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## Placing Ireland's transition to a knowledge economy within a global context

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**Abstract:** Throughout most of the 20<sup>th</sup> century the Republic of Ireland suffered from persistently high unemployment and chronic emigration and as a result employment creation drove industrial policy. During a period of rapid growth in the 1990s, Ireland achieved near full employment and the focus of industrial policy shifted from employment creation to actual development. This chapter demonstrates how a combination of endogenous and exogenous factors and conditions contributed to Ireland's emerging knowledge economy. It argues that while Ireland is not on par with the world's most advanced technology districts, there is nevertheless evidence that a solid foundation necessary to support more knowledge-driven activities is now in place.

### Introduction

This chapter explores the (Republic of) Ireland's growing capacity for value creation and capture. Once associated with poverty and emigration, a period of rapid growth during the 1990s transformed Ireland, one of Europe's more peripheral regions into one of its relatively more successful regions. Rather than serving as an example for dependent development, Ireland's recent success leads other peripheral places to attempt to emulate its development policies (MacSharry and White, 2000). However the prominence of exogenous factors in the Irish development model stands in stark contrast to the emphasis traditionally assigned to endogenous factors (e.g. Porter, 1990). Within the regional development literature, the role of local and regional institutions in facilitating innovation and learning receives particular attention (e.g. Cooke and Morgan, 1998). While not discounting the importance of these issues, several researchers now approach the problem of regional development through more multi-scalar frameworks. As a result, they consider issues such as the roles played by Global Production Networks (GPNs) or transnational networks of knowledge workers, and thereby account for a wider array of factors that influence a given locale's capacity for value creation, enhancement and capture (Henderson *et al.*, 2001). For peripheral regions with little endogenous capacity for generating knowledge, these latter conceptualizations therefore offer greater scope for understanding ways to exploit external sources of innovation.

This chapter is organized as follows. The next section seeks to contextualize regional development by considering the manner in which different influences at multiple scales affect value creation and capture. The following section then discusses the evolution of Irish industrial policy and the measures taken to extract the maximum benefit from inward investment. Data presented in the subsequent section illustrate the extent to which Ireland's capacity to create and capture value grew over time. The last

section explores two embryonic sectors that might contribute to continued economic growth in Ireland. Finally, several conclusions are offered about the successes and shortcomings of Ireland's FDI-led development model and its potential for sustainable regional development in the future.

### **Contextualizing Regional Development**

Throughout the regional development literature knowledge production, particularly at the sub-national or regional scale, assumes a seminal role in generating sustainable economic development (Lagendijk, 2001). Many less favored regions however lack the local capacity for generating knowledge endogenously, and as a result inward investment attraction forms an important component of many regional development strategies (Amin and Tomaney, 1995). These strategies are generally not considered sustainable, so the importance of endogenous development continues to resonate amongst policy makers. Consequently, endogenous growth models focused around the establishment of 'Porterian' clusters represent one of the preferred solutions sold by the regional development industry (Lagendijk and Cornford, 2000). In spite of the prominence given to endogenously-driven development models, more recent conceptualizations are reconsidering the potential for wider influences such as global production networks to foster sustainable economic development (Henderson *et al.*, 2001).

This becomes increasingly evident as the more global nature of R&D networks makes the need to account for non-local sources of innovation even more important (Henderson and Morgan, 2002). Highly localized systems of innovation may inhibit or restrict development if they become too rigid and cut off from outside sources of innovation (Asheim and Dunford, 1997; Scott, 1998). Regional success often depends more on the ability to commercialize technology than actually producing innovative technologies (Grimes and Collins, 2003). For instance, the US biotechnology industry's initial development occurred through the commercial exploitation of knowledge gains made outside of the US. US firms, supported by an active Venture Capital (VC) system, were better equipped than European firms to commercialize the knowledge developed in the mostly public-funded, European research system (Cooke, 2001). With the exception of mobile telephony, European firms possess a weak record of commercializing technological innovation. This poor record of commercializing innovative activity explains partly why Europe's market share (ratio of national exports to world exports) in science-based products declined from 48.6 percent in 1970 to 33.8 percent in 1995, even though world trade in high-tech industries doubled during the same period (Archibugi and Coco, 2001). As a result, policy makers are more aware of the need to facilitate the commercial exploitation of technology, regardless of its origins.

The growing importance of global sources of innovation therefore influences the formation of regional development policies. Development models focusing heavily on endogenous factors, in order to replicate successful technology regions like Silicon Valley, may be misguided given the changing international environment. In a survey of emerging technology regions, Bresnahan *et al.* (2001) note that connections to places like Silicon Valley represent one of the 'deep regularities' among these regions. Consequently, emphasis should not be placed on replicating successful regions, but rather finding ways to integrate with these regions. This interconnectivity occurs most prominently through FDI, but also through transnational networks of skilled knowledge workers. Saxenian (2002) for instance, demonstrates the important

roles returning migrants from Silicon Valley play in the development of the Indian, Chinese and Taiwanese technology sectors.

While not dismissing the importance of local factors, analyzing processes of regional development must clearly occur within a framework that considers multi-scalar influences. This chapter therefore follows the lead of Henderson *et al.* (2001) by seeking to contextualize local economic development within the broader reality of global markets. This involves examination, not just of the methods through which places connect to global production networks, but also the manner in which these connections contribute to processes of value creation and capture. As a result, emphasis is placed on understanding how the process of ‘strategic coupling’ occurs between regional assets and the demands of focal firms in global production networks (Henderson *et al.*, 2001; Dicken and Malmberg, 2001). Institutional influences at multiple scales play key roles in mediating this process (Cooke and Morgan, 1998; Morgan, 1997). Local institutions may act as information brokers relaying the needs of focal firms to local firms or universities or encouraging networking amongst regional stakeholders. Despite the importance assigned to local institutions or ‘institutional thickness’, the empirical evidence testing their efficacy for embedding MNCs shows that institutional factors may represent a necessary, but not sufficient, condition for embedding MNCs and exploiting the regional development benefits associated with inward investment (Phelps *et al.*, 2003).

In addition to understanding processes of value creation, examinations of regional development must also consider the extent to which particular locales capture value (Henderson *et al.*, 2001). Since the demands of global firms and markets change constantly, this involves tracking the development of the local skills pool or the extent to which locally-based affiliates possess an evolutionary capacity. The capacity for multinational affiliates to upgrade and expand their operations through successful intra-corporate competition creates new opportunities for regions to capture greater value from inward investment (Phelps and Fuller, 2000). Locally based institutions may support affiliate development, but the possibility exists that these efforts merely reduce the exit costs of multinationals (Phelps *et al.*, 1998). The diversity of firm organizational practices and regional capabilities and attributes, makes the regional development outcomes produced by the interaction of firms and territories highly variable in nature (Dicken and Malmberg, 2001). In light of Ireland’s small size and history of economic peripherality, these issues are particularly resonant. Since it heretofore lacked the capacity for endogenously led development, Ireland instead accesses global sources of knowledge and global demand to spur regional development. The rest of this chapter describes the manner in which Ireland successfully managed to enhance its internal capacity for value creation and capture.

### **Industrial policy in an era of full employment**

In the late 1950s, the Irish government replaced ineffectual policies of import-substitution industrialization with a programme of export-oriented industrialization in an effort to import development. The new economic policies encouraged inward investment and led to an annual average growth of 4.4 percent between 1960 and 1973 (Sweeney, 1998). Admission to the European Community in 1973 essentially locked in the new policy regime, and perhaps more importantly broke Ireland’s dependence on the UK (FitzGerald, 2000). Nevertheless, Ireland’s economic peripherality remained unchanged and a dual economy emerged between under-performing and uncompetitive Irish firms and more productive, but highly dependent foreign-owned branch plants. Ireland appeared to grow, but the dual economy created

jobless growth. By way of illustration, multinationals created 20,000 jobs between 1973 and 1988, but indigenous industry declined by 30,000 jobs during the same period (Ruane and McGibney, 1991). Therefore foreign industry acted as a substitute for indigenous industry, rather than a complement (Grimes, 1993).

The 1982 Telesis report made clear the shortcomings of Ireland's FDI-led industrial policy. Telesis questioned the benefits accrued from FDI as the branch plants that typified inward investment used little skilled labour and created few opportunities for local sourcing. Moreover, MNCs were highly unlikely to locate any strategic functions (R&D, marketing, etc.) because doing so adds costs and reduces the level of declared profits, thereby undermining their primary reason for locating in Ireland—the tax regime. The Telesis Report (1982) further argued that Ireland must strengthen indigenous industry and use investment incentives only for those firms possessing strategic corporate functions. The Culliton Report (1992) reached similar conclusions ten years later when it reiterated, among other things, the need to better develop indigenous industry so as to eliminate the dual economy.

Changes occurring at the local, European and global scale during the late 1980s and early 1990s altered Ireland's position in the world economy, and made it a more attractive location for higher quality investment. Within Ireland, investments in education and a maturing baby boom created a deepening pool of skilled labor. This pool of skilled labor emerged at a time when many multinational corporations centralized their European operations in anticipation of the completion of the Single Market (Breathnach, 1998). While the "...economic planets all came into alignment at the same time (Haughton, 2000, p. 44)", Ireland took advantage of these factors because its industrial policy adapted pragmatically to the changing international environment. In a sense, the Irish made their own luck. Ireland's success in attracting disproportionate amounts of European-bound inward investment during the late 1980s and early 1990s changed the focus of Irish industrial policy. Whereas unemployment hovered around 20 percent in the mid-1980s, the subsequent economic growth during the 1990s resulted in a condition of almost full employment (MacSharry and White, 2000). Consequently, full employment allowed Irish industrial policy to move away from its traditional emphasis on employment creation and instead focus more on policies designed to stimulate value enhancement and capture.

Irish policy makers respond to these changing local, regional and global conditions in several specific ways. At the most basic level, the Irish Industrial Development Agency (IDA Ireland) consistently becomes more narrow and selective in the activities and firms targeted for inward investment. Market considerations drive the targeting process at the project level. IDA Ireland first identifies market niches that possess high-growth potential and are potentially mobile into Ireland. It then assembles information on successful firms, and firms looking to diversify their international production. Next, it initiates contact with the headquarters of these companies, attempting to get the company to visit Ireland to discuss individual projects (Ruane and Görg, 1997). Specific 'Blue Chip' or 'Flagship' investors are pursued with the intention of using these firms to attract other leading firms from the rest of the industry (UNCTAD, 1999). If lead firms prove successful in Ireland, than a "herd mentality" might emerge throughout the industry with other firms attempting to duplicate the leader's success.

Sectorally, IDA Ireland targets a narrow range of potentially high value-added industries for investment. The evolution of this targeting is illustrated in *Figure 1*, as over time the industries consist increasingly of higher value-added manufacturing and internationally-traded services. During the economic boom of the 1990s, the

industries targeted for investment included electronics (particularly PCs and peripherals), medical devices and pharmaceuticals. IDA Ireland also recognized the growing potential of internationally-traded services (Forfás, 1996). IDA Ireland recognized the potential of internationally-traded services almost twenty years ago when it began targeting software and financial services. But given that most other locations target these same industries (Young, Hood and Wilson, 1994), IDA Ireland attempted to stay ahead of the curve by moving into other industries like teleservices and shared services before their competitors (Grimes, 2003).

Attracting higher quality investment remains an important component of value creation, but it does not ensure value capture. Further efforts are now made to emphasize the latter, particularly in light of the declining number of greenfield investments worldwide (UNCTAD, 2003). Therefore in addition to attracting higher quality investments, IDA Ireland attempts to further embed MNC affiliates and win repeat investments. These embedding efforts involve,

...the [development] agencies working closely with local management of overseas companies to secure a wider corporate mandate and to become a vital part of the corporate value chain, thus helping to ensure the long term survival and growth of the company in Ireland.... This measure will concentrate on persuading Irish subsidiaries to add strategic functions such as R&D, technical support, software development, logistics and shared services in Ireland in an effort to carve out as much autonomy for the Irish operation as possible and to so structure it within the overall group that it becomes virtually indispensable to the parent (Department of Finance, 2000: 138).

At the most basic level, IDA Ireland encourages local affiliate managers to actively lobby their parent for a wider mandate and more sophisticated activities. Irish managers of MNC affiliates are considered quite entrepreneurial, and almost subversive, in their drive to secure wider affiliate mandates (Delany, 1998). Many in fact see their efforts as contributing to a larger programme of national economic development (O'Riain, 1997). The Irish government further supports these efforts by providing funding for employee training and education, and even going so far as to lobby MNC headquarters on behalf of Irish-based affiliates.

In addition to extracting the maximum benefits from inward investment, Irish policy makers have also responded to the diminishing amount of quality investment by also attempting to enhance the value creating potential of indigenous industry. Irish firms still trail foreign-owned firms in terms of productivity and exports, but the gap has narrowed and a pronounced dual economy no longer exists. The software and electrical and optical equipment sectors' recent development accounts for much of indigenous industry's improved performance (O'Sullivan, 2000). The emergence of the indigenous software industry garners particular attention, as Ireland now possesses globally competitive niches in activities such as E-learning and Internet security (O'Malley and O'Gorman, 2001). The Irish government supports actively the development of these export-generating activities. Although more developed than in the past, state funds still complement the Irish VC market as almost 40 percent of indigenous firms received some financial assistance from the government in the two years prior to 2003 (HotOrigin, 2003). State agencies like Enterprise Ireland further assist Irish companies in finding international partners and commercializing their technologies.

These recent developments leave Ireland in a state of transition, as it becomes less competitive in cost-driven activities and attempts to move into more knowledge-driven activities (Bradley, 2002). The continuous strategic recoupling of regional assets and global demands makes this transition an uneven process over time. At the most basic level, a software development job created in Dublin is not a perfect substitute for a low-skill, assembly job lost in one of Ireland's disadvantaged regions. As a result, Ireland's recent economic development led to a significant degree of social and spatial polarization (Breathnach, 1998). The privileging of skills means that the primary benefactors of Ireland's recent growth are those with the greatest access to education. As a result, the gap between the rich and the poor in Ireland trails only the US amongst OECD countries (*The Irish Times*, 21 August 1997). The demand for skills further concentrates economic activities spatially around Dublin because it possesses the greatest number of skilled workers and universities. *Figure 2* depicts the spatial unevenness of this growth. Employment in multinationals makes this spatial disparity particularly evident, as between 1990 and 2000 the Greater Dublin Area's relative share of MNC employment increased 11.2 percent from 33.2 percent in 1990 to 44.4 percent in 2000. Over the same period, the more disadvantaged BMW (Border, Midlands and West) regions saw their regional share decline by a combined 7 percent (Forfás, 2000). Albeit uneven, the processes of regional development occurring in Ireland nevertheless altered the country's place in the world economy. Continued regional development will however depend on Ireland's ability to compete in more knowledge-intensive activities. The next section therefore examines several key indicators related to Ireland's current and future capacity to create and capture value.

### **Value Creation and Capture**

The growing number of people involved in third-level education relates directly to Ireland's enhanced capacity for value creation. During the 1970s, Ireland made significant investments in education while at the same time experiencing a baby boom (Barrett *et al.*, 1999). As a result, the 46 percent of the population currently under the age of 30 (CSO, 2002) are the first generations to benefit from these earlier investments in education. *Figure 3* shows the growing participation rates in both second and third level education since 1970. It is worth highlighting that the number of people involved in third level education increased five-fold since 1970. Consequently, Ireland offered a pool of skilled labour at a time when there was a growing global demand for skilled workers.

Returning Irish emigrants together with skilled labour from places like India and Eastern Europe further supplemented Ireland's stock of human capital. Unlike the past, returning Irish emigrants during the 1990s were educated and after working in places like the UK and US possessed managerial and technical experience. The following numbers reflect the labor quality associated with this influx of people. While 12.7 percent of the domestic labor force aged 30 to 39 had third-level degrees, 28 percent of returning emigrants in the same age group were similarly qualified. The corresponding figure for immigrants was even higher at 43.2 percent (Barrett *et al.*, 2002). This infusion of skills not only deepened Ireland's pool of human capital but also buffered the effects of wage inflation, thereby maintaining some of Ireland's cost competitiveness relative to other locations (FitzGerald, 2000).

However, these improvements in the stock of human capital are more indicative of a convergence with European averages than a leap ahead. This convergence becomes more evident when comparing Ireland to other places. *Figure 4*

shows that with 29 percent of people between the ages of 25 and 34 having third level education, Ireland remains in the middle of the pack amongst several other OECD countries. That said, Ireland's position should continue to improve as total enrolment in tertiary education grew by 18 percent between 1995 and 1999. Of the other countries considered, Irish growth ranked fourth behind Poland, Hungary and South Korea—three other countries in the process of catching up. Ireland also scores particularly well in the number of science graduates produced. In *Figure 5*, Ireland compares favorably with other OECD countries with an average of 2789 science graduates per 100,000 people in the labor force, aged 25 to 34. These figures bode well for future growth in the ICT sector, but recently fewer people are enrolling in science courses and this may pose a direct threat to future competitiveness (National Competitiveness Council, 2002).

While the development of the technological labour pool allows for greater value creation, scepticism remains about Ireland's capacity for value capture. This often revolves around the extent to which the FDI-led development policy leaves Ireland dependent on foreign firms from a limited number of sectors that repatriate most of their profits and create few opportunities for local linkages (e.g. Shirlow, 1995; O'Hearn, 1998, 2000). The data presented in *Table 1* demonstrate that in a relative sense, Irish Economy Expenditures (IEEs) represent a much smaller proportion of total sales for foreign-owned firms than for Irish-owned firms. Whereas IEEs comprise almost two-thirds of total sales for Irish-owned firms in 2001, they signify only a quarter of total sales for foreign-owned firms. The relative lack of local sourcing may draw criticism, but it may also represent the increased integration of Irish-based affiliates within their wider corporate networks rather than some kind of structural weakness within the local supplier base.

These data are also somewhat misleading about the contributions made by foreign-owned firms. Although IEEs as percentage of total sales from foreign-owned firms declined steadily from almost 40 percent in 1995 to 26 percent in 2001, *Table 1* also shows that in an absolute sense total IEEs from foreign-owned firms grew by 69 percent. Multinationals also spend more on wages, even though employing fewer people than indigenous industry. In fact, the average wage in foreign-owned firms is 25 percent higher than in Irish-owned firms (Barry and Bradley, 1997). While foreign-owned firms also lag behind Irish-owned firms in the volume of Irish raw materials, it is worth noting that expenditures on raw materials more than doubled between 1995 and 2001, thereby reflecting greater levels of local sourcing. This has emerged even though multinational activities are becoming increasingly geared toward services activities and are less material in their output.

The ICT sector lies at the heart of Ireland's strategy to make the transition into a more knowledge-driven economy, but at present ICT employment constitutes only 4.6 percent of total business sector employment (National Competitiveness Council, 2002). This puts Ireland behind other European economies noted for their ICT industries like Sweden and Finland (National Competitiveness Council, 2002). Moreover, Ireland imports more technology than it creates. As displayed in *Figure 6*, relative to other OECD countries Ireland runs a significant technology balance of payments deficit. This demonstrates that multinational affiliates overwhelmingly import more technology from their home markets than Irish firms export from Ireland (OECD, 2001). This does not necessarily reflect poor competitiveness, but it does indicate that Ireland remains very much a technology-taker rather than a technology-maker. Ireland's lagging amount of R&D activities highlight these shortcomings. As a percentage of GDP, Ireland ranks 11<sup>th</sup> out of 16 OECD countries in terms of the Gross

Domestic Expenditure on R&D (GERD) (National Competitiveness Council, 2002). That said, with a nearly 15 percent annual change between 1997 and 2000, Ireland's GERD grew faster than the other countries included in the study (National Competitiveness Council, 2002).

Many of the indicators presented above reflect Ireland's convergence with the rest of the developed world. However, they nevertheless demonstrate that Ireland is becoming better equipped to compete in more knowledge-driven activities. As such Ireland is better able to extract greater benefits from FDI, and sources of innovation are no longer so skewed heavily toward exogenous sources like multinationals. Even though foreign-owned firms remain more productive than Irish-owned firms (O'Sullivan, 2000), this is no longer true across all sectors. For instance, the indigenous Irish software industry is widely considered to undertake more sophisticated activities than multinational software affiliates located in Ireland (O'Riain, 1997; O'Malley and O'Gorman, 2001). Therefore in spite of criticisms about Ireland's FDI dependence, the FDI-led development policy placed the country in a position to better manage and meet the world economy's changing demands. Twenty years ago Ireland had trouble catching up to the rest of the world, but it is now well set to keep up. What remains in question is the extent to which Ireland will be able to get ahead. Consequently, the next section describes several ways in which policy makers are attempting to establish Ireland as a key location for several emerging technologies.

### **Possible Futures**

FDI continues to serve as one conduit through which Ireland accesses multiple sources of innovation, but as Ireland moves into more knowledge-driven activities FDI cannot sustain continued regional development. As a result, new areas for value creation must meet several criteria. For instance, new niches must provide opportunities for both small Irish firms and large multinationals, with the opportunities for Irish firms not solely dependent on forming a supplier base for the multinationals. New niches must also allow input from multiple sectors to avoid rigidity and buffer against external threats in specific sectors like the global downturn in telecommunications. In addition, entering these markets must occur at time of significant growth potential and no imminent substitute in sight. Much like FDI-oriented policies, success requires first-mover advantages in order for Ireland to establish itself as a key site before the sector reaches maturity. Two new niches—Digital Content and Biometrics, illustrate the possibilities of this new avenue for industrial development.

Digital content involves the confluence of previously distinct areas such as media and entertainment, multimedia, software and electronic hardware. It is seen as building on Ireland's existing strengths in software, electronics and telecommunications. As an industry, digital content has yet to reach full maturity with the global market estimated at \$178 billion in 2001, but industry analysts expect it to grow at a rate of 30 percent per annum to reach \$434 billion by 2006 (Forfás, 2002). As a result, the growing demand for a wide variety of products and services in areas such as education, entertainment and consumer and business-oriented content presents a window of opportunity for new entrants.

The establishment of the 'Digital Hub' in the Liberties section of Dublin, represents one government programme designed to support the growth of the digital content industry in Ireland. Much like another high profile development project, Dublin's International Financial Services Centre, the Digital Hub was designed partly

to stimulate urban renewal in a previously derelict area but also to create a cluster of related activities (Forfás, 2002). The Digital Hub remains in its infancy and thereby represents more of a policy project than an actual cluster of activity. It does however have a flagship tenant in Media Lab Europe (MLE), a division of MIT's Media Lab. The government hopes that MLE's presence will have a similar effect to other flagship investments such as Microsoft or Intel by serving as a magnet for subsequent investments and lending credibility to the Digital Hub. Several firms now operate out of the Digital Hub, but as currently constituted it represents more of a showcase as the industry remains nascent in character.

Biometrics presents another area with great potential for value creation and capture. Biometrics are automated methods for recognizing and identifying people from physiological characteristics such as fingerprints or voice patterns (*The Irish Times*, 21 July 2003). Much like the digital content industry, biometrics ties into a wide array of other industries like biotechnology and existing Irish specialties like E-security. The industry has yet to reach full maturity with significant growth expected in the near future. Whereas the global market stood at \$200 million in 2001, it is estimated to grow to \$2 billion in 2006 (Venture Consulting, 2002). Global trends will dictate future demand. For instance, as the US implements new visa, passport and immigration systems, the EU is likely to follow the US lead thereby creating more opportunities for Irish firms. Already several Irish firms such as Daon and VoiceVault are developing biometric technology. Daon, for instance, already supplies biometric security software to the London City airport (*The Irish Times*, 21 July 2003).

Both emergent niches are in their infancy and will require local institutional support in order to succeed. The Irish state has traditionally acted as a midwife (O'Riain, 2000) aligning local resources to the needs of industry. As Irish industrial policy attempts to foster more sophisticated activities, the coupling of regional assets and global demands has also changed. As these activities become more knowledge-driven then they will benefit increasingly from collaboration with industry researchers. While this collaboration often happens organically, the state encourages more university involvement through institutions like Science Foundation Ireland (SFI). SFI provides the resources for Irish universities to poach globally recognized researchers and bring them to Ireland. The intent is not only to make Ireland a location for cutting edge research, but also to train a new generation of Irish researchers. In addition to augmenting the local skills pool, the government still must put in place the physical infrastructure—notably broadband, necessary to support these industries both in the long-term and in locations beyond selected sites in Dublin. Success for both industry niches depends not only on local supply-side issues, but is also contingent on developments at other scales.

Non-local influences revolve most notably around regulatory issues at the EU level, as well as within the global trade system. For digital content, the drafting of effective intellectual property protection regulation by the Irish government, the EU and the World Trade Organization influences not only industry growth but also the extent to which producers can capably capture value. The implementation of standards and practices in the US and EU markets similarly influences biometrics. The establishment of European standards played important roles in the development of other industries, most notably mobile telephony (Brunn and Leinbach, 2000). For this reason the launch of the European Biometric Forum (EBF) in Dublin further establishes Ireland as a key site for Biometrics in Europe (*The Irish Times*, 21 July 2003). In addition to setting and enforcing standards, the EU through its Research Framework Programme also represents an important level at which significant

funding for advanced research is distributed (Legendijk and Cornford, 2000). These nascent activities perhaps offer a glimpse of Ireland's future industrial development. Although at their infancy, if they prove successful in delivering each of their constituent parts they will provide significant opportunities not just for value creation, but also value enhancement and capture. In doing so, they might form the foundation for sustainable development that no longer depends on continually securing new waves of inward investment.

## **Conclusion**

Transforming peripheral European regions into dynamic 'learning regions' remains a formidable challenge for policy makers at both the national and EU levels. The confluence of several unique exogenous and endogenous factors led to Ireland's economic turnaround, and their uniqueness somewhat blunts the ability to generalize all elements of the Irish growth phenomenon to other places. While the benefits accrued from investments in education and a pro-business environment are undeniable, two exogenous factors merit further mention. First, the Irish case demonstrates the positive development consequences of being connected to leading technology centres. Ireland enhanced its capacity for value creation by tapping into these innovative milieus through its involvement in GPNs and the attraction of skilled knowledge workers, both foreign and returning Irish emigrants. Second, Ireland's integration in the EU and global markets in general, proved vital in overcoming the small size of its domestic market. For instance, the experience gained by Irish managers working in globally-competitive Irish firms and multinationals—both in Ireland and abroad, better enables them to meet global standards and practices.

Completing the transition into a knowledge-driven economy represents the fundamental challenge currently facing Ireland. Irish policy makers are acutely aware that the country is rapidly losing its relative cost competitiveness. The activities that created the Irish economic boom of the 1990s are not sustainable in the long-term, and as such the development agencies can no longer target cost-driven activities that are merely passing through Ireland on their way to Eastern Europe or Asia. In adjusting to Ireland's new position in the world economy, policy makers now target higher-value added activities that better fit with Ireland current collection of regional assets. The youthful and increasingly educated workforce has created a track record of success that should enable Ireland to remain competitive both for new greenfield investments and importantly repeat investments. The Irish government is also attempting to support the development of emerging sectors such as biometrics and digital content. By combining the high-tech elements of both Irish firms and multinationals, Ireland hopes to take advantage of global demand expected to undergo exponential growth.

In spite of the promise associated with these developments, the continued development of Ireland's knowledge-driven economy faces several obstacles. At the most basic level, the congestion and rising costs associated with Dublin's rapid development diminish Ireland's attractiveness to inward investors and globally mobile knowledge workers (Ellis and Kim, 2001). The inability to rapidly overcome infrastructural deficits, both in terms of transportation and broadband access, inhibits both future growth and the establishment of more balanced regional development. Nevertheless compared to the poverty and high rates of emigration associated with much of Ireland's economic history, these are good problems to have. Ireland is unlikely to ever again experience growth rates like those of the 1990s, but there is

growing confidence that a solid foundation for a knowledge driven economy has been constructed.

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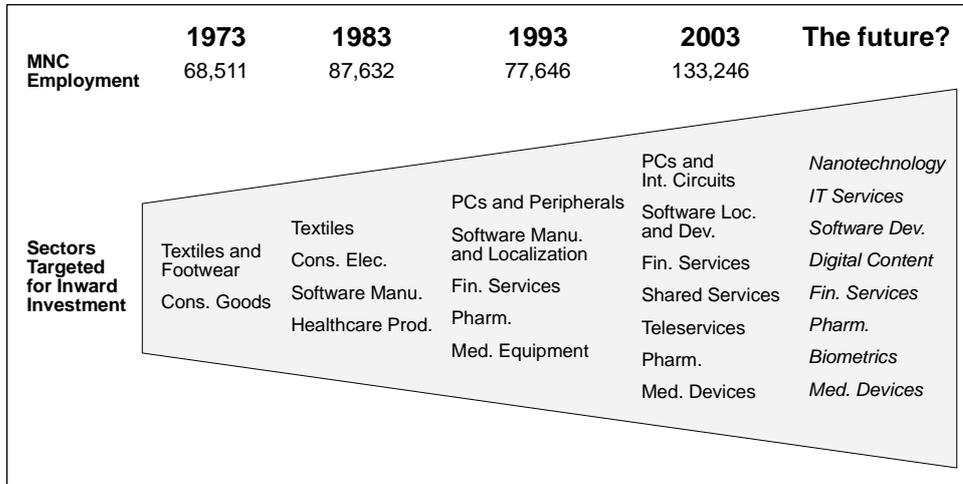
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**Table 1: Estimated Irish Economy Expenditures (€ million)**

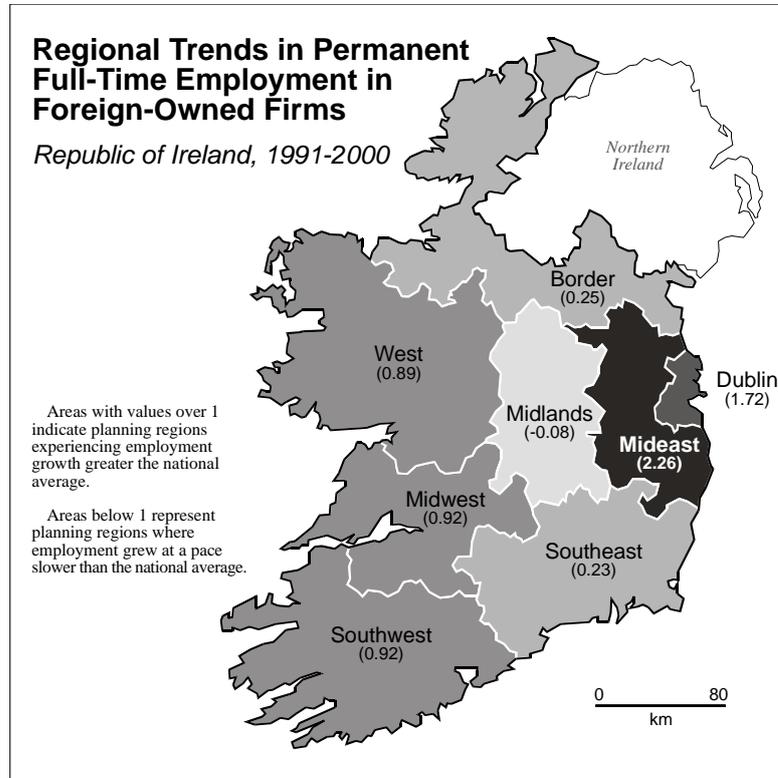
	1995	1996	1997	1998	1999	2000	2001	% Change 1995-2001
<b>Irish-Owned Firms</b>								
Total Sales	17410	19839	18911	19327	21597	21579	23965	138%
Total Irish Economy Expenditures	13550	15724	14588	14827	16240	13988	15472	114%
<i>Of Which</i>								
Wages & Salaries	2637	2888	3058	3212	3785	3837	4309	163%
Irish Raw Materials	7734	9285	8070	7984	8479	7589	8358	108%
Irish Services	2099	2536	2426	2458	2600	2562	2805	134%
IEE as a percentage of total sales	77.8%	79.3%	77.1%	76.7%	75.2%	64.8%	64.6%	
<b>Foreign-Owned Firms</b>								
Total Sales	27893	32611	38019	43671	51582	66205	72102	258%
Total Irish Economy Expenditures	11011	13251	12908	15154	15914	16915	18579	169%
<i>Of Which</i>								
Wages & Salaries	2869	3166	3391	3785	4252	5470	6120	213%
Irish Raw Materials	3205	3727	3798	4678	5438	6107	6474	202%
Irish Services	4464	5766	5073	5848	5136	5338	5985	134%
IEE as a percentage of total sales	39.5%	40.6%	34.0%	34.7%	30.9%	25.5%	25.8%	

Source: Forfás Annual Reports, various years

**Figure 1: Targeted Sectors for Investment since admission to the EEC**



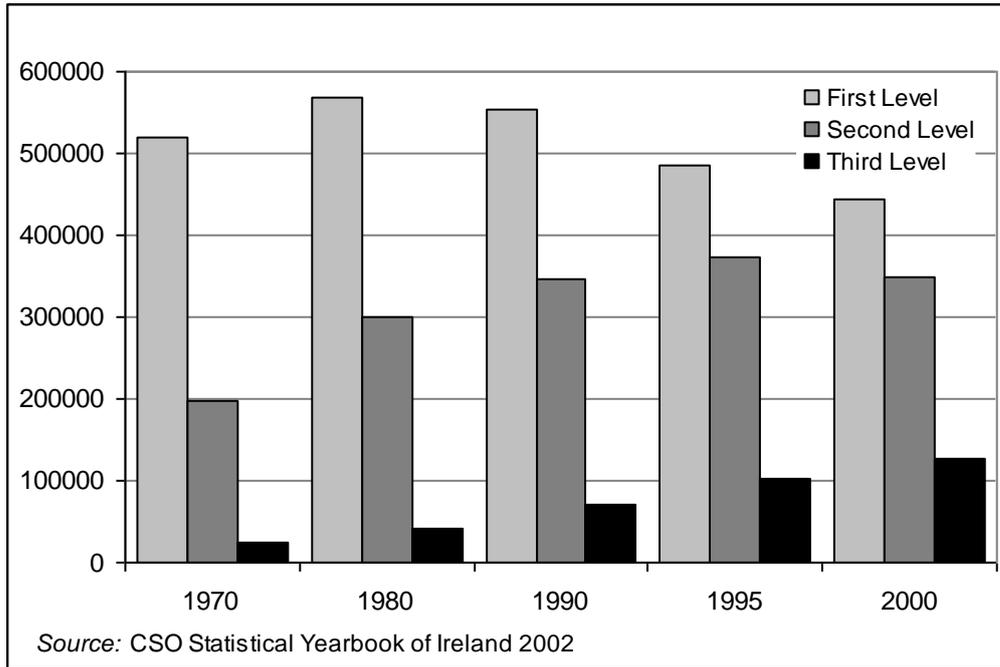
**Figure 2: Distribution of Employment in Foreign-Owned Enterprises, 1991-2000**



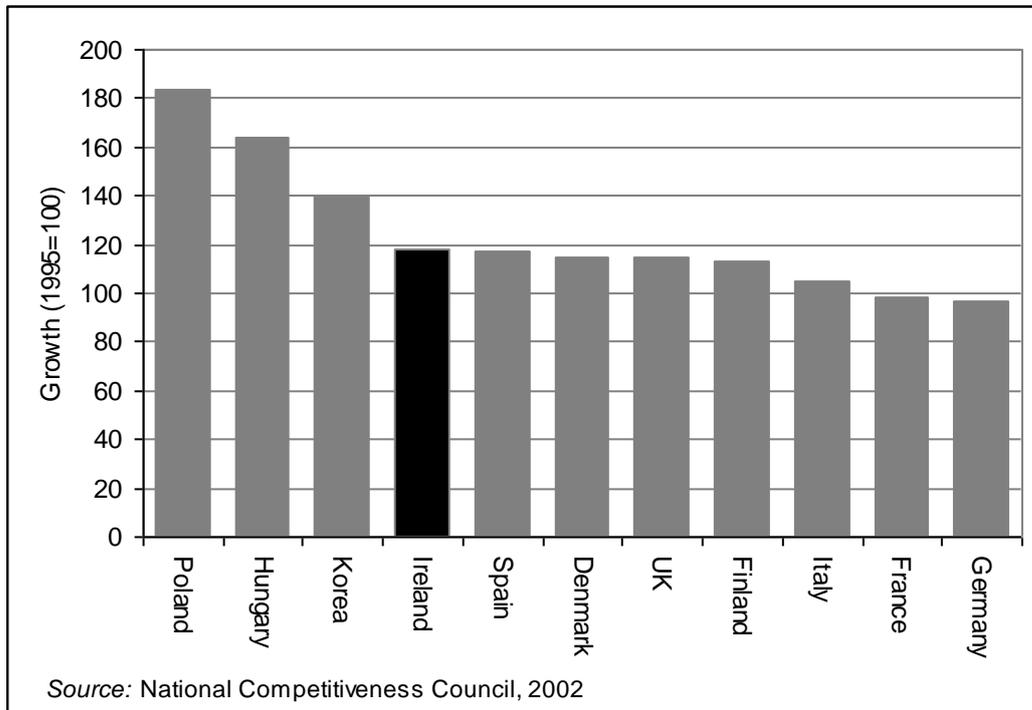
Source: Forfas Annual Employment Survey, 2000

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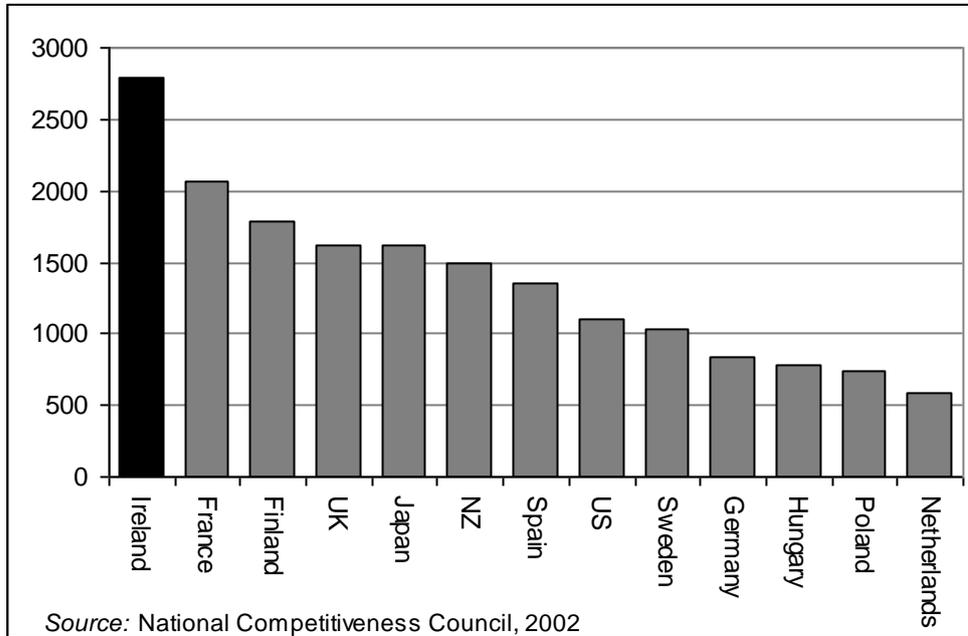
**Figure 3: Persons in Full-Time Education, 1970-2000**



**Figure 4: Total Enrolment in Tertiary Education Growth, 1999**



**Figure 5: Number of Science Graduates at University Level**  
(per 100,000 persons in the labour force aged 25-34)



**Figure 6: Technology Balance of Payments, 1999**

