any particular relation between the parameters listed and the size of the research centre. If there are significant scale effects, they are more likely to operate on the processes and the outputs of research than on the inputs.

(iii) Equipment

Respondents were asked to identify how many items of equipment they had in their departments/research centres as at 1 April 1987 that, at the time of purchase, had cost at least £1000. Only two of the industrial respondents provided data, but nearly all the other respondents gave full replies. The following analysis therefore omits both the industrial sector and chemistry; in each of the other disciplines we had at least four sets of data.

There appears to be little difference between plant science, biochemistry/pharmacology and electrical engineering & electronics in the structure of equipment provision: in each case an average of almost exactly 90% by number of the items in the total equipment inventory had cost £1K-£10K, with 10% costing over £10K. There does, however, appear to be a slight difference between the sectors: 87% of the items of equipment in the research institute sector, and 96% in the university sector, had cost £1K-£10K.

The ABRC has recently published a survey of research equipment in universities and polytechnics; but it was concerned only with items costing over £10K, so the results cannot usefully be compared with ours.

Figure 17. Variation in total expenditure per researcher (£K) with total number of researchers (all sectors and disciplines combined)

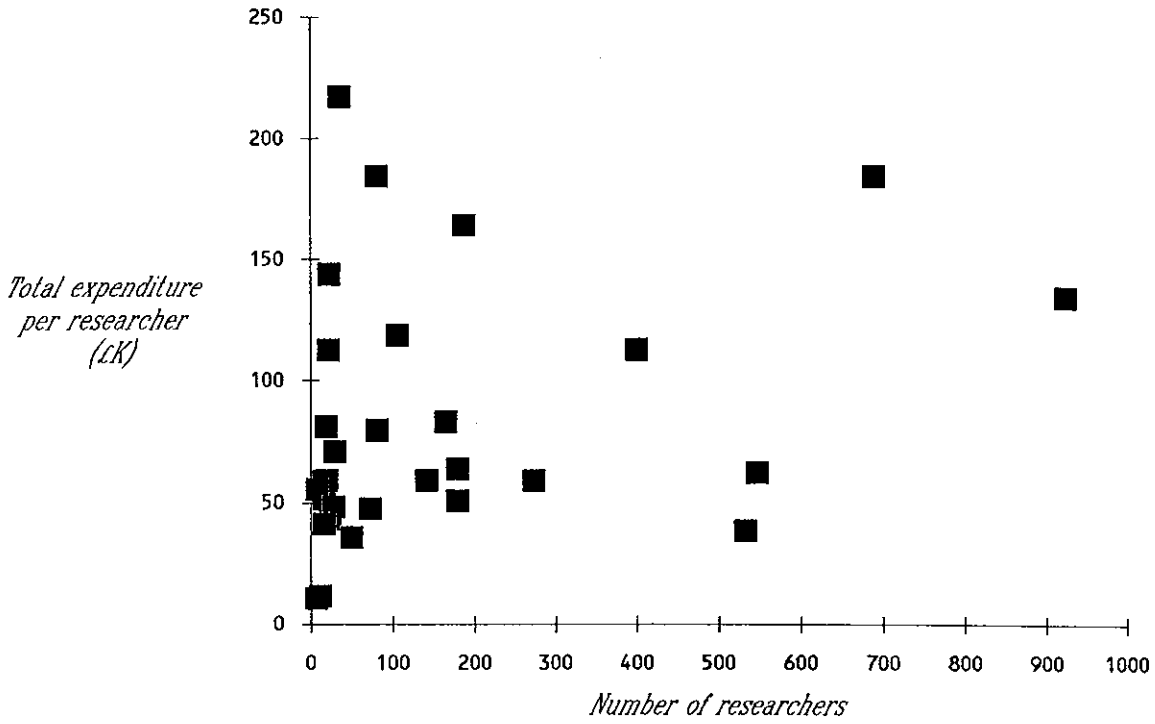


Figure 18. Variation in numbers of support staff per researcher with total number of researchers (all sectors and disciplines combined)

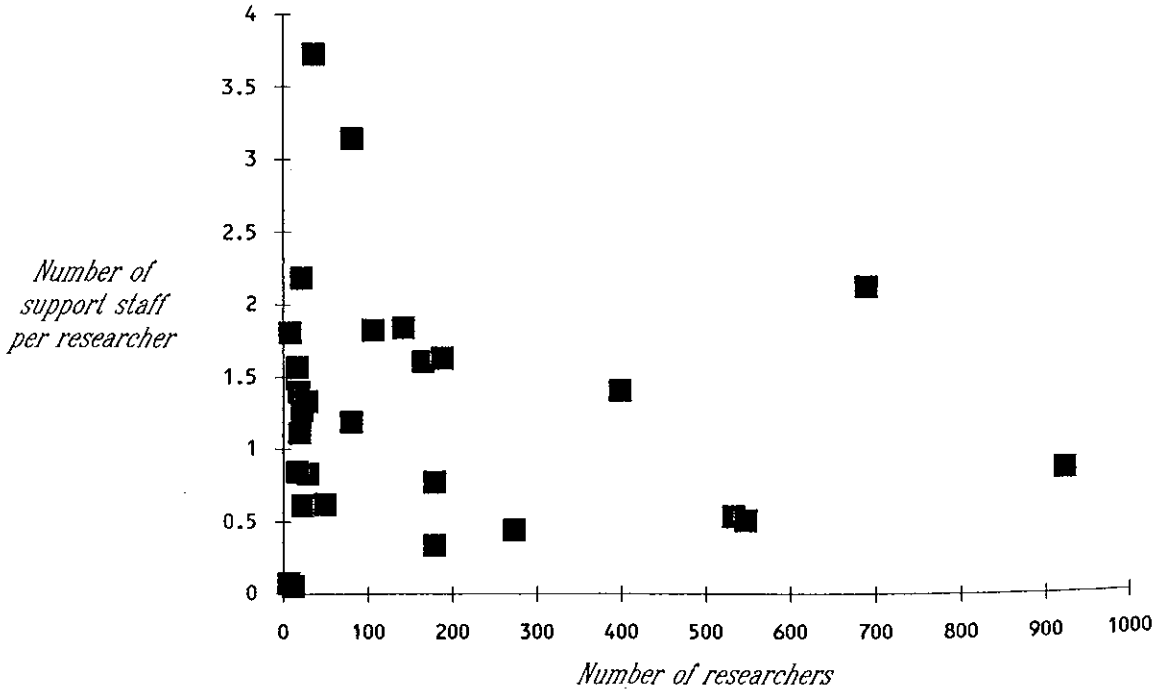


Figure 19. Variation in capital expenditure as a percentage of total expenditure, with total expenditure (£K) (all sectors and disciplines combined)

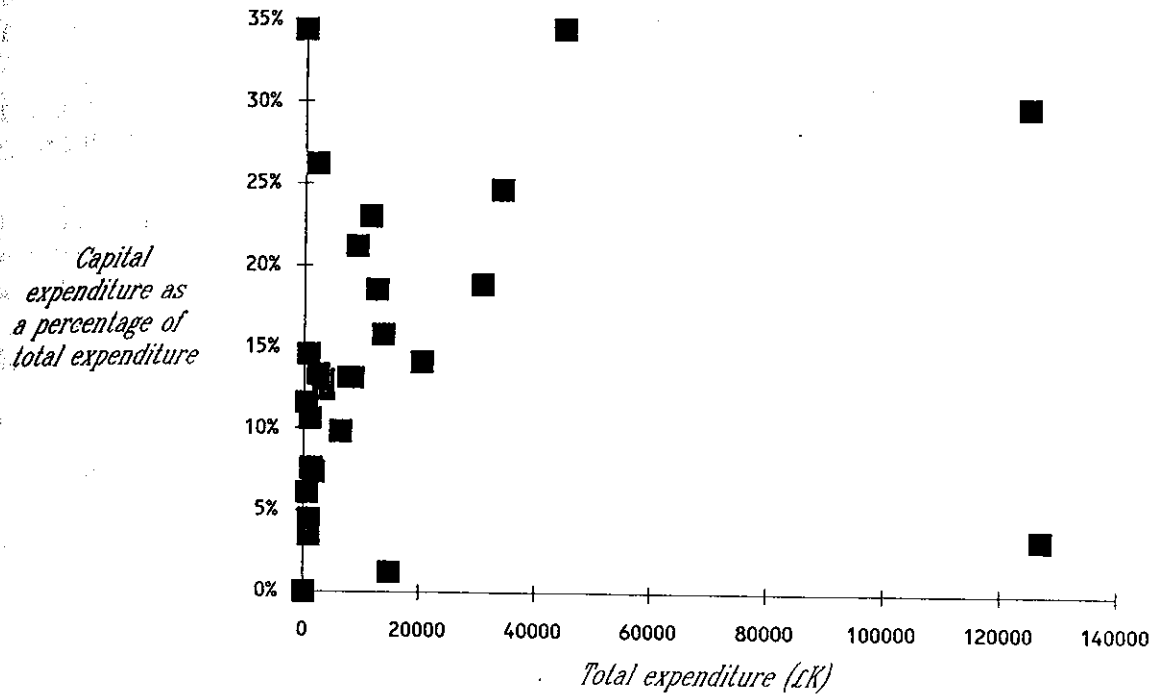


Figure 20. Variation in total non-pay expenditure per researcher (£K) with total number of researchers (all sectors and disciplines combined)

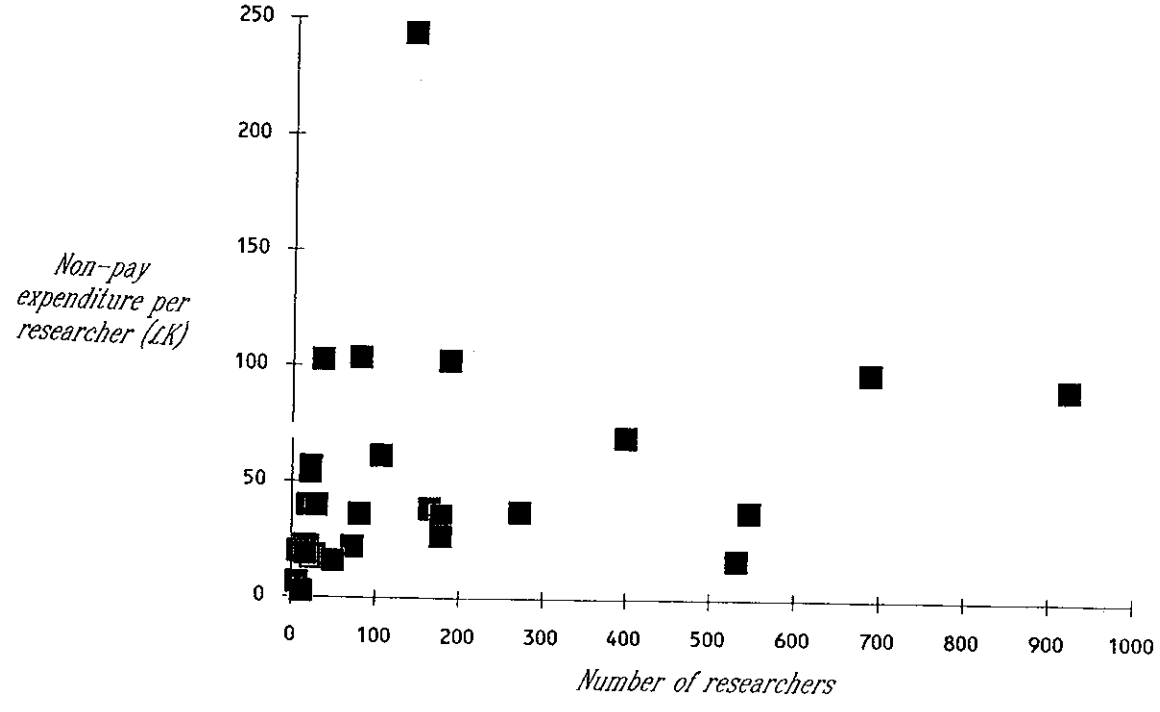


Figure 17. Variation in total expenditure per researcher (£K) with total number of researchers (all sectors and disciplines combined)

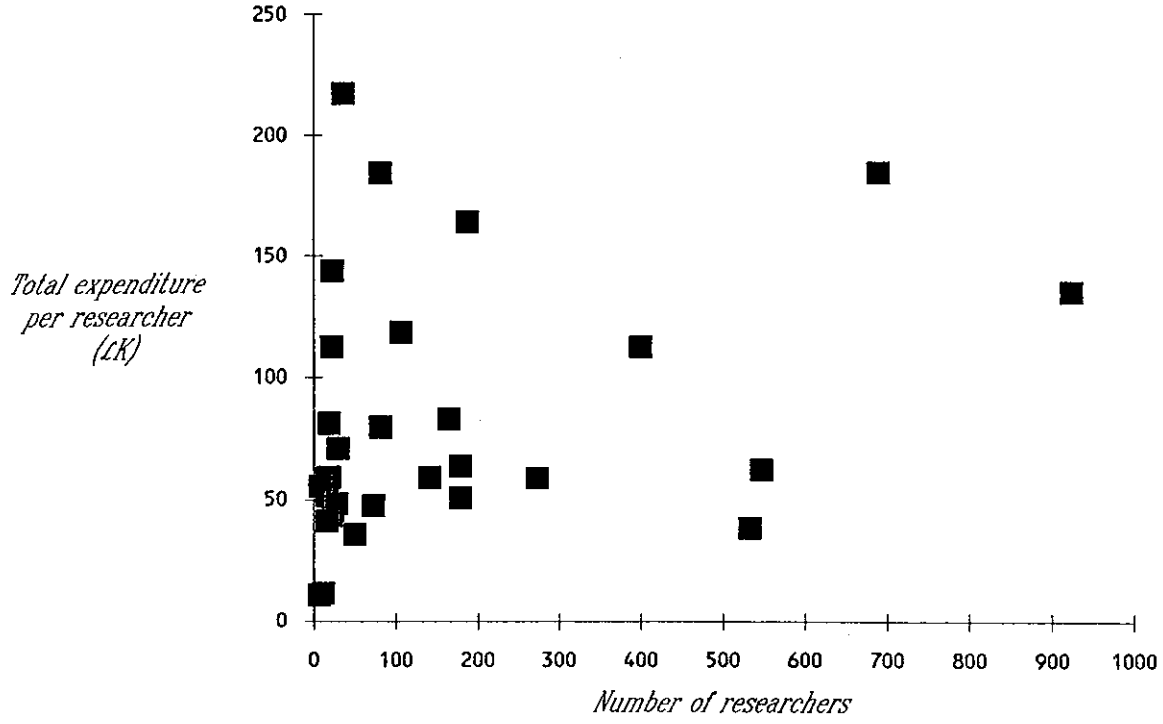


Figure 18. Variation in numbers of support staff per researcher with total number of researchers (all sectors and disciplines combined)

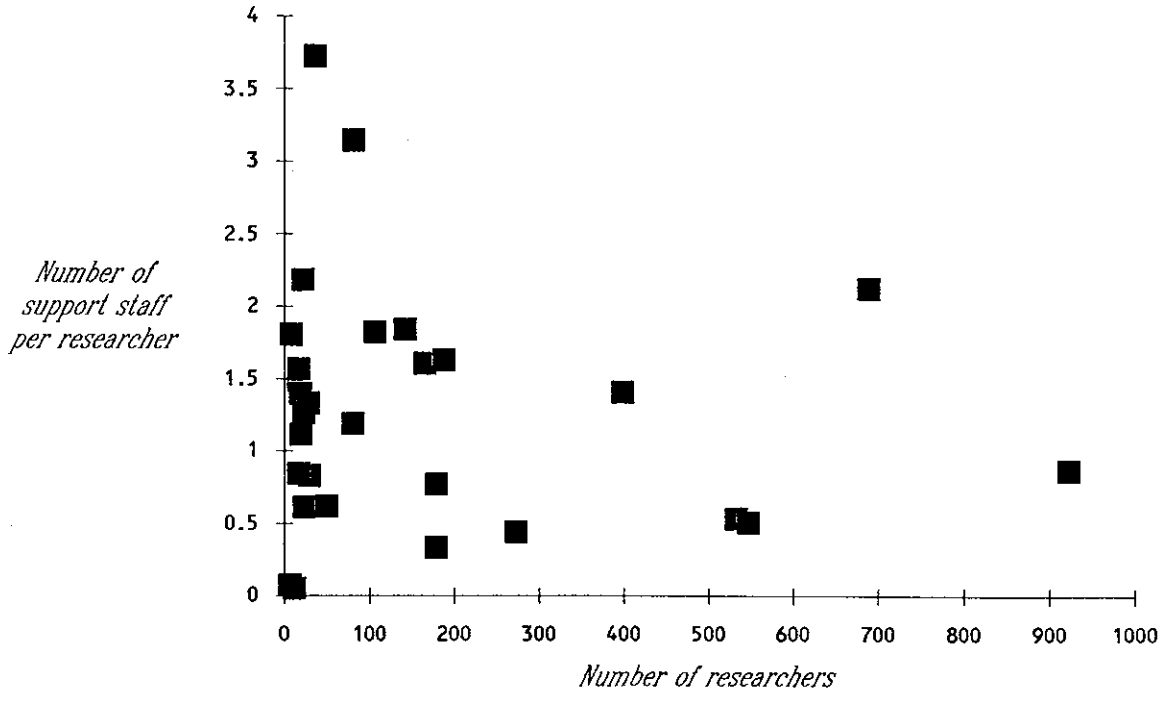


Figure 19. Variation in capital expenditure as a percentage of total expenditure, with total expenditure (£K) (all sectors and disciplines combined)

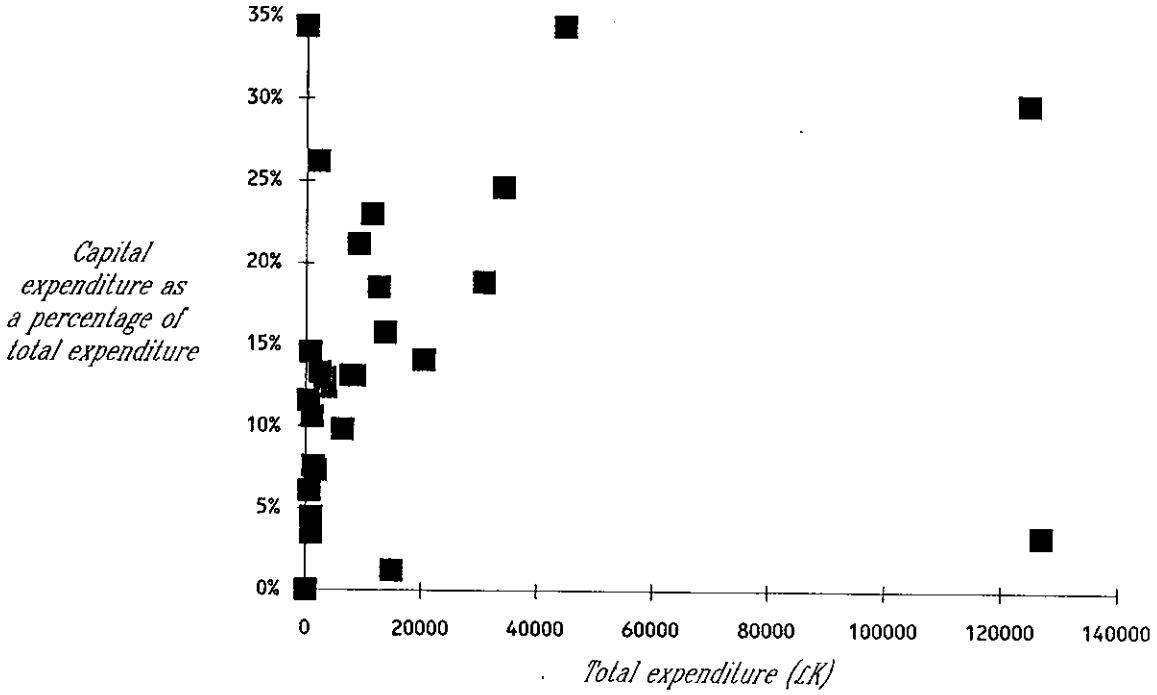
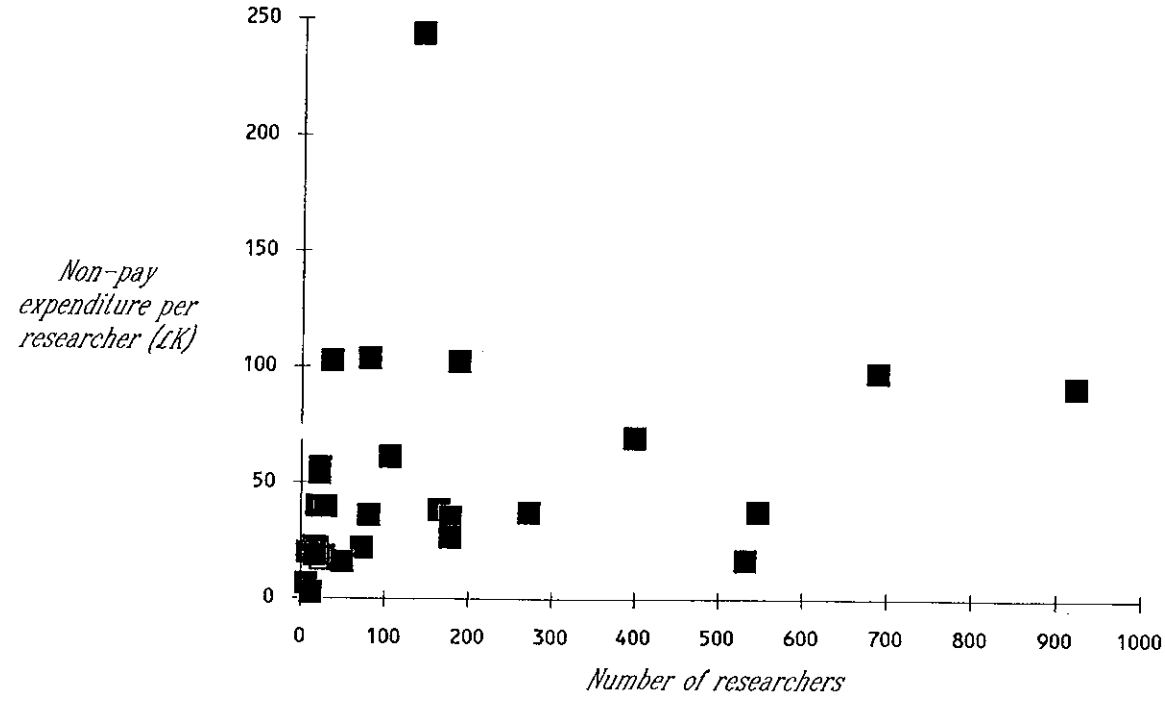


Figure 20. Variation in total non-pay expenditure per researcher (£K) with total number of researchers (all sectors and disciplines combined)



(iv) Teaching/research split

In the university sector we asked not only for data on research expenditure but also, in some parts of the questionnaire, for data on teaching expenditure. The data presented in chapter 3 cover only the research expenditure. However, we can also examine how total expenditure under particular headings is split between the teaching and the research functions.

For the best known teaching/research split – the time of UGC-funded academic staff – we found no clear pattern: in each discipline, the ratio varied between 38 : 62 and 62 : 38.

The division of departmental pay expenditure between teaching and research depends mainly on what proportion of departmental staff are on external funds: such staff are mostly full-time researchers with few teaching commitments. The data in table 3, which cover both UGC-funded and externally funded staff, reflect the varying proportion of those types of staff in the departments we surveyed.

Table 3. Proportion of departmental pay expenditure going on research (university sector only)

Plant science	Biochemistry/ pharmacology	Electrical engineering & electronics	Chemistry	Average all disciplines
68%–80%	49%–80%	52%–63%	59%	65%

Table 4 shows how much of departmental non-pay expenditure goes to research rather than teaching. Overall, the results are not dissimilar to table 3 (as one might expect), with an average for all disciplines combined of 67% for the research share of departmental pay expenditure. However, the picture is markedly different for central expenditure, only 28% of which goes on average to research rather than teaching (table 5).

Table 4. Proportion of departmental non-pay expenditure going on research (university sector only)

Plant science	Biochemistry/ pharmacology	Electrical engineering & electronics	Chemistry	Average all disciplines
77%–82%	59%–67%	63%–65%	48%	67%

Table 5. Proportion of central expenditure going on research (university sector only)

Plant science	Biochemistry/ pharmacology	Electrical engineering & electronics	Chemistry	Average all disciplines
24%–32%	25%–32%	24%	28%	28%

(v) Saving money

Respondents were asked about any special money-saving initiatives that they had introduced.

More cost-effective schemes relating to purchasing were mentioned by the majority of respondents as an important means of saving money. One respondent was part of a consortium of universities that was able to negotiate favourable purchasing deals on behalf of its members. This university also specifically asked for discounts when seeking quotations from suppliers. A special initiative introduced by another department entailed negotiating with computing firms for discounts on purchases. Central buying of equipment was practised by one industrial respondent. Another industrial company automated and improved the control of materials spending, yielding savings of 15% per annum in real terms.

One academic department reduced the number of teaching and support staff. An 'Analytical Services Unit' was set up by another department to improve the allocation of its resources, and good communication links were established between research groups to ensure the best possible distribution of overall resources. In one university, allocation of resources was linked to scientific productivity in some unspecified manner.

One research institute carried out reviews of indirect expenditure, including personnel procedures and internal communications. Where there were cost benefits, contractor service staff, scientists and engineers were used. Stores inventories were being reduced to minimum levels. In another research institute there had been seven successive rounds of redundancies over 3 years; voluntary retirements had occurred, vacant posts had not been filled, maintenance budgets had been cut, and free space had been let to outsiders.

(vi) Stores

The value of consumables held in store ranged from £0.5K per researcher to £9.3K per researcher, with the higher values more likely to be found in industrial research centres and the lower values in universities. The level of stores was a balance between the demands of efficient management of research, the availability of money for buying stores, the economies of bulk buying, the costs of housing and accessing stores, and the cost of the capital tied up in the stores. Few respondents accounted for the latter in any formal way; several argued that it was more than offset by the economies of bulk buying.

(vii) Health and safety

Compliance with developing legislation on health & safety and on environmental protection carried significant costs for respondents in all sectors and disciplines. These costs were often hidden in general programmes of maintenance and refurbishment and so were not readily amenable to analysis, but, for those respondents able to identify such costs, they appeared to amount typically to £5K-£10K per researcher per year.

(viii) Spending priorities

A question about the uses to which a (hypothetical) 10% increase in funding might be put elicited a variety of answers. University respondents were most likely to use it to increase staff numbers – academic or, in some cases, technical staff – or to upgrade the departmental stock of equipment. These priorities were also mentioned by respondents in the other sectors, but they were more likely to use the money instead, or as well, to expand their programme of research into new areas. This may be an indication of the extent to which respondents in the various sectors were content with the existing structure (as opposed to volume) of their research expenditure: universities were more likely to see additional resources as a means of restoring lost posts or correcting imbalances in expenditure patterns than as an opportunity to move into new areas of research.

CHAPTER 5: DISCUSSION

(i) Methodology

Questionnaire

In order to examine the structure of expenditure in research centres, we had first to ensure that we had identified their total expenditure. This led us to produce very substantial questionnaires: we did not necessarily expect to analyse the fine detail of the responses, but we needed to be certain that all relevant expenditures had been included. The detail also served the purpose of providing precise definitions of what was to be included in each of the major headings. Previous attempts to analyse expenditure patterns were weakened by lack of such precise definitions. Consistent use of language is important enough when collecting data from a number of respondents within a single sector: it becomes all the more important when comparisons are to be made between sectors.

The detail was included also because, at the outset, it was not clear how we would focus the analysis: that would depend on which turned out to be the most interesting results. We therefore wanted to keep our options as open as possible. On a future occasion it should be possible to build on our experience and to work with a shorter questionnaire, provided respondents understood precisely what was to be covered in each heading and provided one had a way of checking that respondents had in fact complied with the instructions. The extensive guidelines that we produced to accompany the questionnaires would still be needed. It would also remain necessary to spend time with each respondent to ensure they understood exactly what was being sought, and to help one understand the nature and quality of the data received. These steps cannot be short cut if one is to have confidence in the quality of the data.

Non-research activities

We assumed that industrial research centres and research institutes were devoted 100% to research: all their expenditure could to ascribed to research. This is clearly not the case for universities, which have two distinct missions. We therefore had to allocate all university expenditure, at both departmental and central level, between those two missions. The way we did this is described in chapter 2 and Annex B; it would appear to be reasonably workable. All the university data in chapter 3 refer to research only; chapter 4 has some data on teaching as well as on research.

Sources of funds

In the university sector in particular, there is interest in separately tracing how funds from different sources are spent. For example, it would be interesting to examine how the long-term staff divide their research time (and hence pay costs) between exploratory work with no external funding, work on research council projects (including overseeing short-term staff) where their own contributions are financed internally, and work on projects financed from outside the dual support system where their own contributions should be covered by the external source. It would also be interesting to trace whether there is any transfer between research funds (from whatever source) and teaching funds provided centrally. However, our methodology did not allow us to do this, since we were looking at the total research activity of the research centres over a whole year and not at individual projects. But there is no

reason to suppose that the indirect costs of, for example, research council funded projects are very different from the indirect costs of the total research activity over the year: our results are therefore relevant to project-specific analyses.

(ii) Indirect expenditure ('overheads')

Definitions

Comparison between our data on indirect expenditure and numbers given in the Hanham report and elsewhere is not straightforward. Indirect expenditure on research is normally expressed as a percentage of the pay costs of research and support staff directly involved in research. In our usage, 'indirect expenditure' includes all expenditure on consumables, equipment, travel etc, as well as premises costs and central administration; 'research staff' includes both externally funded research staff and UGC funded staff to the extent that they are involved in research. In Hanham's usage, 'indirect expenditure' excludes expenditure on consumables, equipment, travel etc where such expenditure can be separately identified and related to a specific project; such expenditure is handled instead under the heading 'direct expenditure' and would normally be charged at cost. Hanham's definition of 'research staff', however, is the same as ours. Hanham's definitions are appropriate to the objective of calculating the costs of *research projects*; our definitions arise from our aim of investigating not project costs but *total expenditure on research* by a research centre over a whole year. Calibration of our results with Hanham's depends on what proportion of a centre's expenditure on equipment etc is project-specific.

SEPSU data

Our results, in summary, are as follows. In plant science, biochemistry/pharmacology and chemistry in universities, indirect expenditure (i.e. all expenditure other than the pay costs of staff directly involved in research) is at the rate of about 80% of the pay costs of departmental research and research support staff. In electrical engineering & electronics it is about 140%. In industry, we found rates of about 240% in biochemistry/pharmacology, 190% in chemistry and 165% in electrical engineering & electronics. Rates in research institutes lie somewhere between those in universities and those in industry.

Hanham

The Hanham report suggested that, for a 'typical university', the indirect recurrent costs of research as defined in that report were likely to be between 75% and 150% of the pay costs of research and research support staff. Our data imply that, at least for three of the four disciplines we cover, Hanham's estimate may be a little on the generous side. However, our data concern actual expenditure rather than costs, and in some areas (e.g. materials & equipment, premises) university expenditure would appear to be sub-optimal. The greater universities' indirect income, the more able they are to sustain the 'well found' laboratory.

UGC '40%'

The traditional benchmark figure for indirect costs of research in the university sector is 40%, promulgated by the UGC in 1970/71. Although this figure has become very familiar in discussions about the costs of university research, its precise definition is less well known. The definition differs in several respects from both Hanham's and our use of the term 'indirect expenditure'. It refers only to central expendi-

ture, not indirect expenditure at departmental level. It covers four elements of central expenditure (administration, academic services, maintenance of premises and 'other') but excludes provision for equipment and for the capital cost of accommodation. It is expressed as a percentage of total departmental expenditure from all sources, not as a percentage of pay costs. Finally, it is intended to apply to all departmental activities: it does not refer solely to expenditure on research. Nevertheless, it became accepted practice that universities should aim to recover indirect costs at the rate of at least 40% of total direct costs when negotiating the price for research carried out for bodies outside the dual support system. This target has never been consistently achieved.

UDIL

A report by the University Directors of Industrial Liaison (UDIL) in 1986 produced a range of indirect costs. These were expressed as a percentage of total direct costs (i.e. pay, consumables, equipment, travel etc but not premises costs). 'Marginal indirect cost', estimated at 40%, represented the additional costs to a department of a given project and covered such items as power, use of space and general workshop services. 'Economic indirect cost', at 100%, covered, in addition, the costs of departmental administration, amortization of buildings and equipment and a notional figure for central administration associated with the project. 'Full commercial indirect cost', at 150% – 200%, covered the above plus the full amount of all central administration and service costs. Which form of indirect cost should be used depended on the circumstances, principally the potential benefits to the university of the project. UDIL estimated that 40% of total direct costs was approximately equivalent to 100% of direct pay costs.

The UDIL report did not attempt to measure the indirect costs of research in university departments, because of the difficulties in separating teaching from research: instead, it relied on data from a variety of laboratories in other sectors to arrive at its estimates, though the data were presented in summary only. Our own report would appear to be unique in presenting detailed data on a comparable basis from universities, research institutes and industry. Despite the smallness of our sample, our results should be of value in setting the debate about indirect costs on a firmer factual basis.

(iii) Pay expenditure

Inter-sectoral comparisons

The total expenditure on pay of all categories of staff accounted for two thirds of the total recurrent expenditure on research in universities, all the data falling within a fairly narrow range. In the other sectors about half of recurrent expenditure went on pay, and there was greater variability between respondents. The high proportion spent by universities on pay reflects the relatively low amount they spend on non-pay items, rather than relatively high rates of remuneration.

The average *per capita* expenditure on pay of research staff was highest in industry, as might be expected. However, the difference between industry and universities was not all that large, and in one discipline (electrical engineering & electronics) *per capita* expenditure on pay was lower in industry.

A proper comparison of pay expenditure in different sectors would need to take account of the distribution of researchers in each centre among the levels of seniority. It may be that pay costs for young researchers are broadly similar between industry and universities, but that substantial differences appear at more senior levels both in rates of remuneration and in the availability of posts. In those centres where research staff were rapidly promoted, average pay expenditure would be correspondingly high. Conversely, there may be relatively few promotion opportunities for research staff in industrial electrical engineering & electronics.

Comparisons with other recurrent expenditure

The data on researchers' pay expenditure as a percentage of total pay expenditure (figure 6 (i)) reflect the level of investment in other staff (mainly support staff), while the comparison of researchers' pay expenditure with total recurrent expenditure (figure 6 (ii)) reflects also the level of investment in consumables, minor equipment, maintenance etc. In most disciplines universities spent relatively high proportions on researchers' pay: in electrical engineering & electronics, industry also spent high proportions on researchers' pay.

(iv) Support staff

Technical support staff

There were large variations in the provision of technical support staff (i.e. technicians, postgraduate research assistants, experimental officers etc); over all respondents, the number ranged from 0.3 to 3.4 per researcher. In the absence of a clear overall pattern for particular disciplines or sectors, these variations may be ascribed to the different cultures prevailing at individual research centres: one sees again how difficult it is to talk about the 'typical' research centre. The only really compact result was in industrial electrical engineering & electronics, where technical support staff were relatively few in number.

Secretarial & clerical support staff

Secretarial & clerical support staff were less in demand: in only two research centres were there more than 0.3 per researcher, and in the university sector the average provision was under 0.1 per researcher. One may conclude either that researchers have little need of secretarial or clerical support, or that such support is provided in part by technically qualified staff.

(v) Capital expenditure

Depreciation

Because we were not able to include depreciation in our calculations of capital expenditure, the data are difficult to interpret: several respondents incurred unusually heavy capital expenditure in the year in question. This affects both figure 4 (total capital expenditure) and the various figures that combine capital and recurrent expenditure.

(vi) Premises expenditure

Inter-sectoral comparisons

Our data on premises (rent, rates, power, maintenance, building works etc) include both recurrent expenditure (figure 16 (i)) and recurrent plus capital expenditure (figure 16 (ii)). As explained in chapter 3, premises data for the university sector are not directly comparable to premises data for the two other sectors. Premises expendi-

ture per researcher nevertheless appears to be substantially lower in the university sector.

Deferred maintenance

Premises expenditure illustrates the difference between costs and expenditure discussed at the beginning of chapter 1. 'Costs', in the sense of the amount of money one could usefully spend to run a research centre, should include an annual sum for maintenance and upgrading of buildings, plant and major equipment. 'Expenditure', however, can be manipulated (especially if depreciation is ignored in the accounts) simply by deferring maintenance. In the long run, of course, deferred maintenance is no way to save money, but in the short term it may appear to be an attractive option.

An unpublished survey conducted for the UFC early in 1989 found that, for all UK universities combined, a sum in excess of £300M was needed to bring buildings up to an acceptable standard; this sum covers normal maintenance only and excludes for example upgrading work needed to comply with new building regulations. This compares with an estimated £130M spent annually on maintenance. According to the Universities Statistical Record, total recurrent expenditure on maintenance and running of premises has declined continuously, from 16.4% of total recurrent expenditure in 1981/82 to 13.8% in 1987/88. The period when the new buildings of the 1960s expansion of universities started to incur substantial maintenance needs coincided with the period of cuts in general university funding. Premises expenditure in the university sector is not just lower than in the other sectors: it would appear to be too low for good financial management in the long term.

(vii) Health & safety

It is difficult to separate expenditure to comply with revised health & safety regulations from programmes of continuous maintenance and upgrading of buildings and facilities that are part of any organization's normal expenditure. Nevertheless, it is clear that health & safety regulations have significant cost implications for research centres; in extreme cases, these can include construction of whole new buildings if new regulations mean that existing buildings are no longer suitable for the purposes for which they were intended. The costs of compliance with the law fall on the individual organizations, and in most cases there is no way they can shield their budgets from the impact of these costs. Legislation, then, is an additional variable that has to be accommodated within research budgets.

(viii) Training

Universities appear to spend very little on formal training, in the sense of having budgets to send staff on training courses. Rather more is done in the way of uncosted on-the-job training, but this is not traceable in the accounts. Our data relate to 1986/87; in 1988/89, the CVCP set up the Universities' Staff Development and Training Unit to stimulate efforts in individual universities to devote attention and resources to the training and development of all categories of staff. It is likely that there has been an increase in formal training since the period to which our data refer.

(ix) Teaching/research split

Variability

There is no simple rubric establishing the division of effort and resource in universities between the two functions of teaching and research. Generalizations such as the traditional one that academics devote 30% of their time to research obscure more than they reveal. Even for respondents in the same discipline, we found that the teaching:research split of the time of UGC-funded academic staff ranged from 38:62 to 62:38. With the rapid expansion in numbers of externally-funded staff, who spend most if not all of their time on research, the division of time of total academic staff within a department becomes even more variable.

Pay and non-pay expenditure

Across all four disciplines, there would at first sight appear to be a degree of positive correlation between the proportion of departmental pay expenditure going on research (table 3) and the proportion of departmental nonpay expenditure going on research (table 4). This might be expected, at least to the extent that non-pay expenditure on research is directly related to the number of active researchers. However, when the full data set is analysed within each discipline, no clear picture emerges. Our data are too sparse to allow us to draw conclusions about possible relations between the distribution of pay and of nonpay expenditure between research and teaching. It would be interesting to investigate such relations with a larger data set.

Central expenditure

A much lower proportion of central than of departmental expenditure is attributed to research (table 5). Over all disciplines combined, central expenditure allocated to departments for research accounts for 12% of the total research expenditure associated with departments (table 1). As the devolution to departments/cost centres of budgetary responsibility develops, these proportions may change.

CHAPTER 6: CONCLUSIONS: POLICY IMPLICATIONS

(i) Introduction

Our aim in this report is to produce factual evidence about the structure of research expenditure. Our data are unique in being focused at the level of individual research centres and in covering, on a comparable basis, universities, research institutes and industrial research centres. SEPSU's role is to generate data relevant to policy makers rather than to formulate policy recommendations. In this concluding chapter we therefore restrict ourselves to identifying some of the policy issues to which our data will be relevant.

We should repeat at the outset that our data are derived from a small selection of leading research centres in the chosen sectors and disciplines, and thus relate to best practice under current circumstances. They are indicative of the situation prevailing in these sectors and disciplines in a particular year (1986/87); they cannot be used as a basis for statistical extrapolation to all UK research. In the absence of more wide-ranging data of equal rigour, our results do, however, provide a factual starting point for policy discussions.

(ii) Methodology

Regular monitoring

There would be value in being able to monitor research expenditure on a regular basis, for example in order to identify trends in indirect expenditure. If such monitoring is to be carried out on a large scale, it will be necessary to simplify our methodology. Our methodology is not inherently complex: indeed, industrial research centres were able to complete our questionnaires fairly quickly. Universities had much greater difficulty because they do not normally separate UGC/UFC funds into teaching and research and because much central expenditure is not routinely allocated to departments or cost centres. Regular monitoring of research expenditure therefore implies some changes in university financial management practice.

Depreciation

One particular aspect of financial management that deserves attention here is depreciation of capital investment. The Hanham report argued in favour of retaining the existing university practice of not depreciating capital assets. However, this introduces considerable distortion at the department/cost centre level. It also impedes comparability between universities and research organizations that do use depreciation, which could be significant when universities are negotiating contracts with agreed levels of indirect costs.

(iii) Indirect expenditure ('overheads')

Our data on indirect expenditure ('overheads') are likely to be of interest to policy makers at all levels, since they have implications for both the volume and the structure of funds for research, whether seen from the national, the institutional or the project-specific level.

Dual support system

Accurate calculation of indirect costs is of the greatest importance to any research centre receiving income from more than one source. Inadequate recovery of indirect costs puts pressure on the rest of the system: it becomes more and more difficult to make good the shortfall.

This has become very clear in recent years with the rapid expansion of income for research from non-UGC sources.

The income received by universities from research councils in the form of research grants has increased by 5% p.a. in real terms since 1981/82. Under the dual support system, this increase should have been accompanied by a corresponding growth in UGC/UFC expenditure on research, in order to cover the indirect costs of the research council work. However, UGC/UFC expenditure on research has actually declined slightly in real terms since 1981/82. The proposed transfer of funds from the UFC to the research councils, nominally to allow research councils to pay indirect costs (other than academic salaries and premises costs) as well as direct costs, further highlights the need to have accurate data on indirect costs.

Externally funded research

Knowledge of indirect costs is even more important for dealing with research funded from outside the dual support system. Such research has been expanding by nearly 14% p.a. in real terms since 1981/82. If the externally funded research is priced too low, it will rapidly deplete the other financial resources of the university.

The effect of failing to understand costs, or at least of failing to recover costs, may be illustrated simply. In 1985/86, the actual recovery of indirect costs (as defined by Hanham) on contracts from outside the dual support system averaged about 11% of total expenditure on external contracts, leading to an estimated £40M shortfall for all UK universities against the traditional 40% target. The latest figures from the UFC show some improvement: in 1988/89, income from non-dual support sources for research included an average 14% of total expenditure, or 25% of direct pay expenditure (excluding the pay costs of UGC-funded staff involved in the projects), to cover indirect costs. But this is still much less than any calculation of true indirect expenditure. Continuous failure to recover indirect expenditure threatens the stability of the whole structure of university finance.

Negotiating price

The Hanham report discusses the difference between cost and price, and considers the various factors that should be taken into account when negotiating the price of a given research project. But, as Hanham stressed, the starting point for such negotiation must be knowledge of the full cost. Our report, both in its methodology and in its results, is a step towards improving understanding of full costs.

Our data show that indirect expenditure in industry is generally a good deal higher than in universities. For research projects that industry does not need to carry out itself inhouse, university laboratories would thus appear to offer good value for money, even if full indirect expenditure is included. When discussing the price for research, it would be advantageous to universities if they could provide clear factual evidence about their indirect expenditure.

Indirect expenditure represents the general level of resource available to a department: the 'well-found laboratory' in a strong institutional setting will have relatively high indirect expenditure. High indirect expenditure should not necessarily be seen as implying poor financial management. If a laboratory is not able to recover its indirect costs, it will in time cease to have sufficient basic resource to allow it to function.

(iv) Support staff

Technicians

In the university sector, the increasing numbers of researchers over the past ten years have not been matched by corresponding increases in numbers of technicians. This may point to a lack of efficiency (researchers carrying out tasks that could be performed by less qualified staff); it may point to a growing tendency to use off-the-shelf equipment or components; it may point to increased reliance on postgraduate research assistants for technical support. Our data cover a single year only, so we cannot comment on trends in the total provision of technical support staff as defined in this study. However, such staff constitute an important element in the overall resourcing of research, and one that policy makers might wish to examine more closely. It would be of interest to investigate why there are substantial differences between research centres in the provision of technical support staff, and what these differences imply for the way research is carried out.

(v) Materials and equipment

There were no particularly striking differences between disciplines or between sectors in the proportion of recurrent or of total expenditure devoted to materials and equipment: only in industrial electrical engineering & electronics was the figure notably different from the general pattern. In terms of expenditure per researcher, however, the university sector gave a result about half that of the other two sectors.

One could infer from this that university researchers work in cheaper specialisms than their colleagues in other sectors; or one could infer that they compete in the same specialisms, but on an unequal footing; or that the time-scales operating in the different sectors pose different demands on the availability of materials and equipment. Universities tend to work more towards the fundamental end of the spectrum than the other sectors, and in many fields fundamental research can be cheaper than more strategic or applied research. The latter in particular usually has to be completed on a short time-scale, so a larger range of materials and equipment has to be held to facilitate rapid response to demand. Moreover, universities devoted a higher proportion (67.9%) of their total recurrent expenditure to pay costs in 1986/87 than in any year since 1980/81; the amount available for materials and equipment was correspondingly low.

(vi) Effects of scale

Our respondents ranged from £0.7M to £130M in total annual expenditure, and from 8 to 900 in the number of researchers employed. This gave us an opportunity to see whether there was any connection between the size of a research centre and the structure of its expenditure. We found no significant connection.

Our sample was small, and spread across three sectors and four disciplines. Nevertheless, our finding is of interest in the light of recent discussions about the minimum viable size of university departments. A bibliometric analysis by SEPSU of the output of university earth science departments found no significant correlation between the number of publications per member of staff and the number of

academic staff. An analogous investigation of physics and chemistry departments also failed to produce evidence of a positive correlation between size and productivity. It would seem that discussions of the minimum viable size for a department may more profitably be based on consideration of the processes of research (e.g. access to expensive equipment) or on non-research criteria (e.g. the number of staff needed to teach a degree-level curriculum), than on increased efficiencies in inputs or outputs. Above a fairly low threshold, economies of scale in the management of research are not self-evident.

(vii) Heterogeneity

A great deal of work is currently going on to create funding formulae, for distributing money from the funding agencies to universities, for distributing block grant within universities to individual faculties, cost centres and departments, and for top-slicing external income received directly by departments or cost centres to cover the cost of central administration and facilities. However, one striking finding from our work is the extent to which research centres differ from each other, even within a single sector and discipline. Each centre has its own individual character and, with it, an expenditure structure suited to a particular set of circumstances. There is a danger that, in the interests of administrative simplicity, the various funding formulae will be geared to a hypothetical 'typical' situation that ignores the great variety of circumstances to be found in real research centres. It will be a challenge to devise formulae that combine administrative convenience (and are therefore cheap to implement) with the sophistication and flexibility necessary to meet the needs of individual research centres. Failure to achieve this balance would penalize centres that differ significantly from some 'average': and, according to our results, that means most research centres.

ANNEX A: THE QUESTIONNAIRES

(i) Introduction

We used two questionnaires, one for universities and the other for industry, research institutes and polytechnics. Each questionnaire was accompanied by detailed guidelines, which were discussed with each respondent. The questionnaires are summarized in this annex. Annex B describes the guidelines given to university respondents on how they should separate expenditure on teaching from expenditure on research, and on how central expenditure should be allocated to departments. Annex C gives definitions of key terms.

The questionnaires asked for highly detailed information. Respondents were generally able to supply data at the level of the main headings, but not always at the level of the subheadings. By including the subheadings we sought to ensure that all relevant elements of expenditure were taken into account, even if fully disaggregated data could not always be provided. On a future occasion it might be advantageous to dispense with some of the subheadings.

(ii) The questionnaire sent to universities

The questionnaire sent to universities had three main sections:

* income (21 main heads)
* departmental expenditure (38 main heads)
* central expenditure (57 main heads)

Income covered general recurrent income (e.g. from the UGC block grants), specific recurrent income (e.g. from research grants and contracts) and capital income. Respondents were asked to give both income going to the institution as a whole and income allocated to the department.

Departmental expenditure was divided into three parts: salaries and wages costs, non-pay recurrent expenditure and capital expenditure. The numbers of staff accounted for in each pay category were requested. All elements of departmental expenditure were split between teaching and research. Information was sought on floorspace to facilitate some of these calculations.

Central expenditure covered recurrent expenditure on academic facilities, general educational expenditure, administration and central services, staff and student facilities and amenities, premises costs and capital expenditure. All elements of central expenditure were divided between teaching and research, and the amount allocated to the department for research was then recorded.

All income and expenditure data were requested to the nearest £1000.

The questionnaire concluded with some supplementary questions, the replies to which are analysed in chapter IV. One of these asked for numbers of staff categorized as professional research, graduate research support, technical support, clerical support, professional research management and administration, and other; replies here were used as a cross-check on staff numbers given under head 22—29.

The questionnaire was made up as follows.

INCOME

General Recurrent Income

1 UGC
  a. Block grant
  b. Earmarked grants

2 GRANTS FROM LOCAL AUTHORITIES
3 ACADEMIC FEES AND SUPPORT GRANTS
a. Full-time taught degree and diploma course fees
b. Full time postgraduate research degree
c. Part-time taught degree and diploma course fees
d. Part-time research degree course fees
e. Research training support grants
f. Other
4 COMPUTER BOARD RECURRENT GRANTS
5 ENDOWMENTS, DONATIONS AND SUBVENTIONS
6 RETAINED NET PROCEEDS OF SALES OF BUILDINGS, LAND ETC.
7 OTHER GENERAL RECURRENT INCOME
a. Surpluses/deficits of subsidiary income and expenditure accounts
b. Retained net rental income from Exchequer-funded properties not in normal university use
c. Income for the university Health Service
d. Income from the use/letting of athletic and other recreational facilities
e. Income for responsible body extra-mural courses
f. Other
8 TOTAL GENERAL RECURRENT INCOME
Sum of heads 1 to 7

Specific Recurrent Income

9 RESEARCH GRANTS, CONTRACTS AND CONSULTANCY
a. Grants from research councils
b. Contracts from research councils
c. From other UK central government bodies
d. From UK local authorities
e. From UK public corporations
f. From other UK industry and commerce
g. From UK-based charitable bodies
h. From other UK sources
i. From overseas
10 INCOME FROM THE MANPOWER SERVICES COMMISSION FOR SPECIAL EMPLOYMENT MEASURES
11 OTHER SERVICES RENDERED
a. For special and short courses (from all sources)
b. Course validation fees (from all sources)
c. Use of specialized equipment
d. For specialist services e.g. analytical, safety
e. Conferences
f. Summer lettings
g. From UK government departments
h. From UK hospital authorities
i. From other UK universities
j. Other
12 TOTAL SPECIFIC RECURRENT INCOME
Sum of heads 9 to 11

13 TOTAL RECURRENT INCOME
Sum of heads 8 + 12

Capital Income

14 EQUIPMENT AND FURNITURE GRANT
   a. Balance from previous year including any interest accrued
   b. Interest accrued during year
   c. Grant for the University financial year August-July
   d. Transfer from general income
   e. Other income, including that from sales of equipment and furniture
15 COMPUTER BOARD CAPITAL GRANT
16 MAJOR BUILDING WORKS
17 TOTAL CAPITAL INCOME
   Sum of heads 14+15+16

Other Income

18 INCOME FROM UNIVERSITY COMPANIES
19 SURPLUS/DEFICIT ON YEAR'S WORKING
20 WITHDRAWALS FROM UNEXPENDED BALANCES
   a. Earmarked grants balance
   b. Reserves and other balances

21 GRAND TOTAL
   Sum of heads 13+17+18+19+20

DEPARTMENTAL EXPENDITURE

Salaries and Wages

22 TEACHERS AND RESEARCHERS (staff on non-clinical academic or related scales)
23 OTHER (staff on non-clinical academic or related scales)
24 CLINICAL STAFF
25 POSTGRADUATE RESEARCH STUDENTS (M Phil, PhD)
26 TECHNICAL STAFF
   a. Technicians
   b. Scientific officers
   c. Computer operators
   d. Animal attendants
   e. Others
27 SECRETARIAL AND CLERICAL STAFF
   a. Secretaries, clerical staff, data processors
   b. Library/museum staff
   c. Others
28 OTHER STAFF
   a. Tradesmen
   b. Security staff, porters, cleaners
   c. Gardeners, farm workers
   d. Others
29 ALL STAFF (sum of heads 22 to 28)
30 PAYMENTS TO NON-CONTRACTED STAFF
31 LONDON ALLOWANCES
32 MSC SPECIAL EMPLOYMENT MEASURES
33 TOTAL DEPARTMENTAL PAY EXPENDITURE
   Sum of heads 29+30+31+32

2 GRANTS FROM LOCAL AUTHORITIES
3 ACADEMIC FEES AND SUPPORT GRANTS
a. Full-time taught degree and diploma course fees
b. Full time postgraduate research degree
c. Part-time taught degree and diploma course fees
d. Part-time research degree course fees
e. Research training support grants
f. Other
4 COMPUTER BOARD RECURRENT GRANTS
5 ENDOWMENTS, DONATIONS AND SUBVENTIONS
6 RETAINED NET PROCEEDS OF SALES OF BUILDINGS, LAND ETC.
7 OTHER GENERAL RECURRENT INCOME
a. Surpluses/deficits of subsidiary income and expenditure accounts
b. Retained net rental income from Exchequer-funded properties not in normal university use
c. Income for the university Health Service
d. Income from the use/letting of athletic and other recreational facilities
e. Income for responsible body extra-mural courses
f. Other
8 TOTAL GENERAL RECURRENT INCOME
Sum of heads 1 to 7

Specific Recurrent Income

9 RESEARCH GRANTS, CONTRACTS AND CONSULTANCY
a. Grants from research councils
b. Contracts from research councils
c. From other UK central government bodies
d. From UK local authorities
e. From UK public corporations
f. From other UK industry and commerce
g. From UK-based charitable bodies
h. From other UK sources
i. From overseas
10 INCOME FROM THE MANPOWER SERVICES COMMISSION FOR SPECIAL EMPLOYMENT MEASURES
11 OTHER SERVICES RENDERED
a. For special and short courses (from all sources)
b. Course validation fees (from all sources)
c. Use of specialized equipment
d. For specialist services e.g. analytical, safety
e. Conferences
f. Summer lettings
g. From UK government departments
h. From UK hospital authorities
i. From other UK universities
j. Other
12 TOTAL SPECIFIC RECURRENT INCOME
Sum of heads 9 to 11

13 TOTAL RECURRENT INCOME
Sum of heads 8 + 12

Capital Income

14 EQUIPMENT AND FURNITURE GRANT
   a. Balance from previous year including any interest accrued
   b. Interest accrued during year
   c. Grant for the University financial year August-July
   d. Transfer from general income
   e. Other income, including that from sales of equipment and furniture
15 COMPUTER BOARD CAPITAL GRANT
16 MAJOR BUILDING WORKS
17 TOTAL CAPITAL INCOME
   Sum of heads 14+15+16

Other Income

18 INCOME FROM UNIVERSITY COMPANIES
19 SURPLUS/DEFICIT ON YEAR'S WORKING
20 WITHDRAWALS FROM UNEXPENDED BALANCES
   a. Earmarked grants balance
   b. Reserves and other balances

21 GRAND TOTAL
   Sum of heads 13+17+18+19+20

DEPARTMENTAL EXPENDITURE

Salaries and Wages

22 TEACHERS AND RESEARCHERS (staff on non-clinical academic or related scales)
23 OTHER (staff on non-clinical academic or related scales)
24 CLINICAL STAFF
25 POSTGRADUATE RESEARCH STUDENTS (M Phil, PhD)
26 TECHNICAL STAFF
   a. Technicians
   b. Scientific officers
   c. Computer operators
   d. Animal attendants
   e. Others
27 SECRETARIAL AND CLERICAL STAFF
   a. Secretaries, clerical staff, data processors
   b. Library/museum staff
   c. Others
28 OTHER STAFF
   a. Tradesmen
   b. Security staff, porters, cleaners
   c. Gardeners, farm workers
   d. Others
29 ALL STAFF (sum of heads 22 to 28)
30 PAYMENTS TO NON-CONTRACTED STAFF
31 LONDON ALLOWANCES
32 MSC SPECIAL EMPLOYMENT MEASURES
33 TOTAL DEPARTMENTAL PAY EXPENDITURE
   Sum of heads 29+30+31+32

69 LONDON ALLOWANCES
70 MSC SPECIAL EMPLOYMENT MEASURES
71 TOTAL CENTRAL PAY EXPENDITURE
Sum of heads 67 to 70

Recurrent Expenditure
(i) Academic Facilities

72 LIBRARIES
a. Salaries and wages
b. Books
c. Periodicals
d. Other documents
e. Inter-library loans
f. On-line searches
g. Binding (incl. salaries)
h. Other
73 MUSEUMS AND OBSERVATORIES
a. Salaries and wages
b. Other direct costs
74 CENTRAL EDUCATIONAL COMPUTERS
a. In own institution
i Salaries and wages
ii Purchase of hardware
iii Purchase of software
iv Licensing fees
v Service contracts
vi Repair and maintenance
vii Running costs, consumables
viii Training on system
ix Other
b. In other institutions
75 CENTRAL EDUCATIONAL TECHNOLOGY UNITS
a. Salaries and wages
b. Audio visual aids
c. Reprographics
d. Printing
76 OTHER ACADEMIC FACILITIES AND SERVICES
77 TOTAL RECURRENT EXPENDITURE ON CENTRAL ACADEMIC FACILITIES
Sum of heads 72 to 76

(ii) General Educational Expenditure

78 EXAMINATIONS
79 INFORMATION PRESENTATION
a. Educational publications
b. Contributions to the University Press
c. Public lectures, concerts and exhibitions
d. Other
80 TRAVELLING AND SUBSISTENCE
a. Exploration and expeditions
b. University representation at conferences, seminars etc.
c. Exchange and other visits

81 SUBSCRIPTIONS
a. Subscriptions and contributions to learned societies and similar bodies
b. Contributions to e.g. CVCP and UCCA
c. Other
82 NON-DEPARTMENTAL RESEARCH PROJECTS
83 STUDENT RECRUITMENT COSTS
84 TOTAL EDUCATIONAL EXPENDITURE
Sum of heads 78 to 83

(iii) Administrative and Central Services

85 ADMINISTRATIVE STAFF SALARIES
86 ADMINISTRATIVE COMPUTER COSTS
87 MINOR ITEMS OF EQUIPMENT AND FURNITURE
88 MINOR MAINTENANCE AND REPAIR OF EQUIPMENT
89 STATIONERY AND OFFICE MATERIALS incl. postage
90 PUBLICATIONS
91 GENERAL ADVERTISING
92 INDUSTRIAL/ACADEMIC LIAISON COSTS
93 OTHER ADMINISTRATIVE COSTS
94 TOTAL ADMINISTRATIVE AND CENTRAL SERVICES EXPENDITURE
Sum of heads 85 to 93

(iv) Staff and Student Facilities and Amenities

95 STUDENT FACILITIES AND AMENITIES
a. Careers advisory services
b. Grants to student societies
c. Payments to student union
96 GENERAL FACILITIES AND AMENITIES
a. Accommodation office
b. Personnel
c. Staff education and training
d. Maintenance of athletics and other recreational facilities
e. University health services
f. Surpluses/deficits from catering and residence accounts
g. Support for staff clubs and associations
97 OTHER FACILITIES AND AMENITIES
98 TOTAL EXPENDITURE ON FACILITIES AND AMENITIES
Sum of heads 95 to 97

(v) Miscellaneous Recurrent Central Expenditure

99 CAPITAL EXPENDITURE FROM REVENUE
a. Building work and land charges
b. Renovation expenses
c. Loan charges
d. Other
100 FINANCIAL MANAGEMENT
101 PENSIONS
a. Reimbursable premature retirement payments
b. Other premature retirement payments
c. Other capital sums
d. Other
102 OTHER MISCELLANEOUS EXPENDITURE

103 TRANSFER TO EQUIPMENT AND FURNITURE GRANT
104 EXPENDITURE ON LOCAL DIRECT COSTS OF RESEARCH
105 COSTS OF ESTABLISHING UNIVERSITY COMPANIES
106 TOTAL MISCELLANEOUS EXPENDITURE
Sum of heads 99 to 105

(vi) Premises

107 CENTRAL ADMINISTRATIVE/CULTURAL FACILITIES
a. Rates
b. Rents
c. Insurance
d. Heat, Light, Power, Water
e. Cleaning and custodial services
f. Repair and maintenance
g. Payments to medical authorities
h. Other premises expenditure
108 CENTRAL ACADEMIC FACILITIES
a. Rates
b. Rents
c. Insurance
d. Heat, Light, Power, Water
e. Cleaning and custodial services
f. Repair and maintenance
g. Other premises expenditure
109 TOTAL CENTRAL PREMISES EXPENDITURE
Sum of heads 107 and 108

110 TOTAL RECURRENT CENTRAL EXPENDITURE
Sum of heads 77+84+94+98+106+109

Capital Expenditure

111 EQUIPMENT
a. Purchase
b. Depreciation
112 FURNITURE
a. Purchase
b. Depreciation
113 COMPUTERS
a. Purchase of hardware
b. Purchase of software
c. Installation and networking
d. Depreciation
114 MAJOR BUILDING WORKS
a. New Buildings
b. Renovation and upgrading (minor works)
c. Depreciation
115 MINOR BUILDING WORKS (if capitalized)
116 TOTAL CENTRAL CAPITAL EXPENDITURE
Sum of heads 111 to 115

117 TOTAL CENTRAL EXPENDITURE
Sum of heads 110 + 116

(iii) The questionnaire sent to the industrial companies, research institutes and polytechnics

The questionnaire sent to industrial companies, research institutes and polytechnics was broadly similar to the one sent to universities except that it lacked the section on central expenditure and did not need to separate teaching from research. It was thus considerably shorter, having a total of 50 main heads divided into two sections (income and expenditure). It concluded with the same set of supplementary questions as the university questionnaire.

The questionnaire was made up as follows.

INCOME FOR RESEARCH

1 RECURRENT INCOME FOR RESEARCH FROM PARENT COMPANY/ RESEARCH COUNCIL/NAB
2 RETAINED NET PROCEEDS OF SALES OF BUILDINGS, LAND ETC.
3 RESEARCH GRANTS, CONTRACTS AND CONSULTANCY
   a. Grants from research councils
   b. Contracts from research councils
   c. From other UK central government bodies
   d. From UK local authorities
   e. From UK public corporations
   f. From other UK industry and commerce
   g. From UK-based charitable bodies
   h. From other UK sources
   i. From overseas
4 INCOME FROM THE MANPOWER SERVICES COMMISSION FOR SPECIAL EMPLOYMENT MEASURES (YTS)
5 OTHER SERVICES RENDERED
   a. For special and short courses (from all sources)
   b. For specialist services e.g. analytical, safety, patenting
   c. Use of equipment
   d. Other
6 CAPITAL INCOME FOR RESEARCH
7 TOTAL INCOME
   Sum of heads 1 to 6

EXPENDITURE ON RESEARCH

Salaries and Wages

8 RESEARCHERS
9 SENIOR ADMINISTRATORS
10 CLINICAL STAFF
11 TECHNICAL STAFF
   a. Technicians—professional and technical grades
   b. Scientific officers
   c. Computer operators
   d. Animal attendants
   e. Gardeners, farm workers
   f. Tradesmen
   g. Others e.g. photographers
12 SECRETARIAL AND CLERICAL STAFF
   a. Secretaries, clerical staff, data processors

b. Library/museum staff
c. Others

13 OTHER STAFF e.g. porters, security staff, cleaners (weekly paid staff)
14 ALL RESEARCH AND RESEARCH SUPPORT STAFF (sum of heads 8 to 13)
15 PAYMENTS TO NON-CONTRACTED STAFF
16 LONDON ALLOWANCES
17 MSC SPECIAL EMPLOYMENT MEASURES (YTS)
18 STAFF NOT DIRECTLY SUPPORTING RESEARCH
19 TOTAL PAY EXPENDITURE
Sum of heads 14+15+16+17+18

Non-Pay Recurrent Expenditure
(i) Buildings

20 PREMISES excluding those included in heads 21, 22 and 23
a. Rates
b. Rents
c. Insurance
d. Heat, Light, Power, Water
e. Repairs and maintenance
f. Other
21 GLASSHOUSES AND CONTROLLED ENVIRONMENTAL FACILITIES
a. Premises
i Rates
ii Rents
iii Insurance
iv Heat, Light, Power, Water
v Other
b. Consumables
22 ANIMAL HOUSES
a. Premises
i Rates
ii Rents
iii Insurance
iv Heat, Light, Power, Water
v Other
b. Animal treatments e.g. vaccines
c. Other direct charges

(ii) Facilities

23 DEPARTMENTAL COMPUTER FACILITIES
a. Installation and networking (if not capitalized)
b. Service contracts
c. Repair and maintenance including software maintenance
d. Purchase of software (if not capitalized)
e. Licensing fees
f. Running costs
i Processor time
ii Consumables
g. Training on system
h. Premises
i Rates

ii Rents
iii Insurance
iv Heat, Light, Power, Water
v Other e.g. repair and maintenance

24 INFORMATION SERVICES
a. Books, periodicals and other documents
b. Inter-library loans
c. Reprographics
d. Online searches of databases
e. Educational publications e.g. research reports
f. Non-educational publications
g. Binding
h. General advertising
i. Subscriptions and contributions to learned societies and similar bodies

25 PATENTING COSTS

26 GENERAL FACILITIES AND AMENITIES
a. Personnel
i Recruiting
ii Industrial liaison
b. Education and training
c. Maintenance of athletics and other recreational facilities
d. Health services
e. Surpluses/deficits from catering and residence accounts
f. Staff clubs and associations

27 OTHER FACILITIES AND AMENITIES

(iii) Materials

28 FINE CHEMICALS (Pharmaceuticals only)
29 PROTECTIVE CLOTHING
30 DESIGN AND MANUFACTURE OF COMPONENTS
31 OTHER CONSUMABLES
32 MINOR ITEMS OF EQUIPMENT AND FURNITURE
33 MAINTENANCE AND REPAIR OF EQUIPMENT
34 SERVICE CONTRACTS
35 PHOTOCOPYING

(iv) Other Recurrent Expenditure

36 TRAVELLING AND SUBSISTENCE
a. Conferences
b. Field trips
c. Exchange and other visits

37 ACADEMIC LIAISON
38 FINANCIAL MANAGEMENT AND ACCOUNTANCY
39 PENSIONS
40 OTHER ADMINISTRATIVE COSTS
41 COSTS OF ADMINISTERING RESEARCH AT ORGANIZATION'S/RESEARCH COUNCIL'S HEADQUARTERS
42 EXPENDITURE ON LOCAL DIRECT COSTS OF RESEARCH
a. Research council contracts
b. Other research grants and contracts
c. Other services rendered

43 ANY OTHER RECURRENT EXPENDITURE
44 FLOORSPACE

45 TOTAL NON-PAY EXPENDITURE
Sum of heads 20 to 43

Capital Expenditure

46 MAJOR BUILDING WORKS
a. New building
b. Renovation and upgrading
c. Repair (if capitalized)
d. Depreciation
47 EQUIPMENT AND FURNITURE
a. Equipment
i Purchase
ii Major repair and maintenance
b. Furniture
c. Depreciation
48 COMPUTERS
a. Purchase of hardware
b. Installation and networking
c. Major repair and maintenance
d. Purchase of software
e. Depreciation
49 TOTAL CAPITAL EXPENDITURE
Sum of heads 46+47+48

50 TOTAL EXPENDITURE
Sum of 19+45+49−18

ANNEX B: METHODOLOGY FOR DIVIDING CENTRAL EXPENDITURE BETWEEN TEACHING AND RESEARCH AND ALLOCATING TO DEPARTMENTS

The division of departmental expenditure between teaching and research is outlined in chapter 2. In this annex we describe our approach to dividing central expenditure. It will be seen that in many cases individual approaches had to be developed for particular items. Despite the heavy reliance on pro-rating techniques rather than direct measurement, respondents generally regarded our methodology as acceptable.

This annex follows the structure of the university questionnaire described in annex A. Where appropriate, specific approaches were devised for individual items as described below. Otherwise, we pro-rated by numbers of academic and related (A&R) staff (i.e. heads 22 + 23 + 24) and postgraduate (pg) research students (head 25), or by floorspace:

$$\frac{\text{FTE A\&R staff + pg research students in the department}}{\text{FTE A\&R staff + pg research students in all academic departments}} \quad \text{... (A)}$$

$$\frac{\text{Floorspace in department}}{\text{Floorspace in all academic departments}} \quad \text{... (B)}$$

Respondents generally followed the methodology that we suggested. Some used their own methodology for particular items; the more significant variations are noted below.

Head 72 (a). LIBRARIES salaries and wages

We suggested two possible approaches here.

Method 1

(i) From the return to the Standing Conference on National and University Libraries (SCONUL), calculate the average cost of employing a member of staff in the library:

$$\frac{\text{Salaries expenditure}}{\text{Total number of library staff}}$$

(ii) Calculate the average number of FTE A&R staff and FTE students supported by each member of the library staff.

(iii) Identify numbers of FTE A&R staff and FTE students in the department.

(iv) Calculate the library salaries costs that should notionally be allocated to the academic department i.e.

$$\frac{\text{No. of FTE A\&R staff FTE students in dept.}}{\text{(Av. no. of A\&R staff + students) per member of library staff}} \times \text{Av. cost of member of library staff}$$

(v) Apportion to research in the department on the basis of:

$$\frac{\text{50\% of FTE A\&R staff + total FTE pg research students in dept}}{\text{Total no. of FTE A\&R staff + FTE students in dept}} \quad \text{... (C)}$$

Method 2

(i) Apportion total salaries expenditure to research on the basis of:

$$\frac{\text{50\% of total A\&R staff in univ + total FTE pg research students in univ}}{\text{100\% of total A\&R staff in univ + total FTE students in univ}} \quad \text{... (D)}$$

(ii) Allocate the research element calculated in step (i) to the department on the basis of formula (A).

Most respondents used method 2. When no split was provided, we apportioned pay costs in the same ratio as all non-pay costs combined (heads 72 b - h).

One respondent commented that dividing library pay costs 50:50 between teaching and research would be as good as anything: he thought formula (C) gave too much weight to undergraduates and taught postgraduates.

Head 72 (b - h). LIBRARIES non-pay items

(i) Apportion non-pay expenditure to teaching and research as follows:

Books	– Teaching
Periodicals	– Research
Other documents	– Research
Inter-library loans	– Research
On-line searches	– Research
Binding	– Research
Other	– Research

(ii) Use formula (A) to allocate to the department the types of expenditure allocated to research in (i).

Head 73. MUSEUMS AND OBSERVATORIES

There were none associated with research in the departments we were studying. All central expenditure was therefore apportioned to teaching.

Head 74. CENTRAL EDUCATIONAL COMPUTERS

Apportion salaries and wages in the same way as for libraries (head 72 (a)), *mutatis mutandis*. Most respondents again used method 2; one used direct usage data. Apportion non-pay items *pro rata* to pay costs.

One respondent noted that there were great variations between departments in their usage of central computing facilities.

Head 75. CENTRAL EDUCATIONAL TECHNOLOGY UNITS

Apportion salaries and wages between teaching and research *pro rata* with the division of academic & related staff time. If records of direct usage are available, allocate accordingly; otherwise allocate the research element to the department by formula (E):

$$\frac{\text{FTE A\&R staff in department}}{\text{FTE A\&R staff in all departments}} \quad \text{... } \mathbf{(E)}$$

Head 76. OTHER ACADEMIC FACILITIES AND SERVICES

As for head 75.

Head 78. EXAMINATIONS

Calculate the research element by formula (F):

$$\frac{\text{FTE pg research students in the university}}{\text{Total FTE students in the university}} \quad \text{... } \mathbf{(F)}$$

Allocate to the department by formula (G):

$$\frac{\text{FTE pg research students in the department}}{\text{Total FTE pg research students in the university}} \quad \text{... } \mathbf{(G)}$$

Head 79. INFORMATION PRESENTATION

Apportion all expenditure to teaching.

Head 80. TRAVELLING AND SUBSISTENCE

As for head 75.

Head 81. SUBSCRIPTIONS

Apportion all expenditure to teaching.

Head 82. NON-DEPARTMENTAL RESEARCH PROJECTS

Apportion all expenditure to research. Allocate to the department by formula (E).

Head 83. STUDENT RECRUITMENT EXPENDITURE

Apportion the cost of the postgraduate prospectus (if identifiable) to research. Apportion the cost of recruitment and administration of overseas students to research by the following formula:

$$\frac{\text{FTE overseas pg students}}{\text{Total FTE overseas students}}$$

Allocate to departments by formula (G).

Head 85. ADMINISTRATIVE STAFF SALARIES

(i) *Administrative staff supporting both teaching and research*

Apportion to research by formula (D). Allocate to the department by formula (A).

One respondent commented that formula (D) underestimated the research element.

(ii) *Registry staff*

Apportion to research by formula (F). Allocate to the department by formula (A).

(iii) *Administrative staff involved almost exclusively in teaching or in research*

Apportion according to function. Allocate to the department by formula (A).

Heads 86 – 91, 93. ADMINISTRATIVE COMPUTER EXPENDITURE, MINOR ITEMS OF EQUIPMENT AND FURNITURE, MINOR MAINTENANCE AND REPAIR OF EQUIPMENT, STATIONERY AND OFFICE MATERIALS, PUBLICATIONS, GENERAL ADVERTISING, OTHER

Apportion to research in the same ratio as the teaching/research split of pay costs in the finance department. Allocate to the department by formula (A).

Head 92. INDUSTRIAL/ACADEMIC LIAISON COSTS

Apportion to teaching or research according to function. For example, liaison over sandwich course placements counts as teaching, while CASE studentships and collaborative research count as research. Allocate to the department by formula (E).

Head 95. STUDENT FACILITIES AND AMENITIES

Apportion to research by formula (F). Allocate to the department by formula (G).

Head 96. GENERAL FACILITIES AND AMENITIES

Apportion the accommodation office to research according to the teaching/research split of floorspace in the department (head 51). Apportion personnel, staff education and training and

support for staff clubs and associations in the same ratio as the teaching/research split of pay costs in the finance department. Apportion maintenance of athletics and other recreational facilities, university health services and surpluses/deficits from catering and residence accounts by formula (D). Allocate research costs thus apportioned to the department by formula (A).

Head 97. OTHER FACILITIES AND AMENITIES

Apportion all expenditure to teaching.

Heads 99, 100. CAPITAL EXPENDITURE FROM REVENUE; FINANCIAL MANAGEMENT

Apportion to research in the same ratio as the teaching/research split of pay costs in the finance department. Allocate to the department by formula (A).

Head 101. PENSIONS

Allocate directly to research in the department on the basis of the functions previously performed by those in receipt of pensions.

Head 102. OTHER MISCELLANEOUS EXPENDITURE

Apportion to research in the same ratio as the teaching/research split of pay costs in the finance department. Allocate to the department by formula (A).

Head 103. TRANSFER TO EQUIPMENT AND FURNITURE GRANT

Allocate directly.

Heads 104, 105. EXPENDITURE ON LOCAL DIRECT COSTS OF RESEARCH; COSTS OF ESTABLISHING UNIVERSITY COMPANIES

Apportion all expenditure to research. Allocate directly all specific expenditure associated with research in the department. Allocate any general expenditure by formula (A).

Head 107. CENTRAL ADMINISTRATIVE AND CULTURAL FACILITIES

If the information is available, apportion to research on the basis of the floorspace used by central administration staff in supporting the research effort in departments. Otherwise apportion in the same ratio as the teaching/research split of pay costs in the finance department. Allocate to the department by formula (A).

Head 108. CENTRAL ACADEMIC FACILITIES

Apportion to research in the same ratio as for library pay costs (head 72 (a)). Allocate to the department by formula (A).

Head 111 – 115. CAPITAL EXPENDITURE

Apportion to research in the same ratio as the teaching/research split of pay costs in the central computing section (head 74). Allocate to the department by formula (A).

ANNEX C: DEFINITIONS

TERM & REFERENCE	UNIVERSITY SECTOR	OTHER SECTORS
Capital expenditure (figure 4, 19)	Capitalized expenditure on buildings, equipment, furniture and computing, both departmental and central; excludes depreciation *Heads 58 and 116*	Capitalized expenditure on buildings, equipment, furniture and computing; excludes depreciation *Head 49*
Computers (figure 12)	Departmental computer facilities, central educational computers and administrative computer costs. Excludes pay costs of departmental computer operators (Head 26(c)) *Heads 38, 57, 74, 86, 113*	Excludes pay costs of computer operators (Head 11(c)) *Heads 23, 48*
Education and training (figure 15)	Covers only training funded from the central budget; excludes e.g. on-the-job training on computers and informal training not explicitly budgeted *Head 96 (c)*	*Head 26 (b)*
Expenditure, central (table 1)	Expenditure incurred centrally and allocated to the department *Head 117*	N/A
Expenditure, total (figure 3)	Includes capital and recurrent, departmental and central *Heads 59, 117*	Includes capital and recurrent *Head 50*
External income (figure 2)	Income from non-UGC sources, i.e. 'specific recurrent income' *Heads 9 to 12*	Income other than from parent body *Heads 3 to 5*
Indirect expenditure (figure 9)	All expenditure except the salary costs of departmental researchers and support staff. Includes central expenditure	All expenditure except the salary costs of researchers and support staff
Information services (figure 13)	Departmental and central libraries and museums, including salary costs but excluding premises costs *Heads 27(b), 34, 35, 72, 73*	Library services, including salary costs but excluding premises costs *Heads 12(b), 24*

Materials and equipment (figure 11)	Recurrent: Consumables, non-capitalized equipment and furniture, minor maintenance, photocopying *Heads 39 to 47, 87 to 90* Capital: Capitalized equipment and furniture *Heads 56, 111, 112* Excludes computers	Recurrent: Consumables, non-capitalized equipment and furniture, minor maintenance, photocopying *Heads 28 to 35* Capital: Capitalized equipment and furniture *Head 47* Excludes computers
Pay expenditure, researchers (figure 6)	Pay costs of all staff in 'researcher' category at departmental level *Heads 22 to 24*	Pay costs of all staff in 'researcher' category *Heads 8 to 10*
Pay expenditure, support staff (figures 7, 8)	Pay costs of all support staff at departmental level. Excludes allocated costs of centrally employed staff on similar grades *Heads 26, 27*	Pay costs of all support staff. Includes any costs incurred centrally and allocated to heads 11 or 12 rather than 18 *Heads 11, 12*
Pay expenditure, total (figure 5)	Pay costs of all departmental staff, and central staff allocated to the department, apportioned according to time spent on research *Heads 33, 72a, 73a, 74a(i), 75a, 85*	Direct + allocated pay costs *Head 19*
Premises (figure 16)	Recurrent: rent, rates, power, insurance, etc; minor building & maintenance; costs of glasshouses and animal houses *Heads 36, 37, 50/51, 99a + b, 107, 108* Capital: Building works (excluding depreciation) *Heads 55, 114, 115*	Recurrent: rent, rates, power, insurance, etc; maintenance (excluding salaries); costs of glasshouses and animal houses *Heads 20, 21, 22, 23h* Capital: Building works (excluding depreciation) *Head 46*
Recurrent expenditure (figures 11 – 16)	All expenditure other than capital expenditure	All expenditure other than capital expenditure
Researcher (nearly all figures)	All staff of PhD or equivalent status on academic and related scales. Includes senior administrative staff. Excludes PGRAs. *Heads 22 to 24*	Analogous definition. In polytechnic sector only PGRAs are included as 'researchers'. *Heads 8 to 10*
Secretarial & clerical staff (figure 8)	Secretaries, clerical staff, data processors, library/museum staff, receptionists etc at departmental level directly supporting research *Head 27*	Secretaries, clerical staff, data processors, library/museum staff, receptionists etc directly supporting research *Head 12*

Support staff (figure 18)	Technical staff and secretarial & clerical staff at departmental level directly supporting research *Heads 26, 27*	Technical staff and secretarial & clerical staff directly supporting research *Heads 11, 12*
Technical staff (figure 7)	Technicians, scientific officers, PGRAs, computer operators, animal attendants etc at departmental level directly supporting research *Head 26*	Technicians, scientific officers, graduate assistants, computer operators, animal attendants etc directly supporting research *Head 11*
Total non-pay expenditure (figures 10, 20)	Total expenditure minus total pay expenditure	Total expenditure minus total pay expenditure
Travel (figure 14)	Departmental and central expenditure on travel and subsistence *Heads 48, 49, 80*	Travel and subsistence *Head 36*

ANNEX D: POLYTECHNICS

It was our intention when designing this study to include a selection of polytechnic departments known to be particularly active in research. We invited six polytechnics to participate, and five initially agreed to do so; eventually, two (both in chemistry) provided reasonably complete returns. However, neither of these returns was completed on a comparable basis to those of the other respondents, and to include them in the analysis of data presented in chapters 3 and 4 would be seriously misleading. So they are presented separately here instead.

There are two further reasons for separating the polytechnic data from the main body of our text. One is that the Polytechnics and Colleges Funding Council (PCFC) is publishing a major review of research in the PCFC sector, which it started after our project was launched. This includes data from a survey of the nature and extent of research funding. Our own data are unlikely to add much to the PCFC report. The second reason is that our data are based on a premise that is formally correct but in practice inaccurate: that, apart from special initiatives, long-term academic staff in polytechnics are paid to teach, not to research. Neither of our two polytechnic respondents included any element of the pay costs of academic staff in calculating their expenditure on research. The data are therefore underestimated by a substantial amount, if one assumes that long-term staff do in fact devote a portion of their time to research.

A corollary is that the definition of 'researcher' used for the other sectors breaks down when applied to our polytechnic data. Our polytechnic data can be analysed only if postgraduate research assistants are included as researchers – which obscures comparison with the other sectors.

Since virtually all the results in chapters 3 and 4 are presented in terms of total expenditure, total recurrent expenditure, total pay expenditure or expenditure per researcher, there is little one can do to put the polytechnic data on the same footing as the rest of our report. There are, however, two observations that may be made. One is that polytechnics clearly do attract useful amounts of external funding for research. One of our respondents, for example, secured £25K from research councils, £75K from UK central government bodies and £17.5K from industry; this compared with £21K from the National Advisory Body under its Research Selective Initiative. The second observation is that infrastructure resources in support of research – notably technical support staff, computers and premises expenditure – appear to be markedly sparser in polytechnics than in universities.

More detailed analysis of the structure of research expenditure in polytechnics would require acceptance of the view that research is a legitimate core activity for a polytechnic and thus a legitimate charge on core funds. It would also require development of a methodology for identifying what portion of core funds, at both departmental and central level, was used for research. This could be the methodology we have used for the university sector, or some variant of it.

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