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**Managing Learning and Knowledge: Reflections on the Irish
Growth Experience**

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1. Introduction

Knowledge is increasingly seen, along with capital and labour, as a key factor in productivity, competitiveness, employment and economic growth. It is also seen as providing important challenges to policy makers and managers. It is not surprising, therefore that countries that have achieved sustained improvement in economic performance in the 1990's will be closely analysed for lessons on innovation policy and knowledge management. The objective of this paper is to use the example of Ireland to elucidate some of the issues that will be further developed in the course of this workshop. Hard-earned experience warns us, however, that although innovation and learning are without doubt the main drivers of economic growth, this is often difficult to show in empirical analysis of specific cases.

The first part of the paper will present some quantitative data on the growth of the Irish economy over the past decade. Recent Irish growth has been spectacular, not only by comparison with the other catch-up economies but even with reference to the two decades of sustained growth, experienced post World War II, by mainstream Europe in its Golden Age of economic growth. The second part will investigate how Ireland progressed its learning and knowledge management capability over the period of its economic success. The purpose is to test the hypothesis, and the underlying theme of this workshop, that the competitive advantage of firms is increasingly defined by their ability to manage their knowledge assets and to apply new knowledge to their products and processes. But firms do not operate in a vacuum: effective management of knowledge assets requires continual interaction with a supportive and learning environment. The third part of this paper,

therefore, addresses the issue of *social capability* and the extent to which institutional and organisational learning has advanced *pari passu* with firm learning.

Finally, the techniques of growth accounting are applied to the Irish growth experience to identify what proportion of recent growth is attributable to improved factor productivity and, by inference, is capable of being ascribed to innovation and knowledge management. The thesis is that the assumed links between improved knowledge management, innovation and growth and the resulting implications for innovation policy are best understood when extraneous factors and rare occurrences, unique to individual countries at a particular time, are isolated.

2. The Irish Growth Experience

The basic facts of the Irish growth experience are impressive. For more than a decade now, each year has brought growth in income per head approaching two digits and a substantial increase in employment numbers (Table 1). This progress was achieved with relatively low inflation and without sacrifice of fiscal or balance of payments stability.

Table 1: National Income and Employment Growth, 1987 - 1997
(per cent increase over decade)

	National Income	Employment
Ireland	70	23
US	27	17
EU15	24	5
UK	20	3

Source: Frank Barry (1999)

In the light of these growth figures economic convergence with the EU average has been rapid. Irish GNP per head in 1987 stood at 59 per cent of the EU-15. At the end of the 1990s it had risen to 100 per cent. GNP per capita, which is used here in preference to GDP, grew more slowly than GDP. (by over one per cent p.a.). GNP excludes international capital flows and hence profits repatriated by multinational companies operating in Ireland.

Table 2: Accounting for Catch-up Growth: Post World -War II, Europe and Japan and Ireland (1993 -2000) compared
(per cent growth per annum)

	Output	Labour	Capital	Productivity (TFP)
<u>1953 -1973</u>				
France	5.0	0.3	1.6	3.1
Italy	5.0	0.2	1.6	3.2
Japan	9.2	2.5	3.1	3.6
UK	3.0	0.2	1.6	1.2
W. Germ.	6.0	0.5	2.2	3.3
<u>1993-2000</u>				
Ireland	8.3	4.7	4.3	3.6

Source: Crafts and Toniolo (1996): and (for Ireland) Kennedy (2000)

The relatively low base from which Ireland launched its economic recovery in the mid-eighties meant that the potential for catch-up growth was considerable. It is important, therefore, to view the Irish performance in the perspective of other examples of catch-up growth. The decades following World War II are recognised for the rapid progress made by Europe and particularly Japan, in catching-up with the US economy. Table 2 illustrates that Ireland's performance in the 1990s compares more than favourably with the so-called Golden Age of European recovery.

Irish productivity growth has been substantially higher than the European average since the late 1960s. Labour and capital productivity have both contributed to this outcome (Table 3). With regard to labour productivity, an outstanding performance by the industry sector compensated for a significant decline in agriculture and a relatively static performance by services. Admittedly, the data for services are particularly problematic for Ireland, where IT and financial services have been very high growth areas, because of the difficulties of measuring real growth in that sector.

Table 3: Growth in Labour, Capital and Total factor Productivity (per cent per annum)

	GDP/Worker	GDP/Capital	Total Factor Productivity
1960-1980	3.5	0.0	2.0
1980-1993	3.3	0.7	2.3
1993-2000	3.5	3.8	3.6

Source: National Income and Expenditure, various issues: and Kennedy (1971).

With regard to capital productivity, there has been a substantial acceleration in the growth of productivity of capital since 1993. When we look at the main economic sectors, however, the improvement is essentially confined to industry and is probably associated with structural change towards activities like electronics, which have comparatively low physical capital requirements relative to their output.

The significant growth of capital productivity during the past decade and the more modest increase in labour productivity are, by definition, reflected in the increase in total factor productivity from 2.3 per cent in the 1980s to 3.6 per cent in the 1990s.

3. Investment in Learning and Knowledge Management by Irish Firms

Investment in intangible assets is increasingly viewed as the key determinant of growth, competitiveness and productivity. It is a mistake, however, to underestimate the importance of linkages between physical and intangible assets. If the full value of investment is to be gained, then physical and intangible investment should be viewed as complementary. Investment in physical assets and equipment must go hand-in-hand with in-firm training, skill upgrading and, increasingly, work re-organisation and software enhancement, if the investment is to realise its productive potential. Synergy between investment in physical and intangible assets enhances the accumulation of knowledge stock and competencies.

Aggregate data are available for the rate of accumulation of Irish physical capital and the growth rate was shown to be very strong over the 1990s (Table 3). Investment data for intangible assets, however, are more

elusive. According to the OECD (1992) intangible investment can be divided into four groups:

- (i) Intangible investment in technology to develop the knowledge and competence to introduce new products and processes
- (ii) Enabling intangible investments in human resources, organisation and the information structure
- (iii) Investment in market exploration and market organisation
- (iv) Investment in software including software embedded directly in products and equipment

It is proposed to analyse Irish investment in intangible assets mainly under the first two parts of this taxonomy. While some data are available on marketing and software expenditure these are far less robust and as a result international comparisons are unreliable.

3.1 Intangible Investment in Technology for Products and Processes

Investment in technology to acquire the knowledge to introduce new and improved products and processes includes expenditure on R&D, external technology acquisitions and other activities that directly drive the innovation process. Reliable, internationally comparable indicators are available for R&D expenditure and they show a sustained increase by Irish firms over the decade. Expenditure on R&D by firms (BERD) grew from 0.61% of GDP in 1991 to 1.11% in 1997 and is now relatively close to both the EU average (1.15 %) and the OECD average (1.49%).

Technology developed in-house must normally be complemented by the acquisition of technology developed externally and 'catch-up' economies

are particularly dependent on technical knowledge from this source. Data on international receipts and payments for technology indicate that foreign subsidiaries in Ireland spend about the same amount of resources in acquiring technology from their home base as they spend on R&D in Ireland. But the success of indigenous companies in transferring technology from abroad is not good (Cogan et al 1989). Financial support, offered to companies that conclude technology transfer or licensing agreements has been consistently under-utilised. It is difficult to quantify technology spill-over from multi-national branch plants to indigenous firms but empirical evidence (Tomlin et al 1984) supports the proposition that activity in this area is largely confined to management and production techniques, transferred through the medium of staff mobility.

3.2 Enabling Intangible Investment

The main focus here is in on investment in human resources including firm-based training and skill formation. There are few data on the cost of organisational change to meet the demands of shortening product life cycles and greater competition. It is not surprising that the number of researchers and engineers employed in the business sector has substantially increased, given the current level of Irish BERD. Ireland has made considerable advances in nearly all the OECD technology-related personnel indicators and now holds a position closer to the average of the smaller advanced economies than to the four cohesion countries (Table 4). The Irish output of new graduates in proportion to population in this table is the highest in the EU, but this may be a statistical aberration.

Table 4: R&D Personnel Indicators (latest available year) for selected developed smaller countries

	Belgium	Denmark	Finland	Austria	Ireland
R&D Personnel (per 1000 active)	5.48	10.5	12.89	6.53	6.96
Graduates per 1000, (20 to 24 years old)	9.54	23.67	29.78	7.03	38.58
RSE per 1000 Working in:					
Firms	2.18	2.1	2.17	1.87	1.88
Higher Educn.	2.35	1.61	2.70	1.30	2.73

Source: Second European Report on S&T Indicators, 1997

Indicators of investment in firm-based training and skill formation provide further evidence of an upgrading of competencies in the Irish workforce. A recent survey (IBEC 2000), based on figures for 1998, reveals that the average cost of training as a percentage of payroll is 3.01% for all companies, more than a doubling since the previous survey, published in 1994. The average number of days training per employee is between 5 and 6, but a significant minority of firms provide over 10 days training per annum. After a slow start these figures now compare well with the EU average. The recent survey also found that training had become more structured and that there was a new focus on Management and IT/Technology training and on customised training programmes specific to particular economic sectors.

Turning to investment in education more broadly, public expenditure has more than doubled over the decade: educational expenditure is now 5.5% of GDP (OECD average is 4.9%). Fitzgerald et al (2000) have quantified the average annual rise in education per worker and its (weighted) contribution to the growth of productivity (and output) for the two five-year periods since 1990 (Table 5). The growth in education per worker stabilised in the more recent period but, over the decade, contributed about half of one per cent to annual productivity growth.

Table 5: Growth rates of Education per Worker and its Contribution to growth of Output and Productivity
(per cent per annum)

	Education per Worker	Contribution to Productivity
1990 - 1995	0.94	0.54
1995 - 2000	0.81	0.43

Source: Fitzgerald and Kearney (2000)

4. Improved Social Capability and Market Structure

Notwithstanding the thrust of the two preceding sections of this paper, it would be a gross oversimplification to conclude that a laggard economy, with a GNP of 59% of the EU average in the late 1980's, was singularly transformed within a decade, by a simple shift in economic and innovation policy, into an economy with a standard of living above the EU average. That proposition would raise questions such as:

Why did the transformation take place at this particular time?

Why did Ireland not participate in the post-war Golden Age of European economic growth?

Why have other cohesion countries not shared in this deferred catch-up?

Abramovitz (1994) argues that the significant growth advantages enjoyed by catch-up countries are not exploited because of *persistent* differences in national characteristics including "deeper elements of national culture that limit the response of people to economic opportunities". Abramovitz does concede that there are also *transient*, but reversible, causes of backwardness such as dysfunctional forms of economic organisation and public policy, but persistent impediments must first be removed before significant economic progress is possible. Abramovitz's *deeper elements of national culture* or a deficit in *social capability* (Crafts 1995) may well be the persistent impediment that deferred catch-up growth for Ireland until the late 1980s.

The factors leading to the attainment of social capability by Ireland may have parallels in the conditions that gave rise to the rapid post-war economic recovery in Europe (Eichengreen 1995). Extreme situations precipitated change in both cases, the exceptional circumstances of war and reconstruction in the one and a national crisis in the other. The other common factor is a clear willingness to embrace institutional and social change.

In the early part of the 1980s Ireland was in deep economic and psychological crisis. The country was in near-bankruptcy and intervention by the World Bank was threatened. The national debt was 120% of GNP, current budget deficits were running at up to 10% and

unemployment was around 20%. These exigencies had a cathartic effect on the body politic. Political consensus on an unpopular programme for national recovery was achieved and a readiness to adopt institutional and social change emerged on all sides. Trade unions, employers and government entered into a partnership to seal a commitment to work together in the common interest and signed a social contract that delivered on pay constraint and industrial peace but also negotiated agreed positions on issues such as market de-regulation, taxation and economic infrastructure.

Membership of the European Community, the Single Market and Structural Funds are other institutions critical to the Irish recovery. The organisational and institutional learning, engendered by the process of negotiating Structural Funds, complemented the substantial material assistance received. The process imposed a discipline of evaluation on the Irish policy system and led to the setting up of an Office of Science and Technology and the appointment, for the first time, of a Minister with specific responsibility for Science, Technology and Innovation. The priority, in the allocation of Structural Funds, that was given to investment in human capital and the encouragement of R&D in firms, was destined to have a decisive influence on the Irish economy.

It is unlikely, however, that social capability would have prevailed without a major upturn in the world economy and particularly in the propensity of our main trading partners to import. By the start of the 1990s the growth in the volume of goods imports in the EU and in the OECD as a whole, was restored to the rapid rates that existed before the first oil crisis (Table 6).

Table 6: International growth Rates of Goods Imports
(per cent per annum)

	1960 -'73	1973 -'80	1980 - '93	1993 - 2000
United States	9.1	2.7	6.7	12.1
EU-15	8.7	3.1	3.7	8.1
Germany	10.6	4.7	3.7	7.8
UK	5.9	1.5	4.4	7.8
Total OECD	9.2	2.8	4.5	9.4

Source: OECD Economic Outlook, December 2000 and earlier editions; and OECD, Historical Statistics, various issues.

The large increase, between 1993 and 2000, in imports by the EU, an area receiving two-thirds of Irish exports, is surprising in the light of a moderate (2.5% p.a.) increase in GDP over the same period. The Single European market is probably the key factor. The rapid growth in US imports during the same period is more in line with its 4.1% p.a. growth in GDP. The buoyancy in the US economy helped Ireland in both the supply side and on the demand side. On the supply side, as is widely recognised, the flow of US foreign direct investment into Ireland was critical in enabling the country to realise the potential offered by the Single European Market. For a period in the 1990s, Ireland with only 2% of the population was attracting up to a quarter of US foreign direct investment into Europe.

On the demand side the strong growth in US imports underpinned the buoyancy of world trade, as well as providing a rapidly growing market for Irish goods.

The buoyancy of the demand for Irish exports during the 1990s and the extent to which Ireland took advantage of this to increase its market share is shown in Table 7. The volume of Irish goods exports grew at the extraordinary rate of 16,5 % per annum from 1993 to 2000. While the Irish performance in gaining market share is impressive, this would not have accomplished nearly as much without the acceleration that took place in market growth.

Table 7: Irish Export Performance: Growth Rates
(per cent per annum)

	Volume	Market Size	Irish Performance
1963 - '80	7.7	3.2	4.4
1980 - '93	9.2	4.1	4.9
1993 - 2000	16.5	8.0	7.8

Source: OECD Economic Outlook, various issues. Export performance is measured as the difference between the growth of a country's exports and the growth of its markets.

To conclude this discussion on the impact of buoyant world markets on Ireland's outstanding growth performance over the past decade, we re-emphasise the link between such a phenomenal market performance and supply-side factors. The disproportionate share, achieved by Ireland, of

the sustained flow of US direct investment into Europe, was decisive. The question then arises as to why Ireland was such a favoured location for US investment, compared with other areas of Europe which had the same access to the Single Market. Plausible reasons are the tax incentives offered and the fact that Ireland is a politically stable English-speaking country with strong ethnic links to the US. The earlier commitment to enhancing the country's human capital and infrastructure, with significant support from Structural Funds, was also a factor that merits serious consideration. There is, however, no convincing analysis of the relative importance of the different factors involved.

5. Innovation Policy Lessons for other Countries?

This final section starts with a question mark in order to alert the reader to the pitfalls inherent in trying to transfer to other (perhaps very different) environments innovation policies that appear to be successful in one particular region or situation. First, the Irish growth figures will be further analysed to identify the proportion of the overall growth that is associated with increases in productivity. The assumption is that the component of growth attributable to increases in the volume of factor inputs cannot be directly linked to innovation policies or improvements in knowledge management. Secondly, the productivity-driven component of growth will itself be further analysed to identify to what extent it is due to a cumulative process of innovation taking root within the Irish economy, as opposed to the inter-sectoral effect. The latter refers to the part of recorded productivity increase that is due to structural change, arising from a growing employment share in sectors or firms with high *levels* of productivity.

Table 8: Accounting for Catch-up Growth: Increases in real GDP, Employment and Productivity
(per cent per annum)

	GDP	Employment	Productivity: GDP/Worker
1980 - 1993	3.3	0.0	3.3
1993 - 2000	8.3	4.7	3.5

Source: National Income and Expenditure, various issues

Table 8 shows the growth rates of output volume, employment and labour productivity in Ireland for the rapid catch-up period of the 1990s and for an earlier period. When we compare the high growth phase with the earlier period, three things stand out. First, there is an amazing acceleration in output; secondly, there is virtually no acceleration in the growth of labour productivity which has been relatively high throughout; and thirdly, all the acceleration in the growth of output is accounted for by the acceleration in the growth of employment (4.7% p.a.).

It is instructive to look at how this employment growth figure is constituted because it is an extraordinary rate of growth when judged by contemporary international experience and indeed in relation to previous Irish history. The figure encompasses three entities: a reduction in the unemployment rate, an increase in the labour force participation rate (mainly female participation); and an improved age dependency rate

(fewer dependants). The employment-related increase in economic output associated with each of these three entities impacted directly on GDP per capita and was translated into an improvement in living standards. It is reasonable to conclude, however, that what happened between 1993 and 2000 is a once-off phenomenon and cannot be sustained much longer. The economy is now at full employment, the labour force participation rate of females is approaching the EU average and age dependency is set to rise again as family sizes are on the increase.

Analysis of the contribution of improved productivity to Ireland's catch-up growth is likely to be more relevant for those seeking to learn from the Irish experience. Labour productivity in Irish industry has been increasing by a very impressive 6% p.a. for more than two decades, but recorded productivity in Irish agriculture and services sectors is only a fraction of that figure. Labour productivity growth can, in principle, be separated into two components, the part taking place within economic sectors and the part due to structural change in the economy (low productivity sectors declining and high productivity sectors expanding). The work of Keating (2000) shows that that the latter component (the intersectoral effect) is quite small when measured at the level of the three main sectors - so that most productivity takes place within these broad sectors (intrasectoral effect). But, of course, structural change also takes place within each of the three sectors and Keating's results suggest that if we could disaggregate sufficiently, the intersectoral effect would be about 1% per annum. This is accounted for by the fact that many relatively low-productivity indigenous firms closed during the 1980s while many new high-tech foreign firms prospered.

There remains a very large component of labour productivity that is attributable to more efficient use of labour within existing firms and capital productivity during the 1990s was also high, as shown in Table 3. The implications for innovation policy from this analysis are that Ireland has benefited substantially from its investment in knowledge to introduce new and improved products and processes, and from its strong commitment to upgrading human capital (see section 3). This investment was financed to a considerable extent by the Community Structural Funds (Delors I and Delors II) but more important than the resources received was the institutional and organisational learning that it inspired in the Irish innovation system.

A note of warning is needed, however, because the evidence is not convincing that Ireland has moved out of the catch-up phase of innovation learning and technological competence. The OECD technology indicators in which Ireland has made most progress (R&D expenditure and R&D Personnel) are innovation *input* indicators. Innovation output or performance indicators are more discriminating and with respect to this type of indicator, Ireland holds a more lowly international rating (OECD 1999). The level of patenting activity ranks 18th out of 28 OECD countries and has remained static during the 1990s. Empirical studies (McDevitt 2000) show that the level of networking and technological collaboration by Irish firms is modest but improving. Another source of data on innovation performance comes from the Community Innovation Survey (CIS) and the most recent results (Forfas 1997) suggest that Ireland's performance could be considered "average" relative to the rest of the EU.

6. Conclusion

The Irish growth experience over the past decade has attracted considerable interest, partly because of the search for empirical validation of new growth theories and partly because of the hope of finding a role model for other cohesion countries. This paper has attempted to disaggregate the economic data and to identify that part of Ireland's growth that accrues from improved productivity and hence can be associated with issues of innovation policy and knowledge management. It also highlighted those benign factors in the external environment that propelled Irish growth to unprecedented levels.

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