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Policy Study No. 6

THE CONTRACT RESEARCH BUSINESS IN THE UK

SCIENCE AND ENGINEERING POLICY STUDIES UNIT

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of

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FOREWORD

This report into the dynamics of the contract R&D marketplace will be of interest to three particular groups of practitioners and policymakers: those that undertake contract R&D; current (or potential) customers of contract R&D; and the policy makers influencing the contract R&D marketplace.

The study identifies important changes taking place within the UK contract R&D marketplace. It highlights the role of UK Government policies and their effects on the R&D network (including the move away from funding of near-market research contracts, the consequences of the needs-driven shift of many HEIs from traditional research to consultative development and the ability of the Government to ensure an open 'level playing field'). Such issues are of great significance, both to the players within the contract R&D marketplace and the overall effectiveness of 'UK Limited'.

Other important factors include the considerable broadening of the technical scope of the performers of contract R&D, the novel alliances now being developed, the major push towards collaborative research on the part of the UK Government and the CEC, the increasing number of organizations taking the opportunity to offer out their facilities and the rise in trans-national activity.

A clear conclusion of the report is that the UK is well served by its domestic contract R&D industry. However, growth of this domestic engine of wealth creation is being stimulated by international rather than UK based industry and the implications are that 1992 will increase this trend. Unless UK industry similarly takes proper advantage of the R&D services available this could lead to deterioration of Uk industry's technological capabilities. The report offers perspectives which appropriate Goverment and industrial strategists may wish to incorporate into future thinking.

Dr Ian Nussey F.Eng.
Chairman, SEPSU Management Board

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A study of this sort would be impossible without the willing cooperation of many people: those who completed questionnaires, those who set aside time to be interviewed and to show us round their organizations, those who gave us expert advice. I am most grateful to all concerned.

The Confederation of British Industry much facilitated our enquiries among the industrial customers for contract research by conducting a questionnaire survey of a sample of its members.

The study was financed mainly by SEPSU itself from core funding received from The Royal Society, The Fellowship of Engineering and industrial and commercial sponsors. In addition, a grant was received from the European Commission under the MONITOR/SPEAR programme to cover analysis of the extent to which the market for contract research is becoming Europeanized.

Finally, I should like to thank all my colleagues in SEPSU for their support during the study.

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This study was undertaken to highlight a sector of research and development (R&D) capability within the UK that has remained rather in the background. As our report shows, the UK has a large body of organizations able and willing to undertake contract research. These organizations are, in general, well established and technically sophisticated with close links with UK (and overseas) industry. They are well placed to disseminate new technologies rapidly and effectively to a wide industrial base.

The study set out to examine the market for contract research—both the organizations that provide such services and their customers. We did not include Ministry of Defence (MOD) procurement spend, nor did we include the large amount of contract work undertaken by industry for industry, although this is touched on in chapter 4. We concentrated on the major contract research organizations (CROs) in the UK, such as the member organizations of the Association of Independent Research and Technology Organizations (AIRTO) and similar bodies.

Size of the market

Contract R&D activity in the UK, as undertaken by the major R&D contract organizations, was estimated to be worth about £670M in 1988/89. This excluded contract R&D performed by industrial companies for the MOD and other government departments and for other industrial companies. Indications are that the market is expanding, and will continue to do so over the coming years.

CROs

UK CROs believe they are world experts in particular fields, and undertake a significant amount of overseas work. Most CROs expect to increase such work as the Single European Market (SEM) develops.

There has been a distinct move from the 'master—servant' type of contract R&D (where the customer told the CRO exactly what work was required) towards a more equal partnership between the CRO and customer. Because of their broad and intimate industrial contact base, many CROs now act as technological management consultants rather than 'simple' technical problem solvers, and have developed a range of services to make optimum use of such skills.

HEIs

UK Higher Education Institutions (HEIs) are becoming increasingly involved in the contract R&D market. Some are developing full-time commercial activities, while others are 'testing the water' and have yet to decide how far to engage in competitive contract R&D.

While welcoming HEI interest in industry, many industrial R&D managers are concerned that the HEIs are moving too far towards industry at the cost of diminishing their effectiveness as truly innovative basic research centres and possibly leaving a 'research gap' in future years. CROs, and many industrial companies, have close links with HEIs, which they see as essential for bringing technological innovation into industry. The CROs in particular see part of their role as ensuring that the technology flow from academia to industry is enhanced where possible—in their view for the benefit of the academic institutions, industry and themselves.

Government laboratories

In a similar way, Government R&D laboratories are looking to contract R&D as a method of increasing revenue. At present contract revenue from industry is, in general, not large, but there is evidence that it is increasing.

The effects of the Next Steps Initiative on Government laboratories is an issue that is attracting considerable attention. At present some 50 agencies have been set up (with another 18 under consideration). This includes most, if not all, of the Government's R&D laboratories. The Initiative aims to increase the effectiveness and efficiency of the Civil Service, and to provide a better service to the public. There is some evidence that in this strive for efficiency R&D facilities/services are being offered on a more commercial basis. In time will government agencies be competing against established CROs?

Customers

Industrial companies appear to be making increasing use of the various performers of contract R&D as a way of deploying their R&D resources more efficiently. There are several reasons for this. A major reason is the high cost of developing the wide spectrum of technology an individual company requires to compete in today's global markets. Many companies now concentrate their in-house effort on their main technological area, and buy in additional expertise as and when necessary. In the pre-competitive stages companies often look to club-type research projects where costs are shared.

Some industrial companies now offer out their own R&D expertise on a contract basis. This helps to increase revenue from an expensive piece of otherwise under-used equipment, and often acts as an additional service for their main customers. Specialized development work for such customers, on a contract or collaborative basis, may allow products to be developed jointly, which the first company is then ideally placed to produce.

Many industrial companies note that with the development of the Single European Market they will be looking further afield for expertise to contract, and that they will require 'on the spot' facilities in new export markets.

Single Market issues

UK CROs are already active in European (and global) markets, and they see the Single European Market as facilitating access. In general they do not expect significant increased competition from other Member States. However, some CROs are concerned that there will not be a 'level pitch' on which to compete. In many of the EC States considerable government money is directed at industrial innovation and technology transfer and UK CROs are worried about unfair competition.

Staff mobility and retention are an increasing concern for the CROs. High quality technical staff appear to be in short supply, and some CROs report difficulties in recruiting staff. A number believe such difficulties will increase if the standard of living for scientists and technologists became noticeably better in other Member States. At present only small numbers of non-UK EC technical staff are employed in UK CROs; numbers are expected to increase slowly after 1992.

Many CROs believe there will be an overall increase in the need for standards and quality assurance, as companies enter new markets. Some CROs are active in developing higher standards for the future.

Many CROs see a large new market if public procurement in the EC opens up to the extent it is expected.

Both CROs and industrial companies are involved in EC R&D programmes. Some point to examples of economic benefit from this involvement, either directly from the technology developed, or from further work or ventures with partners. Virtually all those involved report that they have gained enhanced contact with the partner organization. In the majority of cases there has been continued informal liaison with partners, but there is also evidence of continuing collaborative ventures.

There are, however, problems with being involved in these programmes. It takes considerable time and effort to set up a project with partners in different countries, with no guarantees that the projects will eventually qualify for EC funding. Bureaucratic procedures are regarded as unnecessarily cumbersome. However, most managers regard themselves as being on a learning curve, and most agree they are likely to become involved in future programmes.

Highlights

The UK contract research market is a well established, and apparently healthy market. However, it is continually evolving, and those closely involved draw attention to a number of concerns:

- the European Community needs to ensure a fair, open and level 'playing field' for R&D services;
- HEIs need to decide how best to increase industrial revenue, and assess precisely how this will affect their role;
- the effects of the Next Steps Initiative on government laboratories;
- recruitment of qualified scientists and engineers is a problem that is expected to increase rather than ease.

CHAPTER I: INTRODUCTION

(i) Outline

In chapter I we introduce the contract research and development (R&D) market in the UK and define the boundaries of the study. Brief comments on previous studies of this market are included.

(ii) Background

Historical setting

The UK has a long tradition of collaborative or cooperative research organizations focused on industrial needs. Some have been geared to particular industrial sectors, others to a particular technological base. Research Associations (RAs), with a membership format, have been in existence since the 1920s, and a number of independent organizations since before then. These organizations have flourished, and withered, along with the fortunes of British industry during the century, and have evolved greatly from their original forms.

Technological innovation

Industrial need for technological innovation is increasing, as competition from all sources increases. Over the last decade British Industry has undergone, and continues to undergo, considerable upheavals, spurred in no small part by technological innovation (be it by U.K. industry or overseas competitors). Throughout this period there has been, both in U.K. industry and government, an emphasis on increased efficiency and profitability. This ethos has swept across the whole industrial spectrum, and its effects can be clearly seen in the contract research market.

Organizations willing to undertake contract research

This striving for efficiency has led to many changes. In the contract research organizations (CROs) themselves the number of services offered and the quality of the services have, according to many CRO managers, noticeably increased, partly also driven by increased competition and higher customer expectations. Universities and other higher education institutions (HEIs) have been under considerable financial constraints and are looking to making the best use of their expertise. One method is to offer such expertise, on a commercial basis, to paying customers. Government laboratories, under similar pressures, are looking (to varying extents) to paying customers to ensure efficient use of facilities, and increased revenue, without losing their main aims of providing Government with national expertise. With the privatization of many state industries a number of well-founded laboratories now operate on cost centre lines, and within truly commercial organizations. One method of retaining such facilities is to ensure that, when appropriate, they carry out profitable work for external customers. In addition, some private industrial concerns, which require well-founded R&D laboratories in-house, have looked to contracting out such facilities as a method of helping retain them.

This is not to suggest that such activity did not go on before, or that all examples of the above organizations are undertaking contract research (indeed much collaborative/joint work takes place with partner companies in similar fields), but the overall trend is towards many more organizations now able, and actively seeking, to undertake contract R&D of some form.

The study

Our study therefore set out to look at the changing dynamics of the contract R&D business in the UK, from the perspective of both the performers of, and the customers for, contract R&D. Why do industrial companies contract out R&D, rather than undertake work in-house, or collaborate with CROs or other industrial or governmental bodies? Who undertakes this contract R&D, and what sort of work is undertaken? How has the UK contract R&D business changed and where is it headed?

(iii) Definitions

Contract R&D

We have defined the term 'contract research and development', for the purposes of this report, as work of an innovatory nature undertaken by one party on behalf of another under conditions laid out in a contract agreed formally beforehand. We have used this very broad statement to include work undertaken by government laboratories. Core funding from a government department to a laboratory within the department's own sphere has not been included (i.e. Department of Trade and Industry funding to the National Technology Centre (formerly the National Engineering Laboratory) or the National Physical Laboratory). However, government funding for specific projects is included as contract R&D when there is in principle a choice as to where the project is carried out. We have tried to include only those contracts that are open to competition.

However, we excluded the Ministry of Defence (MOD) spend on procurement, and made no attempt systematically to include the large amount of contract work undertaken in industry for industry, although where we came across examples of such activity it was noted (chapter 4). We therefore concentrated on those established CROs which derive a significant amount of their turnover undertaking contract research.

We specifically excluded organizations often referred to as 'testing houses', which undertake independent testing and accreditation services. Testing houses (of which there are some 10 000 in the European Community) may undertake applied development work, but few have the depth and breadth of the major CROs.

CRO

The acronym CRO covers a great variety of organizations in terms of turnover, staff employed, equipment, services offered, range of technology covered, customer base and organizational history. In the UK CROs can broadly be divided into two main types—those that are membership organizations of a non-profit making kind and those that are public limited companies.

We have concentrated on organizations that undertake R&D contracts, often as part of a wider technology based service. Much of the work undertaken by CROs in the UK is of a developmental, innovative, applied nature, although this is backed up by strategic research and is usually based on a long-standing relationship with the broad industrial base, or with particular industrial sectors.

(iv) Previous studies

Research Associations

In the early 1970s two comprehensive studies of Research Associations in the UK were undertaken, namely *Research Associations: the Changing Pattern*, by the Centre for the Study of Industrial Innovation (1972) and *Industrial Research and Development*, the Report of the Committee of Enquiry into the Research Associations 1972/3 (known as The Bessborough Report). Together these two studies produced a picture of the overall RA scene in the UK at this time.

The Rothschild Report

The studies are useful because they followed on the heels of the Rothschild Report (1971) which was to have profound effects on the way Government R&D was funded, and subsequently on the way CROs operated. The Rothschild Report introduced the customer/contractor principle, and Government departments became paying customers rather than providers of grants.

The effects of the Rothschild Report were highlighted in Kennedy et al. (1985) *Changes in the Research Associations over the decade 1972-1982.* This followed up the research undertaken for the Bessborough report and was a comparative study of 37 RAs. The results showed that RAs had, on the whole, moved towards rather than away from government funded projects and that most RAs had moved towards a broader technological base with wider industrial applications.

The European Community dimension

In 1989 the European Commission (DGXIII) published a report by a French group (Bossard Consultants) entitled *Contract Research Organizations in the EEC.* The report consists of two sections: the first describes the overall contract research market in 10 Member States and highlights the major differences between them (such as government support for such activities and CRO working practices); while the second part is a directory of some 130 CROs and includes considerable data on the amount and funding of contract R&D undertaken in each organization. The report provides a useful snapshot of the CROs and highlights the usefulness of such organizations within the European Community (EC). The report reveals a number of points, the most important being that 97% of contract R&D undertaken covered in the survey is carried out in only 5 States: France, Germany, Holland, Italy and UK. It is also clear that the level of governmental financial assistance given to individual CROs varies significantly between Member States. For example in the UK CROs receive no direct grant/subsidy, and only partial funding on projects deemed by the Government to be of a pre-competitive nature, whereas in Germany and Holland some CROs receive direct subsidies and, with support for particular projects, may receive over 50% funding from their respective Governments. In the light of the opening Single European Market this has considerable implications for competition policy, and is a problem that UK CROs wish to see addressed. This is highlighted in our own report.

European Association of Contract Research Organizations (EACRO)

The European Association of Contract Research Organizations (EACRO), recently set up with the encouragement of the European Commission, includes CROs from France, Germany, Italy, the Netherlands and the UK. It aims to raise the profile of European CROs and increase technology transfer through the Community. Membership is extended to organizations which are 'commercially independent of any industrial group or Government institution', and one of its aims is to 'defend the profession against unfair competition from establishments which practise contract research on a non-economic basis'.

The Association of Independent Research and Technology Organizations (AIRTO)

The Association of Independent Research and Technology Organizations (AIRTO) has in recent years become a voice for UK CROs, both in the UK and overseas. It produces a newsletter and an annual Technology Review, and undertakes annual data collection of its member organizations and is thus building up a useful bank of statistics.

Federation of European Industrial Cooperative Research Organizations (FEICRO)

AIRTO is the UK representative in the Federation of European Industrial Cooperative Research Organizations (FEICRO). This is a federation of national associations of technical centres and similar bodies engaged in cooperative research in Europe. One of its prime aims is the furtherance of R&D for industry, especially small and medium-sized enterprises. It also acts as a non-Governmental forum for communication with the European Commission and other European bodies on policy and technical issues.

Confederation of British Industry

Another source of information in the UK is the Confederation of British Industry (CBI); similar organizations in other Member States can provide data on their respective industrial bases for approximate comparisons. The CBI undertakes a number of studies, many on a regular basis, which enable trends to be defined over time. In particular *Innovation Trends 1990* (1991) is the second annual survey looking at the way British industry undertakes industrial innovation. The survey asks industrial companies (over 300) how and why innovation takes place, both for the current year and the expected effort for the following 12 months. It asks companies, for example, for the trend in their current and expected expenditure on the use of individual consultants, Government research organizations and cooperation with academics. A number of findings from the survey are of interest to this report, particularly a slight trend towards industrial collaboration rather than contracting of R&D. The results also showed encouraging signs that companies valued innovation and were continuing, on the whole, to invest despite the recent recession.

Future studies

Such studies give an interesting perspective to our report. In particular the CBI's Innovation Survey should give a valuable perspective with time of UK industry's views on innovation and the use of CROs and consultants within this. In addition further studies of the contract research business within individual Member States of the EC would highlight the commonality, and the differences, between States.

CHAPTER II: METHODOLOGY

(i) Outline

General approach

A questionnaire approach followed by interviews (in person, though sometimes by telephone) was the main method of collecting information. Data from annual reports and other, mostly published sources were used to substantiate questionnaire data. In addition, informal discussions at various meetings, seminars and similar events proved useful.

(ii) The contract research organizations (CROs)

The CROs

Our selection of CROs was based on the membership of the Association of Independent Research and Technology Organizations (AIRTO), though the sample also included organizations that were not AIRTO members, some government laboratories and a small number of Higher Education Institutions (HEIs).

Responses

Questionnaires were sent to 65 CROs within the UK. 9 explicitly declined to participate, 11 failed to reply, 8 replied partially, and 37 replied in full. The usable response rate was therefore 69% (45 of the 65 sent). The questionnaire is given in Annex B.

Interviews

Interviews were undertaken with 21 CROs during 1989/90, many of them being conducted with the Managing Director or Chief Executive. With the majority of CROs being (relatively) small organizations (rarely more than 200-300 staff) these executives have the ability to discuss both the technical laboratory projects and the changing market conditions.

A number of visits were made to HEIs and interviews were mainly conducted with the industrial liaison officer or the managers/directors of the university/polytechnic companies. Data on the amounts of contract R&D undertaken in this sector were obtained from various published sources.

(iii) The industrial customers

Customers' response

In spring 1989 1000 questionnaires were sent on our behalf by the CBI to a non-targeted selection of British industry (based on the Standard Industrial Classification List (SIC)). We received 138 replies, a response rate about normal for this type of such surveys. The responses covered 43 classes from the SIC. 10 classes had 5 or more respondents: the water supply industry, metal manufacturing, chemical industry, metal goods, mechanical engineering, electronics and electronic engineering, motor vehicles, food/drink/tobacco, footwear & clothing and other manufacturing.

Interviews

Interviews were conducted with 18 industrial companies, selected from those who responded to the CBI questionnaire. Interviews were mostly held at the company's premises, usually with the R&D manager.

Table 3.1 University research income from sources other than UGC/UFC (£K, cash terms)

	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
Research Councils	119168	135479	147453	162194	183976	187857	215516
1990 pounds (GDP deflator)	*171960*	*186868*	*193508*	*201985*	*221391*	*214449*	*229272*
UK Government	51523	58329	64301	75951	86329	93355	105372
1990 pounds (GDP deflator)	*74348*	*80454*	*84385*	*94584*	*103886*	*106570*	*112098*
UK Charities	n/a	n/a	57230	72757	93121	110009	132558
1990 pounds (GDP deflator)			*75105*	*90606*	*112059*	*125581*	*141019*
UK industry	27031	32664	47688	59315	68556	78632	93111
1990 pounds (GDP deflator)	*39006*	*45054*	*62583*	*73867*	*82498*	*89763*	*99054*
Other	65097	79409	36877	45803	56176	68444	92124
1990 pounds (GDP deflator)	*93935*	*109530*	*48395*	*57040*	*67600*	*78132*	*98004*
Total research grants and contracts *	262819	305880	353549	416020	488156	538296	638681
1990 pounds (GDP deflator)	*21*	*421903*	*463975*	*518082*	*587432*	*614493*	*679448*

Source: USR University Statisitics, vol 3
Notes: Complete breakdown of income not available before 1984/85.
* All disciplines combined: income figures for science and engineering only are not readily available.

Universities Funding Council, UFC) over recent years.

In 'real' terms as measured by the GDP deflator, total income from research grants and contracts increased by 10.2% p.a. between 1982/83 and 1988/89. From 1984/5 to 1988/89 income has risen particularly rapidly from UK charities (by 17.1% p.a.) and from UK industry (by 16.8% p.a. (1982/83 – 87/88)).

As one would expect, much of the university income is in the form of research grants from the Research Councils and charities that are outside our terms of reference. Of total external income approximately £200 M is attributable to science and technology in 1988/89. Part of this £200M will have been in the form of grants rather than contracts as defined in this study, and part of the contract income will have been for fairly routine work rather than innovatory R&D. Just how large a part is not known. *A reasonable estimate would put the income received by UK universities in 1988/89 for contract R&D in science and technology disciplines, as defined in this study, at around £140M—£150M.*

Universities also organized £71M worth of special short courses in 1988/89, some related to industrial training. Although this is not contract R&D it is a measure of the saleability of university equipment and personnel. Experts used for training purposes may also be used for contract research.

The above figures refer only to the university sector in the UK. They do not reflect the substantial industrial connections of polytechnics and colleges. The Polytechnics and Colleges Funding Council (PCFC) has recently carried out a review of research in the PCFC sector. This found that *PCFC institutions carried out a total of £80M of research in 1988/89, of which about £30M was contract research for industry within the meaning of this study.*

(v) Research Councils

UK Research Councils run a number of specialist laboratories, which, like the universities, have found themselves under pressure to increase revenue from external sources where possible. Again a variety of services are being developed—the hiring of technical equipment, licensing/patenting of research ideas, and consultancy and commercial contract R&D. The proportion of income generated by the Research Councils' institutes from such external sources is growing, and the growth looks set to continue in future years.

Table 3.2 analyses Research Council income by source. Core funding for the Research Councils is ultimately from the DES, but they also attract a considerable amount of additional earned income, both from other Government departments and industry. Much, though not all, of this will be earned from contract research within the meaning of this study.

For all five Research Councils combined, 'earned' income in cash terms was £130M in 1988/89. As with the HEIs, it is difficult to estimate just what portion of external research income should be counted as contract research. *It would seem reasonable to give figures of £100M in 1987/88, and over £100M in 1988/89, for the income received by research councils from external sources for contract R&D.*

(vi) Government research laboratories

Department of Trade and Industry

The DTI runs five main laboratories, with a combined turnover in 1988/89 of £90M:

	Staff	*Budget*
Lab. of the Government Chemist	340	£11M
National Engineering Laboratory (now National Technology Centre)	580	£23M
Warren Spring Laboratory	300	£12M
National Physical Laboratory	800	£42M
National Weights + Measures Laboratory	50	£ 2M
Total	2070	£90M

The role of all DTI laboratories was reviewed in the light of the 1988 Enterprise Initiative. This Initiative led to a move away from government funding of near market research (seen as the role of industry) towards funding of only pre-competitive, collaborative research. The NEL was at this time undertaking considerable amounts of industrial-led research, with support mainly from direct government funds plus other government sources, even though as noted, much of the work was of direct relevance to industry. It was therefore decided such work should be financed wholly by industry. After unsuccessfully attempting to sell NEL to the private sector, the DTI decided instead to convert it to 'agency' status, as defined under the Next Steps Initiative.

Government Agencies are run by a Chief Executive, who works to agreed set targets and limits imposed by the relevant Government department. However, the day to day running, and how these targets are achieved, are in the hands of the Chief Executive. One of the guidelines is the amount of income derived from external contracts—apparently set at a general level of 10% of turnover, although this can vary.

Many of the Government laboratories now have, or are moving towards, agency status. On the whole these laboratories are undertaking government-funded work for the public benefit. However, it is also true that some are under the same pressures as HEIs, looking to increase revenue from wherever it can be generated. In future such agencies may be given more freedom.

At present the limit of 10% would imply that the DTI laboratories carry out not more than £9M of contract work per year. Less than half of this—say £4M—would be contract R&D within the terms of this study.

Ministry of Defence

In recent years there has been a considerable opening up of MOD R&D resources for civil industrial use. In February 1988 the Civil Industrial Access Scheme was launched to publicize MOD facilities and arrange for industrial contracts and collaborations to be set up with MOD laboratories. In addition, Defence Technology Enterprises (DTE) was set up, with the aim of disseminating appropriate scientific and technical advances made in MOD establishments to industry. This, however, has failed to meet expectations.

Following the Next Steps Initiative the five non-nuclear research establishments (Admiralty Research Establishment, Chemical

Table 3.2 Research Council income by source (£K, cash terms)

	1980/81	1981/82	1982/83	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
AFRC									
Total commissions/contributions	41096	48387	53166	56268	58013	60984	58860	57810	52991
Total receipts	78573	90321	96790	102108	104693	113709	116009	112706	114103
1990 pounds (GDP deflator)	*141719*	*148376*	*148296*	*149469*	*146001*	*150508*	*148509*	*136939*	*129418*
ESRC									
Total commissions/contributions	367	299	254	292	473	339	425	823	1324
Total receipts	20586	20955	20905	22732	22452	23926	24245	25686	28338
1990 pounds (GDP deflator)	*37130*	*34424*	*32029*	*33276*	*31311*	*31669*	*31037*	*31209*	*32142*
MRC									
Total commissions/contributions	20197	5047	5491	6061	6575	6855	7556	8408	12315
Total receipts	92934	106571	112993	119770	123727	129165	137597	149967	164238
1990 pounds (GDP deflator)	*167621*	*175070*	*173121*	*175323*	*172545*	*170966*	*176144*	*182211*	*186283*
NERC									
Total commissions/contributions	24778	27564	24200	21732	21574	22967	30779	28428	31479
Total receipts	74859	86598	87819	89825	93132	99924	105498	106444	127901
1990 pounds (GDP deflator)	*135020*	*142260*	*134551*	*131488*	*129879*	*132262*	*135053*	*129330*	*145068*
SERC									
Total commissions/contributions	6461	7916	9332	9993	12343	18012	19957	28718	31625
Total receipts	208245	225079	244177	264527	291426	317617	337215	386703	397139
1990 pounds (GDP deflator)	*375602*	*369752*	*374114*	*387222*	*406412*	*420406*	*431685*	*469847*	*450445*

Source: Research Council annual reports
Notes: Government commissions, main sources
MRC - DHSS until 1980/81, then Health and Saftey Executive: NERC - Dept. of Environment, Dept. of Energy, SERC - DTI and MOD
Other commissions/contributions, main sources:
AFRC - sale of produce; ESRC - sales and publications
MRC - Area Health Authorities, WHO, private donations
NERC - European Community; SERC - NATO, canteen, hostel receipts
Total receipts includes additional miscellaneous receipts

Defence Establishment, Royal Aircraft Establishment, Royal Armament and Development Establishment, Royal Signals and Radar Establishment) are to become part of one 'agency' in 1991. It is expected that over time these will increase the amount of contract work undertaken.

In 1988 the defence establishments carried out £51M of work for other Government departments, and a further £22M for other customers. Of this, some 75%—£55M in 1988—may be regarded as contract research.

Other Government departments/labs

A number of other Government departments also run R&D laboratories, such as the Transport and Road Research Laboratory funded mainly by the Department of Transport, and the Building Research Establishment funded by the Department of the Environment. These establishments also generate some 5-10% of income from contract work of a variety of different services. It is estimated that in 1988/9 the amount generated from contract work as included in this study is in the region of £4-5M.

One of the largest R&D organizations in the UK is AEA Technology, which now operates as a Trading Fund. AEA Technology has recently been reorganized into 9 main business areas, all of which are actively seeking to increase revenue from appropriate sources, particularly industry. The subsequent reorganization has given an added impetus to the role of contract work within AEA Technology as a whole. An approximate figure of £75 M for contract R&D undertaken in 1988 will now be considerably underestimated for AEA Technology as a whole.

(vii) Summary

Total income for contract research received by the various performers of contract R&D in 1988/89 is, approximately, as follows:

CROs	
– AIRTO members	£190 M
– Others	£ 60 M
– **TOTAL**	**£250 M**
HEIs	
– Universities	£150 M
– Polytechnics and colleges	£ 30 M
– **TOTAL**	**£180 M**
Research Council Institutes	
– **TOTAL**	**£100 M**
Government Laboratories	
– DTI	£4/5 M
– MOD	£ 55 M
– Others (including AEA Technology as Trading Fund)	£ 80 M
– **TOTAL**	**£140 M**
GRAND TOTAL	**£670 M**

It should be noted that this does not include contract R&D carried out in industry, for which figures are not readily available. The largest single source of funding for this is the MOD, which in 1988/89 spent £1202 M in industry on R&D. Other Government departments also spent significant sums on R&D in industry, as highlighted below.

Extramural R&D expenditure by departments in private industry, 1988/89

MOD	£1202.0 M
DTI	£183.5 M
(including c. £20 M spent in RAs)	
Energy	£ 10.3 M
Environment	£ 12.2 M
Others	£ 22.0 M

(Data from *1990 Annual Review of Government funded R&D*)

Our total of £670 M for the volume of contract R&D performed in the UK thus excludes an unknown but very considerable amount performed in industry, funded by both industry and Government.

CHAPTER IV: THE PERFORMERS OF CONTRACT R & D

(i) Outline

In chapter III we presented an estimate of the volume of contract R&D performed in the UK. In this chapter we assess the contract R&D business from the point of view of the performers. In chapter V we examine the customers' perspective.

(ii) Contract research organizations (CROs)

(a) Function and structure

The changing role of CROs

The nature and role of CROs in the contract R&D market place has changed greatly in the last 25 years. Up to, and during, the 1960s the relationship between a CRO and its customer was, in many cases, a 'master—servant' relationship. The paying customer was the 'master', dictating how, why and when work was undertaken. Often interaction between a CRO and a customer was restricted to that necessary to solve an immediate problem. The majority of CROs were run as membership based research associations (RAs), generally working for the betterment of an industrial sector as much as for individual members.

During the 1960s, with new technologies emerging, a different form of CRO came to prominence. The focus of these organizations was the use of new technology and developing expertise in technology rather than particular industrial sectors. They marketed themselves as technology driven organizations able to improve customer's productivity through the introduction of new and appropriate technology, and also through reviewing, assessing and updating a customer's product design, marketing, processing and overall business planning. These organizations worked very much as equals to their customers—a customer brought in the CRO not to solve a particular problem in a prescribed way (although this was, and still is, one of the introductions a customer may have of a CRO), but to secure an informed analysis of the problem and to exploit the expertise and experience of the CRO in finding solutions, possibly in unexpected ways or areas.

This move towards technology consultancy is now common and most CROs, including the membership based RAs, have gone some way along this path. CROs are, in many cases, in an good position to assess a customer's technological capabilities in the light both of emerging technologies and of his general position within the marketplace in relation to competitors and the general industrial market, and to then follow up such assessments by introducing/developing any required technology.

Reorganization of CROs

Some RAs have found their membership structure, and the Council and statutes to which they have to adhere, to be a constraint on corporate development. Because of this a small number have undergone management buyouts of their facilities, with the agreement of the members. In such cases the RAs (now with money from the buyout but no facilities) are tied to the new company by agreement. The RA agrees to commission work for its members only from the new

company, and not to set up new facilities in competition. The new company, with shareholders, is free to evolve however it sees fit, to invest where necessary and, of course, to make a profit. Other RAs are trying in less drastic ways to alter their constitutions to allow greater management flexibility. It was generally agreed that more management buyouts or similar quite drastic reorganization of a number of CROs could be expected in the medium term.

A few CROs have been the subject of takeover bids by larger companies. Being relatively small, generally successful and technically advanced, UK CROs in particular are an attractive target, for incorporation as the technical arm of a large company or simply to be taken over as successful businesses.

CROs with membership schemes use them in a variety of ways. Some undertake very little work for non-members, whilst for others non-membership is little or no barrier for placing a contract (though rates charged may be different). All the public limited companies are open to any paying customers.

(b) Customers

The customer base

The customer base of CROs varies widely—from 10 to over 2500, reflecting the industrial sector in which the CRO works—from low-tech, small-medium enterprises (SMEs) such as in the furniture industry, to large, high-tech enterprises in aerospace or nuclear fields. AIRTO figures for 1988 indicate that its 45 members had a client/member base of some 20 000 organizations. Of that total some 12 800 (64%) were companies of fewer than 200 employees and a further 3200 (16%) had 200-500 employees. This suggests that some 80% of the AIRTO client base consists of SMEs. The remaining 20% includes 93 of the UK's top 100 companies. However, it is thought that of the total AIRTO turnover some 80% is derived from the 20% of large enterprises, and 20% from the 80% of SMEs.

Type of customer

In the questionnaire; we asked what percentage of CROs' customers were industrial companies, government bodies or other types of organization. Of the 30 replies to this question, 24 (80%) noted that 70% or more of their customers were industrial companies. For only three organizations were industrial companies less than half of their customer base, and two of these three reported that the bulk of their work was testing, quality and legal evidence work. Six organizations noted that 20%-35% of their customers were governmental, and two organizations noted that over 70% of their customers were central or local government. Other customers, in general less than 10% of total customers, included academic organizations, charities, 'information' groups and similar.

Geographical distribution of customers

We asked about the geographical location of the CROs' customers for the last financial year. 18 (60%) of the CROs reported that at least 90% of their customers were based in the UK, and a further 8 (27%) that UK organizations accounted for 70%-90% of their customers. 5 (16%) organizations reported that overseas customers constituted over 30% of their total customers, and 3 (10%) that over 70% of their customers were based overseas. However, a number of organizations commented that although numbers of overseas customers were

small, the amount of revenue they brought in was often significantly higher, and growing.

Single-client vs multi-client R&D projects

31 CROs replied to this section, of which 15 reported that over 90% of their contracted R&D projects were funded by a single client, and an additional 8 reported that 50%-90% of their contract R&D projects were single-client funded. Only 4 of the CROs reported that 90% or more of their R&D projects were multi-client funded, and a further 4 reported that 50%-90% of their work was multi-client funded.

Most contract R&D projects undertaken by the CROs in our sample were thus for single clients rather than groups of clients. This may reflect the extent to which work is sufficiently near market to be commercially confidential. It may also reflect a certain amount of technology consultancy activity, related to specific technical problems experienced by individual clients. However, some CRO managers described difficulties organizing multi-client projects and a few gave the impression in interviews that multi-client projects were avoided where possible. One manager commented, after noting the hassles caused by multi-client projects, 'maybe we do them badly'.

However, some organizations undertook considerable amounts of multi-client work—often on strategic, timely projects of relevance to industry. Often these were organized on an open club basis, while others were arranged with the CRO acting as the link between 3 or 4 interested companies on a more confidential basis. Work could be undertaken at the CRO, or it could act as the central coordinator, providing the common ground where companies met to discuss results from each in-house project.

It should also be noted that most DTI funding for R&D projects is available only for multi-client rather than single-client projects. Some RAs organize at least part of their core programme of research around such multi-client projects, thus both bringing together member organizations to undertake or at least be involved with advancing new technologies, and also allowing the RA to be involved in new technology cheaply, or even at a profit. Most DTI project funding is directed at pre-competitive projects involving emerging technology, which is often the research required for a core programme of R&D. From the DTI's perspective the use of CROs (particularly RAs) to undertake such projects (or at least play a central role in them) helps ensure results are (usually) quickly available to a wide industrial base.

Attracting customers

Contract research is a business, and the same marketing ploys are used to attract customers as in any other business. Mailshots, attendance at trade fairs, publishing of news-sheets and direct advertising were standard practice. Some organizations had overseas agents, and a small number of CROs had daughter organizations based overseas. These were sometimes the result of takeovers, or occasionally they were set up with the host government's financial support.

Most CROs had at least one employee in charge of publicity/customer relations, in one case the managing director was himself responsible, in the first instance, for 66 client companies, and many had small dedicated teams. Some teams coordinated and had at least a working

knowledge of all contracts. Such teams had a greater role than simply advertising the CRO: some acted as the first line of customer contact, and might remain the CRO's 'overseeing' arm, ensuring that while the customer was being dealt with by the technical experts everything ran smoothly and to plan.

A number of CROs believed they had developed a high tech image that actually scared off smaller customers, and were concerned to counteract this ('we're not as expensive as you may think'). One CRO manager noted he tried to encourage the high tech smaller companies, for the reason that 'next year a few will be very successful'.

All CRO managers agreed that the personal touch with clients was vital. Considerable time was spent in building up a stable working relationship with a customer, with the aim of ensuring repeat work in the future (which is often the case in practice)—CROs aimed to be the customers' 'friends'. One CRO manager reported they were particularly attentive if the customer was new, or the CRO was moving in an area in which it may actually not know much more than the customer.

The marketing approach, with dedicated staff, was more prevalent in the 'technology consultants' type of CRO. As one manager put it, 'we train our scientists to act as businessmen', and on the rare occasion that a scientific staff member just could not act in this manner he was kept back from the business aspects of the work, entering only technical discussion.

However, no matter how hard a CRO sold itself and got in front of the industrial 'eye', no contracts could be signed until technologists from the customer had talked with technologists from the CRO, and agreed a work programme.

The reputation and professional integrity of any CRO were of paramount importance. Great efforts were made to ensure nothing was allowed to blemish their record or associate the CRO with 'dubious' dealings. All CROs realised their reputation for quality, confidentiality and general professional standing had taken a long time to build but took very little to erode. Protecting a reputation had, on occasion, led to court action.

(c) Competitors

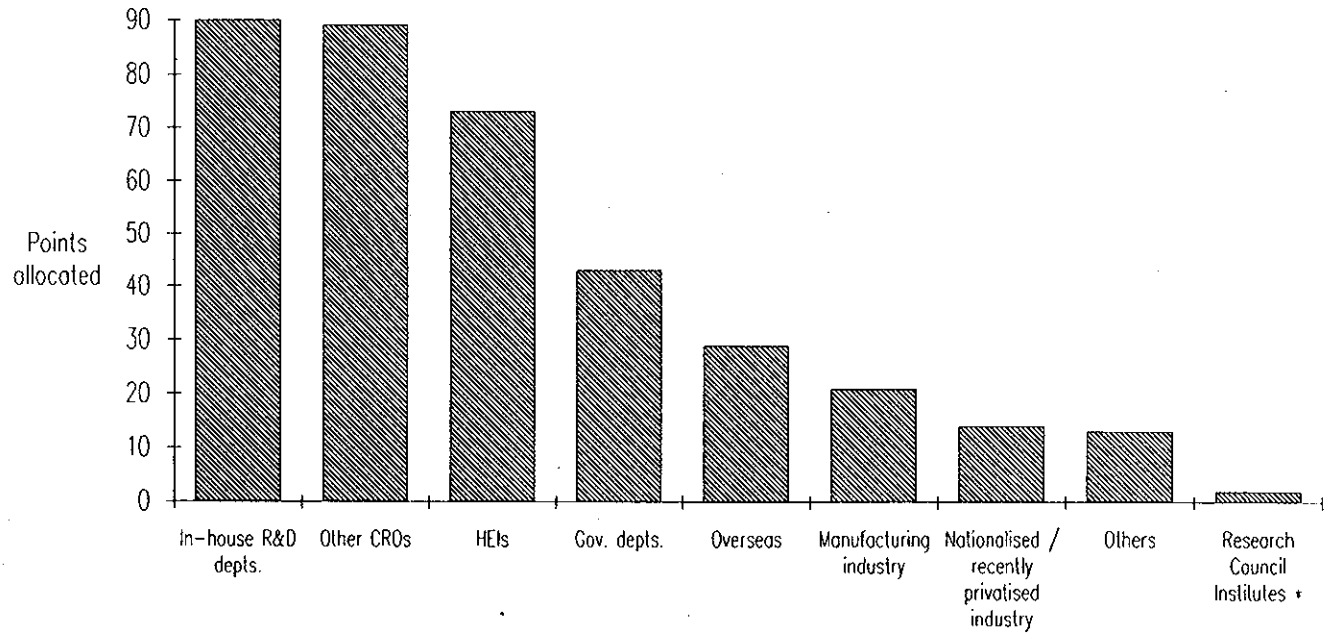
We asked CROs to identify their five main competitors from a list, and to prioritize their answers on a scale of 1 to 5. We analysed the replies by allocating five points for the most important answer, down to one point for the 5th placed competitor. 27 companies prioritized their answers, with an additional three noting 'all are competitors'.

The results are given in figure 4.1.

In-house R&D departments

The customer's in-house R&D departments were always mentioned as a major competitor—it is this department the CRO has to beat to win a contract. A number of the business consultancies noted that much of their work came from contact with the business manager rather than the R&D manager of a company. Such consultancy CROs often concentrated on selling a technological business package rather than

Figure 4.1 Perceived competitors to the UK CROs



individual technical solutions.

'Other CROs'

'Other CROs' also featured high on the list of competitors. This usually referred to one or two CROs in similar specialist technological areas. Generally though CROs, because of their specializations, were not in competition with each other.

HEIs

Most CROs thought that HEIs, in general, were of little threat to their mainstream activities (based on specialized experience of the industrial market). They believed few HEIs had the overall experience to compete for the bulk of a CRO's work. However, most CROs did note that for testing/using sophisticated equipment and some consultancy work HEIs had entered the market and were in competition. This was felt most in those CROs that undertook a considerable amount of testing, and specially in the smaller CROs, where any threat to turnover was serious. In addition, a number of CROs noted a few specialist HEI spin-off companies that were forces to be reckoned with in their fields; these were being closely watched.

Industrial companies

A number of engineering based CROs noted that there had been a distinct move by engineering companies to offer their own specialized facilities on a contract and/or collaborative basis. This was perceived as an economic necessity for a few companies, but more usually as a result of the general increased 'business' awareness leading to pressure to provide additional services for a company's main customers. Some companies were undertaking considerable amounts of this contract/collaborative work and were affecting at least one CRO's market.

Government laboratories

As with the universities, Government laboratories were not, in general, thought to be seriously challenging the CROs' industrial base, although

in particular areas the CROs were watching and attempting to become partners with such organizations rather than competitors. However, where such laboratories were strongly moving into the independent contract R&D business (such as AEA Technology and NEL) they were seen by CRO managers as having a distinct competitive advantage. This was particularly so for AEA Technology, which as part of the former UKAEA has entered the CRO market in a major way with laboratories and staff built upon government funds. However, others noted that, at least in the recent past, AEA Technology had been quite expensive, and that much contract work was placed there because of the unique facilities offered, rather than for the industrially relevant expertise of the staff. Many CRO managers expressed some concern that organizations such as AEA Technology and NEL would still receive forms of government aid, if not directly then indirectly through funding for projects that, although probably not directly applicable to the industrial market, would provide the base on which industrially relevant work could be developed. It was felt that this, at least in the short term, would give such organizations an unfair advantage in the highly competitive market.

(d) Income of CROs and services offered

Turnover

The turnover of the 37 CROs in our sample varied considerably, from £0.75 M to £112 M. Only four organizations had turnovers in excess of £20 M; the majority had turnovers of between £2.5M and £10M. Many of the UK CROs were relatively small organizations. As such they were prone to changes in their particular markets and in the economy in general.

Sources of income by activity

We collected data on total income and on the services that brought this in. Responses varied tremendously and only a brief overview is given below.

CROs offered a wide range of services, with managers noting they were constantly looking for new areas, services and approaches to increase revenue, although they were conscious that they must not lose established custom by changing too drastically.

Major R&D contracts

Income from major R&D contracts ranged from 5% to 98% of total income, with 7 companies reporting over 80% of their income was earned by such contracts, 13 reporting 50%—80%, 10 reporting 35%—50% and the remainder reporting less than 35%.

Such R&D contracts formed the bulk of CROs' workload, whether applied or strategic research or single or multi-client funded, and were based on experience of the industrial market place. The CROs, by working for a wide range of customers, built up, and continually developed, a breadth of industrially relevant technical expertise.

Testing and short term consultancy

Income from short-term contracts/consultancy ranged from 2% to 65% of total income, although the majority fell between 20% and 35%. This included routine testing and short-term technical assistance, often trouble-shooting, which formed a core of work that CROs could generally rely on, and often led to further work.