COMMENTARY

Introduction

The level of public expenditure on activities which are classified as 'science and technology' is quite large and this has become increasingly recognised. The total amounted to £646m in 1996 and rose to £693m in 1997. An additional £130m in 1996, and £127m in 1997, was generated from earned income or fees directly associated with these public expenditures. So the total amount involved is rapidly approaching the billion pound mark.

It is important to be careful in interpreting these figures as the definition of science and technology used here is a wide one. It includes the social sciences as well as the natural sciences and engineering and covers the entire range of science and technology activities including R&D, technical services, technology transfer and education and training.

Findings

While the body of this document details the 9 Government Departments and 33 separate agencies which go to make up the Science and Technology Budget it is useful to divide this total into five broad categories according to main activity of departments and agencies. Amounts shown are public funds (exchequer plus Community Support Framework) allocated to science and technology in 1997.

- **Education and Training (in scientific and technological fields)** (47%)

-	HEA	£163.9m Education and research in universities
-	Department of Education	£157.4m Funding of RTCs etc.
-	Dublin Institute for Advanced Studies*	£1.4m Research in physics

- **Health and Social Services** (26%)

-	Health Laboratories*	£132.7m Performance of medical tests
-	Central Statistics Office	£18.1m Collection and publication of official statistics
-	Department of Justice	£14.5m Technical back-up to the Gardaí
-	Department of Social Welfare	£4.3m Technical support for social welfare programmes
-	Health Research Board	£3.9m Funding of health research and development
-	State Laboratory	£2.9m Chemical and toxicological analysis
-	ESRI, NESC, Central Bank	£3.0m Economic and social science research

*estimate

- **Enterprise Development** (13%)

- the Department of Enterprise and Employment and its agencies (e.g. Forbairt, IDA Ireland, Forfás, FÁS, Shannon Development), the National Microelectronics Research Centre (NMRC), plus Údarás na Gaeltachta (£90m)

- **Natural Resources** (10%)

- Department of Agriculture, Food and Forestry and its agency (Teagasc) plus COFORD (£58.4m)
- Marine Institute (£10m) and other institutions under the aegis of the Department of the Marine (£3.5m)

- **Environment (4%)**

- Department of Arts, Culture and the Gaeltacht	£2.0m	Forestry and wildlife research
- Met Éireann	£4.9m	Meteorological service
- Ordnance Survey	£5.1m	Production of ordnance survey maps
- Environmental Protection Agency	£5.2m	The national agency for environmental protection
- Geological Survey	£2.3m	Advice and information on the geology of Ireland
- Department of the Environment	£1.9m	Technical support to the department
- Department of Transport, Energy and Communications	£1.3m	Technical support to the department
- Radiological Protection Institute	£1.3m	Technical support to the Government on radiation issues
- National Roads Authority	£1.7m	Technical support on road construction and maintenance

The overall increase in public funds (exchequer plus CSF) in the Science and Technology Budget for 1997 amounts to just over £40m. Five areas accounted for almost 80% of this increase; these were:

HEA/Dept. of Education	+£13m	(mainly compensation for fees abolition)
Forbairt	+£5m	(increased grants for R&D in industry)
Health Laboratories	+£8m	
Marine Institute	+£5m	(infrastructure investment and increased funds for marine research).
Department of Justice	+£5m	(mainly telecommunications development)

This overall increase masks a decrease of £4m in the allocation to the Central Statistics Office due to the completion of the fieldwork for the 1996 Census of Population.

Key Issues

Prioritising National Spending

The Government has recently put in place new structures and procedures which are intended to assist in identifying national S&T priorities, in devising a long-term strategy for S&T and in facilitating planning of S&T spending. An Inter-Departmental Committee on Science and Technology has been established, comprised of senior officials in the major S&T spending departments. This Committee will review each year the actual S&T spend across departments and agencies and will examine proposed S&T spending for the following year. It will make proposals on S&T spending to the Cabinet Committee on Science and Technology, which has ultimate responsibility for the setting of national priorities and budgets. This edition of the Science and Technology Budget will be the first to be made available to the Inter-Departmental Committee.

The Government has also established a National Science, Technology and Innovation Advisory Council to advise Government on the strategy direction of science and technology policy, embracing all aspects including scientific research, third-level education, technology and R&D in industry, financing for innovation, public awareness of S&T, and prioritisation of state spending on S&T. The views of the new Council will be an important input into the work of the Inter-Departmental Committee.

The annual Science and Technology Budget is an essential input into this process of national priority setting. It has been prepared, with the full co-operation and assistance of the organisations concerned, by mid-1997 so as to be available for the annual estimates process for 1998.

Support for Research and Development (R&D)

Ireland's gross expenditure on R&D (GERD) as a percentage of GDP is low by international standards and although there has been an increase in public funding of R&D in recent years (much of it due to Structural Funds support from the EU) the level of government funding of R&D here is below international levels. This is illustrated by the latest indicators from the OECD which show how other governments support total R&D or GERD (gross expenditure on R&D) in their economies:

Gross Expenditure on R&D (GERD) 1995 (or latest available year)		
	Total Expenditure (% GDP)	% GERD Financed by Government
Denmark	1.82	38
Finland	2.32	40
Ireland	**1.40**	**23**
Netherlands	2.04	44
New Zealand	1.03	56
Norway	1.65	49
Portugal	0.60	65
EU Average	1.84	36
OECD Average	2.16	35

Although the level of GERD in Ireland is below that in Denmark and Norway, as well as below the EU and OECD averages, it nevertheless is well above countries like New Zealand and Portugal. This is despite the relatively low level of financial support for R&D from the State.

R&D is performed in three main sectors - industry, state research institutes and third level colleges.

- industrial R&D is now approaching EU average levels. In fact the level of business sector R&D in Ireland and Denmark, as a percentage of GDP, is about the same. OECD figures indicate that Government funding of industrial R&D in Ireland is around the EU/OECD average, mainly due to the significant amounts of money being made available via the Industry Initiative (Measure 1 of the Industry Operational Programme of the ERDF).
- there is a low level of R&D performed in the public sector, partly reflecting the absence of a comprehensive infrastructure of well-funded public research organisations.
- the position in the third level colleges is shown clearly in the following table which compares the situation of higher education research and development (HERD) in Ireland with the same range of relevant small countries as above. HERD comprises all monies for research in third level colleges including government ear-marked funds and also HEA funds which are attributed to research on the basis of coefficients derived from surveys of academics.

Higher Education R & D (HERD) as % GDP	
	1995 or latest available year)
Denmark	0.41
Finland	0.44
Ireland	**0.27**
Netherlands	0.60
New Zealand	0.30
Norway	0.45
Portugal	0.27
EU Average	0.39
OECD Average	0.38

The problem for R&D in Ireland is the low level of HERD compared to other advanced countries. There is a double disadvantage for us as the colleges here must take up some of the slack from the absence of public research institutes (this they do, for example, via the Programmes in Advanced Technologies). The gap in total R&D between e.g. Ireland and Denmark is now due to the relatively lower levels of HERD in Ireland.

This is an issue to which the Science, Technology and Innovation Council drew attention in its report in 1995. It was also identified as a major problem in the CIRCA Group's report on the organisation, management and funding of university research in Ireland, which concluded that "public funding of university research in Ireland is among the worst in OECD". Further Paper on Science, Technology and Innovation, which estimated that funding for basic research in Ireland is about 10% of the OECD average.

Impact of EU Funds

The major financial impact of EU programmes on the Irish science and technology landscape has been well documented. The total EU support for the RTD (research and technological development) component of the current Community Support Framework (CSF) amounts to £354m between 1994 and 1999, or roughly 8% of the total EU funds allocated. For the Industry Operational Programme alone the EU contribution to R&D is £264m or 32% of the total EU funds for the Programme.

The STI Council pointed out that government support for S&T prior to the first Community Support Framework (CSF) in 1989 was inadequate and a major cause of low industrial innovation and a poorly functioning national system of innovation. The Government decision to give a high profile to science and technology in the CSF for 1989-1993 enabled a wide range of new initiatives to be introduced; these included the Programmes in Advanced Technology (to link university expertise with industry), the industry research and development initiative (to support R&D projects in enterprises), and a range of mechanisms to improve the technological performance of indigenous industry - Technology Audits, Placements, the Technology Transfer and Partnerships programme. The new CSF for 1994-1999 also contains a major science and technology element, enabling these initiatives to continue and also providing some new money for basic research in the colleges and to support a new technology management initiative in industry.

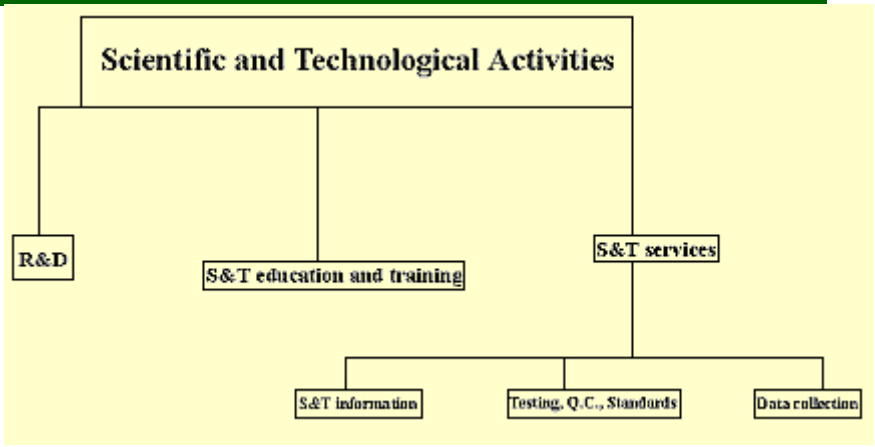
This EU support is not distributed uniformly across the five categories in the Science and Technology Budget which were identified above, due in part to the eligibility criteria for funding under the CSF but also to the opportunity for S&T infrastructural development offered by the Operational Programmes in specific areas. It represents about 44% of public funds in 1997 for Enterprise Development and 24% for Natural Resources, only 12% of funds for Education and Training and very minor amounts under Health and Social Services.

1. BACKGROUND

1.1 Science, Technology and Innovation

'Science and Technology' (S&T) covers a wide range of activities which use pure and applied science to generate innovation via the creation and exploitation of new ideas. The most widely known and measured of these activities is research and development but there are other important ways of acquiring, disseminating and utilising technical knowledge and expertise within the economy. Figure 1 gives a broad indication of what these other activities are.

Figure 1 Schematic representation of S&T activities



1.2 Availability of Data on S&T

Traditionally, S&T policy has used statistics and indicators based on research and development as an input to decision making, mainly because detailed data on R&D have been available since the mid 1960s, while the development of indicators on the other aspects of S&T has proceeded at a much slower pace.

When the National Board for Science and Technology was established in 1978, one of the first tasks it carried out was the establishment of a data collection mechanism encompassing all government funded science and technology activities. A lengthy time series now exists on government funding of all S&T activities. This data can be used for the setting of national priorities and targets for science and technology, although the paucity of international comparisons make this task more difficult than the setting of R&D objectives.

This document provides details of the allocations made by Government to S&T activities. In all, 42 government agencies/departments were included in the 1997 analysis - some of which are wholly concerned with S&T activities, others of which may allocate a very small proportion of their activities to S&T. The analysis also includes non-exchequer monies - mainly fees and other income, including income earned from EU Framework Programme contracts - of institutions which operate science and technology programmes.

The information on which the analysis is based was supplied by government departments, offices, agencies and other recipient institutions following finalisation of the overall government estimates for the public services for 1997, and after the operating institutions had decided on the distribution of their allocations over their programmes.

Figure 2 summarises the departments, agencies and offices funding science and technology in 1997.

Figure 2. Government Departments/Agencies Funding S&T, 1997

DEPARTMENTS	AGENCY	DEPARTMENTS	AGENCY
Agriculture, Food & Forestry	Teagasc COFORD	**Education**	HEA DIAS
Enterprise & Employment	Forbairt IDA Ireland	**Environment**	EPA NRA
	NMRC	**Social Welfare**	
	Patents Office NMAC	**Arts, Culture & the Gaeltacht**	Údarás na Gaeltachta Natural History Museum
	FÁS Innovation Centre Forfás	**Health**	HRB Postgraduate Medical & Dental Board
Transport, Energy & Communications	GSI RPII Met Eireann	**Marine**	Marine Institute BIM Central Fisheries Board
		Taoiseach	NESC
		Justice	

OFFICES	CSO	OPW	Central Bank	State Laboratory	Ordnance Survey
INCORPORATED COMPANIES	ESRI	Shannon Development		SRAI	

See Appendix 3 for explanation of acronyms.

2. GOVERNMENT FUNDING OF S&T

2.1 Total funding and trends

Irish public funds for science and technology come from three sources

- the exchequer
- Community Support Framework (CSF) of the European Union
- income earned by the agencies / departments implementing science and technology programmes including income earned from EU Framework Programme contracts.

These three sources taken together amounted to £820m - the Science and Technology Budget for 1997 - and Table 1 identifies the contribution which each makes to the overall total.

Table 1 Government funding of Science and Technology by source of funds

	1986		1991		1996		1997	
	£m	*%*	*£m*	*%*	*£m*	*%*	*£m*	*%*
Exchequer funds	315.77	81.49	335.12	69.19	539.51	69.51	559.04	68.21
CSF funds	2.26*	0.58	37.80*	7.80	106.35	13.70	133.31	16.27
Total public funds	**318.03**	**82.07**	**372.92**	**76.99**	**645.86**	**83.22**	**692.35**	**84.48**
Earned income	69.48	17.93	111.43	23.01	130.26	16.78	127.24	15.52
Total	**387.52**	**100.00**	**484.35**	**100.00**	**776.12**	**100.00**	**819.59**	**100.00**

* ESF funds for courses in third level colleges not included.

The total 1997 allocation to S&T amounts to £819.6m. This is an increase of 5.6% over the 1996 level or £43m The public funds component of the total increased at a slightly higher rate of 7%, or £46m. The main reasons for this increase are: the increased exchequer funding of third level S&T courses to compensate for the loss of fee income by the colleges; increased funds for R&D in companies; infrastructural investment and increased funds for research in the marine area.

In 1986, the exchequer contributed 82% of the total science and technology budget, a share which declined to 77% in 1991 but which in 1997 at 84% is above the 1986 level. This reversal of the trend is due, in part, to the contribution of CSF funds which in 1997 reached 16% (£133m) of the total science and technology budget.

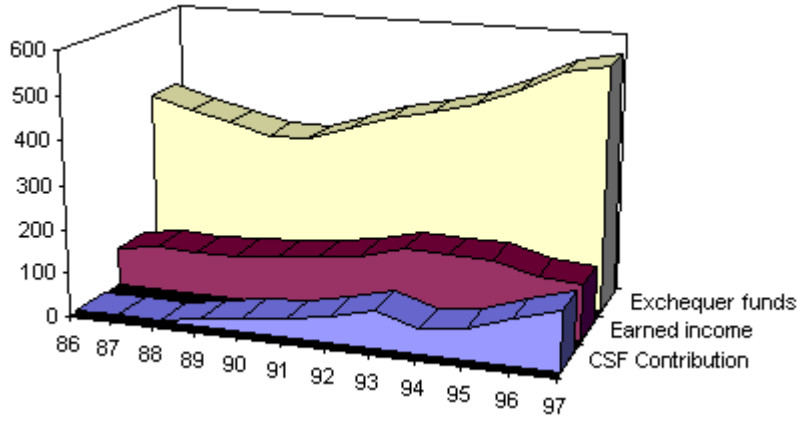
The Community Support Framework comprises a number of individual funds, all of which support S&T activity to a greater or lesser extent. These funds are the European Regional

Development Fund (ERDF), the European Social Fund (ESF) and the European Agriculture, Guidance and Guarantee Fund (EAGGF). See Appendix 2 for further details.

Despite accounting for 16% of the total science and technology budget in 1997, earned income marginally decreased its share of the total between 1996 and 1997. The 1997 level, however, is 7 percentage points lower than it was in 1991. This is due to the phased abolition of fees for third level courses which started in 1996. Exchequer funds are now substituting for what was, in the past, income generated by third level colleges.

Figure 3 illustrates these funding trends.

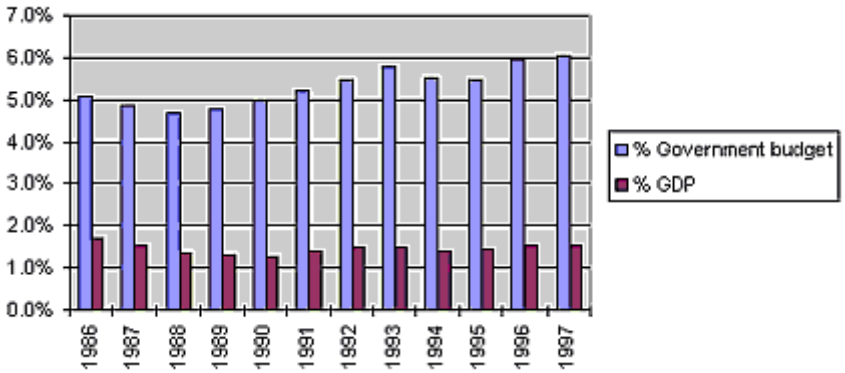
Figure 3 Distribution of Goverment supported S&T by source of funds, 1997 prices, £m



An analysis of the actual amounts of money spent or allocated to S&T shows that in real terms exchequer funds grew by 2.8% per annum between 1986 and 1996. The real increase between 1996 and 1997 amounted to 3.6%, reflecting increased exchequer funding in 1997. Earned income grew by a real 3.5% per annum between 1986 and 1996, a trend which was reversed in 1997 when earned income showed a decline of 2.3% in real terms over the 1996 level.

2.2 Comparison with GDP and Total Government Budgets

Figure 4 Public* Funding of S&T, % Goverment budget, % GDP



* Exchequer & CSF funds

Public funding for S&T as a percentage of total government budgets increased steadily since 1990 to drop slightly in 1994 and 1995 and increase again in 1996 to reach 6.0% in 1997 (Figure 4). Public funds for S&T as a percentage of GDP have also grown since 1990, and have returned to the levels achieved in the mid-1980s.

2.3 International comparisons on Research

Table 2 Government funding of R&D per head of population and as a percentage of GDP, 1994 (most recent year available)		
	per head population £	% GDP
Belgium	92.7	0.62
Denmark	127.0	0.68
Germany	155.9	0.93
Greece	13.5	0.22
Spain	40.2	0.49
France	185.4	1.21
Italy	73.0	0.63
Netherlands	115.5	0.80
Austria	115.2	0.70
Portugal	27.8	0.48
Finland	132.3	1.04
Sweden	181.5	1.22
UK	90.7	0.78
Ireland	29.7	0.31
EUR-15	112.1	0.85
Source: Eurostat		

Greece is the only country which has a lower level of Government funding of R&D than Ireland.

2.4 Government Departments/Agencies funding science and technology

Table 3 shows that four government departments together account for 87% of the total allocation of public funds for S&T in 1997.

Table 3 Allocation of public * funds by government department, 1997	
Department of Education	£311m
Department of Health (estimate)	£138m
Department of Enterprise and Employment	£87m
Department of Agriculture, Food and Forestry	£66m
13 other departments / officesn	£90m
Total	£692m

* Exchequer & CSF funds

Table 4 1997 Public * funds allocation to S&T analysed by Funding ** Department and Source of Funds				
	Exchequer Funds	CSF Funds	Total Public Funds	% Total
	£'000	£'000	£'000	
	% total	% total	% total	
Departments:				
Taoiseach	457		457	0.7
	100		100	
Finance	1476		1476	0.21
	100		100	
Justice	14502		14502	2.09
	100		100	
Environment	8774	418	9192	1.33
	95.5	4.5	100	
Education	255899	54901	310800	44.89
	82.3	17.7	100	
Marine	8992	4594	13586	1.96
	66.2	33.8	100	

State Investment in Science & Technology 1997

Arts, Culture and the Gaeltacht	2756		2756	0.40
	100.0		100	
Agriculture, Food and Forestry	46016	19764	65708	9.50
	70.0	30.0	100	
Enterprise and Employment	34931	52030	86961	12.56
	40.2	59.8	100	
Transport, Energy and Communications	12726	1604	14330	2.07
	88.8	11.2	100	
Social Welfare	4477		4477	0.65
	100.0		100	
Health	138331		138331	19.98
	100.0		100	
Offices:				
Central Statistics Office	18074		18074	2.61
	100		100	
Office of Public Works	3593		3593	0.52
	100.0		100	
State Laboratory	2878		2878	0.42
	100.0		100	
Valuation and Ordnance Survey	4879		4879	0.70
	100.0		100	
Central Bank	279		279	0.04
	100.0		100	
Total	559094	133311	692351	100.00
	80.7	19.3	100	

* Public funds are Exchequer + CSF funds
**This analysis identifies the government source of funding for S&T regardless of where the activity actually takes place e.g. R&D grants paid by Údarás na Gaeltachta are re-imbursed by Forbairt, thus the Dept. of Enterprise & Employment is the source of funds

Table 4 shows that the contribution of the CSF funds to these departments varies widely. The Department of Enterprise and Employment receives 60% or £52m of its S&T allocation from the CSF, with the Department of Agriculture, Food and Forestry also depending significantly on CSF funds, which account for £19.8m or 30% of its S&T allocation. At the other end of the scale, the Department of Health receives no CSF support for its S&T activities while the Department of Education's CSF funds account for £54.9m or 18% of its total S&T allocation. ESF funds for third level fees is the main component of the Department of Education's CSF receipts.

Most of these departments have a well developed infrastructure to implement their S&T programmes and, with the exception of the Department of Agriculture, Food and Forestry, very little S&T activity is carried out within the departments themselves. The Department of Education supports S&T training and research in all universities (via the Higher Education Authority) and third level technical colleges. Hospital laboratories and the Health Research Board implement the Department of Health's S&T activities while Forbairt, IDA Ireland, Shannon Development and Forfás (including NSAI and NAB) are the main S&T agencies under the aegis of the Department of Enterprise and Employment. The NMRC, while part of University College Cork, receives funding for some of its research activities from the Department of Enterprise and Employment.

Reflecting the pattern of funding for individual government departments discussed above, some agencies are extremely reliant on non-exchequer sources for their income in the form of CSF funds and earned income while others are funded entirely from exchequer sources. In all, 10 agencies receive less than half of their S&T funds from direct exchequer sources, the balance being made up to a greater or lesser extent by CSF funds and earned income. The most significant agencies in this regard are Forbairt, IDA Ireland, FÁS, COFORD and the NMRC. Table 5 presents each agency's allocation to S&T analysed by source of funds.

Table 5 1997 Science and Technology Allocation to Agencies/Departments by source of funds

	Exchequer Funds	CSF Funds	Total Public Funds	Earned income	Total
	£000	£000	£000	£000	£000
Department of the Taoiseach					
- National Economic and Social Council	457	0	457	15	472
Central Statistics Office	18074	0	18074	1370	19444
Department of Finance					
- Central Bank	279	0	279	0	279
- Economic and Social Research Institute	2151	0	2151	2068	4219
Office of Public Works	3593	0	3593	0	3593
State Laboratory	2878	0	2878	22	2900
Valuation and Ordnance Survey Office	5129	0	5129	4300	9429
Department of Justice	14477	0	14477	32	14509

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Department of the Environment	1924	0	1924	0	1924
- Environmental Protection Agency	4999	199	5198	2694	7892
- National Roads Authority	1747	0	1747	150	1897
Department of Education	112663	44751	157414	95	157509
- Higher Education Authority (see note below)	144067	19868	163935	44883	208818
- Dublin Institute for Advanced Studies (estimate)	1421	20	1441	327	1768
Department of the Marine					
- Marine Institute	7111	2960	10071	384	10455
- Bord Iascaigh Mhara	872	980	1852	53	1905
- Central & Regional Fisheries Board	1036	378	1414	10	1424
- Salmon Research Agency of Ireland	157	31	188	426	614
Department of Arts, Culture and the Gaeltacht	1951	0	1951	0	1951
- Udaras na Gaeltachta	1725	300	2025	0	2025
- Natural History Museum	315	0	315	0	315
Department of Agriculture, Food & Forestry	18012	2891	20903	6569	27472
- Teagasc	25736	11093	36829	14037	50866
- COFORD	170	510	680	0	680
Department of Enterprise & Employment	5311	320	5631	0	5631
- Forbairt	19515	34387	53902	18176	72078
- IDA Ireland	1106	6019	7125	0	7125
- Forfas (inc. NSAI and NAB)	1655	0	1655	6219	7874
- Shannon Development	6725	2500	9225	0	9225
- Innovation Centre	300	265	565	8	573
- National Microelectronics Research Centre	1428	1579	3007	5676	8683
- National Microelectronics Applications Centre	76	75	151	426	577

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- Fas	2223	4130	6353	0	6353
- Patents Office	-2399	0	-2399	5023	2624
Department of Transport, Energy & Communications	1329	0	1329	9	1338
- Geological Survey of Ireland	2285	0	2285	65	2350
- Radiological Protection Institute of Ireland	1334	0	1334	590	1924
- Met Eireann	4841	55	4896	5049	9945
Department of Social Welfare	4327	0	4327	4327	4415
Department of Health	132684	0	132684	<7364	140048
- Health Research Board	3907	0	3907	1107	5014
- Postgraduate Medical & Dental Board	1449	0	1449	0	1449
Total	**559040**	**133311**	**692351**	**127235**	**819586**

* Where there are transfers from one S&T agency/department to another the funds are accounted for in the performing agency.

Note: Earned income aligned to the Higher Education Authority refers to funds which the colleges under its aegis receive by way of fees for education courses and income generated from contract research activity. These funds are not allocated by the HEA to colleges.

State Investment in Science & Technology 1997

Table 6. Planned Transfer payments between S&T organisations for S&T activities, 1997, £'000																	
From:	DAgri	DAC&G	C&RFB	COFORD	Dept E&E	Dept. Educ	Dept. Energy	Dept. Envir	Forbairt	Dept. Health	HEA	Dept. Just.	Marine Inst	NRA	SFADCo	DSocW	Total
To:																	
BIM													33				33
C&RFB		265											33				265
DIAS													16				16
EPA								199									199
ERSI					50	100			50		291					150	641
Forbairt	215			162	36568		4540										41485
HEA	6150			675	5714	11167		135				25	310				24176
HRB										72							72
IDA					6000												6000
Innov Centre															300		300
NMRC					2106				676		901						3683
MAC					100												100
Marine Inst			325														325
Met Éireann														54			54
OS	250																250
SFADCo					3750												3750
SRAI													15				15
Teagsc	3552			88				84									3724

U na G					300												300
Total	10167	265	325	925	54588	11267	4540	468	676	363	901	25	374	54	300	150	85388

The science and technology infrastructure is very complex with a range of agencies/departments donating and receiving funds from each other to fund various S&T activities. Table 6 outlines the flows of funds for 1997. Some of these flows come about when agencies are requested to carry out specific activities on behalf of another government institution, while others result from contracts won on a competitive basis. A range of CSF-funded initiatives became fully operational during 1995 and many of them, particularly the Agriculture, Marine and Environment R&D sub-programmes involve funding research in higher education colleges during 1997. The full extent of such funding was not known at the time of this analysis and in some cases these potential transfers are not reflected in the data.

2.5 Science and technology for enterprise development

The science and technology budget has a very wide coverage incorporating S&T activities in the productive sectors, the education area, in support of general public services, health laboratories and the economic and social sciences.

This section focuses on those science and technology activities which are funded in order to improve the overall performance of the enterprise sector. Two areas will be considered:

- Enterprise Development via the Department of Enterprise and Employment
- Natural resource based industries including the food sector via the Departments of Agriculture, Food and Forestry and the Marine.

2.5.1 Enterprise development

The Department of Enterprise and Employment is the Government Department charged with furthering enterprise development in Ireland and securing maximum employment for the labour force. On its own behalf and through its subsidiary agencies it funds a range of science and technology activities.

The following table summarises the 1997 S&T activity of agencies under the aegis of the Department of Enterprise and Employment which fund and/or perform science and technology activities. The table also identifies the sources of funds for these S&T activities.

Table 7					
Department/Agency	Exchequer Funds	Net contribution of CSF funds	Total Public Funds	Earned income	Total
	£000	£000	£000	£000	£000
Forbairt * +	21094	39128	60222	18852	79074
IDA Ireland	1106	6019	7125		7125
Forfas (includes NSAI)	1655		1655	6219	7874
Shannon Development	6725	2500	9225		9225
Innovation Centre	300	265	565	8	573
National Microelectronics Research Centre**	1276	1125	2401	5000	7401
Microelectronics Applications Centre	76	75	151	426	577
FÁS	2223	4130	6353		6353
Patents Office (estimate)	(2399)		(2399)	5023	2624
Total	32056	53242	85298	35528	120826

* excludes re-imbursements to IDA Ireland and Shannon Development for grants to industry

* * excludes funds transferred from Forbairt

\+ includes allocations to third level colleges

Forbairt is the dominant agency accounting for over 65% of the total. The other industrial development agencies, IDA Ireland and Shannon Development, together account for £16m or 14% of the total. FÁS and the National Microelectronics Research Centre are the other main S&T agencies. It is worth noting that CSF funds account for 44% of the total. Údarás na Gaeltachta also funds industrial development but as it comes under the auspices of the Department of Arts, Culture and the Gaeltacht it is not included in this analysis.

These agencies fund a range of activities which are discussed below.

Direct funding of companies for S&T activities

Table 8

Activity	Agencies responsible	Exchequer funds	Net contribution of CSF funds	Total public funds
		£000	£000	£000
R&D	(Forbairt, IDA (Ireland, (Shannon (Development	10205	24845	35050
Feasibility Studies		3125		3125
Technology acquisition	Forbairt, IDA	156	19	175
Placement of graduates	Forbairt	600	1800	2400
Software development	Forbairt	250	750	1000
Total		14336	27414	41750

Traditionally the technological capacity of Irish industry has been low. R&D expenditure as a percentage of GDP has in the past ranked among the lowest of our EU partners and while company investment in R&D has been increasing in recent years at 1.0% of GDP it is still below the EU average of 1.2%.

The recent Measure 1 initiative under the Operational Programme for Industrial Development has made increased funds available to support in - company R&D; together with exchequer funds this support amounts to £35m in 1997.

Companies also avail of feasibility and technology acquisition grants, although the relatively low level of funding for technology acquisition is a cause for concern.

The Techstart and Techman schemes place new qualified and experienced graduates in science and engineering disciplines in companies for a limited period of time. An evaluation of these schemes has shown that companies were extremely satisfied with the acquisition of highly skilled staff into their companies and about 80% of placements were retained by the company.

Provision of technical services for companies

Technical services for companies cover a very broad range of activities, as shown in Table 9.

Table 9

Activity	Agency responsible	Exchequer funds	Net contributionof CSF funds	Total public funds	Earned income	Total
		£000	£000	£000	£000	£000
General technical services	Forbairt	6096	3662	9758	5002	14760
Microelectronics	MAC	76	75	151	426	577
Start-up development	Innovation Centre	300	275	565	8	573
Inter-firm co-operation	Forbairt	50	150	200		200
Patent applications	Patent Office (estimate)	(2399)		(2399)	5023	2624
Standards and laboratory accreditation	Forfás, NSAI	835		835	6219	7054
Total		4958	4152	9110	16678	25788

Forbairt is the dominant agency in terms of providing technical services to industry. There has been a reduction of £7m in Forbairt's allocation to S&T services in 1997. £4m of the £7m reduction is accounted for by the energy programme while the remaining £3m is spread relatively evenly across the other technology areas. In all £9.8m of public funds is allocated to S&T services by Forbairt in 1997 and this is supplemented by £5m which will be earned in fees. The services offered cover the following technologies and sectors:

- forestry
- manufacturing
- materials
- energy
- environment
- electronics testing

A metrology service is also provided to companies as is a general information programme directed specifically to the needs of indigenous industry.

The Microelectronics Application Centre in Limerick develops new and improved electronic, software, telematic and information products and processes for Irish industry while the Innovation Centre provides a range of facilities including workshop, feasibility studies and product development assistance to entrepreneurs. The Patents Office has responsibility for processing and granting patents, designs and trademarks. Both the Patents Office and the Microelectronics Applications Centre earn a surplus of income over their expenditure.

The National Standards Authority of Ireland (NSAI) came under the auspices of Forfás until April 1997 when establishment day was set and NSAI achieved autonomous status.

Compliance with international standards is a sine qua non for all companies which wish to compete on world markets. The existence of an infrastructure of properly accredited laboratories is essential to guarantee the quality of manufactured products. The NSAI and NAB (which is still part of Forfás) are expected to earn £6.2m from fees in 1997 - a measure of the value to companies of standards and accreditation.

The contribution of CSF funds is very significant in this area - with over 45% of public funds coming from that source.

Transferring technology to industry

Table 10

Activity	Agency responsible	Exchequer funds	Net contributionof CSF funds	Total public funds	Earned income	Total
		£000	£000	£000	£000	£000
Programmes in Advanced Technology	Forbairt NMRC	2499	7501	10000	16840	26840
Technology Centres	Forbairt	400	1200	1600	2000	3600
Co-operative research between industry and 3rd level colleges	Forbairt	675	2025	2700		2700
Training in the effective use of technology	Forbairt	333	1000	1333		1333
Technology transfer and partnerships	Forbairt	1133	1300	2433		2433
Total		5040	13026	18066	18840	36906

The higher education sector is a vast reservoir of knowledge and expertise which is tapped in various ways to aid economic development. The CSF-supported Programmes in Advanced Technology are designed to transfer high-technology applications into industry.

The following eight technology areas have been identified as being of strategic importance:

- biotechnology
- advanced manufacturing technology
- power electronics
- optoelectronics
- advanced materials
- telecommunications
- software
- advanced microelectronics.

Each technology area has a number of centres located in universities and contract research is undertaken for industry. One of the key mechanisms whereby the PAT centres transfer technology to industry is the employment of former PAT staff in Irish industry. All of the PATs have now been subject to external evaluations, as well as recommendations from the Science, Technology and Innovation Advisory Council, and while these are generally positive about the

objectives and achievements of the PATs some changes are now under consideration to improve their effectiveness and industrial relevance.

An analogous programme - Technology Centres - exists in Regional Technical Colleges and the Dublin Institute of Technology. Centres in areas such as food, clean technology, bioengineering and advanced manufacturing and management systems are supported in these colleges and provide consultancy services for Irish industry. Some modifications to this programme are planned following a recent evaluation.

Forbairt operates two schemes where co-operative research between industry and the third level sector is funded. Academic researchers receive funds from Forbairt which is matched by support from the company. Evaluations of these schemes have been very positive with companies reporting significant benefits resulting from participation.

2.5.2 Natural Resource Development

The Department of Agriculture, Food and Forestry and the Department of the Marine are responsible for developing our natural resource base in order to maximise its contribution to economic development.

The following table summarises the agencies under the aegis of these Departments which fund and/or perform science and technology activities. The table also identifies the sources of funds for these S&T activities.

Table 11

Department/Agency	Exchequer Funds	Net contribution of CSF funds	Total Public Funds	Earned income	Total
	£000	£000	£000	£000	£000
Department of Agriculture, Food and Forestry *	19533	7456	26989	6569	33558
Teagasc	25736	11093	36829	14037	50866
COFORD *	339	1016	1355		1355
Marine Institute * +	7192	3205	10397	384	10781
Salmon Research Agency of Ireland (estimate)	157	31	188	426	614
Bord Iascaigh Mhara	872	980	1852	53	1905
Central and Regional Fisheries Board	1036	378	1414	10	1424
Total	54865	24159	79024	21479	100503

* includes allocations to third level colleges
+ includes funds allocated from Central and Regional Fisheries Board

Teagasc is the main agency undertaking S&T in this area accounting for 51% of the 1997 total. The Department of Agriculture, Food and Forestry accounts for a further 33%. Traditionally funding of science and technology in the marine area has been low but 1997 sees a significant increase on recent levels with the Marine Institute allocating £10.8m to S&T. One of the main activities of the Institute, apart from funding marine-related research, is the co-ordination and promotion of all marine-related areas in the country.

Much of the research funded by agencies in the natural resource area is carried out in third level colleges, the allocation to which in 1997 is not yet known for all areas.

The contribution of the CSF to this area is about one-third of public monies.

These agencies between them fund a range of S&T activities which are described below.

Research and development

Table 12

Activity	Agency responsible	Exchequer funds	Net contributionof CSF funds	Total public funds	Earned income	Total
		£000	£000	£000	£000	£000
R&D for the food industry	Teagasc, Department of Agriculture, Food and Forestry *	4738	6933	11671	1667	13338
Agriculture research	Teagasc, Department of Agriculture, Food and Forestry *	8876	6414	15290	4865	20155
Marine researchinc. data centre	Marine Institute,* SRAI (estimate)	7349	3236	10585	810	11395
Forestry research	COFORD, * Teagasc, Department of Agriculture, Food and Forestry	3618	1457	5075		5075
Total		24581	18041	42621	7342	49963

* includes allocations to third level colleges

Research is funded in two ways. Research funds are made available by the Department of Agriculture, Food and Forestry, the Marine Institute and COFORD to which individual researchers or institutions can apply for funds. The operating institutions define specifically the areas eligible for funding and research grants are awarded on a competitive basis. The third level sector has been the main recipient to date. These research programmes are funded as part of the CSF.

The second stream of research is carried out within Teagasc, the Department of Agriculture, Food and Forestry and the Salmon Research Agency of Ireland. Much of this research is carried out on behalf of the food, agriculture and mariculture sector. Fee income in the order of £7.3m from research activities is projected for 1997.

Technical services

Table 13

Activity	Agency responsible	Exchequer funds	Net contributionof CSF funds	Total public funds	Earned income	Total
		£000	£000	£000	£000	£000
Food and agriculture	Teagasc, BIM,Department of Agriculture, Food and Forestry	18621	289	18910	8120	27030
Fish stock monitoring	Central and Regional Fisheries Board	1036	378	1414	10	1424
Total		19657	667	20324	8130	28454

Teagasc, the Department of Agriculture, Food and Forestry and BIM offer a range of technical services. Product development services for the food sector with analytical services in the meat, dairy products, vegetables, milk, soil and feedstuffs areas are provided by Teagasc.

The Department of Agriculture, Food and Forestry provides analytical services in the meat, dairy and feedstuffs areas, with a substantial allocation (£5.8m in 1997) going to the veterinary services.

The Central and Regional Fisheries Board monitors the water quality of fresh-water lakes and rivers and assesses their potential for fishery development.

Exchequer funds account for almost 70% of funds for technical services with a further 28% being earned in fees.

Advisory services

Table 14

Activity	Agency responsible	Exchequer funds	Net contributionof CSF funds	Total public funds	Earned income	Total
		£000	£000	£000	£000	£000
Extension service to farming community	Teagasc	9331	4659	13990	5972	19962

Teagasc provides professional advice to farmers dealing with dairying, cattle, tillage crops, horticulture, financial management, agri-tourism, farm modernisation, environmental conservation/control of farm pollution, winter feed quality and overall farm management. These activities are expected to generate £6m in fees during 1997, with £4.6m allocated from CSF funds.

Education and training

Table 15

Activity	Agency responsible	Exchequer funds	Net contributionof CSF funds	Total public funds	Earned income	Total
		£000	£000	£000	£000	£000
Training of fishermen	BIM	517	793	1310	35	1345

BIM's training programme is geared to developing practical skills with respect to efficiency, safety and management functions in order to support the maintenance and expansion of sustainable employment in sea-fishing, aquaculture, processing and distribution. This programme is supported by the European Social Fund.

2.6 Third level research and development

Research funded by Forbairt in the third level sector can be considered under four broad headings:

- Basic research;
- Strategic research;
- Co-operative research with industry (applied research);
- Post-graduate fellowships.

All university research is indirectly supported by the general grant-in-aid from the HEA to the colleges. Monies provided in this way (£10m in 1997), while facilitating a minimum level of S&T research activity by academic staff, do not provide sufficient resources to establish a strong on-going research base within the colleges. The Office of Science and Technology, through Forbairt and the National Research Support Fund Board, provides funding on a competitive basis for individual research projects.

Table 16 shows the trend in this direct Government funding of third level research since 1990.

Table 16 OST Funding of Third Level Research £'000 1990 to 1997					
	1990 £000	1992 £000	1994 £000	1996 £000	1997* * £000
Basic Research Grants Scheme	532	854	833	1990	2250
Strategic Research Grants Scheme	975	798	1001	1217	1470
Applied Res. Grants Scheme - RTCs	972	1303	991	746	1000
Applied Res. Grants Scheme - Univs	1202	728	152	1326	1700
Industry Scholarships *	343	552	507	1175	1180
Research Scholarships Awards	483	552	507	1175	1180
Drugs Scheme				525	294
Total	4507	4636	3883	7273	8154

* 50% of Scholarships funded by sponsoring company which is not reflected in the figures
* * Budgetted amounts

Increases evident since 1996 have been in response to the recommendations from the Science, Technology and Innovation Council that support for third level research should be considerably strengthened.

2.7 Balance between current and capital funds

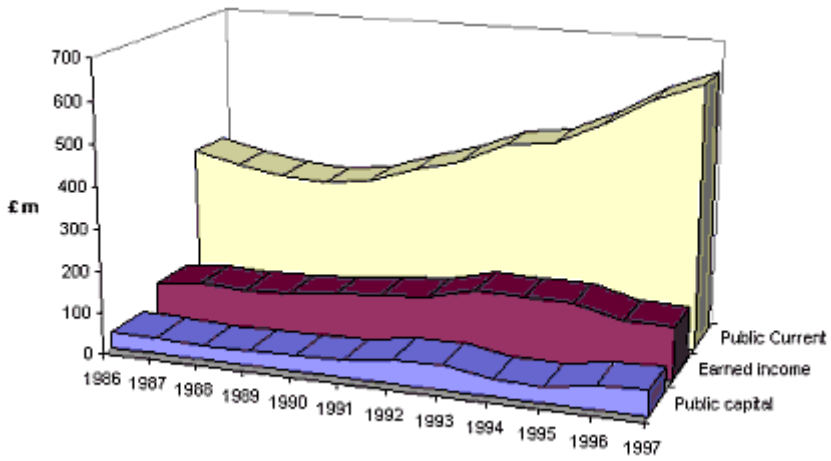
Table 17 Government funding of Science and Technology by type of costs								
	1986		1991		1996		1997	
	£m	*%*	*£m*	*%*	*£m*	*%*	*£m*	*%*
Public * current monies	285.24	73.61	335.88	69.35	587.52	75.70	631.31	77.03
Public capital monies	32.79	8.46	37.04	7.65	58.34	7.52	61.04	7.45
Total public funds	**318.03**	**82.07**	**372.92**	**76.99**	**645.86**	**83.22**	**692.35**	**84.48**
Earned income	69.48	17.93	111.43	23.01	130.26	16.78	127.24	15.52
Total	**387.52**	**100.00**	**484.35**	**100.00**	**776.12**	**100.00**	**819.59**	**100.00**

* Public monies are exchequer + CSF funds

Table 17 and Figure 5 show that when exchequer and CSF funds are combined, public current monies have a real growth of 5% per annum in the 11 year period to 1997. Public capital monies have remained relatively stable as a percentage of the total since 1986.

Table 18 looks at the changes which have occurred at agency/departmental level with regard to

Figure 5 Trends in Goverment supported S&T expenditure, 1997 prices, £m



public funding of S&T since 1996. 1996 saw the first real commitment of funds under the present series of Operational Programmes and this trend of expenditure set in 1996 is

continued into 1997. The main increases in public expenditure in 1997 occur in the Marine Institute and COFORD. The Office of Public Works has allocated funds for a range of S&T buildings in 1997 (see Appendix 1) resulting in an increase of over 100% since 1996. The Ordnance Survey has a 1997 allocation of £5m - an 80% increase on the 1996 level. One of the largest decreases occurs in the Central Statistics Office, which had been allocated an additional £12m in 1996 to carry out the 1996 Census of Population and in 1997 has a reduction of 20% (£4.6m) now that the field-work associated with the Census is complete.

Table 18 1996 Science and Technology Allocation to Agencies/Departments (*) by type of costs

	Public Funds * *			Increase in public funds over 1996 outturn
	Capital	Public Current	Total Public	
	£000	£000	£000	%
Department of the Taoiseach - National Economic and Social Council		457	457	31.0
Central Statistics Office	686	17388	18074	-20.3
Central Statistics Office - Central Bank		279	279	9.8
- Economic and Social Research Institute		2151	2151	-6.0
Office of Public Works	3550	43	3593	116.4
State Laboratory		2878	2878	35.6
Valuation and Ordnance Survey Office		5129	5129	82.3
Department of Justice	7073	7404	14477	49.8
Department of the Environment		1924	1924	5.7
- Environmental Protection Agency	775	4423	5198	3.4
- National Roads Authority		1747	1747	-0.7
Department of Education	13943	143471	157414	3.3
- Higher Education Authority	7350	153585	163935	5.5

State Investment in Science & Technology 1997

- Dublin Institute for Advanced Studies		1441	1441	2.8
Department of the Marine - Marine Institute	2411	7660	10071	72.3
- Bord Iascaigh Mhara	513	1339	1852	20.1
- Central & Regional Fisheries Board		1414	1414	7.1
- Salmon Research Agency of Ireland	20	168	188	-44.2
Department of Arts, Culture and the Gaeltacht		1951	1951	100* * *
- Udaras na Gaeltachta	2025		2025	5.0
- Natural History Museum	225	90	315	-14.4
Department of Agriculture, Food & Forestry		20903	20903	13.4
- Teagasc	1780	35049	36829	6.2
- COFORD		680	680	193.1
Department of Enterprise & Employment		5631	5631	1.8
- Forbairt	1273	52629	53902	10.3
- IDA Ireland	7125		7125	28.1
- Forfas (inc. NSAI and NAB)		1655	1655	31.3
- Shannon Development	9225		9225	-6.3
- Innovation Centre		565	565	3.3
- National Microelectronics Research Centre	2051	956	3007	-4.5

State Investment in Science & Technology 1997

- National Microelectronics Applications Centre		151	151	-45.5
- Fas		6353	6353	1.5
- Patents Office		-2399	-2399	-4.0
Department of Transport, Energy & Communications	50	1279	1329	19.1
- Geological Survey of Ireland	78	2207	2285	13.5
- Radiological Protection Institute of Ireland	125	1209	1334	6.3
- Meteorological Office	763	4133	4896	14.9
Department of Social Welfare		4327	4327	-15.0
Department of Health		132648	132648	6.9
- Health Research Board		3907	3907	10.0
- Postgraduate Medical & Dental Board		1449	1449	5.7
Total	61041	631310	692351	7.2

*	Where there are transfers from one S&T agency/department to another the funds are accounted for in the performing agency
* *	Public funds are exchequer & CSF funds
* * *	Due to the transfer of responsibility from O.P.W. to the Department of Arts, Culture and the Gaeltacht

3. ACTIVITIES AND OBJECTIVES

In order to examine in detail how science and technology funds are distributed within agencies, two types of analysis are carried out. The first examines the science and technology activity within agencies and objectives. Examples of S&T activities are R&D, S&T information and technical services. The second examines the objective of the funding, such as the development of industry or agricultural production.

3.1 Funding by Activity

Figure 6 Distribution of S&T funding by S&T activity 1997 (including earned income)

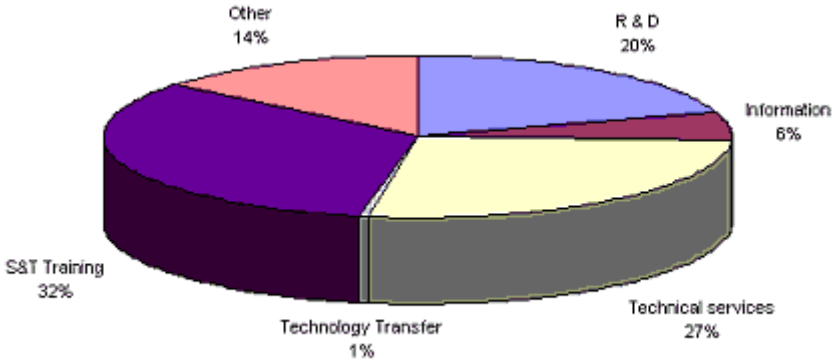


Figure 6 and Table 19 illustrate how funding of S&T is distributed across the range of activities in 1997. S&T training courses account for 32% of funds, technical services 27% and R&D 20%.

Table 19 1997 Science and Technology Allocations (including earned income) by activity and objective

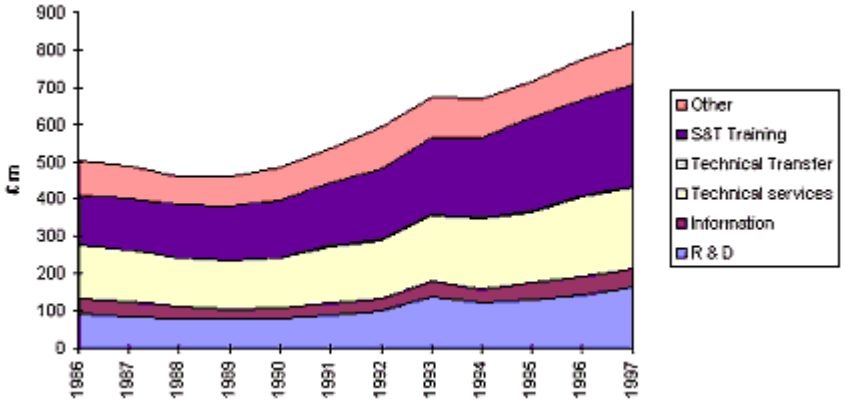
	Research and Development *	Information and Specialist Advisory Services	Scientific and Technical Services	Technology Transfer	Training Courses * * *	Other Activities * *	Total
	£000 % activity	£000 % activity	£000 % activity	£000 % activity	£000 % activity	£000 % activity	£000 % activity
Education & Manpower	45208 *11.88*	118 *0.03*	85 *0.02*		268560 *70.55*	66676 *17.52*	380647 *380647*
Health	4738 *3.25*	763 *0.52*	134791 *92.58*			5295 *3.64*	145587 *100*
Industry	71946 *62.91*	7588 *6.64*	17104 *14.96*	4528 *3.96*	1358 *1.19*	11832 *10.35*	114356 *100*
Agriculture & Forestry	21659 *32.88*	24506 *36.62*	18240 *27.26*	40 *0.06*	8 *0.01*	2463 *3.68*	66916 *100*
General Public Services	2935 *4.13*	6365 *8.97*	41743 *58.80*	56 *0.08*	32 *0.05*	19857 *27.97*	70988 *100*

Marine ~	6343 *48.78*	43 *0.33*	1977 *15.20*			4640 *35.68*	13003 *100*
Economic & Social	5963 *63.31*	569 *6.04*	1042 *11.06*			1845 *19.59*	9419 *100*
Environment	4410 *39.30*	2799 *24.94*	2907 *25.90*			1106 *9.86*	11222 *100*
Energy	250 *4.50*	4441 *80.00*	702 *12.65*			158 *2.85*	5551 *100*
Transportation	644 *33.95*	235 *12.39*	898 *47.34*	65	55		1897 *100*
Total	**164096** 	**47427** *5.79*	**219489** *26.78*	**4689** *0.57*	**270013** *32.95*	**113872** *13.89*	**819586** *100*

*	Research an development carried out in universities is classified under Education and Manpower
* *	Other activities comprise overhead, capital and extramural expenditure
* * *	The expenditure on Training Courses specified to the various objectives is aggregated in the Education and Manpower expenditure
~	The Marine area includes freshwater as well as seawater activities

Figure 7 illustrates this trend over time.

Figure 7 Funding of S&T activities (including earned income) 1997 prices, £m



S&T Training: Funding accounts for 32% of the total - down from 33% in 1996 - and includes all third level education and training in S&T areas. Most of this activity takes place within the universities and third level colleges of technology but also includes relevant FÁS courses. Earned income at £27m is substantially lower than the £36m earned in 1996. This is due to the continued phased reduction of fees for undergraduate courses.

S&T Services: Accounts for 27% of the total at £219m, down one percentage point on the 1996 share. It includes the technical services of industrial support agencies such as Forbairt, MAC and the Innovation Centre. Also included are the S&T services of Teagasc, government institutions such as the GSI, CSO, Ordnance Survey and the State Laboratory. The largest single area of S&T services occurs in the laboratories funded by the Department of Health, which in 1997 accounted for an estimated 61% (£134m) of the total S&T services allocation.

S&T Information: Funding for this activity was £47.4m in 1997 - 6% of the total, the same level as in 1996. Information services provided mainly by Forbairt and Teagasc.

Other Activities: Funding classified under this heading largely comprises capital, overhead and extramural expenditures including overhead and support services in third level colleges and at £114m is 14% of the total, the same level as in 1996.

R&D: The government funds R&D across a very wide range of areas. In all, 1997 R&D funding amounted to £164m, an increase in share of the total from 18% in 1996 to 20% in 1997. The main government agencies supporting R&D are listed in Figure 8.

Figure 8 Main Government Agencies/Departments * Supporting R&D Activities, 1997

Department/Agency	Amount * *	Description
HEA (see note below)	£39.7m	R&D in Third Level Colleges
IDA Ireland	£7.1m	Grant-aid for R&D projects in MNEs
Forbairt	£43.7m	R&D for companies and funding of PATs and other in-house R&D
Teagasc	£22.7m	R&D for food and agriculture sectors
Marine Institute	£5.9m	R&D in the marine area
Shannon Development	£8.3m	Grant-aid for R&D projects in companies
Dept. Social Welfare	£2.2m	Social research, inc. the Combat Poverty Agency
HRB	£4.7m	Medical and health research
ESRI	£2.9m	Economic and social research
Dept. of Agriculture, Food and Forestry	£7.3m	Developmental work in crop and livestock areas
NMRC	£5.7m	R&D in microelectronics
Údarás na Gaeltachta	£2.0m	Grant-aid for R&D projects in companies
Others	£11.9m	R&D work of 20 other agencies
Total	£164.1m	

* where there are transfers of funds from one institution to another the funds are accounted for in the performing agency/department

* * includes earned income

Note: Earned income aligned to the Higher Education Authority refers to funds which the colleges under its aegis receive by way of fees and income generated from contract research activity. These funds are not allocated by the HEA to colleges.

Figure 9 illustrates the funding sources for all S&T activities comprising the science and technology budget.

This Figure also identifies the sectors in receipt of Government funds for research and development. Indirect government funds for research in the third level sector are derived from the HEA's grant-in-aid to academic departments in the universities. In 1997 it is an estimated £10.4m compared to the direct public (exchequer and CSF funds) funding of research in all third level colleges which amounts to £15.8m. The business sector also provides funds for research in the third level sector and the figures quoted here refer to business funds which match public funds for joint third level-industry research.

CSF funds are allocated to support R&D in the business sector to the value of £25.9m compared to direct exchequer support of £15.3. Income from other sources for research is indicated. Receipts from EU contracts and business account for 40% of the direct funds for research in third level colleges.

Figure 9 Indicative distribution of science and technology budget funds, 1997, £m

	RESEARCH AND DEVELOPMENT					S&T Info.	Tech. Services	Tech Transfer	S&T Ed. &Train	Overheads &Capital	Total
Sourse of funds:	Business £000m	Third Level[1] £000m	PATS[2] £000m	Govern. £000m	Total £m	£m	£m	£m	£m	£m	£m
Direct Exchequer	15.3	4.2	2.3	35.7	57.5	21.2	182.2	1.4	199.1	87.4	548.8
Indirect		10.4[5]			10.4						10.4
CSF funds	25.9	11.6	7.1	11.8	56.4	7.6	4.0	3.3	44.2	17.9	133.4
EU contracts		5.0	6.9	1.9	13.8	0.1	1.9				15.8
Business		7.8	6.4	4.8	19.0	8.2	11.8			0.6	39.6
Other earned income		3.2	2.7	4.8	10.7	10.3	19.6		26.7	4.3	71.6
Total	41.2	42.2	25.4[3]	59.0	167.8[3]	47.4	219.5	4.7	270.0	110.0	819.6

(1) Science and Technology departments only

(2) AMT Ireland is classified under S&T information and technical services

(2) Overheads and capital for PATS are included in Research and Development total

(4) Including Overheads supporting science and technology departments in third level colleges

(5) Indirect funds for R&D are calculated on the basis of HEA allocations to academic departments only

3.2 Funding by Objective

This section analyses S&T expenditures by objective.

Figure 10 % real change in public funds 1986 - 1997

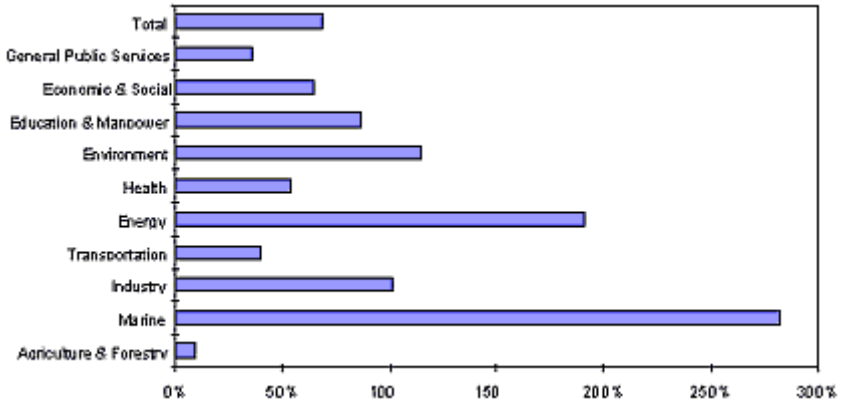


Figure 10 shows that the largest real changes between 1986 and 1997 in public funds for science and technology have occurred in the marine area (283%), the energy area (190%) and the environment (114%). Agriculture and forestry shows a marginal real increase of 9% over the period.

Table 20 shows how the total 1997 science and technology budget is distributed across the ten objectives of S&T investment. Education and manpower accounts for 46% of the total with health (18%) and industry (14%) the next largest receivers of funds.

Table 20 1997 Science and Technology Allocations by objective and source of funds

	Exchequer Funds	CSF funds	Earned income	Total	%Total
	£000	£000	£000	£000	
	(%)	(%)	(%)	(%)	(%)
Education & Manpower *	264430 *69.5*	70868 *18.6*	45349 *11.9*	**380647** ***100***	46.44
Health	136871 *94.0*		8716 *6.0*	**145587** ***100***	**17.76**
Industry	33740 *29.5*	44846 *39.2*	35770 *31.3*	**114356** ***100***	13.95
Agriculture & Forestry	37510 *56.1*	11605 *17.3*	17801 *26.6*	**66916** ***100***	**8.16**
General Public Services	57850 *81.5*	55 *0.1*	13083 *18.4*	**70988** ***100***	**8.66**
Marine ~	8627 *66.3*	3556 *27.3*	820 *6.3*	**13003** ***100***	
Economic & Social	7248 *77.0*		2171 *23.0*	**9419** ***100***	**1.15**
Environment	7116 *63.4*	731 *6.5*	3375 *30.1*	**11222** ***100***	**1.37**
Energy	3901 *70.3*	1650 *29.7*		**5551** ***100***	**0.68**
Transportation	1747 *92.1*		150 *7.9*	**1897** ***100***	**0.23**
Total	559040 *68.2*	133311 *16.3*	127235 *15.5*	**819586** ***100***	**100**

* Funds allocated to research in the HE sector are accounted in Education and Manpower

~ The Marine area includes freshwater as well as seawater activities

Tables 21 and 22 examine how the different objectives are funded since 1986. The industry area earns almost one-third of its S&T funds from fees and other earned income. The agriculture and forestry areas receive one-quarter from non-public sources a level similar to that in 1986. Fee income also plays a significant role in the provision of public services accounting for 18% of the total. The increasing reliance of the Economic and Social Research Institute on fee income is evidenced in the economic and social area now earning 23% of its S&T income, compared to 12% in 1986. Much of the activity of the environment objective is the provision of technical services to local authorities on a fee-paying basis and in 1997 this objective received 30% of its funds from fees and other income.

State Investment in Science & Technology 1997

Within the public funds provision for S&T the industry and agriculture and forestry objectives are receiving increasing shares of their funds from the CSF.

Table 21 Expenditure on science and technology by objectiveh

		1986 outturn	1991 outturn	1996 outturn	1997 outturn	Change in 1997 allocation over 1996 outturn
		£000	£000	£000	£000	%
Education & Manpower *	**Total**	**175113**	235290	372103	380647	2.30
	%public funds *	79.4	75.0	86.4	88.1	
	%earned income	20.6	25.0	13.6	11.9	
Health	**Total**	**73055**	87567	135739	145587	7.26
	%public funds *	93.7	92.2	94.3	94.0	
	%earned income	6.3	7.8	5.7	6.0	
Industry	**Total**	**40062**	56611	104797	114356	9.12
	%public funds *	75.3	71.0	68.2	68.7	
	%earned income	24.7	29.0	31.8	31.3	
Agriculture & Forestry	**Total**	**47754**	40526	62638	66919	6.83
	%public funds *	72.6	62.5	72.0	73.4	
	%earned income	27.4	37.5	28.0	26.6	
General Public Services	**Total**	**35479**	44461	64887	70988	9.40
	%public funds *	92.6	79.8	77.4	81.6	
	%earned income	7.4	20.2	22.6	18.4	
Marine ~	**Total**	**2641**	3627	8610	13003	51.02
	%public funds *	92.9	83.8	90.9	93.7	
	%earned income	7.1	16.2	9.1	6.3	
Economic & Social	**Total**	**3839**	4835	9722	9419	-3.12
	%public funds *	88.2	72.8	82.5	77.0	
	%earned income	11.8	27.2	17.5	23.0	
Environment	**Total**	**3682**	6099	10509	11222	6.78
	%public funds *	76.7	69.5	67.7	69.9	
	%earned income	23.3	30.5	32.3	30.1	
Building & Construction	**Total**	**2443**	2294	* *	* *	
	%public funds *	70.6	66.2			
	%earned income	29.4	33.8			

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Energy	**Total**	**2208**	2102	5205	5551	6.65
	%public funds *	66.7	72.8	94.2	100.0	
	%earned income	33.3	27.2	5.8	0.0	
Transportation	**Total**	**1239**	934	1910	1897	-0.68
	%public funds *	77.9	79.9	92.1	92.1	
	%earned income	22.1	20.1	7.9	7.9	
Total	**Total**	**387515**	484346	776120	819586	5.60
	%public funds *	82.1	77.0	83.2	84.5	
	%earned income	17.9	23.0	16.8	15.5	

*	Public funds are Exchequer + CSF funds
* *	Building & Construction is incorporated in Industry (Forbairt's programme) and Environment (Dept. of Environment's programme)
~	The Marine area includes freshwater as well as seawater activities

State Investment in Science & Technology 1997

Table 22 Public * expenditure on science and technology by objective					
		1986 outturn £000	1991 outturn £000	1996 outturn £000	1997 allocation £000
Education & Manpower * *	**Total**	**139053**	**176530**	**3211371**	**335298**
	% exchequer	98.4	88.4	81.6	78.9
	% CSF funds	1.6	11.6	18.4	21.1
Health	**Total**	**68455**	**80755**	**127988**	**136871**
	% exchequer	100.0	100.0	100.0	100.0
	% CSF funds				
Industry	**Total**	**30158**	**40212**	**71505**	**78586**
	% exchequer	100.0	58.1	51.2	42.9
	% CSF funds		41.9	48.8	57.1
Agriculture & Forestry	**Total**	**34673**	**25339**	**45114**	**49115**
	% exchequer	100.0	99.9	79.4	76.4
	% CSF funds		0.1	20.6	23.6
General Public Services	**Total**	**32868**	**35488**	**50248**	**57905**
	% exchequer	100.0	100.0	82.3	70.8
	% CSF funds			17.7	29.2
Marine ~	**Total**	**2454**	**3041**	**7830**	**12183**
	% exchequer	100.0	100.0	82.3	70.8
	% CSF funds				
Economic & Social	**Total**	**3386**	**3519**	**8022**	**7248**
	% exchequer	100.0	100.0	100.0	100.0
	% CSF funds				
Environment	**Total**	**2823**	**4239**	**7117**	**7847**
	% exchequer	100.0	97.5	90.7	90.7
	% CSF funds		2.5	9.3	9.3
Building & Construction	**Total**	**1724**	**1518**	*** * ***	*** * ***
	% exchequer	100.0	93.5		
	% CSF funds		6.50		
Energy	**Total**	**1473**	**1531**	**4905**	**5551**
	% exchequer	100.0	82.6	82.9	70.3
	% CSF funds		17.4	17.1	29.7
Transportation	**Total**	**965**	**746**	**1759**	**1747**
	% exchequer	100.0	100.0	100.0	100.0

State Investment in Science & Technology 1997

	% CSF funds				
Total	**Total**	**318032**	**372918**	**645859**	**692351**
	% exchequer	99.3	89.9	83.5	80.7
	% CSF funds	0.7	10.1	16.5	19.3

*	Public funds are Exchequer + CSF funds
* *	Funds allocated to research in the higher education sector are accounted in Education and Manpower
* * *	Building & Construction objective now incorporated under Industry (Forbairt's programme) and Environment (Dept. of Environment's programme)
~	The Marine area includes freshwater as well as seawater activities

Appendix 1 Community Support Framework initiatives in support of S&T -

INTRODUCTION

The EU Community Support Framework (CSF) consists of a series of Operational Programmes many of which have Measures in support of S&T initiatives. These Operational Programmes are listed below with their appropriate source of funds.

The Community Support Framework comprises a number of individual funds, all of which support S&T activity to a greater or lesser extent. These funds are the European Regional Development Fund (ERDF), the European Social Fund (ESF) and the European Agriculture, Guidance and Guarantee Fund (EAGGF). This appendix describes in detail the S&T programmes receiving CSF support.

Table 1. Operational Programmes and their Funding sources

Operational Programme	Funding source
Industrial Development	ERDF, EAGGF, ESF
Agriculture, Rural Developmentand Forestry	EAGGF, ERDF, ESF
Fisheries	ERDF
Environmental services	ERDF
Economic infrastructure	ERDF
Human Resources Development	ESF, ERDF

Table 2 presents a list of Operational Programmes, Sub-Programmes and Measures which have an S&T component and which are included in the science budget.

Table 2 List of RTD-Related Activitiesin the Community Support Framework 1994-1999 Covered In The Science Budget

Operational Programme for Industrial Development

Sub-Programme 3: Research and Development

Measure 1		Industry R&D Initiative
Measure 2		Human Resource Development
	Sub-measure 1:	Graduate Training
	Sub-measure 2:	Enterprise Development
	Sub-measure 3:	RTD Management Development 4
Measure 3		Industry/Third Level Co-operation Services
	Sub-measure 1:	Capability Support
	Sub-measure 2:	Technology Services
	Sub-measure 3:	Technology Service Centres
	Sub-measure 4:	PATs

Measure 4		Research Support

Sub-Programme 6: Development of the Food Industry

Measure 3

Sub-measure 1:	Research and Development In-Company Research and Development
Sub-measure 2:	Institutional Research and Development

Operational Programme for Agriculture, Rural Development and Forestry

Sub-Programme 1: Structural Improvement and Rural Development

Measure 5

	Research
Sub-measure (a):	Research in Sustainable Agriculture and Rural Development
Sub-measure (b):	Research Stimulus Fund

Sub-Programme 2: Forestry

Measure 2

Sub-measure (b):	Forestry Development Research and Development

Table 2 continued
(List of RTD-Related Activitiesin the Community Support Framework 1994-1999)
Covered In The Science Budget

Operational Programme for Fisheries

Sub-Programme 3: Research and Development

Measure 8		Marine Research
	Sub-Measure 1:	
	Sub-Measure 2:	
	Sub-Measure 3:	
	Sub-Measure 4:	Research Vessel Capability
	Sub-Measure 5:	National Marine Research Laboratories Fisheries/Aquaculture R&D
	Sub-Measure 6:	Marine Food Processing National Marine Survey
	Sub-Measure 7:	Marine Technology Development Evaluation of STRIDE OP

Operational Programme for Environmental Services

Sub-Programme 4: Environmental Monitoring, Research and Development

Measure 1:	Environmentally Sustainable Resource Management
Measure 2:	Cleaner Production

Operational Programme for Economic Infrastructure

Sub-Programme 1: Energy

Measure 2		Energy Efficiency/Conservation
Operational Programme for Human Resources Development		
Sub-Programme 1: Initial Education and Training		
	Advanced Technical Skills Programme	
Sub-Programme 5: Measure to Improve the Quality of Training Provision		
Measure 5		Vocational Training Infrastructure
Sub-measure 1:		Third Level Capital
		Dublin Institute of Technology, Regional Technical Colleges and Vocational Education Committee Colleges Sector
		University Sector

At the start of the CSF 1994-1999 yearly targets of funding were set. These are presented in Table 3, as an indication of the level of support given by the individual Operational Programmes. Timing differences which have occurred in some areas limit the direct comparability of these data with those presented in the science budget analysis.

Table 3: Research and Technology Development Expenditure, CSF 1994-1999 Breakdown by Measure and Year

IR£m	1994	1995	1996	1997	1998	1999	Total
Research and Development Sub-Programme							
(Sub-Programme 3, OP for Industrial Development)							
Measure 1: Industry R&D Initiative							
Total	26.914	30.295	30.060	29.735	29.735	29.665	176.404
Measure 2: Industry/Third Level Co-operation Services							
Total	30.867	31.962	31.962	31.262	32.552	32.942	191.657
Measure 3: Human Resource Development							
Total	1.295	2.826	2.826	2.826	2.826	2.826	15.425
Measure 4: Research Support							
Total	2.750	3.090	3.140	3.640	4.474	5.020	22.114
Total Measures 1-4							
Total	61.826	68.173	67.988	67.463	69.697	70.453	**405.601**
Food Research and Development							
(Measure 3, Sub-Programme 6, OP for Industrial Development)							
Total	12.883	12.363	12.226	13.078	14.027	14.194	**78.771**
Agriculture and Rural Development Research							
(Measure 5, Sub-Programme 1, OP for Agriculture, Rural Development and Forestry)							
Total	6.801	6.239	6.239	6.239	6.239	6.239	**37.992**
Forestry Research and Development							
(Sub-measure (b), Measure 2, Sub-Programme 2, OP for Agriculture, Rural Devel. and Forestry)							
Total	1.000	1.000	1.000	1.000	1.000	1.000	**6.000**
Marine Research							
(Measure 8, OP for Fisheries)							
Total	1.358	1.722	1.198	1.198	1.268	1.578	**8.322**
Environmental Monitoring, Research and Development							
(Sub-Programme 4, OP for Environmental Services)							
Measure 1: Environmentally Sustainable Resource Management							
Total	0.938	0.510	0.420	0.420	0.420	0.385	**3.092**
Measure 2: Cleaner Production							
Total	0	0.321	0.411	0.411	0.411	0.447	**2.001**

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Total Measures 1-2							
Total	0.938	0.831	0.831	0.831	0.831	0.832	**5.093**
Energy Efficiency/Conservation							
(Sub-Programme 1, Measure 2, OP for Economic Infrastructure)							
Total	2.345	4.286	6.873	6.873	6.955	6.793	**34.124**
Advanced Technical Skills Expenditure							
(in Sub-Programme 1, OP for Human Resourced Development)							
Total	10.087	7.871	7.871	7.871	7.871	7.871	**49.439**
TOTAL PLANNED EXPENDITURE							
	97.239	**102.486**	**104.225**	**104.552**	**107887**	**108.958**	**625.342**

Figures may not sum due to rounding.

Appendix 2 - Methodology & Definitions

METHODOLOGICAL NOTE

The information given in this document relates to 42 institutions in receipt of monies from the exchequer for the performance or support of scientific, technological and related activities in every field and is based on the information supplied by these institutions.

Following discussions with the Department of Finance and the Irish Productivity Centre in the preparation of this document it was agreed that their programmes formerly included in the science and technology budget would be removed from the analysis due to their lack of conformity to the definitions of science and technology.

In preparation for the 1997 science and technology budget the Department of Agriculture, Food and Forestry re-examined its programmes included in the science and technology budget. Additional activities were subsequently added to the analyses. Met Éireann also included its fee income in the data supplied for the 1997 analysis - data which had not been made available previously.

In order to ensure consistency of analysis the database has been adjusted back to 1986 to take account of the above addition and deletions.

In 1997, Forbairt's Construction Programme was amalgamated with the Materials Programme, and is not separetly identifiable. The Housing Programme in the Department of the Environment which was the only remaining programme in the Building and Construction objective was re-classified to the Environment objective. In 1997 also, Manufacturing Consultancy Services in Forbairt were amalgamated into the Business Development Directorate and as they are now not separately identifiable from non-S&T activities in Forbairt they will not be included in the analysis from 1997 onwards.

The recently formed Science, Technology and Innovation Council has identified as one of its priorities an examination of public funding of science and technology. It is anticipated that further methodological changes may result from this work. The areas of change may include a greater emphasis on funders of S&T in the analysis and a move towards using GDP as a deflator rather than CPI as is currently used.

In general, institutions and information relating to them are listed separately. In a few cases an institution is listed with its parent department or organisation but identified separately. Where practicable the programmes of the various institutions have been separated and categorised in accordance with international practice into relevant scientific and technological activities i.e.:

- research and development (R&D)
- information and specialist advisory services
- scientific and technical services
- training (including courses) and
- technology transfer.

However, in many instances, especially in institutions with few staff, institutions operate several programmes jointly, sharing resources in an administratively appropriate unit. In these circumstances the programmes, as described here, do not represent truly independent programmes. Consequently, the data should be interpreted with caution if expansions or contractions are being considered.

Expenditure data for specific programmes refer to the 1996 outturn costs of programmes and to the expected costs in 1997. The outturn costs are mainly funded by matching grant-in-aid or voted monies. Where programmes are funded in other ways these monies are noted separately. In these instances the expenditure (cost) data shown includes both exchequer and other income contributions.

Expenditures are based on unaudited figures, except in a few cases where they are identical with a Vote by the Oireachtas. For convenience, general overheads, where shown, are distributed in proportion to programmes' expenditures. Programmes are attributed to the institution most directly involved, that is to those actually operating them, but not necessarily funding them. An example of the latter is the Department of Enterprise and Employment, which funds, but does not operate or manage, many programmes. Only their own administrative costs are attributed to the funding institutions in such cases.

Numbers of staff involved on individual S&T programmes are shown only where a reasonable subdivision is possible. Where institutions are involved in funding a large number of external R&D (or similar) personnel, data on these external personnel are not given.

In some cases it is possible to give an indication of output, e.g. numbers of grants awarded, samples analysed etc. per annum. The information given relates to 1996 unless otherwise stated.

Apportionment problems arise in the third level sector (mainly the monies distributed by the Higher Education Authority and the Department of Education to technical colleges). In the case of the HEA, total funds are first apportioned between S&T faculties and non-S&T faculties in the colleges. (Expenditure on non-S&T faculties is not included in this document).

The extent and cost of the R&D work undertaken in colleges, and funded out of the HEA's general block grant, is determined indirectly from surveys of academic staff in colleges. These surveys are carried out by Forfás on a multi-annual basis and the corresponding cost data are, of necessity, based on historical estimates. The 1997 analysis introduced a refinement not available in previous years whereby HEA funding of academic departments was isolated from administration and support services within colleges. Co-efficients of research time derived from Forfás surveys are now applied to funding of academic departments only, not including the administration and support services as had been included in the past. In the case of RTCs, costs are apportioned between S&T departments and second level activities; the latter are not included.

DEFINITIONS OF S&T ACTIVITIES

i. **Research:** Original, experimental or theoretical investigations under-taken to acquire new knowledge, with or without a particular application or use in view.
ii. **Development:** Systematic work drawing on existing knowledge gained from research and/or practical experience, that is directed to producing new products, processes, systems, services, varieties and breeds and to improving substantially already existing ones. Data collection conducted solely or primarily as part of the research and development (R&D) process included under "research" or "development" as appropriate.
iii. **Information and Specialist Advisory Services:** Provision of information via **formalised scientific and technical information and documentation (STID)** services includes all expenditure (manpower and materials) involved in acquiring, controlling or transmitting information to users with the involvement of staff whose primary function is in formalised STID services, e.g. provision of S&T information, advice, liaison.
iv. Specialist advice, information analysis, libraries, publications and documentation services, translations, technical seminars and conferences. Provision of information via **non-formalised STID services** includes expenditures on providing know how and expertise by members of staff who, while not specifically engaged in formalised STID

services, provide specialist advice, liaison, consultancy or other general information services.

v. **Technical Services:** Specialised support services of a scientific or technical nature generally provided by centralised laboratories or facilities, and can be of a routine or non-routine nature. Essentially they comprise the technical back-up analytical, diagnostic and data collection/processing services.

vi. **Training:** Education and training of third level or equivalent students in science and technology disciplines.

vii. **Technology Transfer:** Activities which are directed solely or primarily towards the transfer and adoption of new technology, generally in enterprises. The horizontal transfer of technology, primarily from abroad, but also from colleges to enterprises is included here.

viii. **Other S&T Activities:** Activities which cannot be conveniently grouped under the above headings can be included here e.g. grants to international organisations, policy planning units etc.

Other Definitions

ix. **Third Level Education:** All universities, Regional Technical Colleges and Dublin Institute of Technology.

x. **Public Funds:** Exchequer monies and funds from the European Regional Development Fund.

Appendix 3 - Index of Acronyms

BIM	Bord Iascaigh Mhara - The Irish Sea Fisheries Board
C&RFB	Central and Regional Fisheries Boards
CenBank	Central Bank
COFORD	National Council for Forest Research and Development
CSF	Community Support Framework
CSO	Central Statistics Office
DACG	Department of Arts, Culture and the Gaeltacht
DAgri	Department of Agriculture, Food and Forestry
DEduc	Department of Education
DEE	Department of Enterprise and Employment
DEnrg	Department of Transport, Energy and Communications
DEnv	Department of the Environment
DHlth	Department of Health
DIAS	Dublin Institute for Advanced Studies
DJust	Department of Justice
DMar	Department of the Marine
DSocW	Department of Social Welfare
EAGGF	European Agriculture Guidance and Guarantee Fund

EOLAS	Eolas - The Irish Science and Technology Agency
ERDF	European Regional Development Fund
ESF	European Social Fund
ESRI	Economic and Social Research Institute
EU	European Union
FÁS	FÁS - the National Training and Employment Authority
Forb	Forbairt
Forfás	Forfás - the Policy and Advisory board for Industrial Development
GSI	Geological Survey of Ireland
HEA	Higher Education Authority
HRB	Health Research Board
IDA	Industrial Development Agency Ireland
InnovC	Innovation Centre
MAC	National Microelectronics Applications Centre
MI	Marine Institute
MS	Meteorological Service
NAB	National Accreditation Board
NESC	National Economic and Social Council
NHMus	Natural History Museum
NMRC	National Microelectronics Research Centre

NRA	National Roads Authority
NSAI	National Standards Authority of Ireland
OPW	Office of Public Works
OS	Ordnance Survey
OST	Office of Science and Technology - Department of Enterprise and Employment
PatO	Patents Office
PGMDB	Postgraduate Medical and Dental Board
RPII	Radiological Protection Institute of Ireland
SFADCo	Shannon Development
SRAI	Salmon Research Agency of Ireland
StLab	State Laboratory
TEAG	Teagasc - The Agriculture and Food Development Authority
UN	United Nations
UnaG	Údarás na Gaeltachta