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Innovation Systems in the European Periphery: the case of Ireland and Greece*

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Abstract

Two decades ago, Greece and Ireland stood passive spectators of political, economic and technological developments at the core of an emerging European Economic Community. Away from the industrial centres of Europe, the attainment and application of new ideas, it seemed, had no place among the prescriptions of policy. The pursuit of each country's comparative advantage dictated that they be net consumers of technological wares invented elsewhere. And while a lot has changed in the meantime, a great deal has also endured.

Today, innovation is no longer confined to the fringes of industrial policy; it features prominently, throughout the continent, as 'the solution' to the re-discovered riddle of competitiveness. Ideas on how to best mobilise intellectual assets for innovation abound. Theory suggests that institutions are important in shaping productive efforts towards innovation; the experiences of Ireland and Greece offer a fitting testing ground.

Ireland has made strides in the FDI route to prosperity, no longer enjoying a 'cohesion' status. Greece however faces pressing economic problems, in the aftermath of celebrated, largesse-fuelled growth. Over the period in question though, nowhere else have the differences between the two countries become more accentuated (and apparent), as in matters of innovation. We propose that the key to these differences lies with the drafting of policy and the consequent shaping of their institutions. We observe that importing solutions from abroad, with Greece looking to Brussels and Ireland to the US, was central to their respective experiences.

Keywords: innovation policy, exogenous innovation, institutions, science technology and innovation actors

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Introduction

Assessing the performance of an economy for any given period is a complex affair; current dynamics and the breadth of options available to policy makers are determined among other things by history and geography. The paths to economic development followed by both Ireland and Greece have variably intersected and diverged over the last half century. Adherence to Keynesianism in the post war period had different ramifications for Ireland and different for Greece. By the 1980s both countries were looking to Brussels for solutions to their deep rooted economic problems. In the following two decades policy prescriptions in the area of Science Technology and Innovation (STI) played a crucial role in their development trajectories. Ireland has made strides in the FDI route to prosperity, no longer enjoying a 'cohesion' status. Greece however faces pressing economic problems, in the aftermath of celebrated, largesse-fuelled growth.

On a superficial level comparing Ireland and Greece may look like a simple task of comparing successful and less successful European economies at the start of the 21st century, however, the situation is somewhat more complex. For instance, and of special relevance here, neither country is an example of success in terms of innovation as measured by the Commission (EIS, 2003). For all the attention it has received over the last 10 years as 'the world's leading exporter of software', Ireland is still far from being a world leader by any accepted measure of innovation. Greece, while not enjoying the high levels of growth like Ireland, also fares poorly. While we recognise that the link between innovation and growth is, in both cases, open to question, we propose that 'innovation policy' is an effective focusing instrument for broader industrial development. In the following sections we show how different approaches to such policy have differentiated the experiences of the two countries in the last two decades.

Both Ireland and Greece have committed to the Lisbon Agenda and have laid out plans to induce improvements in their national innovative capacity (Furman, Porter and Stern, 2002). And while we agree that increasing innovative output is an important end in its own right – we highlight that the rhetoric of innovation is a potent focusing mechanism for approaching industrial and broader economic development issues. Here we attempt to map out the different approaches that have led to a divergence in their shared path, the institutions and actors that differentiated their cases. We also question the extent to which imported solutions to national problems are appropriate. In doing so we recognise value in expanding the definition of innovation to include novel approaches to governance. The following paper examines the Irish and Greek cases separately before concluding.

THE IRISH CASE

The relative youth of the Irish economy makes its transformation over the last 20 years all the more notable. Attaining the status of Republic in 1948 26 years after it became independent of British rule, the road to economic success over the preceding years has been a 'rocky one' (O'Grada, 1997). At independence the Irish state had a living standard near the average of most Europeans of the time. By the end of the

Second World War Ireland was facing forty years with the label of Europe's 'poor man'. There are many different interpretations as to how Ireland managed to turn itself around by the start of the 21st century. The nationalist interpretation places the blame for Ireland's lack of development prior to 1950 squarely on the shoulders of Great Britain. It cites evidence that Irish economic fortunes improved once dependence on British markets ended (O'Hagan, 1995). This view is not too dissimilar from dependency theory which emphasises the harmful results of links between a centre and periphery. Theorists such as Munck, 1993 identified the mechanisms whereby external forms of dependence created internal forms of uneven development (Kirby, 2002).

In fact, dependency theory can be reapplied to the Irish case in the early 1990s. Replacing the dependent relationship on an ex-colonial power was a new dependence on the influx of foreign investment into Ireland. For the likes of O'Hearn (1989; 1990; 1998) Ireland's new dependency was characterised by radical free trade, free enterprise and foreign industrial domination. He draws a direct correlation between this and the lack of any critical mass in indigenous industry unable to withstand the competitive pressures of such 'radical' free trade. In true dependency theory style, O'Hearn examined the 'continual oppression of Ireland within a dynamic structure of global capitalism' (1993: 2). On which he places the blame for rising social inequalities through the creation of a rich investing class at the expense of a low skilled service class. Others are less convinced (see MacLaughlin, 1994; Kirby, 2002) they point to increasing living standards across all sectors of Irish society resulting from the influx in investment monies and a lack of an alternative practical solution (O'Donnell, 2000).

While valuable, where much of the dependency theory as applied to Ireland falls down is in taking a narrow view of Ireland in the global context. In fact, a great deal of complexity lies behind the flows of capital and labour into and out of Ireland the work of O'Riain (1998; 2000; 2004), Kennedy (1998) and O'Malley (1998) goes some of the way to highlighting this. Taking a more political economy approach in the late 1990s O'Riain moved away from the singular view of foreign direct investment as a positive or negative and went on to define Ireland as a flexible developmental state, by which he meant an ability to bring global networks of flow down to the local level through the nodal presence of MNCs in Ireland. So while admitting there are problems of profit repatriation within the MNC sectors he also highlights the positive contribution made via their sub-supply linkages and spill-over effect (O'Riain, 2004). Taking a similar line, O'Donnell (2000) sees Ireland's place in Europe as central to its recent transformation, primarily through economic and social governance (he points to the handprint of the EU on one of the Irish government's most innovative policies, the social partnership that commenced in the late 1980s). For both O'Riain and O'Donnell the place of the state in Ireland's success is key. Recent work carried out by Collins and Grimes (2005) adds to the efforts of O'Riains later work by attempting to place Ireland in networks of global production. Wary of the critique of the Irish FDI development model, they attempt to re-define embeddedness in the Irish context by examining the process of leveraging of power by foreign-owned multinational affiliates in Ireland. This global-local view as seen in Coe et al (2004) goes beyond the simplicity of the dependency school of thought through the empirical analysis of non-Irish operations gaining regional and global remits over product flow.

Ireland's development towards a knowledge based economy and the innovation focus.

For many, the seeds of the now well renowned Celtic Tiger were sown as early as the 1960s and are most easily identified with liberalisation. Economic liberalisation took place in three elements: firstly, the use of grants and tax concessions to encourage export-oriented production; secondly, the attraction of foreign manufacturing enterprises; thirdly, dismantling protection in return for greater access to markets abroad (Kennedy et al, 1988). It was the second which assumed dominance. As O'Grada put it:

> "At the outset few foresaw the rapid growth of the foreign sector, but direct foreign investment in Irish industry soon became the cornerstone of government policy…The remarkable transformation of the economy between the late 1950s and the early 1970s may be largely attributed to the arrival of the multinationals" (1997, 114).

Irish industrialisation since the late 1960s was characterised by more sophisticated products such as machinery, pharmaceuticals, instruments and electronics. Ireland was the first country to establish what came to be known as an export processing zone[1]. This was one example of the government's foreign investment-led, export-oriented industrialisation strategy. By 1973, overseas firms in Ireland accounted for almost one-third of all employment in manufacturing (68,500 out of 219,000). By 1983, there were almost 1,000 foreign firms in Ireland who had invested well over (IR)£4 billion in the country; half of them came from the US, one-eighth from Britain and one-tenth from Germany (O'Grada, 1997, 115). Between 1958 and 1973, manufacturing output grew by 6.7% per annum while manufacturing employment grew by a more modest 2.4% per annum (O'Malley 1992). Exports as a percentage of gross output grew more dramatically, from 19.4% in 1960 to 41% in 1978.

With a panoply of tax breaks and subsidies, Ireland successfully induced foreign companies to set up branches in Ireland, and by 1974 new industry accounted for over 60% of industrial output. Indeed the 10% tax on profits in manufacturing had made the country something of a tax haven. However, by the nature of this type of industrialisation, backward linkages in terms of purchasing and sub-contracting to indigenous firms were weak owing to the basic manufacturing nature of foreign branch plants.

Economic liberalisation was important in the Irish case and a key enabler of that was the Industrial Development Authority; IDA Ireland. Since its inception in 1949, through its overseas offices it sold Ireland's advantages to generations of executives around the world though most successfully to the US. In 1992 it was restructured and became the Industrial Development Agency[2], as a result it placed greater emphasis on developing MNC subsidiaries and worked closely with their management to support efforts to win mandates in higher-value added activities such as advanced manufacturing, R&D, Supply Chain Management and shared services. As Ireland's

[1] Established when the Shannon Free Airport Development Company was set up in 1958 in the Midwest region. This State-backed industrial zone handed out special incentives to attract foreign investors to import materials which underwent some degree of processing before being exported again

[2] The Authority was essentially split in two with the creation of Enterprise Ireland a development agency solely focused on indigenous industry.

cost advantage eroded, it sought to carefully target FDI in new sectors such as bio-pharma and e-business. More recently, inspired by global restructuring and organisational change the Agency has placed more emphasis on R&D (see below) (Begley et al, 2005).

1973 saw Ireland's accession into the European Economic Community. Following the signing of the Anglo-Irish Free Trade Agreement and subscription to GATT in 1965 and 1967 respectively, Ireland's membership of the EU had truly opened up to free trade. Now, over 30 years later – funds worth €53 million have been transferred from the EU and when contributions are taken into account, Ireland's net receipts amount to €35 billion. What Ireland's membership of the EU also meant was access to a greater (one of the world's largest) market. This embellished the original remit of the IDA and Ireland's attempt to attract investment from abroad. US FDI in particular recognised the increased attractiveness of Ireland as a location to serve the EU. This is supported by figure 1 where when we consider Irish population at 1% of the EU total we see Ireland punching well above its weight.

Figure 1. Foreign Direct Investment in Europe and Ireland.

Bn €	**2000**	**2001**	**2002**
European Union	689	389	374
Ireland	26	16	19
Ireland as a % of EU	3.7%	4.1%	5.1%

Forfas (2004)

Ireland's recent economic success can be attributed to a wide range of factors, from EU structural funds, social partnerships on wage agreements between the government, trade unions and employers, to increased inward investment. It is the type of inward investment that was attracted that has been fundamental to the newfound prosperity. The conscious focus on the software industry has been pivotal, enabling the country to become the highest exporter of software in the world, exporting over €8bn worth of products annually (ibid).

FDI, which totalled $164 million in 1985, skyrocketed throughout the 1990s. The inward FDI volume in 1995 added up to $1.45 billion, $2.74 billion in 1997, $11.04 billion in 1998, $14.93 billion in 1999 and $16.32 billion in 2000. From 1991-1998, foreign-owned firms accounted for 95 percent of the growth in Irish industrial exports, and by 1999 foreign-owned industry accounted for an estimated 38 billion euro, or almost three-quarters of total Irish exports. Foreign direct investment flows into Ireland in the 1990s originated mostly from export-oriented United States multinationals. By 1998, U.S.-owned companies in Ireland were responsible for 70 percent of Irish industrial exports. By 2002 the overall stock of FDI in Ireland was equivalent to 129% of GDP (158% of GNP) – higher than any other country benchmarked and some distance ahead of second (Forfas, 2004; IDA, 2005).

Thus, Ireland has pursued its economic development path with a great deal of emphasis on exogenous factors. For dependency theorists and political economy thinkers alike many statistics can highlight the negative impacts of this model, not least the dwarfing of indigenous enterprise by their foreign-owned neighbours and the increasing social inequality of Ireland's newfound wealth. That said the growth

trajectory that Ireland has followed has made it the envy of many other EU states not least the former cohesion states. To this end the next section will attempt to map out in greater detail the innovative side of Ireland's economic development by focusing on policy and policy enactors. Juxtaposing the Irish case with the Greek one helps to make the different paths chosen easier to pinpoint relative to each other.

An Innovative Ireland – but not as you know it.

What makes the Irish case even more noteworthy in the European context is the lack of a positive correlation between its newfound wealth and the current state of Irish innovation as measured by traditional indicators. From the above we can easily recognise the dominance of the multinational, especially high-tech multinationals. Less than 1/3 of foreign-owned MNCs carried out R&D in 2001 (300 out of 900ish) of these a mere 20 firms accounted for over 2/3 spent on R&D (Forfas, 2004). This is not industry specific either – for all the IDA talk on focusing on high tech industries in a high tech Ireland: Ireland's R&D as a percentage of output of the foreign owned ICT sector was 1.2% which compares poorly to the OECD average of 5.6%. How this rather negative snapshot of 'knowledge-based' Ireland fits with the success of recent years involves looking back over industrial policy and especially innovation policy.

Talk of science technology and innovation was far from the policy making tables in Ireland prior to the 1970s. For the most part science and industrial policy were geared solely towards solving Ireland's massive unemployment problem. The IDA oriented its strategy towards attracting companies in the electronics, chemicals and other high tech sectors with high export potential. This was not an articulated technology policy, but a response to the availability of a relatively well-educated workforce, an advantage which Ireland held in comparison with other newly industrialising countries seeking foreign investment (Cogan and McDevitt, 2000). By the start of the 1980s policy documents were beginning to find holes in the one-track approach towards industrial development. The Telesis report of 1982 was critical of short-termism inherent in the FDI model. Most criticism was concentrated on the lack of embeddedness and linkages between foreign owned operations and the local economy. A National Linkages Programme set up by Forbairt in 1985 to counter this achieved little. The fact is no real pressure was put on MNCs. By 1996, out of 2,667 SMEs only 174 were sub-suppliers to MNCs, the sectoral distribution of which would hardly be described as hi-tech. 114 were in plastics, fabricated metals or paper/printing products, 33 in electrical engineering or computers and 2 in chemicals (Breathnach and Kelly 1999).

The publication of the Science and Technology Act in 1987 saw the first attempt to integrate with industrial policy. S&T policy was given a central role with the administration and its own Minister of State. "The aims [of Science and Development Programme] is to develop in Ireland the level of technological capability necessary to underpin the competitiveness and more rapid development of industry. Technology is a major force in the creation of wealth and jobs" (Government, 1988 in Cogan and McDevitt, 2000). Innovation policy in the 1990s is marked firstly by the publication of the Culiton Report and the sustained campaign which followed resulting in the establishment of a Science Technology and Innovation Advisory Council (STIAC) in 1995 and the White Paper on Science Technology and Innovation which was published a year later. A common theme ran through each, the need to move away

from dependence on exogenous factors by concentrating on R&D and doing work of higher value add: for which innovation was key. The formation of the Irish for Science Technology and Innovation (ICSTI) followed. The new institution was mandated "to advise the government on the strategic direction of science and technology policy, embracing all aspects including scientific research, higher education, technology and R&D in industry".(Cogan and McDevitt, 2000). The main outcome of which was the restructuring of the IDA, which focused itself explicitly on foreign investors while the development of indigenous industry became the remit of Enterprise Ireland.

While innovation was bandied about in the 1990s, it never really gained the type of broad appeal that employment creation policies gained in the 1970s and 1980s. There are two main reasons for this: first is the coincidence of rising productivity of Irish operations that came about during the advance of the Celtic Tiger. Second, innovation is a much less tangible construct and as a result of its somewhat loose definition it was less likely to embed itself in public consciousness. Therefore, throughout the 'golden era' of the 1990s much of Irish industry found 'little need to change what was not broken'. Also a great deal of the work being carried out in Ireland, while it was dominated by 'high-tech' industries, in many cases, there was little high tech in what they did. In the software sector for instance, it was basic manufacturing with some localisation and shared services: activities that lie at the opposite end of the value chain from research and development. For this reason many of the policies and agendas pushed by policy makers had little relevance for the main part.

In the past five years, some considerable changes have occurred in Irish industry, not least the restructuring that was necessary post 2000/2001. What role innovation policy has had to play on this is questionable. It is true however, that the policies enacted in the past number of years have been more targeted and as a result more effective in at least raising consciousness regarding R&D and innovation. This can be seen by looking at the relative amounts of money earmarked for STI investment over two phases: 1995-1999 €0.5 billion while in the NDP covering the years 2000- 2006 the government committed €2.5 billion of public money to be invested in STI (OECD, 2004 , Green and Hilliard, 2005).

External influences

Perhaps more than other EU states Ireland was willing to follow the EU lead in focusing on the knowledge based economy. As we have seen, little in terms of real innovation policy had ever taken hold in Ireland in the 1970s and 1980s. It is true that greater structural changes inspired by the EU have had enormous effects on its member states like de-regulation. Yet as tightly as Ireland could follow the 'innovative lead' of Europe, it's expenditure on R&D remains 2/3 of the EU average.

On the more subtle side of things, looking at EU policy in terms of the promoting innovation through Information Society initiatives a clearer line of influence becomes apparent. For more than 20 years the EU's Framework Programme of research had been playing a modest role in increasing the R&D capacity of cohesion countries like Ireland. Grimes and Collins (2003) sought to uncover the role of one EU initiative played in promoting the knowledge economy in Ireland. Using the ESPRIT (part of

the fourth framework programme which ran under the prior three FPs) a programme which focused on pre-competitive research (R&D removed from the market focusing on generic technologies) they showed that for many businesses in Ireland throughout the 1980s this was the only way to fund innovative actions: "Esprit allowed us to undertake certain development that we couldn't have undertaken without that funding. Also it exposed us to real world issues" (Interview with CEO of founder of indigenous tech company). Yet for many the funding only provided a brief foray into the world of R&D, however, the programme was responsible for the creation and promotion of informal collaborations of actors from different backgrounds which proved beneficial to Irish industry as a whole (see Grimes and Collins, 2003).

Closely related to the ESPRIT programme with a high overlap of participants are the Programmes in Advanced Technologies (PATs). These programmes fostered technology transfer between university research departments and private enterprise. Initiated in the early 1990s in partnership between Enterprise Ireland, industry and universities, the PATs have benefited from ERDF support since 2000 to improve the quality of their services and their capacity to respond to emerging technologies. In ensuring more effective links between the academic and industrial sectors, the PATs (now termed "initiatives in specific advanced technologies") aim to provide better commercial results from public investment in research. The ERDF provided support of around €76 million, about one third of total project costs.

Whether it is on the micro (project) level or macro (policy) level the handprint of Brussels can be found in Ireland's approach to innovation. This is most recently seen in the publication of the 2004 Action Plan "Building Ireland's Knowledge Economy- the Irish Action Plan for Increasing Research and Development by 2010", a report prepared by a high-level Inter Departmental Steering Group. The evolution of this group can be traced back to the Lisbon Agenda of 2000. Following on from this the heads of State met in Barcelona and agreed to target an R&D spend of 3% of GDP by 2010. In 2003 the Commission published the actions required to achieve this entitled "Investing in Research: An Action Plan for Europe". It was in response to this that the Minister for Enterprise Trade and Employment established the high level group that set out its vision for R&D as:
"*Ireland by 2010 will be internationally renowned for the excellence of its research and be at the forefront in generating and using new knowledge for economic and social progress, within an innovation driven culture*".
Very much influenced by the master document of 2003, the above is replicated in its goals in many of the other member states

Yet, Ireland has been and remains different to the other EU states in terms of its performance in the face of relatively poor innovation levels. Here we briefly try to uncover why. In asking this question, we have looked and the economy and society of Ireland and found how it differentiates itself – its openness and not just with regard the EU but more especially with regard its other major investor, the US.

As we have seen from above a significant majority of the FDI in Ireland comes from the US, however, this has not done much to impact the rather poor innovation expenditure. What first comes to mind is the dependency theory critique of Ireland's development set out by writers such as O'Hearn (2002) and Kirby (2002). Yet, from work carried out on the foreign-owned tech sector we see a different story begin to

emerge. While it may be true that for the most part, MNCs in Ireland are doing little in terms of value added, it would be unfair to say that none are moving up the value chain. A recent survey by the IMI (2005) with over 250 respondents from the MNC sector over half claimed to have increased the remit / control of their Irish operation significantly in the past 3 years, in essence moving the operation away from its original remit and up the 'value-chain' (see Birkinshaw, 1997). Case studies on the process of leveraging control are depicted in detail in Collins and Grimes (2005). What is little regarded by any indicators or yardsticks nationally or internationally is that this very process is innovation itself.

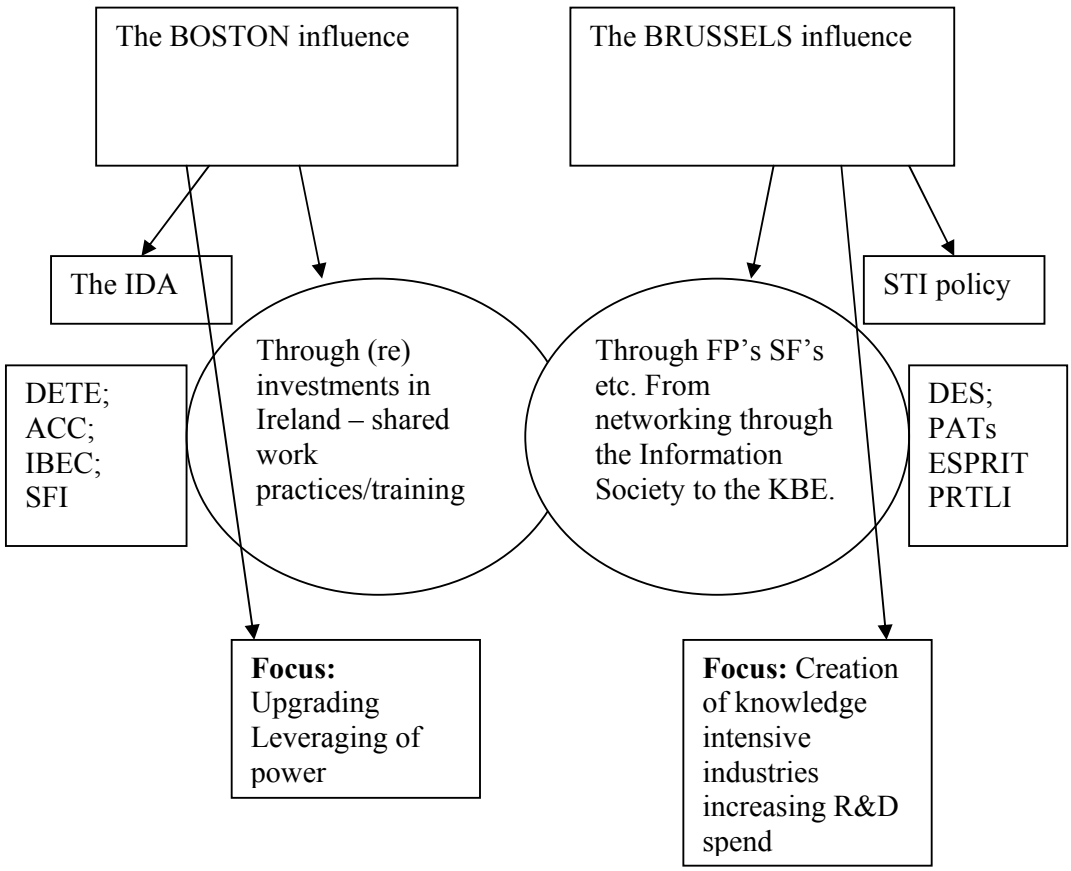
This is something that has been foremost in the minds of many of the Irish managers of US owned operations in Ireland. Many see the movement upwards away from the basic or original remit (usually manufacturing) as something of an innovative process which can garner increased levels of control of an affiliate as well as higher value added work with increased returns to the local economy. What is most interesting is the lack of linearity seen by most managers in the end-point of R&D at the top of the value chain. Therefore, many see innovation as the taking on of different remits and not necessarily creating employment in the research laboratory. There is a feeling among some of the bigger organisations located here, that the advantage may not necessarily lie in a country of researchers: "R&D is as footloose as manufacturing" "What I want this operation to have is control, and that is more easily got through global/regional remits over the production process than R&D on its own" "the Irish focus on R&D may have gone too far, I will find it very difficult to sell Ireland as a good location to carry out high-end manufacturing" (various interviews 05/06)

The place of the IDA in this is crucial. As a policy enactor its influence over the type and sustainability of operations located in Ireland is paramount (see Pontikakis et al, 2006). Something of a change in the direction of the organisation can be deemed from the following quote by its CEO: "The expansion of existing clients… is important because their contribution is something we expect to grow in the future. This is happening not only because it is a logical consequence of the critical mass we have now built up in several sectors, it is also now a key focus of policy". (IDA, 2004 p.ii)

Statistics back this logic; repeat investments have taken over Greenfield investments by foreign investors and are seen as the spark of Irish recovery after the lull of 2000/2001. The IDA's ability to work closely with its clients alongside other forums such as the American Chamber of Commerce have created a unique environment in Ireland that some have termed 'tribal or clan-like'. This refers to the willingness of industry leaders to put the constantly refer too and think about what is good for the country as well as what is good for their company. As one senior scientific advisor put it. "It's like everyone in the MNC sector have their 'Ireland Inc' hats which they don in the interests of the country as a whole… It is almost subversive behaviour above and beyond their job remit, it amazes me, you have cut throat rivals [in business] sitting opposite each other thinking up ideas that work for their rivals – as well as themselves." (Interview SFI, 2006). These unique factors alongside industrial upgrading are what has given Ireland its competitive edge over the past 6 years and can be seen (although difficult to measure) as the true innovation that is fuelled economic growth.

Irish Case Conclusion

Figure 2. Policy Dualism in Irish Innovation System



Ireland's geographic location as well as its history has divided its loyalties between the EU and the US. Both are huge contributors to the Irish success story and will continue to be as Ireland looks to the future. This is depicted through a brief look at Ireland's somewhat schizophrenic innovation system. Ireland's use of STI policy and catchphrases are employed second-hand from Europe, European monies keep many of Ireland's flagship innovation projects afloat. Yet the ease at which Ireland marries this with its relationship with the US, is what makes the case particularly interesting. An example of which is the research body, Science Foundation Ireland. Run by the Department for Enterprise, Trade and Employment, SFI was inspired by the technology foresight exercise in 1998, which itself was inspired by the European Commission. SFI was allocated €711 million of government money and was essentially based on the US model of the National Science Foundation. "Until recently, SFI was full of US accents, there were guys from the NSF that helped get the thing off the ground…Other EU states tried to emulate… but the main difference with these guys is the fact that they would not be willing to let Americans run the show in the outset, we in Ireland do not seem to have that problem." (SFI – director – interview). A reality which was also expressed by Ireland's second in Command:

"As Irish people our relationships with the United States and the European Union are complex. Geographically we are closer to Berlin than Boston. Spiritually we are probably a lot closer to Boston than Berlin". (Tainsite Mary Harney)
http://www.entemp.ie/press/2000/210700.htm

What the above diagram also depicts is the different, but no less important innovation results. This is perhaps most easily divided between the EU focus on R&D and the more tangible product innovation and the Boston focus on the less tangible process innovation. Both have immediate implications for the Irish economy and its ability to sustain its current growth rate. Yet the Ireland's STI policy has taken somewhat of a blinkered approach to this dualism more recently. This has seen the publication of policy documents with a somewhat linear view of both innovation and the place of productivity in Ireland. This has brought with it the narrow view of innovation as R&D and little else, yet as the above has attempted to prove, innovation is a much broader phenomenon, and according to one of the most productive sectors in Ireland, the US MNCs, something that STI policy needs to address.

THE GREEK CASE

Policy interest in technology matters has existed in one form or another for much of Greece's recent history. Although intentions did not always translate into action, ideas on how to best encourage the transfer, spread and indigenous generation of technology date at least as far back as the 1950s. The Greek economy experienced exceptional growth from the 1950s up to the early 1970s[3], for there was plenty of room for economic expansion; the Second World War and the brief but destructive Civil War that ensued, had effectively devastated the country's industrial capacity and public infrastructure, had polarised Greek society and left confidence in its institutions in ruins. Policy planners recognised an opportunity to foster economic transformation, although they rarely agreed on how this might be best achieved. That was the subject of intense policy debate at the time, resulting in starkly distinct propositions. Digressions focused on a range of issues, most notably regarding the extent of government involvement and the particular 'model' of industrial and economic organisation that should be adhered to. Proposals included the encouragement of full-blown industrialisation along Western-European lines (Prof. Zolotas), an exclusive focus on the development of the agricultural sector (Prof. Varvaressos) as well as the promotion of central planning and state control of "heavy industry" in the image of the Soviet model (D. Batsis) (Drakatos, 1997; Psalidopoulos, 2004). Few were failing to notice the central role of technology in economic affairs[4]; however the extent to which the Greek economy was in a position to productively assimilate the fruits of innovation was heavily contested[5]. Ideology, factional affiliations and national

[3] Often termed the '*take off period*' and even the '*Greek economic miracle'*.
[4] The contemporary proliferation of mass media (and the extent to which they acted as conduits for WWII, and subsequently, Cold-War propaganda) had a profound effect on public consciousness. The imagery of marching machines in the battlefield, in production as well as in civic life delivered a potent message; the association of advanced technology (and technological advancement itself) with both absolute and relative national prosperity.
[5] Notably Prof. Varvaressos, in his report presented to the Bank of Greece in 1952 underplayed the potential impact of technology transfer as he believed higher production levels were owed to the existence of "*an entire range of favourable conditions lacking in the poorer nations*" and that the use

antipathies meant that consensus as to how to proceed was difficult to achieve – as evidenced by the eventual adoption of no plan at all until 1953.

It was then that a *Programme for Economic Reconstruction* was put forward, backed to a significant extent by foreign aid in the form of the Marshall Plan. In it, for the first time in Greek reality, economic policy attributed a key role to matters of technology – of course not yet coherently articulated as an 'innovation' or even 'technology' policy per se but then implicit in the normative suggestions of planners regarding industrial structure. The Programme called for a sharp focus on manufacturing, with the core of its prescriptions featuring measures to encourage the creation of "*sustainable industrial units using appropriate equipment and new technology*" (Drakatos, 1997:31). The contemporary situation did not allow for an industrial leap; rather the bulk of funds were spent on 'emergency' infrastructure and subsidies for the primary sector. Ambitious in scale, the Programme envisaged large energy infrastructure projects (state owned hydroelectric and thermoelectric power stations and closely linked lignite extraction facilities), transport and communications infrastructure as well as the provision of generous manufacturing subsidies and tax-breaks (Stasinopoulos, 2006). While many of its targets were eventually met, haphazard execution, political wrangling and the gradual withdrawal of foreign aid meant that it was not implemented in its entirety[6].

Arguably one the most profound effects the Programme had was in focusing public debate on a loosely defined target of "*industrialisation*". Among policy advocates, irrespective of conviction, a common vocabulary emerged, featuring such terms as "*heavy industry*", "*novell methods*" and "*modernisation*"[7]. The results of industrial dirigisme begun to become apparent by the end of the decade. By the 1960s a number of state-owned or state-supported companies were active in the energy, utilities and mineral extraction sectors. At the same time there was increasing participation of the private sector in this government-led industrialisation process. Private investment, both domestic and foreign, helped establish internationally competitive production outlets (aluminium, steel, shipbuilding, petrochemicals and oil refining, chemicals, fertilisers, cement etc) (Drakatos, 1997). These were sectors where Greece possessed an obvious comparative advantage (in terms of cost, resources, location) and were receiving continuous state sponsorship and so presented almost risk-free investment options. According to Drakatos (1997) manufacturing growth was driven by both strong domestic consumption and considerable increases in exports[8]. Closely associated was the drastic growth in construction activity, fuelled by rising incomes and the rapid urbanisation process. Moreover, on the political front, Greece sought accession to the emergent EEC. The signing of the *Athens Agreement* granted Greece the status of Associate Member of the Community (entailing a limited-scope customs union and access to a $125m-strong 'productive investment' fund) effective from November 1962.

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of technology "*is the result of, not the reason for, the existence of favourable production conditions*" (Papadimitriou, 2003:2).

[6] Drakatos (1997) argues that the Programme's role was "*indicative*", as *"…the execution [of its targets] was hampered by the lack of an institutionalised process of monitoring and control*" (Drakatos: 32).

[7] Developments in Greek economic policy at the time are well documented in Drakatos (1997), Dertilis and Fragkiadis (1997), Psalidopoulos (2004) and Stasinopoulos (2006).

[8] As an indication, Drakatos (1997: 62) calculates that total exports increased by a factor of 50 in the period 1957-1972.

Despite this period's achievements in delivering rapid economic growth, employment increases and general improvements in welfare, planners had failed to deliver the promised profound structural changes that would ensure long-term sustainability. At the end of the 1960s the country's main products remained concentrated in a handful of traditional, labour-intensive sectors (primarily textiles, food and beverages) that presented few opportunities for returns to technical change. Moreover these industries were characterised by high-industrial concentration (Dertilis and Fragkiadis, 1997; Varvaressos, 2002) and political stewardship (Stasinopoulos, 2006) that shielded them from the potential leverage of either demand-pull or supply-push technical change. The modest success that was the creation of a fledgling manufacturing sector represented a potential stepstone to higher-value manufacturing and associated services. Unfortunately though, it is only with hindsight that this opportunity has been appreciated. It appears as if industrial policy (as distinct from general macroeconomic management) lost its purpose once the flow of foreign aid was halted. Perhaps Greek political reality at the time made it impossible to appreciate; the 1967-1974 military dictatorship detracted from long-term development planning and further undermined confidence in the country's political, legal and economic institutions[9]. More directly, the ensuing international isolation put an abrupt end to a tentative wave of foreign direct investment from third countries seeking to benefit from access to EEC markets, under the provisions of the Athens Agreement.

The restoration of democracy in 1974 brought significant challenges to policy makers, not least, with regard to the introduction of institutional safeguards to prevent a relapse. The attention of planners was occupied with political and legal institution building, including the difficult preparations for formal accession to the EEC. It is probably because of this that there is little during that period that could be directly interpreted as technology policy. The 1970s heralded the beginning of a long period of global macroeconomic volatility which was to affect Greece profoundly. The weak Greek economy was unprepared for the effects of the two oil crises in 1973-74 and again 1979; cost increases manifested themselves in rapidly accelerating inflation, in turn calling for strict credit control with a commensurate effect on investment. In the immediate aftermath of the oil shocks total investment shrunk by 25.6 per cent in 1974 and then again by 6.5 per cent in 1980 (Drakatos, 1997: 84). A packet of carefully crafted incentives and the prospect of full EEC membership allowed for a modest flow of FDI inputs to resume (UNCTAD, 2004).

Greece's accession to the EEC in 1981 marks the birth of modern self-contained STI policy. As is to be expected, government policy on innovation was initiated in direct response to EEC membership and was by extension greatly influenced by the

[9] The democratic deficit was economically dire in a number of ways, many of which were indirect and had long-term effects. The regime sought legitimisation by appealing to Greek national sentiment (Papandreou, 1973). It did so by promoting customs and tradition, Greek antiquity, religious values and awareness of Greece's perceived 'enemies' east and west. A package that eventually culminated in the Cyprus events of 1974 and a renewed Greco-Turkish geopolitical antagonism that continues to this day. This 'heritage' has meant that the proportion of Greek GDP spent on defence is almost twice the average of either the EU or NATO (Athanassiou et al. 2000) – that is of course to say nothing of its effect in shaping a conservative popular culture. The period also sees a sharp rise in popular animosity against the U.S.– widely believed to have supported the regime.

orientation of the Community's technology policy[10]. The 1980s also saw sharp changes in economic policy, with a left-leaning government favouring economic expansion at the expense of fiscal prudence. Financed by extensive borrowing and EEC aid, the government undertook the construction of an elaborate social welfare system (health, social services and education), backed massive expansion in state corporations and increased defence spending. Much of this expenditure was not directed at productive investment, but represented an inherently unsustainable expansion of state services (Drakatos, 1997; Alogoskoufis, 1997).

It is against this backdrop that the first formative steps towards the creation of a STI policy took place. This early STI framework followed an input-oriented approach where the purchase of equipment and the introduction of associated infrastructure took priority (Korres, 1995). The focus on infrastructure was motivated by a realisation that Greece lagged behind in the diffusion of several key technologies for development; it was also a policy that was not incompatible with contemporary economic views that perceived a positive link between public investment in infrastructure and productivity (e.g. see Aschauer, 1989). A political business cycle exerted its effect too. Lambrinidis et al. (2005) demonstrate that public infrastructure investment peaked in the years preceding national elections. Along similar lines, the modernisation of the primary sector (agriculture, fisheries, minerals) materialised in the form of subsidies for the purchase of imported equipment. Its positive contribution was limited to a one-off effect in productivity gains and international competitiveness.

Reflected in their magnitude is the lower priority attributed to capital inputs in education and basic research; throughout the 1980s Greece consistently spent the lowest proportion of its GDP in education among its European partners (OECD, 2004b) while Government Expenditure on Research and Development (GOVERD) as a percentage of GDP was among the lowest in the OECD (2004a). To be sure, funds directed at the nascent Public Research Institutes (PRIs) were significant by contemporary standards, if only because there is no earlier point of reference that comparisons can be made against. Funds directed towards PRIs and universities encouraged the creation of an incipient research community[11] and backed it with fledgling infrastructure[12]. Importantly though, no formal mechanisms were established for linking tertiary education to industrial needs, contemporary or

[10] This was to become a recurring theme in Greek innovation policy and one that continues to this day. Policy drafted at the European level directly translated into commensurate actions at the national level. Spurred on by European funding, innovation policy programmes were (as a rule) only hastily adjusted to meet the agendas of co-ordinating national bodies with little regard for national specificities. In any case national needs have been difficult to identify due to a lack of detailed innovation statistics. At the same time there has been an insufficient institutional framework for implementation. Unlike Ireland, in the case of Greece the responsibility for the co-ordination of innovation projects rests with high-level policy makers (ministries and ministerial secretariats) that possess incomplete information of individual needs and are unable to efficiently micromanage.

[11] Beneficiaries of such funding included the then newly established (1980) *National Documentation Centre* (national database and knowledge dissemination overseer body), the *National Hellenic Research Foundation* (a research centre focusing on basic science and the humanities), the *Hellenic Organisation for Standardisation* (ELOT), the *Foundation for Economic and Industrial Research* (IOBE) and others.

[12] FORTHnet, a national computer network facilitating data interchange among Greek Universities and Research Institutes and linking them with similar networks abroad was initiated in 1984. Its later commercialisation paved the way for the spread of the Internet in Greece. Today FORTHnet is one of the largest Internet Service Providers (ISPs) in the country.

anticipated[13]. The skills profile of Greek graduates was more a reflection of departmental politics and the inflexibilities of public sector employment legislation than real occupational demand. True then as is today, education was seen as simply another welfare expenditure, not an investment in human capital, with *social* as well as private returns.

Furthermore, attempts were made to lower the cost of market entry in a number of capital-intensive and high technology sectors[14]. Among the measures employed were higher subsidies and investment grants[15] directed at start-ups in these favoured sectors. However, Anagnostaki and Louri (1995) show that this policy did not succeed in increasing their relative output[16] in the economy. While ideology and political-cycle driven state expansionism had a detrimental effect in national accounts and further stimulated the already existing inflationary pressures (Alogoskoufis, 1997), in common with the 1960s experience, it did appear to stimulate private investment. Far from crowding out private funds, there is evidence to suggest that increased public expenditure[17] throughout the 1980s had a positive (albeit small) effect on private investment throughout Greece's regions (Laopodis, 2001). However the qualitative elements of public expenditure indicate that economic policy did not have a single strategic aim in focus but rather allocated funds in whatever short-term target maintained an appearance of profitability. Indirect evidence indicate that infrastructure investment in particular was aimed at alleviating regional disparities[18] (Lambrinidis et al., 2005) while simultaneously pursuing the (potentially conflicting) target of improving international competitiveness.

More profound were the effects of institutional interventions that took place during this time. These included the establishment of the short-lived *Ministry for Research and Technology* (1982-1985) and the general overseer body that is still around today, the *General Secretariat for Research and Technology* (GSRT) in 1985[19]. The GSRT undertook a mission to implement technology and innovation policy with provisions for technology transfer, education and training as well as research and development. The foundation of GSRT was an important event in its own right as it signalled a long-term commitment to technological matters. The institutional framework surrounding intellectual property rights was also strengthened by the foundation of the *Organisation for Industrial Property* (OBI), the Greek patent registration office in 1987. Another noteworthy organisational development was the founding of the *Hellenic Organisation of Small and Medium Sized Enterprises & Handicraft* (EOMMEX), a body overseeing the co-ordination government programmers relating

[13] This is an inadequacy that persists to this day (Liagouras et al. 2003).
[14] Sectors with main activity the manufacture of rubber and plastics, chemicals, petroleum and coal derivatives, non- metallic minerals, basic metals, metal products, machinery, electrical appliances and electronics (Anagnostaki and Louri, 1995)
[15] Under the provisions of Law 1262/82 eligible sectors are those under SIC 30-37.
[16] "*While numbers of entrants were shifted significantly upwards in the favoured sectors, their total assets were not affected. Thus, since relative sizes were not influenced the effect of policy in restructuring must have been minimal."* (Anagnostaki and Louri, 1995: 66)
[17] This result does not appear to hold however with regard to military expenditure (Laopodis, 2001).
[18] Using a panel of regional infrastructure investment data for the period 1982-1994, Lambrinidis et al. (2005) found, among other things, that infrastructure allocations were negatively associated with regional product per capita and positively associated with the existing stock of infrastructure capital as well as with the proportion of regional GDP originating in agriculture.
[19] Which consequently fell under the jurisdiction of the Ministry of Industry (1985-1996) and then the Ministry of Development (1996 to present).

to small businesses. Additionally, the law 1514/85 outlined the institutional framework for the development of scientific research and was a legal cornerstone for Greek technology policy (GSRT, 2004b). The law established for the first time in Greece the role of a 'researcher' as distinct of that of other employees in tertiary education. As a consequence, it opened the possibility of research funding and facilitated the measurement of research output in Greek universities and other research institutions. The same legislation outlined a framework for the management of PRIs and declared that the direction of R&D should be in the country's 'economic interest'.

While many of these institutional developments had their parallels in Ireland (e.g. GSRT vs. Forfás) – the contemporaneous Irish institutional mix is in sharp contrast, particularly with regards to the degree of its diversification and a related division of labour across the different facets of innovation policy. Contrary to the case of Greece where high-level ministerial bodies have traditionally attempted to micromanage all aspects of innovation policy, Ireland possessed a diverse set of small, institutionally-autonomous 'policy enactors' (e.g. the IDA, SFI, HEA and the various research councils - see Pontikakis et al. 2006) who continuously interacted with relevant stakeholders, acting as loci for the accumulation of valuable context-specific knowledge. Crucially it was this experience that allowed them to identify perverse incentives and inform the drafting of effective, context-tailored prescriptions.

The 1990s posed a number of challenges for planners emanating from the country's membership in what was to become the European Union (EU). Participation in the 1992 customs union and preparations for European Monetary Union (EMU) monopolised the policy debate. The globalisation and liberalisation of the Greek economy that followed increased the competitive pressure among enterprises mainly in the manufacturing and services sectors, and less in the agricultural sector (Anastassopoulos, 2003). Incoming FDI, before and after 1992, was concentrated on traditional sectors (primarily trade and the provision of services) where it displaced uncompetitive domestic firms.

At the same time, a single, long-term policy with regards to technology and innovation was still an elusive target. Dependence on EU funding, ministerial intervention and (almost exclusively) state-sponsored R&D output characterised the Greek national innovation system. Not that the emergence of a coherent innovation *system* had been actively promoted; prior to the 1990s no concrete provision for the facilitation of a national innovation system had been made, where institutional actors from education, research, the state and industry could come together to foster R&D and diffusion. Policy making in the area involved measuring the yield of inputs onto specific outputs while ignoring underlying communication and feedback mechanisms as outlined in systemic approaches to innovation (e.g. see Lundvall, 1992, Freeman, 1995 and Edquist, 1997). Well into the 1990s different policy actors largely perceived the institutions under their authority to operate in isolation and drew policy accordingly. Multiple government ministries had taken on the task to promote innovation and the spread of technology. Such a responsibility overlap is, in some

areas, still prevalent today[20]. The GSRT aimed to change this situation by assuming a central role in coordinating the evolution of a national innovation system.

The lack of adequate (country-specific) statistics and accompanying analysis on the field also hampered the formulation of effective technology policy. In a rapidly developing economy (as was Greece during the 1990s) an initial technological needs analysis, followed by specific policy responses, could provide a stepstone upon which a broader technology policy framework could evolve. This was attempted by the Development Ministry's "EPET I" (1990-1992) (Research and Technology Executive Programme), "STRIDE Hellas" (1992-1994) and "EPET II" (1994-1999) which sought to "*upgrade the research and technology infrastructure and develop important research products*". EPET I embarked on the direct funding of basic scientific R&D projects deemed of relevance to the Greek economic and social reality, industrial R&D (manufacturing, construction and especially ICT) and University research. A major initiative was the establishment of *technology parks* to act as contact conduits between the research community and industry (Kellesidis, 1998; Bakouros et al. 2002). Funded by the EU's Framework Programme[21], EPET I aimed to encourage technology transfer and diffusion via the creation of technology parks and technological and human resource databases[22]. In addition it carried for the first time, the responsibility for the assessment of Greek technology policy and the provision of new overall policy recommendations. STRIDE Hellas was essentially an extension of EPET I, with a renewed emphasis on interaction between research actors and industry. EPET II however, set more ambitious targets. EPET II aimed to support S&T activities particularly in innovation-intensive industries (ICT, biotechnology, new materials) (GSRT, 2003).

The programmes have so far delivered only modest results; while research output (in terms of publications and patents per capita) has been consistently increasing after the 1980s, in relative terms Greece continues to occupy the last positions among European innovation league tables. A key failing has been the lack of engagement with the private sector[23] and in particular, with technologically leading multinational enterprises. The more recent (1996) founding of *Hellenic Centre for Investment* (ELKE) aims to correct this by promoting a set of legal incentives to such firms (ELKE, 2003). The Greek economy is also making progress in the diffusion of key technologies (OECD, 2001). However the spread of technological hardware is contemporaneous with only limited productivity improvements (Maudos et al., 2003).

Not unrelated is the issue of the skill content of the Greek workforce. Despite evidence of technical change, the Greek economy still suffers from a particularly acute problem of higher unemployment among its skilled workforce[24]. Nelson and

[20] The Ministry of Education, The Ministry of Development, the Ministry of Industry, the Interior Ministry, the Ministry of Defence and the Ministry of Economy and Finance are all directly involved in funding R&D, training personnel and facilitating the spread and assimilation of new technologies (National Documentation Centre, 2003).
[21] Later Programmes (Stride Hellas, EPET II etc) have also been dependent of EU funds.
[22] The so-called "*Innovation Relay Centres*" (IRCs).
[23] Data from the OECD (2004) show that Greece and Portugal jointly occupy the last position within the EU (15) in terms of Business Expenditure in Research and Development (BERD) as a proportion of Gross Expenditure in Research and Development (GERD).
[24] In an observation that could just as well hold true for modern Greece, Mokyr (1992) brings down the inability of ancient Graeco-Roman society to sustain continuous innovation to the then prevalent

Phelps' (1966) seminal work indicated how the diffusion of technological equipment may have a positive effect on the employment of skilled workers. It comes therefore as a surprise that, while (thanks in part to policy interventions) technological hardware has proliferated throughout Greek industry, overall demand for highly skilled workers is still low (Logotech, 2001; Liagouras et al. 2003). Astonishingly, Asteriou and Agiomirgianakis (2001) found that the social returns to university education in particular were negative. In contrast with this observation is the shortage in ICT skills highlighted by Zambarloukos and Constantelou (2002)[25]. The above underline that the qualitative elements of 'technical change' and the content of skill' are important[26]. The chronic disassociation of the education system from market needs is probably the ultimate culprit. There is much to be achieved by an alignment of industrial with education policy under the umbrella of innovation; a study of Greek manufacturing in the period 1995-1996 found that high technology and capital-intensive manufacturing sectors contribute mostly to net employment growth (Voulgaris et al., 2005). Technical change in *key sectors* can stimulate demand for *specific skills*; a plan that aims to stimulate demand for skilled workers will have to be the result of a continuous feedback process between education and industrial policy.

The fact that the overall direction of STI policy is initiated at the EU level is also a mixed blessing. Arguably EU-directed programmes are useful in stimulating interest and activity in the area of STI that would otherwise receive little attention. Their contribution in providing general direction towards proven effective technology policies is notable. Perhaps most importantly, such programmes provide much needed funds in the form of the *Community Support Framework* for structural adjustments that poorer EU countries such as Greece could not afford otherwise. At present, EU technology policy fosters R&D and diffusion through the development of pan-European innovation institutions aimed not only at the creation of national innovation systems but also at the long-term development of supranational synergies among member states. There is little doubt that the development of cross-boundary technology linkages would be a positive development. Nonetheless, this integrationist agenda meant that technology policy in Greece has been gearing institutions to promote a national 'innovation system' to the extent that it belongs to an EU-wide supranational innovation system.

It is the priority assigned to these supranational synergies that has called for uniform, blanket approaches to EU policy schemes (with the possible exception of the regional aspects of such programmes[27]). However, EU technology policy is frequently based on assumptions and is fine-tuned according to the economic reality prevalent in the core Western European economies. These are countries with developed economies,

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manning of productive professions with slaves. He concludes that: "*In a society in which those who are educated do not work and those who work are not educated, the inarticulateness of the productive classes will thwart the diffusion and adoption of new technology in the unlikely event that it emerges*" (Mokyr, 1992: 175)

[25] In another study, Liagouras et al. (2004) propose that the position of Greek companies along global production chains (raw material extraction, transport and logistics) are the ultimate reason behind their lack of interest in innovation.

[26] The case of Greece indicates that the association may hold as long as skill is not defined solely quantitatively (e.g. years of schooling) but its qualities (i.e. relevance to occupational needs) are also considered.

[27] Even region-specific programmes tend to group together European regions on the basis of common characteristics. This is arguably an approach that hardly accounts for national specificities.

long-established scientific and R&D traditions, with efficient accompanying institutional frameworks which are at the forefront of technological development. Their requirements with regards to the assimilation of the very latest technologies and the sustainability of their current thrust in the generation of innovative ideas place them at a very different position to that of poorer countries in the European periphery. This is the main thesis of Liagouras et al. (2004) who argue that technology policy should be primarily motivated by country-specific needs. Liagouras et al. (2004) review the behaviour of market and policy actors in Greece in the emerging fields of biotechnology and e-commerce. They found that (EU funded) EPET II schemes had very little success in stimulating collaborative projects, adoption and R&D in neither field (biotechnology nor e-commerce). They believe that this failure comes down to the different characteristics of the Greek pharmaceutical, agricultural and IT sectors as opposed to the rest of Europe. Operations in the aforementioned industries in Greece are largely confined to the later stages of production (packaging, marketing, distribution) where there is little scope for innovative activity. Liagouras et al. (2004) conclude that the mere imitation of technology policies of economically advanced countries could prove totally inappropriate for economic laggards. They propose that intermediate economies should focus on upgrading productive capacities while stimulating domestic demand for innovations.

Most of the current inadequacies are essentially structural problems; the much hyped structural transformation has yet to materialise. It is because of its sectoral nature (and the position of companies within the lateral stages of production within those sectors) that Greek industry exhibits low demand for high-skilled workers and does not think innovation a profitable venture. So far policy appears to have delivered modest results; while there are signs of improvement, it is clear that it has as of yet not succeeded in generating the momentum necessary for a sustainable, market-driven and market-oriented national innovation system. The GSRT (2003a) acknowledges the need for policy adjustments based on the experience of EPET I, STRIDER Hellas and EPET II. It has formulated a new *Executive Programme of Competitiveness* (EPAN) to run in the period 2000-2006 on funding provided by the EU's Community Support Framework. Notable are also recent attempts to benchmark the results of policy and draft long-term innovation policy that is detached by the ephemerality of EU programmes. The recent *Technology Foresight Exercise* forms part of this overall process and in that respect is a step in the right direction.

By antithesis the case of Ireland serves to underscore key policy differentiators. There, sectorally defined structural change came about as the result of a conscious, concerted effort to attract investment from a number of technological leaders. This happened because a diverse set of flexible and politically autonomous policy enactors were given a clear mandate to pursue this agenda. These policy enactors could act in the knowledge that the overall direction of their work would not be determined by the casual whims of alternating ministers or by the uncertain nature of EU funding. The above of course were the product of a climate of consensus, emerging in response to a severe employment problem. They were also conditional on the effort of an efficient and honest public sector. The quality of the public sector apparatus itself is also a sharp delineator between the two countries. In a study of 20 OECD countries assessing the long-term efficiency of their public sectors, Greece fared consistently last while Ireland occupied one the top five positions in every measure considered (Afonso et al., 2003).

CONCLUSIONS

Up until the 1980s there was little that separated the Greek from the Irish case. Both countries possessed economies with overwhelmingly large primary sectors and had suffered from their positions on the European periphery. Both earned the label 'cohesion' country owing to their depressed output and both had been major benefactors of European structural funds. What differentiates the Irish experience from its Greek counterpart is how both approached the solution to their entrenched problems. The best way to describe this is that the Irish approached the 1980s and economic misfortune as an employment problem, while Greek policy makers perceived their economic woes as the result of output and productivity deficits. With different perceptions of the problems, came different attempts at the solutions. In terms of the use of technology policy in an attempt to address poor economic performances, the Athens government favoured policies that focused on inputs in infrastructure and capital goods. Their counterparts in Dublin placed a greater emphasis on the development of skilled labour force as a supply-push motivator for employment growth (Healy, 1983).

The 1980s were very much a decade of centralisation in Europe, where, the first to suffer were those on the periphery. Therefore, with the shifting of manufacturing activity away from Europe, employment in manufacturing fell sharply in all countries removed from the EU core. Ireland and Greece were no testament to this process. But it was the track that Ireland set about in the late 1980s and early 1990s that would see it reach levels of growth that could never have been predicted. What Ireland did was continue to pursue a select amount of high growth potential foreign investors with the immediate goal of creating employment and the longer-term goal of positive spillovers for the local economy. At the same time it employed a flexible set of policy enactors (such as the IDA, SFI, ACC, IBEC, Research Councils etc.) which provided the basis for continued FDI-led growth, in high-tech, capital- and skilled labour-intensive operations. The a constant in-tune institutional support gave confidence to foreign investors in Ireland, the result of which has seen Irish operations of US MNCs most likely to achieve EU headquarters status than any other European country.

However Greek policy had no long-term strategic provisions. A culture of Dependency had set in in Greece, for too long it had been a major benefactor of funds from the Marshall plan to EU structural funds. Industrial policy had grown contingent on the presence of these funds. Also, the use to which these funds were put was very different from that in Ireland. As was very much acceptable at the time – and espoused by many theorists as a crucial part of the development process, Greece placed a greater emphasis on physical infrastructure at the expense of social or economic infrastructures. The lack of policy and especially flexible policy enactors has been detrimental to the Greek case. A coherent set of institutions and guidelines were absent and has contributed to a lack of 'political entrepreneurialism' which in itself is responsible for an entrepreneurial culture that is inherently risk averse[28].

[28] Throughout the post-war period the economic environment presented few rewards for those taking risks.

So the cases of Ireland and Greece diverged over 20 years ago. In retrospect, Ireland's unemployment rates of 20% may have been what sparked the country into an innovative answer. As opposed to Greece, which saw the problem as the less tangible productivity decline[29], Ireland was faced with its inertia on a daily basis with unemployment being a main political issue. Its response through the construction of social infrastructures such as investment in education as well as the creation of an economic climate amiable to foreign monies proved to be part of the answer to its problems. Yet, as mentioned at the outset, neither Greece nor Ireland fares well in terms of international indicators for R&D (see European Innovation Scoreboard, 2003). What we have attempted to make explicit here through our focus on the Irish case is a need to broaden the definition of innovation beyond the laboratory. The place of process innovation in terms of what O'Riain (2004) terms 'intraprenuerialism' needs to be recognised. The application of new practices to increase the mandates of Ireland's most productive sector (the MNCs) also needs to be recognised as innovative behaviour. With a more extensive idea of innovative activity that relates to wealth creation, documents like the Lisbon Agenda will prove to be much more beneficial to countries like Greece and the most recent member states of Europe.

[29] Approaching the problem from a productivity and growth perspective removed its sense of urgency.

REFERENCES

Afonso, A., Schuknecht, L. and Tanzi, V. (2003), "Public Sector Efficiency: An International Comparison", The European Central Bank, Working Paper Series, http://www.europa-kommissionen.dk/upload/application/b60de408/ecbwp242.pdf, 06/10/04

Alogoskoufis, G. (1997), *Greek Economic Policy in Crisis,* Second Edition, Kritiki Publications, Athens, (original title in Greek "Η Κρίση της Οικονομικής Πολιτικής")

Anagnostaki, V. and Louri, H. (1995), "Manufacturing entry in Greece, 1982-1988: did sectoral policy work?", Journal of Economic Studies, Vol. 22, No. 6, pp 60-68

Anastassopoulos, G. (2003), "MNE subsidiaries versus domestic enterprises: an analysis of their ownership and location-specific advantages", Applied Economics, No. 35, pp 1050-1514

Aschauer, D.A. (1989), "Is public expenditure productive?", Journal of Monetary Economics, Volume 23, Issue 2, pp. 177-200

Asteriou, D. and Agiomirgianakis, G. M. (2001), "Human capital and economic growth: Time series evidence from Greece", Journal of Policy Modelling, Vol. 23, pp 481-489

Athanassiou, E., Kollias, C. Nikolaidou, E. and Zografakis, S. (2000), "Greece: Military Expenditure, Economic Growth and the Opportunity Cost of Defence" Middlesex University Business School, Working Paper No. 8, March

Bakouros, Y. L., Mardas, D. C., and Varsakelis, N. C. (2002), "Science park, a high tech fantasy?: an analysis of the science parks of Greece", Technovation, No. 22, pp 123-128

Breathnach, M. and Kelly, D., (1999), 'Multinationals, subcontracting linkages and the innovative performance of indigenous firms: some Irish evidence', paper presented at the European Network on Industrial Policy International ICTICe; Dublin, 9-10 December

Begley, T, Delaney, E and O'Gorman, C (2005) Ireland at a Crossroads: Still a Magnet for Corporate Investment Organizational Dynamics 34 (3) 202 –217

Coe, N., Hess, M., Yeung, H., Dicken, P. and Henderson, J. (2004) 'Globailizing' regional development: a global production networks perspective Transactions 29 (4) 468-484

Cogan, D and McDevitt, J (2000) Science Technology and Innovation Policy and Evaluation. Paper presented to the CONVERGE Workshop Madrid, 5 October 2000

Collins, P and Grimes, S (2005) "Strategic leveraging of power by foreign owned MNCs in Ireland" Paper Presented to the Regional Studies Association, Irish Branch, April 14th 2005

Culliton Report (1992), *A Time for Change: Industrial Policy for the 1990s*, Report of the Industrial Review Group, Dublin: Stationery Office.

Dertilis, G. B., and Fragkiadis A. (1999), "Landmarks of the Greek Economy in the 20th Century", Greek Economic Post, Issue 23/12/1999, Lambrakis Publications, Athens

Drakatos, K., 1997, *The Big Cycle of the Greek Economy; 1945-1995*, Papazisi Publications, Athens, original title: "O Megalos Kyklos tis Ellinikis Oikonomias"

Edquist, C. (ed.) (1997), *Systems of Innovation: Technologies, Institutions and Organizations*, Pinter, London

ELKE (2003), "Invest in Greece: Research and Development", Hellenic Center for Investment, http://www.elke.gr/files/publications/RandD.zip, 6/6/2006

European Innovation Scoreboard (2002) 'European Innovation Scoreboard: Technical Paper No. 3: EU regions' November 2002; available at http://trendchart.cordis.lu/ July, 2003

Forfás (2004) Ahead of the Curve: Ireland's Place in the Global Economy, (2004), Available from: http://www.forfas.ie/publications/esg040707/

Forfás (2005) Annual Employment Survey 2004, May 2005

Freeman, C. (1995), "The National System of Innovation in Historical Perspective", Cambridge Journal of Economics, 19, pp. 5-24

Furman, J. L., Porter, M. E. and Stern S. (2002), "The determinants of national innovative capacity", Research Policy, August, Vol. 31, No. 6, pp. 899-933

Grimes, S and Collins, P., (2003) Building a Knowledge Economy in Ireland Through European Research Networks, European Planning Studies, 11 (3) pp. 395 - 413

GSRT (2003a), "Research and Technology: Ministry of Development's Priorities", GSRT, Ministry of Development, http://www.gsrt.gr/site.asp?cat=137&id=348, 9/23/03

GSRT (2003b), "Towards the knowledge economy: Prospects and Roles", GSRT, Ministry of Development, November, http://www.gsrt.gr/site.asp?cat=137&id=348, 9/23/03

GSRT (2004a), "Basic Priorities of Research and Technology Policy", GSRT, Ministry of Development, http://www.gsrt.gr/default.asp?V_ITEM_ID=139, 8/10/04

GSRT (2004b), "History – Important Milestones in the history of the GSRT", GSRT, Ministry of Development, http://www.gsrt.gr/default.asp?V_ITEM_ID=1868, 8/10/04

Healy, M. (1983), "Innovative Ireland-Technological, Industrial and Societal Challenges", Technovation, 2, pp. 45-53

Hilliard, R and Green, R (2005) Innovation Policy Governance and Institutional Change in Ireland. Paper to be presented at the DRUID Tenth Anniversary Summer Conference, Denmark, June 27th 2005

IDA (2005) Why Invest in Ireland? Vital Social and Economic Statistics The Industrial Development Agency; Dublin. 2004 Annual Report/2003 Annual Report, available at: http://www.idaireland.com/home/index.aspx?id=83

Kennedy K.A., Giblin, T. and McHugh, D., (1998), *The Economic Development of Ireland in the Twentieth Century*, London: Routledge.

Kirby, P., (2002) *The Celtic Tiger in Distress: Growth with inequality in Ireland* Palgrave, New York.

Kelessidis, V. C. (1998), "The Role of Technology Parks in Regional Development – The Case of Northern Greece", XV IASP World Conference on Science and Technology Parks, http://www.mred.tuc.gr/home/kelesidi/TP_01.pdf, 29/08/04

Korres, G. M. (1995), "Technological Performance in Greece with the European Community", unpublished PhD dissertation, University of London, Queen Mary and Westfield College

Lambrinidis, M. Psycharis, Y. and Rovolis, A. (2005), "Regional Allocation of Public Infrastructure Investment: The Case of Greece", Regional Studies, Vol. 39, No. 9, pp 1231-1244

Laopodis, N.T. (2001), Effects of Government Spending on Net Private Investment, Applied Economics, Vol. 33, No 12, pp. 1563-1577

Liagouras, G., Protogerou, A. and Caloghirou, Y. (2003), "Exploring Mismatches Between Higher Education and the Labour Market in Greece", European Journal of Education, Vol. 38, No. 4, pp 413-426

Liagouras, G., Zambarloukos, S. and Constantelou, A. (2004), "The Long Road from Technology to Development: Impasses and Challenges of Technology Policy in Intermediate Economies", DRUID Summer Conference 2004 on Industrial Dynamics, Innovation and Development, http://www.druid.dk/ocs/viewpaper.php?id=95&cf=1, 10/11/2004

Logotech (2001), "National Innovation Survey in Greek Enterprises; 1994 – 1998", General Secretariat of Research and Technology, Athens

Lundvall, B. Å. (1992) (ed), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning*, Pinter, London

MacLaughlin, J (1994) *Ireland the Emigrant Nursery and the World Economy,* Cork, Cork University Press

Margolis, S.E. and Liebowitz, S.J. (1995), "Path Dependence, Lock-in and History", Journal of Law Economics and Organization, Vol. 11, No. 1, pp. 205-206

Maudos, J., Pastor, J.M. and Serrano, L. (2003), "Human Capital in OECD Countries: technical change, efficiency and productivity", International Review of Applied Economics, Vol. 17, No. 4, October, pp. 419-435

Munck, R (1993) *The Irish Economy: Results and Prospects* London, Pluto Press

Mokyr, J. (1992), *The Lever of Riches*, Oxford University Press, Oxford

National Documentation Centre (2001), "Science and Technology Indicators", http://www.ekt.gr/en/rtd-serv/st_indicators_gr/themeII.html, 11/06/03

National Documentation Centre (2003), "R&D and Innovation in Greece", http://cordis.europa.eu/greece/rd_system1.htm, 4/6/2003
O'Donnell, R., (2000) *Europe: the Irish Experience*. Institute of European Affairs.

Nelson, R. and Phelps, E.S. (1966), "Investment in Humans, Technological Diffusion, and Economic Growth", The American Economic Review, Vol. 56, No. 1/2, pp. 69-75

Ó'Gráda, C., (1997) *A Rocky Road: The Irish Economy since the 1920s* Manchester: Manchester University Press.

O'Hagan, J.W. (1995) *The Economy of Ireland: Policy and Performance of a Small European Country*, Dublin: Gill and MacMillan.

O'Hearn, D., (1989) The Irish Case of Dependency: An exception to the exceptions? American Sociological Review 54: 4 pp. 578-96

O'Hearn, D., (1993) Global Competition, Europe and Irish Peripherality, The Economic and Social Review 24:2 pp. 169-97

O'Hearn, D., (2002) *The Atlantic economy: Britain, the US and Ireland"* Manchester: Manchester University Press.

O'Malley, E., (1992). Problems of Industrialisation in Ireland, in I.H. Goldthorpe and C.T. Whelan (eds) *The Development of Industrial Society in Ireland*, pp. 125 - 154 Oxford: Oxford University Press.

O'Malley, E., (1998), 'The revival of Irish indigenous industry 1987-1997' Quarterly Economic Commentary, April, pp. 35-60.

O'Riain, S., (1998) A Tale of Two Globalisations: the Irish Software Industry and the Global Economy. Working Paper No. 10l, ESRI, Dublin.

O' Riain, S., (2000), The flexible developmental state: globalization, information technology, and the "Celtic tiger", Politics and Society, 28(2), pp. 157-94.

O'Riain, S., (2004) The Politics of Mobility in Technology-Driven Commodity Chains: Developmental Coalitions in the Irish Software Industry. International Journal of Urban and Regional Research 28(3):642-663

OECD (2002), "Greece Progress in Structural Reform", OECD Economic Surveys, No. 13, pp 269-364

OECD (2004a), *Main Science and Technology Indicators*, OECD Publications, Paris

OECD (2004b), *Education at a Glance: OECD Indicators*, OECD Publications, Paris

Papadimitriou, H.A. (2003), "Visionary economist stands test of time", Kathimerini, February 2, www.ekathimerini.com/4dcgi/_w_articles_ell_5233690_04/02/2003_26036, 2/5/2006

Papanastassiou, M., (1999), "Technology and production strategies of multinational enterprise (MNE) subsidiaries in Europe", International Business Review, No 8, pp. 213-232

Papandreou, A. (1973), *Democracy at the gunpoint*. Pelican, London

Papazafeiropoulou, A., Pouloudi, A. and Doukidis, G. (2000), "Electronic Commerce Policy Making in Greece", Working Paper, Athens University of Economics and Business, http://www.eltrun.gr/papers/bit.pdf

Pontikakis, D., McDonnell, T. and Geoghegan, W. (2006), "Ireland's National Innovation System: An Exploratory Study of Supporting Institutions and Dynamic Actors", Prometheus, Vol. 24, No. 1, pp. 37-58

Psalidopoulos, M. (2004), "Economic Thought and Greek Post-World War II Reconstruction, 1044-1953", The University of Athens Doctoral Programme in Economics Seminar, Department of Economics, October

Stasinopoulos, G. (2006), "Before the 'take-off': Economic Policy in Greece during the period of reconstruction, 1945-1953", Economic History Seminar, Department of Economics, University of Athens

Telesis (1982) Review of Industrial Policy. Dublin; Stationery Office

Transparency International (2003), "Corruption Perceptions Index 2002", Berlin, August, available on: http://www.transparency.org/cpi/2002/cpi2002.en.html, 11/02/03

UN (2001), *Human Development Report: Making New Technologies Work for Human Development*, UNDP, Oxford University Press, New York

UNCTAD (2004), "FDI Statistics: Greece", United Nations Conference on Trade and Development, http://r0.unctad.org/en/subsites/dite/fdistats_files/pdfs/Greece_profile.pdf, 10/05/04

Varvaressos, K. (2002), *Report on the Economic Problem in Greece*, Revised edition edited by Lykogiannis A. (original 1952), Savvalas Publications, Athens

Voulgaris, F., Papadogonas, T. and Agiomirgianakis, G. (2005), "Job Creation and Job Destruction in Greek Manufacturing", Review of Development Economics, Vol. 9, No. 2, pp. 289-301

Zambarloukos, S. and Constantelou, A. (2002), "Learning and skills formation in the new economy: evidence from Greece", International Journal of Training and Development, Vol. 6, No. 4, pp. 240-253