

The Fifth European Framework Programme: a comparison of Scotland and Ireland Involvement

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Introduction

The knowledge economy is recognised as a key driver of economic progress. It is also recognised that within a successful knowledge economy an important role is played by research and development and its effective transmission into the market place to the benefit of the local economy. These views express themselves in the European Union context in the goal set at the Barcelona Council 2002 to increase R&D investment to approach 3% of GDP by 2010 from its current level of 1.9% and to increase business R&D from its current level of 1.06% to around 2% of GDP. This goal is a particular challenge to a country like Scotland where business R&D, at around 0.53% of GDP, is low compared to the European average: (Scottish Executive).

There are a number of programmes at national and European level designed to assist the development of the knowledge economy. One of the most important programmes is the EU Framework Programme, which provides funding assistance and encourages research links and networks throughout the EU. The purpose of this paper is to examine the participation of organisations in Scotland and Ireland in the Fifth Framework Programme (FP5), and compare the patterns of participation in the two countries. A particular emphasis in the paper is to consider the involvement of business in Scotland and Ireland in FP5. The information used was collated from the European CORDIS database of FP5 projects as at end February 2003.

The structure of the paper is as follows. The first section gives a brief description of the Framework Programmes. The second section, which constitutes the main part of the paper, examines the participation of different types of organisation, (Higher Education Institutions, businesses, and public bodies), in FP5. The main conclusions are that there has been a relatively low level of participation by Scottish businesses in FP5 compared to Ireland, and also that the level of links established between businesses and the education/research sector in Scotland is relatively low.

In the final section, we make recommendations on what we believe is required in Scotland to give more value added to

the economy from the operation of the programme. In particular we recommend that attention should be paid to the mechanisms for advising and supporting Scottish businesses in relation to the Framework Programme, and to co-ordination with other EU supported programmes like COST and Eureka. There is also the important issue of whether some supplementary mechanism might be required to facilitate greater involvement of Scottish firms with research partners in other parts of the UK.

The European Framework Programmes: background and importance

The background to the Framework Programme initiative was the view that while the scientific potential of the EC was considerable; this potential was insufficiently exploited, partly because communication and co-operation between scientists working in different parts of Europe was inadequate, and partly because R&D levels tended to be low. The First European Framework Programme began in 1984 and was designed to provide the Community with a means of selecting and orchestrating scientific and technological aims: with a means of planning which could co-ordinate Community and national activities: and with a means of financial provision. (Guzzetti, 1995).

An individual Framework Programme typically has a life span of four years, with the Fifth Framework being instituted in 1998, and the Sixth at end 2002. Projects may apply for financial support under a given Framework programme if these projects are consistent with the published aims of the programme. Projects usually involve collaboration between organisations from more than one EU member country (or, in some cases, external participant countries).

The priorities of the Fifth Programme reflected the major concerns of the requirement to increase industrial competitiveness and to improve the quality of life for European citizens (Cordis). Activities under the Fifth Framework Programme are organised under eight major areas, the budgets for which are shown in the following table.

Table 1: Fifth framework budget

<i>Theme</i>	<i>Budget • million</i>
Quality of life and management of living resources (Life)	2,413
User Friendly Information Society (IST)	3,600
Competitive and Sustainable Growth (Growth)	2,705
Energy, Environment and Sustainable Development (EESD)	2,125
International (INCO)	475
Innovation/Encouraging SME participation (Innov SME)	363
Improving human research potential (Human Potential)	1,280
Joint Research Centre	739
Euratom (EAE)	1,260
Total	14,960

The first four items above are the principal themes covering research and technological development. On average it was expected that 10% of the budget on these four programmes would be for small and medium sized enterprises (SMEs). The fifth item in the budget covers international commitments in R&D particularly with less developed economies. The budget for innovation covers projects promoting innovation and encouraging SME participation. The human potential budget is to foster research mobility, improve training of researchers, and increase the socio-economic knowledge base.

Note that, although some projects receive 100% funding, this is relatively unusual. In most cases, funding via the Framework Programme amounts to a portion, usually no more than 50%, of the project costs, with the remaining co-funding coming from project members.

The total amount of funding available under the Framework Programme has clearly been significant, with the total budget of the Fifth Programme at almost •15 billion. The budget of the Sixth Programme, which started at end 2002, is •17.5 billion. Like FP5, FP6 will encourage projects in themes such as Life etc, through its funding, but it differs from FP5 in its emphasis on the creation of Networks of Excellence and Integrated Projects. What this means is the creation of network structures that will be more permanent, thus allowing consortia to exist for a longer period than the duration of an individual project.

As already stated, Scotland has historically had a low level of business R&D. As regards Ireland, despite its recent economic success, business R&D is still relatively low (0.89% of GDP). It is therefore of interest to examine how Scotland and Ireland have participated in the Fifth Framework Programme, and to compare their experience.

Scottish and Irish participation in the fifth framework programme

As noted above, a healthy knowledge economy involves not just a high level of R&D, but effective transmission of R&D into the market sector. One of the aspects we will be particularly concerned to examine, therefore, is the degree of private sector involvement in the Framework Programme, and the extent and nature of the local linkages between the research environment and the private sector.

The data

The data upon which this analysis is based were drawn from the EU CORDIS database of Fifth Framework Projects which is accessible on the Internet. CORDIS is a searchable database of individual projects. Essentially the projects selected for the study were Framework Five projects involving at least one partner from Scotland or Ireland. Projects selected for Ireland where the only Irish partner was in Northern Ireland (N.I.) were excluded.

For the selected projects, the information manually extracted from the database included the following:

- 7 Theme: e.g., Life, Growth, Human Potential, EESD, etc.
- 7 Names of Scottish or Irish participants
- 7 Country of lead contractor
- 7 Descriptive information on subject of project.

As noted in the introduction, the data for this exercise was extracted from the CORDIS database as at end February 2003.

Projects by organisation type and theme

There were 801 Fifth Framework projects involving at least one Scottish partner, and 779 involving at least one Irish (excluding N.I.) partner; that is, a ratio of Irish to Scottish participant organisations of 0.97. This compares with a population ratio of 0.76 between Ireland and Scotland. In other words, in terms of overall participation in FP5 Projects, Scotland's performance is relatively much poorer than Ireland's.

In fact, if Scotland had performed as well as Ireland in terms of projects per head of population, we would have expected there to be around 1,053 projects involving Scottish organisations. On this basis, Scotland appears to have under-performed in comparison to Ireland to the extent of about 250 projects.

For the purposes of the study, we have grouped projects in terms of the types of organisation involved, that is, as to whether the institutions involved from Scotland or Ireland were education/research institutions, businesses, or public bodies, or mixes of these types of body. Table 2 shows the breakdown of projects by this classification.

Table 2: Projects by types of organisations involved in Scotland or Ireland

Type	Scotland	%	Ireland	%	Ratio Ireland to Scotland numbers
Education/Research					
Institutes	604	75.4	448	57.8	0.74
Private	113	14.1	189	24.4	1.67
Public Bodies	34	4.2	63	8.1	1.85
Education/Research and					
Private Sector	26	3.2	50	6.5	1.92
Education/Research and					
Public	17	2.1	11	1.4	0.65
Private and Public bodies	5	0.6	12	1.5	2.4
All types	2	0.2	2	0.3	1
No information	-	-	4	0.5	..
Total	801	100	779	100	0.97

The noticeable feature from Table 2 is that a much higher percentage of Scottish projects have a domestic involvement of Education/Research Institutions, (75.4%), compared with 57.8% in Ireland, whereas the percentage of projects involving private organisations (primarily SMEs) is a good deal higher for Ireland than for Scotland (Ireland 189, or 24.4% against 113 in Scotland, that is 14.1%). The percentage of projects involving public bodies is also somewhat higher in Ireland than in Scotland.

The final column in Table 2 shows the ratio of Irish to Scottish projects. As already noted, Scotland under performs in total on a per capita basis: this column enables us to identify where the underperformance occurs. In fact, for projects involving education/research institutes, the Irish/Scottish ratio is very much in line with the population ratio, recalling that the ratio of Ireland's to Scotland's population is 0.76.

This however is not the case for almost all other organisation types in the table. In particular, it can be noted that for the private category, (which is important both numerically and in terms of economic impact), the ratio of Irish to Scottish, at 1.67, is more than twice what we would expect on a per capita basis. If Scotland had performed in this category as well as Ireland on per capita terms, we might have expected 255 projects in this category compared with the 113, which were observed. Furthermore, in the category involving dual involvement of the education and private sectors, where there were only 26 such projects in Scotland, we might have expected 68 if we had performed as well as Ireland. In other words, in numerical terms, the Scottish underperformance is largely accounted for by low involvement of businesses, whether on their own or in conjunction with other organisations in Scotland.

Table 3 shows the distribution of projects in each country by theme, both in terms of numbers of projects, and percentages: also shown is the ratio of Ireland to Scotland project numbers.

Table 3: Distribution of projects by theme

Theme	Scotland		Ireland		Ratio Ireland to Scotland: numbers
	Numbers	Percent	Numbers	Percent	
Life	250	31.2	173	22.2	0.69
IST	130	16.2	192	24.6	1.48
Growth	98	12.2	142	18.2	1.45
EESD	134	16.7	103	13.2	0.77
Inco	39	4.9	20	2.6	0.51
Innovation-SME	5	0.6	4	0.5	0.8
Human Potential	127	15.9	134	17.2	1.06
EAE	18	2.2	11	1.4	0.61
Total	801	100	779	100	0.97

The first theme, Life, includes primarily projects in agriculture, aquaculture, fisheries and forestry, (that is, the primary sector), as well as projects in Life Sciences, that is biological sciences, genetics, immunology, health and medicine. A preliminary division of projects into "Primary sector" and "Life Sciences" using key words and descriptions of projects in the Cordis database suggests that the split between the two groups in both countries is approximately 45% "primary sector" and 55% "Life Sciences". As the table indicates, Scotland's involvement in this theme is greater than Ireland's on a per capita basis.

The IST theme includes all types of electronics, communications etc. on a per capita basis Scotland's participation in this theme is a good deal lower than Ireland's.

Scotland's participation is also lower for the Growth theme which includes industrial manufacturing, transport, shipping, logistics, and aerospace. The EESD theme includes environmental protection and energy, covering fossil fuels and renewable sources of energy: both countries' participation in this theme is similar as measured on a per capita basis.

Overall, from Table 2 and Table 3, a pattern emerges of a higher percentage of Scotland's projects involving only education/research institutions and a relatively higher percentage of projects occurring in the Life area: while in Ireland, a higher percentage of projects involve businesses and a relatively higher percentage are in the Growth and IST areas.

Involvement of individual organisations

In this section, we wish to examine in more detail the linkages between the type of organisation and the theme. Up to now we have considered the individual project as the basic unit of analysis, however, since one project may involve several domestic organisations, it is in some ways more revealing to consider individual organisation involvements in projects. For example, if a Scottish University and a Scottish firm are involved in the same project, we regard this as two Scottish organisation involvements.

Table 4 shows the number of organisation involvements for each country, breaking this down by the type of organisation. Since a small number of private organisations were bodies like professional associations, lobbying bodies etc. rather than traditional commercial companies, the category of private organisation has been sub-divided into "business" and "association" to reflect this.

Table 4: Organisation involvement

	Scotland	%	Ireland	Ratio: Ireland to % Scotland	
Education/Research	704	75.9	540	58.8	0.77
Business	150	16.2	279	30.4	1.86
Association/ Professional Body	11	1.2	5	0.5	0.45
Public Body	62	6.7	95	10.3	1.53
Total	927	100	919	100	.99

Recalling that the ratio of Ireland's population to Scotland's is about 0.76, the table confirms a feature already noted, that the relative involvement of the education/research sector in the two countries is broadly in line with population, but that Ireland's business sector and public bodies have a rate of involvement in the Framework Programme which is relatively much higher than Scotland's.

We now consider the themes in which these different types of organisation are involved and examine whether the pattern of subject area involvement differs between the two countries. Tables 5A and 5B show for Scotland and Ireland respectively, the percentage of involvements for each type of organisations falling into the different themes (percentages have not been given for Associations because of the small numbers involved).

Table 5A Scotland: Organisation involvement by theme (percentage)

	HEI/ Research	Business	Assoc.	Public Body	Total
Life	31.7	17.3	..	54.8	31.1
IST	16.5	20.7	..	9.7	16.5
Growth	10.5	26.0	..	9.7	12.9
EESD	14.8	31.3	..	22.6	18.0
Inco2	5.4	1.3	..	0	4.6
Innov	0.6	0	..	1.6	0.5
Human Potential	18	0.7	..	1.6	13.9
EAE	2.6	2.7	..	0	2.4
Total	100	100	..	100	100
Total Number	704	150	11	62	927

Table 5B Ireland: Organisation involvement by theme (percentage)

	HEI/ Research	Business	Assoc.	Public Body	Total
Life	24.1	16.8	..	24.2	22.0
IST	20.4	36.2	..	27.4	25.9
Growth	13.5	31.2	..	22.1	19.7
EESD	13.1	12.9	..	15.8	13.3
Inco2	3.3	0.7	..	0	2.2
Innov	0.2	0	..	2.1	0.5
Human Potential	24.1	1.4	..	4.2	15.0
EAE	1.3	0.7	..	4.2	1.4
Total	100	100	..	100	100
Total Number	540	279	5	95	919

For both countries, a higher percentage of businesses are involved in Growth and IST than either education/research institutions or public bodies – while on the other hand, businesses have a lower involvement in the Life area. It is also true that, for both countries, a much higher percentage of education/research institutions are involved in the Human Potential area than for either of the other two main types of organisation.

On top of these general features, there are some very marked differences between the two countries in the pattern of organisational involvement by subject area. In particular:

- 7 Businesses in Scotland have a much higher involvement in EESD projects, at 31.3%, compared to businesses in Ireland at 12.9% (a study of these Scottish projects indicates that a high proportion of them are in the oil and gas areas). Scottish businesses have, however, a much lower participation in IST projects (20.7% compared to 36.2%) and a somewhat lower involvement in Growth.
- 7 Education/research institutions in Scotland are more highly involved in Life projects (31.7% compared 24.1%) but are somewhat less involved in Human Potential and IST than Irish institutions.
- 7 Public bodies in Scotland have a very much higher involvement in Life projects (54.8% against 24.2%), and to some extent in EESD projects, but are a great deal less involved than Irish bodies in IST and Growth.

The cumulative effect of the higher overall participation of Irish businesses in FP5, combined with their higher propensity to participate in IST and Growth projects, has a substantial effect on the absolute numbers of companies involved in these key themes. For example, there are 101 Irish business involvements in IST projects, compared to 31

Scottish business involvements and there are 87 Irish business involvements in Growth projects, compared with 39 Scottish.

Participation of individual Higher Education Institutions

We now turn to the participation of individual education and research organisations in the Fifth Framework programme. Table 6 below shows the dominance of the university sector in this group.

Table 6: Participation of Education/Research Organisations in the Fifth Framework

	<i>Scotland</i>	<i>Ireland</i>	<i>Ratio Ireland to Scotland</i>
Universities /HEIs	547	467	0.85
Other Colleges	7	26	3.71
Research Institutions/ Research Councils	150	47	0.31
Total	704	540	0.77

For research and education bodies as a whole, the ratio of participation by Irish institutions compared to Scottish institutions is similar, at 0.77, to population ratios. Within this total, the ratio of Irish to Scottish HEI participation, at 0.85, is broadly in line with population ratios.

The participation of other types of colleges and research institutions is affected by the way research is organised in the two countries. In Ireland, there is a strong technical college sector. In Scotland, there is a strong tradition of agricultural research institutions including the Macaulay, Rowett, Scottish Crop Research Institute, etc. The other feature particular to Scotland is the work of the laboratories funded by the UK research councils, namely the NERC and the MRC.

As would be expected, the number and nature of the organisations involved in this research institution sector has a marked bearing on the number of projects and the types of subject with which the institutions become involved. For example, a more detailed study of the information available on the data base indicates that of the projects in which research institutions in Scotland were involved, almost 75% were in the Agriculture/Fisheries, Biomed, or Energy areas. This reflects the composition of research institutions in Scotland and the involvement of research council laboratories, as already noted.

Overall, 21.3% of participations by Scotland's education/research organisations in FP5 are by these research

institutions and research councils, as compared to 8.7% in Ireland. By their specialist nature, they influence the types of subject area in which Scotland is involved.

Now considering the University sector in more detail, Table 7 shows the numbers of participations by individual institution in the Fifth Framework Programme in Scotland and Ireland.

Table 7: Number of involvements of each university in the Fifth Framework Programme

<i>Scotland</i>		<i>Ireland</i>	
Edinburgh	166	Cork	141
Glasgow	88	Trinity	103
Strathclyde	61	UCD	87
Aberdeen	60	Galway	62
Dundee	36	Limerick	32
Heriot Watt	35	Dublin City	27
St Andrews	33	Maynooth	15
Stirling	28		
Napier	14		
RGU	11		
Paisley	5		
GCU	4		
Abertay	3		

It is clear that there is very great variation between institutions in the number of their involvements, with a tail to the distribution in Scotland involving institutions with very limited participation. However, to make more sense of these figures it is necessary to take into account other factors such as the variation in size between institutions. One measure of this is full time student numbers (undergraduate and post-graduate). Chart 1 indicates that there is a broadly linear relationship between student numbers and involvement.

To examine this relationship in more detail, a regression model was fitted between involvements in the Fifth Framework programme as the dependent variable, and with student numbers, and a dummy variable indicating whether an institution was Irish or Scottish as independent variables. The results of the regression are given in the following table.

Regression Results

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>
Intercept	-40.6025	16.92076	-2.39957
Student nos.	0.008701	0.001584	5.491703
Ireland Effect	25.51465	13.19275	1.933989

R² = 0.665

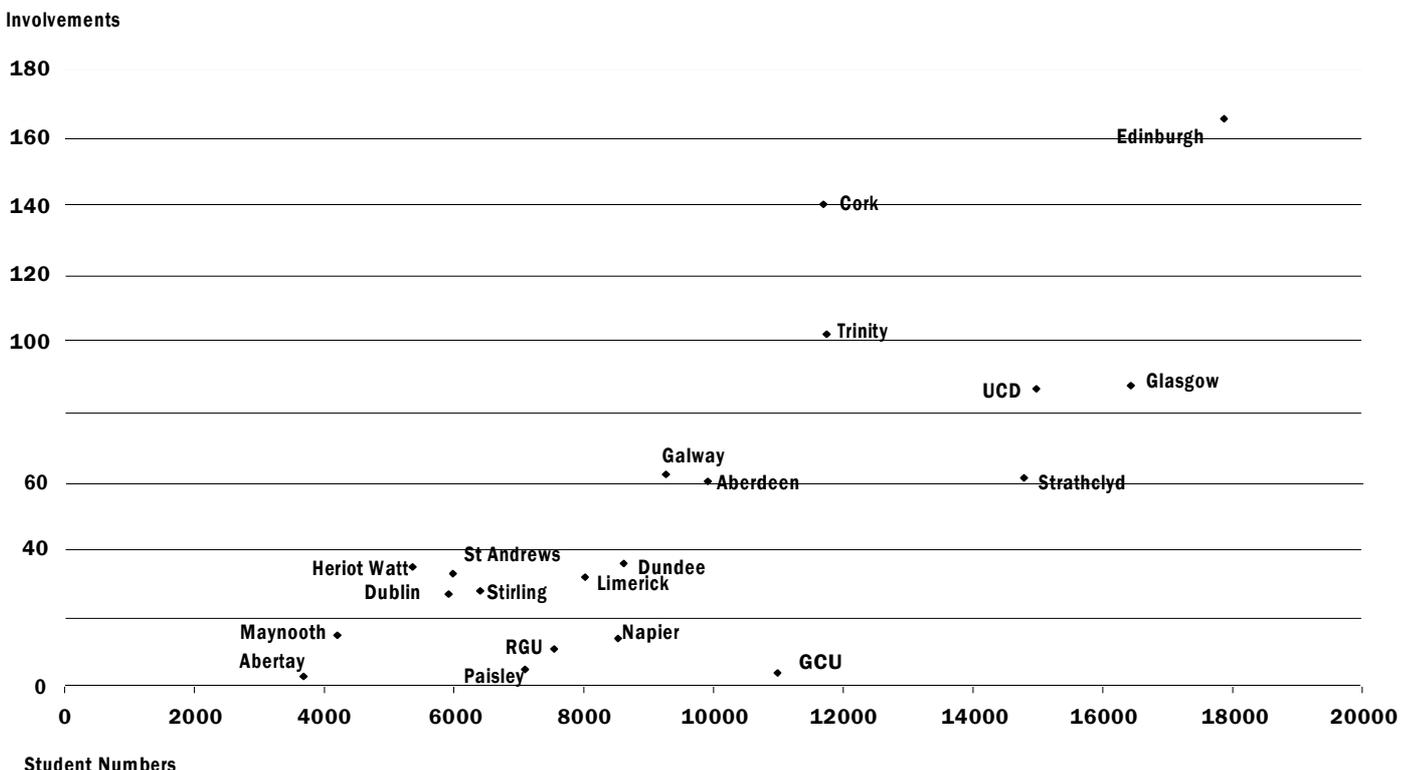
The highly significant coefficient associated with the student numbers variable confirms the impression given in the chart, that scale plays an important part in determining involvement. This is not surprising.

An interesting feature of the regression results, however, is the statistically significant negative intercept term. This means that the fitted regression lines have a positive intercept with the student number axis. This suggests that there is effectively a fixed cost associated with involvement in the Framework Programme, so that very small institutions tend to have limited involvement: another way of putting this is that there are effectively economies of scale in involvement with the framework programme.

The dummy variable indicating an Irish institution is positive, and has an associated t-value, which just fails to be significant at the 5% level (p value = 0.07). This provides suggestive, (but not entirely conclusive) evidence of a positive Irish effect. That is that an Irish institution may have a somewhat higher level of participation, compared with Scottish institutions, than predicted by their size alone. The point estimate of the size of this effect provided by the co-efficient of the dummy variable suggests that the size of this effect could be to contribute around 25 extra participations to an Irish institution, (though, given the relatively large standard error associated with this term there is great imprecision attached to such an estimate.)

Although scale does play a major part in explaining Framework Five participation, it is also clear from the chart that this is not the whole story. For example, for institutions which have around 11,000 students, Glasgow Caledonian's participation is 4, Trinity's 103, and Cork's 141. From examination of the regression residuals, it appears that institutions that have relatively higher participation than predicted by the regression (that is, positive residuals) include Edinburgh and Cork in particular, as well as Heriot Watt. The institution with the largest negative residual, that is where participation is less than expected from the model, is Glasgow Caledonian. However, other institutions with large negative residuals include University College Dublin (UCD), Strathclyde, Limerick and Napier.

Figure 1: HEIs - Involvements by size of university



Projects by lead country

One of the items of information extracted from the Cordis database for the purposes of the present study was the country in which the lead contractor on each project was located (we denote this by "Lead Country"). Table 8 shows, for the 801 projects involving a Scottish organisation, and the 779 projects involving an Irish organisation, the location of the Lead Country.

Table 8: Projects by lead country

<i>In which:</i>	<i>Scotland</i>	<i>Ireland</i>	<i>Ratio Ireland to Scotland: Numbers</i>
Home Country in Lead	294	192	0.65
Lead by the Other Country *	12	25	2.08
Rest of UK in Lead	86	160	1.86
Rest of EU in Lead	370	372	1.01
Other World in Lead	39	30	0.77
Total	801	779	0.97

*The number of projects where Scotland is involved and the lead is Ireland, or vice versa.

From the first row of Table 8, it can be seen that Ireland leads in a smaller proportion of projects compared to Scotland than would be expected on a per capita population basis. For projects where a third country is the prime contractor Irish participation is considerably higher than that of Scotland, particularly in projects led by organisations in UK (exc. Scotland) and also, although to a lesser extent, where the lead contractor is located elsewhere in the EU.

The next question that is relevant to consider is whether, and how, the principal features noted in Table 8 vary by the types of organisation involved. We consider this question for the two main groups of projects: (a) those where the domestic involvement is by education research organisations only; (b) those where the domestic involvement is by the private sector only. Tables 9 and 10 show similar information to Table 8 for these two groups of projects

Table 9: Projects involving only education research institutions in home country by lead country

<i>In which:</i>	<i>Scotland</i>	<i>Ireland</i>	<i>Ratio Ireland to Scotland: Numbers</i>
Home Country in Lead	225	132	0.59
Lead by the Other Country *	9	16	1.78
Rest of UK in Lead	58	80	1.38
Rest of EU in Lead	288	206	0.72
Other World in Lead	24	14	0.58
Total	604	448	0.74

*The number of projects where Scotland is involved and the lead is Ireland, or vice versa.

Table 10: Projects involving only businesses in home country by lead country

<i>In which:</i>	<i>Scotland</i>	<i>Ireland</i>	<i>Ratio Ireland to Scotland: Numbers</i>
Home Country in Lead	42	30	0.71
Lead by the Other Country *	2	3	1.5
Rest of UK in Lead	11	52	4.73
Rest of EU in Lead	48	94	1.96
Other World in Lead	10	10	1
Total	113	189	1.67

*The number of projects where Scotland is involved and the lead is Ireland, or vice versa.

Dealing with Tables 9 and 10 together, the important points to note are:

- (a) The greater propensity of Scottish organisations to take the lead appears to be entirely due to education research institutions.
- (b) For both education research organisations and for businesses, Ireland has a proportionately much higher involvement than Scotland in projects where the lead contractor is in "rest of UK". This effect is particularly marked for businesses, where about five times as many Irish businesses as Scottish businesses are involved in projects led by RUK.
- (c) For projects where the lead contractor is in "rest of EU", Irish businesses have greater involvement than do Scottish companies. This is not the case for education

research organisations where involvement of Irish institutions is relatively lower than Scottish involvement on a per capita basis.

Conclusions

To summarise, the following are main conclusions emerging from this study. The most striking and important points from the perspective of economic development in Scotland are:

- 7 Overall, Scotland is involved in fewer FP5 projects than Ireland on a per capita basis.
- 7 Both in absolute terms and on a per capita basis, businesses in Scotland have much less involvement in FP5 than is the case in Ireland.
- 7 Linkages between the education/research sector and businesses in FP5 are particularly low in Scotland relative to Ireland.
- 7 Scottish businesses are very much less likely to be involved in projects led from the rest of the UK than are Irish businesses.
- 7 Scottish businesses are less likely to be involved in projects led from the rest of the EU than Irish businesses.

As regards higher education and research organisation participation, findings from the study are:

- 7 For these organisations, Scotland's participation in FP5 is in line with Ireland's on a per capita basis. This, together with the relatively low overall participation for Scotland, implies that the education/research sector in Scotland has a more dominant role in the country's participation in FP5 than is the case in Ireland.
- 7 Scottish education/research organisations are more likely than their Irish counterparts to lead in FP5 projects and are less likely to be involved in projects led from the rest of the UK. However they are slightly more likely to be involved in projects led from the rest of the EU.

Finally we note that:

- 7 There are differences between the two countries in the themes in which different types of organisation are involved. Businesses in Ireland are more likely to be involved in IST and Growth projects than businesses in Scotland while education/research organisations in Scotland are more likely to be involved in Life projects than their counterparts in Ireland.
- 7 Scottish public bodies are in absolute terms and on a per capita basis less involved in FP5 than Irish public

bodies: (note however that public bodies in both countries are less involved than other groups in FP5).

Recommendations

The key features emerging from the conclusions are the low level of business involvement in Scotland in the Fifth Framework Programme, and the low level of links between businesses and the education/research sector. To increase the level of Scottish business participation in the Framework Programme we recommend that attention should be paid to the following questions:

- a) Are the advice and support mechanisms for businesses in Scotland suitably organised to maximise Scottish business participation in the framework programmes? It may be relevant, for example, that in Ireland there is a centralised system of technical specialists who advise businesses on these matters and that there is a recognisable single point of contact for the Framework Programme. In Scotland, by contrast, there is a regional support system for businesses and support tends to be provided by generalist business advisers, with a separate interlinked structure for Framework support.
- b) Is part of the reason for low participation in FP5 due to poor articulation with other EU initiatives like the COST and Eureka programmes? In Finland, for example, the COST, Framework, and Eureka programmes are regarded as an integrated suite of initiatives providing support for concepts at different stages along their development trajectory between blue skies research and market. In Scotland, participation in COST and Eureka is low, and responsibility for co-ordinating these programmes rests with the DTI. We recommend that the question of how to improve articulation among these programmes should be examined.
- c) How can linkages be improved between businesses in Scotland and education/research organisations? Our findings confirm the need for initiatives such as the recently introduced "Scottish Proposal Assistance Fund", which provides £1 million to assist applications to FP6 involving businesses and education/research organisations from Scotland. However, the problem is so large that more will probably be required to be done.
- d) What are the implications of the very low participation of Scottish businesses in projects led from the rest of the UK? Clearly, since the Framework programmes were set up to encourage transnational co-operation within Europe, this observed feature is perhaps not surprising. However, given the close geographic, economic (and language) ties with the rest of the UK, in an ideal world the rest of the UK should provide a major source of linkages for Scottish firms. The question then arises as to whether some supplementary mechanism should not be brought in to make sure

that Scottish firms are able to realise the full potential of the RUK pool of potential partners while engaging in Framework programmes.

- e) Should the system of support offered to firms on the framework programme be modified to take into account the new features of FP6? In particular, given that FP6 will incorporate semi-permanent centres of excellence, should there be a permanent support structure in Scotland linking with these centres of excellence?

Two possibilities, not necessarily mutually exclusive would be:

(i) Since, universities have a long term presence in particular specialisms, for example, life sciences, aquaculture, information technology, etc., they could be encouraged to act as a bridge between local businesses and the relevant centre of excellence.

(ii) In Finland, a substantial element (around 50%) of the enterprise budget goes to support technology circles. These are R&D groups including businesses from one or more related sectors as well as relevant education and research organisations. The intention is to use these technology circles for widening the benefits of FP6 participation. Should a similar type of mechanism be considered for Scotland?

- f) It is possible that the subject areas of the projects in which Scotland is engaged are heavily influenced by the types of research organisation operating in Scotland, rather by a rational assessment of Scotland's knowledge economy needs. It should be considered whether the structure of Scotland's research institution framework is appropriate to the current and future needs of the Scottish economy.

Where the above are clearly areas that need to be examined, the development of a policy towards European Framework Programme and associated programme funding goes beyond just addressing these questions. Such a policy should be seen as part of an integrated approach to improving the knowledge economy in Scotland.

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