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SYMPOSIUM ON SCIENCE, TECHNOLOGY AND INNOVATION: THE IMPLICATIONS OF THE STIAC REPORT FOR IRELAND'S ECONOMIC DEVELOPMENT

The Tierney Report - a Challenge for Leadership

NOEL MULCAHY
University of Limerick

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1. BACKGROUND

This paper is presented as a means of demonstrating that the Tierney Report, arising from the work of the Science Technology and Innovation Advisory Council (STIAC), has the potential to stimulate a new phase of socio-economic development as the end of the century approaches. As a member of STIAC this writer is pleased to have the opportunity to join with Dr Tom Hardiman and Mr Charles Carroll in addressing this subject; both of whom have been working colleagues of mine, the former in Radio Eireann and RTE and the latter in the Irish Management Institution.

Hardiman played a very important role in setting up the former National Science and Technology Council, and he had to witness its demise and transformation into Eolas for reasons that are hard to comprehend. One can only hope that its a case of *un pas en arrière pour la mieux sauter.*

The Tierney Report pointed to a lack of awareness in Ireland of the importance of science, technology and innovation (STI). I hope to show what action the Report suggested as a way of improving the situation. For instance, although Bertie Ahern's address to the Fianna Fáil Ard Fheis did refer to Irelands 'Silicon Valley' and Intel, it contained no commitment to indigenous innovation as a force for economic development. Knowledge and technology transfer by means of mobile international investment is an important component of national economic strategy, but it is only one element in the vector of development forces.

In June of the year (1995) we organised a workshop in the University of Limerick to make some responses to the Tierney Report. I am including here the terms of the invitation to participants. I believe it catches the mood of the moment.

WORKSHOP
CHALLENGES FOR PARTNERSHIP
BETWEEN UNIVERSITIES AND INDUSTRY:
A RESPONSE TO THE TIERNEY REPORT
ON SCIENCE, TECHNOLOGY AND INNOVATION

- *The Workshop being held in Limerick "Challenges for Partnership between University and Industry: a Response to the Tierney Report on Science, Technology and Innovation" provides an opportunity for those who are concerned about Science, Technology and Innovation (STI) policy in Ireland. A task force has been set up under John Travers, Chief Executive, Forfás, to consider action and decisions to be taken based on the report. There is still a lot that can be done without waiting for the 'Travers Repo*

- *The Tierney Report emphasises the link between technical progress and economic development and employment. Basically, the finding is that 60 per cent of economic growth can be traced to technical progress. The principal strategy followed by Ireland up to the present has been that of harnessing mobile international investment. Ireland has been less effective in concentrating its development focus on indigenous industry. This must change.*

- *The Tierney Report emphasises the need for a* ***NATIONAL SYSTEM OF INNOVATION.*** *Innovation is defined 'as the creation and exploitation of new ideas'; thus innovation is not confined to Science and Technology alone. it is a function of the attitudes, behaviour and skills of society as a whole. The Tierney Report identifies that only 15 per cent of the innovating firms considered that the universities and higher education were important sources of information for their new developments. Only 14 per cent of the innovating firms had co-operative links with the third level sector.*

- *The Tierney Report recommends new STI administrative structures both at the departmental administrative and political levels. The Tierney Report made suggestions for a radical overhaul of government interdepartmental and, indeed, departmental structures including having a committee of the Cabinet chaired by the Taoiseach.*

- *The Tierney Report wants the State to take Science, Technology and Innovation seriously. For instance, under the original National Board for Science and Technology legislation, the Science budget was to have been debated annually in the Dail and in the Senate; in fact, this has not taken place for some 15 years. This is a most unsatisfactory situation but reflects the low priority given in the past to Science, Technology and Innovation as the major force for economic development.*

· *The workshop is focusing on these issues. The main players from industry, academia and the state agencies will be at the University of Limerick to consider some of the fundamental priorities.*

2. THE TIERNEY REPORT IS THIS PAPER

Dermot Hogan of Forfás produced a most useful booklet - *Conclusions and Recommendations from the Report of the STIAC*, March 1995. It contains 160 recommendations organised under the chapter headings of the report. Clearly it would not be possible to deal in any comprehensive way with such a wide ranging list of action items. This paper offers one or two pointers to certain facts and data isolated by STIAC, and to some key action items. The choice of course will reflect the biases and predilections of this writer; other members of STIAC would make a different selection from the list of 160.

The paper is organised under the following headings:

- Ventilating some DATA
- Organisation and the Role of the State
- Studies, particularly the GDP-Employment-Technology Linkages
- Crucial Factors

3. VENTILATING SOME DATA

STIAC received about 130 papers or proposals as part of the analysis of STI policy; also a number of special studies were commissioned. Some of the data revealed during the course of the work was startling; in many cases the sources and uses of funding were difficult to present in a readily understandable way to the members of STIAC, in spite of the obvious average high IQ of the group.

The Matrix

The Council asked Forfás to present data on STI expenditures in the form of a Sources and Uses Matrix; this we were able to understand. The Minister, Mr Seamus Brennan, mentioned a figure of £650 million for the Science Budget, when he launched STIAC. The Research and Development (R&D) budget was said to be about £360 million. Business R&D was placed at £200 million. GERD, BERD and HERD were bandied about with abandon in both absolute and percentage terms. How was Exchequer, European and Private funding to be differentiated? The Matrix was the answer. Refer to Tables 1 and 2 which are reproductions of Tables 2.1 and 2.2 respectively of the Tierney Report. There, all is revealed (for 1993).

The first column gives Business Expenditure on R&D (BERD) at £235 million (recent more up to date figures give £273 million). The percentage contribution by different sources can be calculated quite easily. Second and third columns give

Table 1 INDICATIVE DISTRIBUTION OF FUNDS FOR SCIENCE AND TECHNOLOGY ACTIVITIES (PART 1) 1993, £M

SOURCE OF FUNDS	RESEARCH & DEVELOPMENT Sectors of R&D performance: Business Sci. Bud. £m	Business Other £m	Business Total £m	Higher education Sci. Bud. £m	Higher education Other £m	Higher education Total £m	PATs Sci. Bud. £m	PATs Other £m	PATs Total £m	Government Sci. Bud. £m	Government Other £m	Government Total £m	Non-profit Sci. Bud. £m	Non-profit Other £m	Non-profit Total £m	TOTAL R&D Sci. Bud. £m	TOTAL R&D Other £m	TOTAL R&D Total £m
Exchequer Direct	4.1		4.1	2.1	0.6	2.7	1.6		1.6	26.9		26.9				34.7	0.6	35.3
Exchequer Indirect				19.9	11.5	31.4										19.9	11.5	31.4
ERDF	27.8		27.8	1.8		1.8	5.2		5.2	1.6		1.6				36.4		36.4
EU research contracts		5.8	5.8	13.5	1.7	15.2	2.5		2.5	3.5		3.5		1.0	1.0	19.5	8.5	28.0
Business		181.1	181.1	8.7	0.6	9.3	2.0		2.0	5.6		5.6		1.0	1.0	16.3	182.7	199.0
Other earned income	0.8	15.6	16.4	3.2	1.4	4.6	2.2		2.2	3.9		3.9		1.3	1.3	10.1	18.3	28.4
Total	32.7	202.5	235.2	49.2	15.8	65.0	13.5		13.5	41.5		41.5		3.3	3.3	136.9	221.6	358.5
	BERD			HERD												GERD		

Table 2

INDICATIVE DISTRIBUTION OF FUNDS FOR SCIENCE AND TECHNOLOGY ACTIVITIES (PART 2) 1993, £M

SOURCE OF FUNDS	S&T INFORMATION			TECHNICAL SERVICES			TECHNOLOGY TRANSFER			S&T EDUCATION AND TRAINING			OTHER SERVICES			TOTAL NON-R&D ACTIVITIES			TOTAL ALL ACTIVITIES		
	Sci. Bud. £m	Other £m	Total £m	Sci. Bud. £m	Other £m	Total £m	Sci. Bud. £m	Other £m	Total £m	Sci. Bud. £m	Other £m	Total £m	Sci. Bud. £m	Other £m	Total £m	Sci. Bud. £m	Other £m	Total £m	Sci. Bud. £m	R&D only: Other sources £m	Total *** £m
Exchequer Direct	22.9		22.9	124.8		124.8	1.0		1.0	135.3		135.3	36.5		36.5	320.5		320.5	355.2	0.4	355.8
Exchequer Indirect																			19.9	11.5	31.4
ERDF	1.8		1.8	3.8		3.8	2.6		2.6	72.2		72.2	6.1		6.1	86.5		86.5	122.9		122.9
EU research contracts	2.2	n/a	**	3.0	n/a	**	0.2	n/a	**		n/a	**		n/a	**	5.4	n/a	**	24.9	8.5	33.4
Business	5.3	n/a	**	6.8	n/a	**	0.4	n/a	**		n/a	**		n/a	**	12.5	n/a	**	28.8	182.7	211.5
Other earned income	4.5	n/a	**	11.3	n/a	**		n/a	**	64.8	n/a	**	6.2	n/a	**	86.8	n/a	**	96.9	18.3	115.2
Total	36.7	n/a	**	149.7	n/a	**	4.2	n/a	**	272.3	n/a	**	48.8	n/a	**	511.7	n/a	**	648.6	221.6	870.2

HERD for higher education; sixth column gives figures for GERD (Gross Expenditure in R&D). Fourth column gives government's own direct expenditure. Table 2 of the Matrix mainly covers expenditure in training and services.

Thus, the £650 million figure can be traced and, a figure of £870 million is available should some form of 'political' case be required. With all this money seemingly going into STI it was no wonder that the scientists on STIAC were somewhat confused, because they knew that the Forbairt/Eolas code line for direct university basic research support was more like £0.5 million per annum including old as well as new projects. The plot thickened. We knew that whatever we put in a final report it would have to have a table of recommended expenditures, clearly articulated. Table 8.2 in the Tierney Report served that purpose.

STI capability and R&D performance

On an ongoing basis there was a need to measure and assess the science, technology and innovation capability of Irish industry. The following emerged as a list of indicators.

Indicators of STI Capabilities

1. Technology in Industry Survey
- *Overall performers of R&D by ownership, size etc.*
- *Sectoral performers of R&D incl. High/Medium & Low Technology*

2. Census of Industrial Production
- *Overall industry structure*
- *Analysis of non-R&D Performers*

3. Innovation Survey
- *Innovators by size, ownership, allocation of resources*
- *Barriers to Innovation*
- *Technology Acquisition & Transfer*

4. Technology Audits
- *Technology Capabilities/Problems*

5. World Competitiveness Report
- *Business Enterprise R&D*
- *Government Share of BERD*
- *R&D personnel*
- *Patents*

With this analysis the sorry state of research and development activity in Ireland was revealed.

Only 12 per cent of Irish indigenous firms performed R&D; 24 per cent of foreign firms. Total in Ireland is 14.5 per cent; 192 out of 797 foreign firms performed. This led to a great debate on carrot and stick incentives to improve on this performance. A range of incentives is suggested in the Report but in the event of unsatisfactory progress in improving these figures the concept of the Repayable Cash Contribution (RCC) was suggested as a possible measure to deal with the problem. This gave rise to many heated arguments in STIAC. Vol. III of the Report indicates how this strategy might work.

Industry Sectors

- Marine

Some comparative data

Country	**R&D Personnel**	**Country**	**Expenditure (ECU per capita)**
Ireland	62	Ireland	0.45
Spain	400	Portugal	0.91
Portugal	400	Germany	1.74
France	158		

- Construction

Output rising to £4 billion
Only 3 firms doing R&D; worth £0.2 million

- Food Industry

Average 0.2/0.3 per cent of sales devoted to R&D in a major strategic sector !!

- Service Sector

Over 60 per cent of employment
Only 9 per cent of BERD

For a detailed view of the situation see Tables 3-5 which show R&D Firm Performance and Table 6 which gives Research Intensity for various sectors.

Table 3 Propensity to perform R&D by Irish firms, by firm size

Firm size: number of employees	Number of R&D performing firms	Total number of firms	No. of R&D firms as % of total firms
3-9	106	1593	7.0
10-99	385	2494	15.0
100+	175	515	34.0
Total	666	4602	14.5

Table 4 Percentage of total R&D expenditure by Irish firms, by firm size (sales category £m) and technology level, 1991

Technology level of firm	0-1	1-5	5-10	10+	Total
High	6.7	17.7	4.7	70.8	100
Medium	9.4	11.0	10.7	69.0	100
Low	16.6	12.2	5.9	65.4	100

Table 5 R&D performance by Irish firms, by firm ownership

Ownership	No. of R&D performing firms	Total number of firms	No. of R&D firms as % of total firms
Irish	474	3805	12.0
Foreign	192	797	24.0
Total	666	4602	14.5

Source: Technology in Industry Survey 1991 (Eolas 1993). Tables 3.1 to 3.3 respectively.

Innovation

Innovation is defined in the Report as "creating and exploiting new ideas", (not just 'exploiting' as is the case in the UK Innovation Report). Ideas can be 'soft' or 'hard'; STIAC dealt with the wider concept and avoided getting backed into a more confining linear model of innovation based on the 'basic research - investment' spectrum. This topic is well developed in recent literature, including Dermot O' Doherty's (Forfás) recent book (1995).

The National Technological Audit Programme showed a poor result for innovation performance as measured by new product development.

Improved Manufacturing Techniques	81%
Improved Existing Products	32%
New Product Development	8.5%

Table 6 Research intensity by sector

Sector	R&D/ Sales (%)	
	Indigenous	Foreign
High technology	*3.0*	*3.1*
Electrical machinery	1.3	1.9
Electronic equipment	2.9	4.6
Drugs	4.6	1.4
Instruments	10.1	1.4
Software	17.4	44.5
Medium technology	*0.8*	*2.4*
Chemicals	0.7	2.8
Non-ferrous metals	1.7	0.8
Machinery	0.6	2.8
Rubber and plastics	0.8	0.5
Other manufacturing	0.2	2.4
Other transport (excl. cars)		1.4
Low technology	*0.4*	*0.3*
Petroleum refining	0.3	-
Ships	0.5	-
Fabricated metal	2.5	2.2
Food, drink and tobacco	0.3	0.2
Textiles and clothing	2.5	1.1
Stone, clay, glass and cement	0.5	1.0
Paper and printing	0.3	2.4
Wood and furniture	2.0	1.3
Total all sectors	0.7	1.5

Source: Technology in Industry Survey 1991 (Eolas 1993). Table 3.8

Basic Research Expenditure

Table 7 shows the breakdown of expenditure 1991/1992 between Basic and Applied Research. This gives some 'feel' for the proportion of funds spent on so called 'pure' research, say £22m out of £260m, i.e. less than 10 per cent (in the education sector the figures is 25 per cent).

Table 7 R&D Expenditure by the education and industry sectors by type, including pay and non-pay (£ m)

Type	Basic research	Applied research*	Total (£m)
Education sector 1992	15 (25%)	46 (75%)	61
Business sector 1991	6.9 (4%)	167 (96%)	173.9
Programmes in advance technology	-	12 (100%)	12

*Source: Forfás surveys. * Includes oriented basic research.*

Education Output

The council was surprised at the supply/demand mentality which pervaded the debate about the number and mix of doctoral graduates from the third level system. The Tierney Report discusses the issues and Table 8 gives the figures for 1991 (recent more up to date ESRI studies are now available).

Table 8 Output of Doctorates, 1991

Subject	Number
Maths/statistics	4
Physics	13
Chemistry	24
Biochemistry	12
Botany/zoology	24
Earth sciences	4
Microbiology	17
Pharmacology/pharmacy	14
Computer sciences	5

Source: Table 5.3 of Tierney report.

STIAC considered that the output target for numbers of PhD graduates in key fields of study was a most important strategic variable. The PhD output was like the summit of the knowledge and skill mountain; the peaks above the clouds proving that a solid base of bachelors and masters were in position. PhD students keep the professors on their toes. The PhD thesis (in the Anglo-Saxon system) demonstrates that research has taken place at a quality level. Although one cannot always predict where the doctoral graduate is going to end up working, the data are revealing. We can look forward to the publication of the special studies being carried out for Forbairt by Hughes and others in the ESRI; some of the information available to STIAC showed that a significant number were working in Ireland although many of these had spent a period abroad. It is understandable that Forbairt studies should place a lot of emphasis on the manpower planning aspects, and comment on the costs to society of producing doctorates for export. However, this preoccupation ignores

the strategic issue - the doctoral output variable is a good indicator of research activity and, through development, may lead to added value. For instance, one of the interesting findings of Storey's research on Science Parks at the University of Warwick is the fact that the surviving park companies are those owned by PhD graduates. But this is only one variable in the equation.

What concerned STIAC was that the strategy formulators were not aware of this issue and *did not seem to understand its importance*.

In 1981 there were 1,060 PhDs in pure science engineering and computer science in the working population. The figure went to 1,160 by 1986 an increase of 100 - not so exciting!

In 1990 the total PhD output (graduating) was 285 out of 10,130 degree awards - 2.8 per cent; in 1991 the figure dropped back to 273 out of 10,580 degree awards.

When it comes to an appraisal of the proportion of PhD output in the categories of fields of study it gets worse. We say that computers are important and boast about Ireland's "Silicon Valley"; the PhD output in Computer Science between 1986 and 1991 averaged 3 per annum!

The Food and Dairy industries are central to the economy - PhD output is 3 on average, but in 1991 the figure was <u>one</u>

For engineering PhDs the scene is no better. Output in 1983 was 17, in 1991 it was 18!! The average for economics was one per annum; <u>none</u> in 1985, <u>one</u> in 1991. Does this tell us something? PhD output in Arts and Humanities in 1991 was 58!!

It is quite clear that the new STIAC must study this issue and suggest targets in the key sectors for PhD output. We do not need to repeat the Foresight exercises carried out by others; the Japan Futurology Institute and other reports are available. All that's needed is to ensure that the requisite PhD output for the strategically important technologies is incentivised and achieved. To accelerate this process consideration should be given to shifting the focus from full-time study to Action Learning based part-time study.

In fairness to the national education planning system for the third level it must be said that at primary degree, national certificate and national diploma levels the picture is much better. Some 20 per cent of the working population have third level qualifications, of which the doctoral population is about 2000. The most significant improvement occurred in the NCEA sector. In September 1966 the Minister for Education, Donagh O'Malley, gave a steering committee the following brief:

"*To advise the Minister generally on technical education. In particular, on behalf of the Minister, to provide the Department of Education Building Consortium with a brief for the technical colleges.*

The committee should ensure, in as much as it is possible, that their brief will harmonise with any future thinking on third level technical education

The committee in preparing their brief should consider all masters relevant to such a task"

The Steering Committee (chaired by the writer) struggled to deal with supply/demand issues; it was decided to put the emphasis on 'NEED'. The following is the relevant section from the 1967 report of the Steering Committee.

"NEED/DEMAND FOR TECHNICIANS AND SKILLED PERSONNEL

The need for certain kinds of education and training must be distinguished from demand. This point has been made many times in reports in the past few years. A business firm or a national economy must adapt in order to survive in a changing environment, and the environment of Irish industry will be changed radically by free trade conditions with Great Britain and by probable entry to the Common Market. If the demand for needed skills does not arise naturally, it must be stimulated artificially. We feel that the Regional Technical Colleges will provide one of the answers to this problem.

Irish people generally have not had the opportunity to become technically skilled and the academic bias in the educational system has not helped. This leaves a serious gap in the stock of knowledge and skill necessary for the development of productive enterprise.

Our views on this matter are summarised as follows:

a) *The availability of increased technical knowledge and skill at all levels is a necessary, though not sufficient, condition for further economic growth and the promotion of innovation and enterprise amongst the people. Ireland has largely failed to provide this resource;*

b) *The projections of output of qualified technical personnel from the education sector must take into account the probability that some of those qualifying from Regional Colleges may choose to work abroad because of the world shortage of such personnel;*

c) *Due account must be taken of the economic and social needs of developing regions, where investment in education is a necessary part of industrial development. The lack of productive enterprise in these regions is partly due*

to an economic, educational, cultural and social environment which has not encouraged its development.

One of the ways in which demand could be stimulated would be to give due recognition to the various awards to be obtained in the Regional Colleges. We recommend the establishment of a National Council for Educational Awards."

In 1960 the writer could not find even one person with an appropriate technical qualification to work in the industrial estate in the Shannon Free Zone. In 1981 there was about 9,000 qualified technicians in the workforce; this rose to some 21,000 in 1986 and must be even higher now judging by NCEA graduate figures.

The targets in the Steering Committee Report were more than achieved because the approach was strategy based. The mix of science and technology graduates now in the labour force is reasonably compatible with the national industrial strategy; primary degree at 50 per cent, technicians 40 per cent, masters degree at 7.4 per cent and doctorates at 2.6 per cent. However, the doctoral level must be considered to be inadequate. The 2.6 per cent figure begs for some international comparative figures. In the case of engineering graduates, USA and Canada figures may help.

For engineering degrees awarded in the USA at Bachelor, Master and Doctoral levels, the proportions are 68, 26 and 6 percent respectively; for Canada the percentages are 71, 23 and 6.

For Ireland the percentages are 86, 13 and 1.2. With 1.2 per cent of engineering graduates at doctoral level, clearly we have a problem. The new STIAC must act on this.

4. ORGANISATION AND THE ROLE OF THE STATE

Chapter 8 of Tierney discusses the problems with the present system. For an effective "National System of Innovation" it is recommended that:

- The Science & Technology office should remain within the Department of Enterprise and Employment, for pragmatic reasons, despite many proposals from other bodies for a more independent highly visible situation, i.e. Taoiseach's Department should be headed up by an Assistant Secretary level division.

- An Interdepartmental Committee chaired by the Minister of State should meet to review previous years' Science Budget, develop current (estimates) budget, and, update a 3 year plan.

- The budget and plan should be reviewed by a Cabinet Committee chaired, once a year by An Taoiseach.

- An Oireachtas Committee should review the Science Budget and Plans.

- There should be a new STIAC.

- The Science Budget should be debated in both houses of the Oireachtas annually, unlike the failure to do so, despite legislation, in the past 15 years.

5. STUDIES

STIAC examined a number of ad hoc studies some of which are given in the 3 volumes making up the Tierney Report.

- Awareness Study
- Fiscal Incentives
- Evaluation of National Technological Park, Limerick
- Review of Programmes in Advanced Technology (PATs)
- STI in relation to National competitiveness and Economic Development prepared by CIRCA, and published as Volume II of the STIAC Report)

These would need to be studied on a stand-alone basis. The Fiscal Incentive Report produced by a sub group chaired by the writer, reported early in 1994, and last years' Finance Bill adopted a number of the recommendations.

The Technology Park evaluation was conducted in the context of the proposal for a Science Park in Dublin.

The CIRCA study aimed at reviewing the literature covering theories advocated by Dennison, and Solow in the 50s and 60s and combed through 118 references up to 1994, plus 15 detailed notes culminating in Porter's 'cluster' ideas. The 'bottom line' conclusion was, that the "contribution from science technology, (innovation in products, processes, productivity, and therefore competitive status) has been computed to be in excess of 60 per cent"; and "*Technical Progress is by far the most important source of economic growth of the industrialised countries*".

If this be the case why do we still have doubters amongst the dismal profession!! Why does Charles Carroll continue to use the PIMS data base to knock investment in technology? Maybe he is asking the data base the wrong question?

6. CRUCIAL FACTORS FOR INDUSTRY

In developing the analysis for chapter 3 of Volume I of the Tierney Report, seven crucial issues were identified, and, the group working on that chapter brought forward specific quantified targets for recommendations to deal with these crucial factors.

- Size and Scale; There are very few large firms and even the food companies don't perform well in R&D.
- Multinational Companies (MNCs); MNCs are determining work practices, forcing the skill levels and mix, and dominating the manufacturing sector. The global industrial system is dominating industrial practices.
- Funding Crisis (EU) in 1999
- What will happen to Government STI support in 1999?
- EU STI policies are driving the National STI structures - where to?
- Perception of Entrepreneurship in Ireland - Risk Averse
- Low Value Added being extracted from Irish indigenous resource

7. RECOMMENDATIONS

As outlined in Section 1 of this paper Table 8.2 of Tierney gives the costs of the various recommendations in terms of the incremental annual costs. This is reproduced here as Table 9. It is a convenient summary of the 160 recommendations. If anyone wishes to really understand what Tierney is advocating they must comprehend this table. This is not easy. This writer is still trying to do so.

Table 9 Costs of recommendations - Incremental annual cost above base year (£ m)

Chapter	Recommendation	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5
3	Double BERD	8.0	13.0	17.0	28.0	34.0
	Promote co-operation	3.0	11.0	20.0	-	-
	Increase placements	1.0	2.0	1.5	1.0	-
	HE/industry joint R&D (HEIC)	3.0	5.0	7.0	7.0	7.0
	Patent cost support	2.0	4.0	5.5	5.5	5.5
	Venture capital fund	3.0	4.0	5.0	5.0	5.0
	Technology acquisition	3.0	4.0	5.0	5.0	5.0
	Miscellaneous	2.0	3.0	4.0	4.0	4.0
4	'New blood' for Forbairt	1.1	-	-	0.2	0.5
	Expand technology audits	0.3	0.3	0.3	0.3	0.3
	Medical R&D	2.7	2.7	2.7	2.7	2.7
	Monitoring, evaluation & data	0.6	0.6	0.6	0.6	0.6
5	Basic research	2.0	3.5	4.5	4.5	4.5
	Oriented basic research	1.8	2.0	2.0	2.0	2.0
	Regenerating skills	0.5	1.0	2.0	2.0	2.0
	Research equipment	5.0	5.0	5.0	5.0	5.0
	Scholarships	0.5	1.0	1.5	1.5	1.5
	Intellectual property	0.2	0.5	0.5	0.5	0.5
6	Technology brokerage	1.0	1.0	1.0	1.0	1.0
7	Awareness	1.0	1.0	1.0	1.0	1.0
	Grand total	41.7	64.0	86.1	76.5	82.1

N.B. Does not include any increased provision for marine, forestry or the environment.
Source: Table 8.2 of Tierney report.

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