



# **INFORMATION TECHNOLOGY AND ECONOMIC DEVELOPMENT:**

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## **IRELAND'S COMING OF AGE WITH LESSONS FOR DEVELOPING COUNTRIES**

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# *Information Technology and Economic Development: Ireland's Coming of Age with Lessons for Developing Countries*

## ***Abstract***

The contribution of information technology (IT) to economic growth and development is seen as an important factor underlying the pace of development in many countries. While Asia's tiger economies are often portrayed as models for economic growth, Ireland's recent economic performance has attracted considerable attention, earning it the label, *Europe's Celtic Tiger*.

We adopt a framework of IT-led development to show how, despite having a weak indigenous IT sector, Ireland succeeded in creating a world-class industry in computer hardware, software and services. Behind this success lies a policy of "industrialization by invitation" through which Ireland selectively targeted foreign investment in high-tech industries using a menu of financial and tax-based incentives. Despite Ireland's success, intense competition from regions such as Eastern Europe and Southeast Asia has forced Irish policy makers to question whether this policy can produce sustained economic benefits.

Ireland's response to these challenges contributes to the literature on IT-led development, providing valuable lessons for developing countries as they strive for greater economic growth.

**Key words:** **Computing in Developing Countries (BD06), Economic Impacts (BA01), Information Industry (BA0211), Public Policy (BC03)**

# 1. Introduction

Policy makers have long recognized the potential for information technology (IT) to contribute to economic growth and development. For example, investments in IT that lead to higher factor productivity and increased competitiveness can have a direct impact on economic growth (Kraemer and Dedrick 1994). This relationship, researchers argue, underlines the key role that IT has played in the development of Southeast Asia's newly industrialized economies (NIEs) (Mody and Dahlman 1992; Rahim and Pennings 1987). Specifically, as the NIEs' share of global *IT production*<sup>1</sup> increased from 6.3% in 1985 to 17.7% in 1994 — denoting a six-fold increase in output — annual GDP grew by an average of 16.7% (OECD 1997)<sup>2</sup>. Consequently, *IT production* is seen as a high-growth sector with enormous potential for employment creation and economic growth (Dedrick and Kraemer 1995).

Although many countries continue to focus on *IT production*, there is a belief among scholars in IT-led development that countries might be better served by policies that promote *IT use*. This argument is based on the notion that payoffs from widespread use of IT permeate many sectors of the economy whereas payoffs from IT production can be confined to the computer sector alone. In addition, an emphasis on IT use might be more “cost-effective”, considering that for many developing countries, the cost of creating a viable global presence in IT production can be prohibitive considering the high-priced incentives that many countries now offer to foreign multinationals. One way that countries have tried to promote greater use of IT is through national IT plans. For example, Malaysia's “2020 Vision” campaign and Singapore's “IT 2000” plan represent deliberate attempts to increase government and corporate use of IT, besides stimulating public interest in IT. National governments have also overseen the creation of science and technology parks, such as the Kulim High-Technology Industrial Park in Malaysia and the

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<sup>1</sup> In 1994, the worldwide market for *IT production* (referring to the production of computer hardware and telecommunications equipment) was valued at \$711.3 billion, representing an annual average increase of 8.7% since 1985 (OECD 1997).

<sup>2</sup> In contrast, during the same period, average annual U.S. production of IT increased by a mere 3.3%, while annual GDP growth averaged 5.9% (OECD 1997).

Hsinchu Industry and Science Park in Taiwan, as incubation sites for highly innovative, technology-intensive companies. Behind such plans is a belief that increased levels of IT diffusion and use provide opportunities for economic growth. While the effectiveness of such policies is debatable (Kraemer, Gurbaxani and King 1992), rising levels of IT spending within countries suggest that the potential contribution of IT use to economic growth and development cannot be overlooked.<sup>3</sup>

While Asia's tiger economies have traditionally been promoted as models for economic growth, Ireland's recent economic performance has attracted considerable attention, earning it the label, Europe's *Celtic Tiger*. By all accounts, Ireland's economic performance has been remarkable – as the fastest growing economy in the OECD, real GDP growth has exceeded 7% each year since 1993, unemployment has fallen from 16% to 7% in just under five years, inflation has stabilized below 2% while productivity levels are among the highest in Europe. Indeed, as shown in Figure 1, Ireland's recent economic performance has surpassed that of Asia's tigers and the world's leading industrialized nations. As a small open economy of 3.5 million people, the reasons behind Ireland's economic success are worthy of note, particularly as annual GNP<sup>4</sup> growth is expected to remain at 5% until 2005 (ESRI 1997).

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**Insert Figure 1 about here**

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While there are several plausible explanations for Ireland's success, the role played by IT is especially important. Through a policy of "industrialization by invitation", Ireland has become one of the world's leading producers of computer hardware and software. Yet, with this success has come a sense of vulnerability and foreboding as policy makers question whether Ireland's continuing focus on *IT production* can provide sustainable economic growth. In this paper, we follow the development of Ireland's IT industries, focusing on the economic payoffs Ireland has received and the steps it has taken to

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<sup>3</sup> In 1995, the worldwide market for IT, which includes spending on PCs, workstations, servers, data communications equipment, packaged software and services, was estimated at \$527.6 billion (OECD 1997).

<sup>4</sup> The difference between gross domestic product (GDP) and gross national product (GNP) is explained by "net factor flows". Though this distinction is rarely important, in the Irish context, massive financial outflows in the form of repatriated profits by foreign-owned enterprises make GNP a more realistic measure of growth. For example, in 1997, net factor flows amounted to IR£5.6 billion, or 12.2% of GDP totaling IR£45.9 billion.

avoid problems associated with being a low-cost producer of IT. Although Ireland is clearly a developed country, its approach to IT-led development and its efforts to achieve sustainable economic growth provide valuable lessons for developing countries seeking to join the global *IT production* bandwagon.

The remainder of this paper is organized as follows. In the next section, we introduce a theoretical framework of IT-led development. We then apply this framework to develop insights into how Ireland, despite having a weak indigenous industrial base, succeeded in developing a world-class IT industry in hardware, software and services. Finally we abstract from Ireland's experience to provide general insights into how developing countries can use IT to achieve economic growth and development

## **2. Research Framework**

Several studies provide empirical evidence that IT investment contributes to industrial and economic output (De Long and Summers 1991; Dewan and Kraemer 1998; Oliner and Sichel 1994). For example, in an econometric study of 36 countries on data from 1985 to 1993, Dewan and Kraemer (1998) found evidence of positive and significant returns to *IT capital*,<sup>5</sup> but only for developed countries. In contrast, for less developed countries, they found evidence of positive and significant returns to *non-IT capital*. In their conclusion, they argue that “perhaps a substantive base of capital stock and infrastructure is [required] for IT investments to be productive” (p. 4). Since developed countries have an already-established infrastructure with significant investments in both capital equipment and education, they are arguably in a better position to leverage their IT investments to produce greater economic payoffs. However, without a critical mass of resources, both in terms of technological infrastructure and human capabilities, less developed countries face steep barriers to technology payoff.

In a separate study of IT production and use in East Asia, Dedrick and Kraemer (1998) introduce a theoretical framework of IT-led development based on four broad sets of variables, namely

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<sup>5</sup> IT capital is defined as a nation's stock of computer hardware, software, data communications and services. In contrast, non-IT capital includes investment in plant, machinery and equipment.

*environmental factors, industrial policy, industry structure and IT diffusion.* An adaptation of this framework, shown in Figure 2, shows how industrial policy, industry structure and environmental factors combine to influence the relationship between IT and economic payoffs. For example, industrial policy can encourage firms to invest in IT by providing financial incentives or by sponsoring R&D activities which directly support the creation of an IT industry. Industrial policy can also influence IT diffusion by attracting overseas investment in high-tech industries. Policies such as this can directly contribute to the establishment of an IT industry, as was the case in Singapore with the disk drive industry. Finally, greater levels of IT diffusion in the form of IT production and IT use can provide economic benefits.

While this framework is particularly appropriate in an Irish context, it overlooks certain variables that might be seen as important for IT-led development in a different context. For example, in countries such as Singapore, Sweden, Denmark and Switzerland, public sector organizations have emerged as leading adopters of new technologies. However, as a relatively low-tech user of IT, the public sector in Ireland has had no discernible influence on IT diffusion among the private sector. Other variables, which might be seen as relevant elsewhere, include the provision of funding for IT projects from groups such as the World Bank or the United Nations Development Program (UNDP). Subject to these limitations, in the next section, we apply the framework to evaluate Ireland's approach to IT-led development and the economic benefits it has realized from IT.

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**Insert Figure 2 about here**

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### **3. Ireland's Approach to IT-led Development**

Krugman (1994) argues that the sheer level of private investment in Asia's tiger economies is a key explanation for their economic success. Others are less sanguine with this explanation and point to the critical role of government in creating human capital, infrastructure and providing incentives for private investment (Wade 1990; World Bank 1993). In that sense, it is unlikely that Ireland's economic success would have occurred through market forces alone. Instead, it points to deliberate and sustained

intervention by successive Irish governments around a policy of “industrialization by invitation”. Since the 1970s, this policy has been used to selectively target foreign investment in high-technology growth industries, initially in computer production but later expanding to include software and services. Ireland’s policy makers have consistently taken the view that what is good for overseas investment is good for Ireland. While this approach to IT-led development parallels that used by other Asian *tigers*, particularly Singapore, Ireland’s social, political, economic and cultural traditions render it truly unique.

### **3.1 Environmental Factors**

When Ireland achieved independence from the United Kingdom in 1922, it had virtually no industrial base. Ireland’s economic fortunes were closely tied to agriculture, which employed over 50% of the labor force. Agriculture was deemed of such importance to the economy that the first Minister for Agriculture declared that the primary aim of Ireland’s economic policy should be to maximize farmers’ earnings, and that this should take precedence over programs aimed at achieving self-sufficiency and reducing unemployment (Kennedy, Giblin and McHugh 1989).

Ireland operated a free-trade policy until 1932, when in an attempt to increase employment and reduce emigration, it reverted to protectionism. Unlike the selective protectionist policies favored in Japan and South Korea, Ireland’s protectionist policies were indiscriminately applied across all sectors of the economy. These policies were only partially successful, for while protectionism favored firms in technically mature industries with low barriers to entry, it excluded Ireland from participation in more technology-intensive industries (O’Malley 1989). Protectionism failed to nurture an export capability among Ireland’s indigenous industries while it also allowed inefficiencies in production to go unchecked. As a result, when tariffs and quotas were finally dismantled in the early 1960s, the false sense of security engendered by protectionism gave way to increased emigration<sup>6</sup> and unemployment. This failure revealed the deep-rooted problems facing indigenous firms while it simultaneously suggested a need to resort to

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<sup>6</sup> Emigration, once considered a “safety valve” against rising unemployment, re-emerged during the 1950s to claim 400,000 people, or 12.5% of the entire population.

overseas investment. Besides creating employment opportunities, overseas investment was seen as a way for Ireland to acquire industrial expertise and capabilities that indigenous firms were unable to provide.

### **3.2 Industrial Policy**

By the early 1960s, protectionism had been dismantled and replaced with a policy of “industrialization by invitation”. This policy focused on attracting overseas investment through a system of financial and tax-based incentives. For example, non-repayable grants were provided to cover the cost of land and buildings, while in an attempt to boost exports and to create an indigenous export capability, profits from export sales were declared exempt from corporation tax.

These incentives, coupled with the availability of low cost labor, were key factors behind the first wave of foreign investment into Ireland. These incentives became even more important when Ireland joined the European Community in 1973 (later to become the European Union), transforming Ireland into a low-cost manufacturing base for firms wishing to enter the European market. In 1980, the introduction of a 10% corporation tax on manufacturing profits,<sup>7</sup> reinforced Ireland’s attractiveness as a location for overseas investment. Finally, to secure the profits of foreign-owned firms against additional taxes when profits were repatriated, double tax agreements were negotiated with foreign governments.

Besides the availability of grants and the favorable tax treatment of manufacturing profits, the presence of a large young, educated and computer-literate workforce was another key factor in firms’ decisions to locate in Ireland during the 1980s. Recognizing that a large influx of overseas firms (principally in *IT production*) would require a significant number of skilled workers, third level educational institutions placed an increased emphasis on engineering, computer science and other technical degrees during the 1980s. As far back as the late 1960s, a system of regional technical colleges had been established to provide apprentice and technician training in several electronics and engineering fields. As Ireland’s IT industries became more prominent, many of the courses provided by these

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<sup>7</sup> This 10% rate of corporation tax applies to all manufacturing activities, software production and internationally traded financial services. This rate is guaranteed until 2005 after which a 12.5% rate will apply.

colleges, and to a lesser extent Ireland's mainstream universities, were tailored to the needs of the IT industry. Indeed, Ireland's educational system has been so successful at adapting to the needs of its industrial sector that Ireland is now ranked as having the second best educational system in the world in terms of responsiveness to the needs of a competitive economy (IMD 1997). Language courses were also provided, helping to ensure a multilingual graduate population.<sup>8</sup> Consequently, by the early 1980s, a large pool of educated, technically proficient university graduates was available to satisfy the growing needs of the computer industry. Entering firms were also able to tap into a growing body of skilled workers already employed by overseas firms engaged in the manufacture of IT hardware.

Between 1949 and 1994, the Industrial Development Authority (IDA) — an independent agency of the Irish government — was responsible for Ireland's industrial planning and policy determination. Critics would later claim that by focusing on overseas investment, the success of Ireland's industrial policy was being achieved at the expense of its indigenous industries. In an attempt to address this issue, in 1994, the Irish government reorganized the IDA into three separate organizations. While the IDA retained responsibility for overseas investment, responsibility for the development of Ireland's indigenous industries was assigned to Forbairt, a newly established government agency. In 1998, Forbairt merged with the Irish Trade Board to form Enterprise Ireland. A number of directorates were also established to support initiatives related to the development of an indigenous software industry in Ireland. Finally, in an attempt to separate responsibility for policy formulation from policy implementation, the government established Forfás, a new agency to which it allocated overall responsibility for policy planning and determination. Recently, groups such as Irish Council on Science, Technology and Innovation (ICSTI) and the Information Society Steering Committee (ISSC) have been created to advise Forfás on issues relating to IT and its role in industrial policy, with a particular emphasis on how Ireland can benefit from electronic commerce. Figure 3 provides an overview of Ireland's industrial policy institutions.

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<sup>8</sup> In 1995, 73% of all students completing second level education and 25% of all university graduates had studied a European language.

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**Insert Figure 3 about here**

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### **3.3 Building an IT Industry**

By the early 1970s, Ireland's policy of "industrialization by invitation" was being used to selectively target overseas investment from multinational corporations (MNCs) in the high growth computers and electronics sector. In the sense that this policy focused on "picking winners", policy makers identified specific firms with emerging technologies and world-class manufacturing practices. In many ways, the creation of Ireland's IT industry can be traced to this point.

In 1971, Digital Equipment Corporation became the first company to establish a mini-computer manufacturing facility in Ireland. Other computer manufacturers that followed include Amdahl (1978), Apple (1980) and Wang (1980). However, the operations that these and other MNCs established and operated during the 1970s were, with few exceptions, little more than sub-assembly operations. Basic components or partially completed units were imported into Ireland for final or partial assembly. The end product was then exported from Ireland for further assembly elsewhere or was packaged and shipped to distributors in overseas markets. O'Malley (1989) acknowledges that Ireland was particularly suited to this type of activity, noting that as products approach maturity, pricing becomes an important competitive issue. Helleiner (1990) expands upon this noting that proximity to final markets and special concessions such as financial and tax-based incentives are important factors in selecting a location for export-oriented activities. Consequently, transferring production of labor-intensive manufacturing activities to less developed countries to take advantage of lower labor costs can provide an important cost advantage.

Yet, despite the availability of financial incentives, several foreign enterprises closed their Irish operations as soon as their grant allocation had expired. Fearing that the IDA's policy of "industrialization by invitation" was faltering, the National Economic and Social Council (an economic advisory board to the Irish government) invited the U.S. Telesis Consulting Group led by Ira Magaziner to undertake an independent assessment of Ireland's industrial strategy. The Telesis report that emerged from this study

noted that “foreign-owned industrial operations in Ireland with few exceptions do not embody the key competitive activities of the businesses in which they participate; do not employ significant numbers of skilled workers; and are not significantly integrated into traded and skilled sub-supply industries in Ireland” (NESC 1992, p. 24). Telesis noted that MNCs were not necessarily at fault for failing to establish local sub-supply linkages. Rather, the MNCs had no choice but to source supplies from overseas since indigenous Irish suppliers (if they even existed) lacked essential technical and managerial expertise. Ireland’s indigenous suppliers were also less capital intensive than their overseas competitors. Consequently, when operating with low capacity levels, Irish suppliers were unable to realize sufficient economies of scale to enable them to maintain cost competitiveness with overseas suppliers. In light of these issues, it would seem unlikely that Ireland’s indigenous IT sector could have matured into a viable IT industry without the involvement of overseas firms. Although reliance on MNCs might be considered a risky strategy for industrial development in any economy, in Ireland’s case, there was no alternative.

While computer hardware producers dominated the first phase of overseas investment during the 1970s, a second phase of overseas investment in software and services began to emerge during the 1980s (Sweeney 1998). Companies establishing in Ireland during this period include IBM (1983), Lotus (1984), Microsoft (1985), Oracle (1987), Claris (1988), Corel (1989) and Symantec (1991) in software, EDS (1989) in computing services, and Dell (1990) and Gateway 2000 (1993) in direct selling and PC production. Together, the Irish operations of these MNCs account for over one-third of all PCs sold in Europe (IDA 1998a). Indeed, Ireland’s success in computer production has made it the eighth largest exporter of computer equipment in the world, ahead of many Asian NIEs (ITC 1998).

From the standpoint of developing an IT industry, Ireland’s flagship overseas investment came in 1990 when Intel selected Ireland as the site for its European manufacturing center. Intel reports that Ireland was chosen because of its “location as a member of the European Union, the quality of the infrastructure – roads, airports, water – the overall balance of costs, the financial incentives offered by the Irish authorities and . . . the quality and numbers of highly qualified people coming out of the educational

system” (Intel 1998). Since 1990, Intel has invested over \$2.5 billion in developing its Irish operation, making it the most significant overseas firm in Ireland.

High-tech firms, such as Intel, are increasingly attracted by the high rates of return earned by foreign-owned firms operating in Ireland. As shown in Figure 4, between 1994 and 1997, U.S. computer hardware producers in Ireland enjoyed a return on investment that was on average four times higher than elsewhere in the E.U. (BEA 1998). The potential for returns on this scale has drawn large numbers of U.S. firms to Ireland. For example, since 1980 Ireland has captured over 40% of all new U.S. electronics investment in Europe. In 1997 alone, Ireland captured one-third of all U.S. electronics investment in Europe, resulting in the creation of 13,000 new jobs (*Irish Times, January 3, 1998*).

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**Insert Figure 4 about here**

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Ireland has also enjoyed tremendous success in software to the point where Ireland is now the fifth largest producer, and the second largest exporter of packaged software in the world, second only to the U.S. (Irish Trade Board 1998). These statistics are largely a reflection of Ireland’s success in software localization. For example, an estimated 40% of all PC package software currently sold in Europe, including 60% of all business software, has been produced in Ireland. Considering the small scale of Ireland’s software industry, this seems a surprising result.

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**Insert Table 1 about here**

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As shown in Table 1, by the end of 1997, the Irish software sector comprised 679 firms, employing 18,300 people (NSD 1998). The key to Ireland’s success in software has been the 118 foreign-owned software companies, who in 1997 accounted for 88% of industry revenues and 91% of Ireland’s software exports. These foreign-owned companies are highly export-oriented, exporting virtually 100% of their output. Increased export sales are also contributing to the growth of indigenous software firms with export sales now accounting for some 69% of revenues, up from 41% in 1991. While foreign-owned software firms continue to focus on mass markets in business software, Ireland’s indigenous software

firms are instead focusing on niche areas. This has proven to be a successful strategy for firms like Iona Technologies (object-oriented development tools), Kindle (banking systems) and Baltimore Technologies (Internet security tools) who are now emerging as key international players in their respective software markets. As many as 66% of Ireland's indigenous software firms are owned and managed by people who once worked for overseas software companies in Ireland, proving that the overseas software firms are an important source of technical and managerial expertise (O'Gorman, O'Malley and Mooney 1997).

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**Insert Figure 5 about here**

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Exports of hardware and software are key to the success of Ireland's IT industries. In 1995, exports accounted for 97.6% of hardware production and 93.8% of software production (CSO 1998b). As shown in Figure 5, hardware and software exports currently account for one-fifth of Ireland's total exports, indicating the importance of IT exports to the overall economy. Ireland also boasts the fastest growth rates in computer hardware exports among the top producing nations (ITC 1998). Consistent with this increased emphasis on IT exports, there has been an increase in employment in these industries. For example, from 1991 to 1996, employment in hardware production increased from 7,400 to 15,200 (CSO 1998a) while employment in software production grew from 7,800 to 18,300 (NSD 1998).

Ireland's ability to leverage its pool of multilingual graduates has made it an ideal site for software localization by international software firms. For example, Microsoft's Worldwide Products Group, based in Dublin, currently localizes Microsoft products for its European and South American markets. This involves approximately 1,000 people translating over 100 products into 20 different languages (IDA 1998b). Ireland is also the location of Microsoft's European Operations Center, from which it handles the distribution of Microsoft's products throughout Europe. In the year to end-June 1995, Microsoft's Irish operations accounted for one-third of Microsoft's worldwide revenues of \$6 billion, indicating the importance of Ireland's localization and distribution efforts to Microsoft (IDA 1998b).

The availability of a multilingual workforce and a modern telecommunications infrastructure<sup>9</sup> has made Ireland an important location for international call centers. In recent years, Ireland has done much to improve its infrastructure by directing a large share of its allocation of E.U. structural and cohesion funds<sup>10</sup> towards infrastructure modernization projects. This has enabled Ireland to capture over 40% of all E.U. international call centers (Telecom Éireann 1996). During the 1990s, firms such as American Airlines, Best Western, Compaq, Corel, Dell, Gateway 2000, ITT Sheraton, Kao, Korean Air, Quarterdeck, United Airlines and UPS established multilingual call centers in Ireland to handle service requests from customers throughout Europe. Employment in call center operations is expected to grow from its current level of 4,000 to approximately 10,000 by the year 2000.

### **3.4 Industry Structure**

Overseas firms dominate the Irish computer hardware industry. As shown in Table 2, in 1996, overseas firms accounted for 97% of industry revenues and 87% of industry employment. In terms of firm size, indigenous Irish firms tend to be small, with on average of 56 employees, compared with an industry average of 220 employees. Meanwhile, U.S. firms constitute the largest body of computer hardware producers in Ireland, with an average firm size of just under 500 employees. These statistics suggest that Irish firms face stiff competition from MNCs, particularly in mass markets where economies of scale help to reduce production costs and improve overall competitiveness. This also helps to explain why Irish producers are more likely to operate in niche areas which are traditionally less attractive to MNCs.

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**Insert Table 2 about here**

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From an economic perspective, the disparity between the performance of Irish and overseas firms highlights a serious problem facing Ireland's indigenous firms in terms of their ability to compete in a

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<sup>9</sup> During the 1980s, Telecom Éireann invested \$5 billion to develop a fully integrated digital telecommunications infrastructure. Over 80% of telephone users are now connected through digital lines (Telecom Éireann 1996).

<sup>10</sup> In an effort to prevent the peripheral states from being marginalized by the more prosperous states, in 1993, the E.U. made available structural and cohesion funds to the "poorer" member states in the E.U. (Greece, Ireland, Portugal and Spain). Ireland's share of these funds is expected to total IR£6 billion over a ten-year period from 1989 to 1999, the highest per capita of all recipient nations.

global IT market. The Economist (1997) referred to this dual structure as “a tale of two economies: a still backward, unproductive and labor-intensive one owned by the Irish, and a modern, exceptionally productive and capital-intensive one owned by foreigners” (p. 22).

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**Insert Figure 6 about here**

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As shown in Figure 6, productivity comparisons between indigenous and foreign firms indicate the true extent of this disparity, with productivity in overseas firms dwarfing that of indigenous firms. Although critics claim that these data provide an unfair comparison – the productivity of overseas firms in Ireland is inflated since employees outside Ireland are not taken into account – significant differences still remain. While transfer pricing by MNCs might explain some of this productivity gap, it nevertheless suggests that Ireland’s indigenous firms lack the necessary managerial and technical skills to match the productivity levels exhibited by their overseas counterparts. Consequently, critics claim that while Ireland’s industrial policy has been successful at attracting overseas investment, Ireland’s indigenous IT industries remain marginalized and underdeveloped.

### **3.5 IT Use**

Despite Ireland’s success in IT production, corporate use of IT among indigenous firms remains low by international standards. The presence of high-tech MNCs has produced some spillover effects as companies like Intel and Dell use EDI to coordinate with their Irish suppliers, requiring them to upgrade their capabilities on a frequent basis. A 1996 government survey found that low levels of IT use among businesses and consumers constituted a significant problem. For example, they found that only 40% of businesses had access to the Internet and that executives did not consider IT as an important business issue. Consistent with these findings, IT spending by Irish firms remains low. For example, in 1997, Irish firms spent 1.5% of GDP on IT, compared with 4.1% for the U.S. (WITSA 1998). In addition, only 20% of adults use a PC which suggests that, at least in the short term, electronic commerce in Ireland will likely be restricted to business-to-business rather than business-to-consumer.

As shown in Table 3, IT spending in developing countries was less than 1% of GDP during the period 1992 to 1997. In contrast, the more industrialized nations spent 2.6% of GDP on IT, while Ireland spent a mere 1.6% of GDP, reflecting lower levels of IT use among indigenous Irish firms. Lower levels of IT spending are unlikely to produce a critical mass of investment in IT infrastructure, with the result that Ireland and other developing countries are unlikely to derive significant benefit from IT use in the short term. Consequently, there is still a significant emphasis on building up IT infrastructure in these countries rather than trying to leverage that investment through greater IT use. For example, 70% of IT spending in developing countries goes towards computer hardware, compared with 43% in the more industrialized nations. Further evidence of this is given by the fact that spending on software and services in developing countries is 7% and 18% lower, respectively, than in G7 countries. An analysis of IT spending in Ireland also reflects a significant emphasis on hardware, though not to the same extent as in developing countries. Consequently, while Irish firms continue to invest in critical IT infrastructure, IT use is likely to remain low.

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**Insert Table 3 about here**

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Recent government policy documents indicate a growing awareness that increased levels of IT use contribute to economic growth and development. For example, in late 1996, the Office of Science and Technology within the Department of Enterprise and Employment issued a white paper on Science, Technology and Innovation, in which it outlined a series of action points aimed at increasing IT use. Areas targeted include R&D, inter-firm collaboration, research and corporate awareness of technology (Department of Enterprise and Employment 1996). The nature of government support for indigenous industries has also changed to reflect an increasing emphasis on IT use. For example, Enterprise Ireland now offers a range of technology services, including technology audits that identify appropriate process technologies, and technology transfer programs designed to increase technology diffusion through joint ventures, licensing and international partnership agreements.

In 1996, Forfás delivered a comprehensive report entitled “Shaping our Future: A Strategy for Enterprise in Ireland in the 21st Century”. This report clearly identifies technology as a key success factor in Ireland’s future economic and social development. In its recommendations, Forfás states that “science and technology policy should be brought to the heart of national development policies, as a foundation for increased productivity growth, as a source of opportunity in new growth areas, and as a basis for creating knowledge-driven competitive advantage across all sectors of the economy” (p. 184). Against the background of this report, the government established an Information Society Steering Committee to determine a strategy that would enable Ireland to gain maximum benefit from the information society. In an effort to promote Ireland as a hub for electronic commerce in Europe, Ireland signed a joint communiqué with the U.S. in September 1998, committing both countries to work together to ensure the removal of legal, taxation and technological barriers in electronic commerce. The extent of Ireland’s desire to embrace electronic commerce led Ira Magaziner, now an advisor to the Clinton administration on IT, to declare that “there is potential for [electronic commerce] to be the engine which drives Ireland into a leadership position in Europe,” (Irish Independent: June 29, 1998).

Yet if this potential is to be realized, Irish policy makers must convince both indigenous firms and consumers that the Internet represents a secure and viable medium for business. As part of this effort, a number of low-population towns (less than 50,000 population) have been selected as sites for emerging technologies from smart cards to new home-based technologies. Efforts are also underway to try to increase Internet use among small and medium size enterprises (Irish Times, *February 19, 1999*).

#### **4. Lessons for Developing Countries**

Despite Ireland’s economic success, over-reliance on overseas investment and MNCs renders it vulnerable to shifts in global demand for IT. For example, in late 1997, over-capacity in the disk drive industry and fallout from Asia’s economic crisis led to the closure of Seagate’s Irish plant with the loss of 1,400 jobs. As far back as 1993, the closure and subsequent transfer of DEC’s mini-computer

manufacturing facility to Scotland heightened fears that other countries might try to duplicate Ireland's cost and tax-based advantages, which in a global economy would erode Ireland's competitiveness. These fears were confirmed when in February 1999, Apple outsourced production of its iMac computer to LG Electronics, a Korean firm, with the loss of 500 jobs. Based on these experiences, Irish policy makers have concluded that while cost-based advantages constitute an important strategic factor in determining international competitiveness, an industrial strategy based on low-cost production cannot provide sustainable economic benefits indefinitely. As a way to reduce Ireland's reliance on high-tech MNCs, policy makers are making a concerted effort to build up indigenous IT firms.

Recognizing that many developing countries can compete with Ireland in terms of cost-based advantages, Ireland's policy makers are also trying to move beyond pure factor-based competition. In order to create exit barriers to discourage MNCs from relocating their Irish investment offshore, Ireland is now moving towards a "one-stop" model of overseas investment. Specifically, by encouraging MNCs to establish multi-functional operations in Ireland, it is hoped that Ireland can achieve differentiation via managerial and technical expertise in non-manufacturing areas. The fact that companies such as Dell and Microsoft have relocated aspects of their R&D, marketing and logistics functions to Ireland, indicates that Ireland has already achieved a certain managerial and technical maturity that MNCs can exploit for reasons other than mere cost-based advantages.

Ireland's experience with overseas investment reveals that MNCs are not a panacea for economic growth and development in every instance. Similarly, developing countries who opt for a low-cost strategy in IT production should realize that "industrialization by invitation", as in the Irish context, constitutes a Faustian bargain. As Ireland found during the 1970s, without exit barriers or prolonged financial incentives (which can represent a significant drain on a developing country's resources), short-term gains from overseas investment can evaporate if MNCs relocate their investment in response to changing market conditions.

Despite such reservations, Ireland's economic success still indicates what IT production can achieve in the short term. Specifically, IT production creates employment opportunities which in Ireland's case provides a much-needed alternative to emigration. Irish workers in MNCs can also develop key technical and managerial expertise that can enable them to form businesses in niche areas. Finally, IT production brings foreign capabilities which diffuse into indigenous firms that supply MNCs – the adoption of EDI by Irish suppliers being one example.

#### **4.1 Strategies for Sustained Economic Growth**

If cost-competitiveness in IT production is unlikely to provide sustainable benefits, what then should developing countries do to achieve sustainable economic growth? While developing countries will likely be attracted by the benefits Ireland has gained through its focus on *IT production*, researchers indicate that *IT use* is more likely to provide sustainable economic growth (Dedrick and Kraemer 1998). However, a lack of critical IT infrastructure and human capabilities in developing countries can restrict IT use and, therefore, hinder the realization of payoffs from IT investment (Dewan and Kraemer 1998). This inability to translate IT investment into immediate economic benefits should not discourage developing countries from investing in IT. On the contrary, as evidenced by Ireland's investment in IT education and telecommunications, every effort should be made to develop critical IT infrastructure and to foster an investment environment conducive to increased levels of IT use. There is also a risk that complacency in maintaining an effective human and IT infrastructure could erode competitiveness. Consequently, there is a need to develop human and IT capabilities on a continuous basis, consistent with the demands of an increasingly dynamic and turbulent global IT environment

If developing economies cannot provide sufficient incentives to support IT production, or if reduced levels of IT spending restrict IT use in the short term, an interim solution might be to move in the direction of “production close to use”, as represented by the provision of information services. Despite low levels of IT use, Ireland is particularly adept at offering professional services in areas such as

outsourcing, network management, custom programming, software localization, call center operations, systems integration and web development services. While these services are still dependent on MNCs, they nevertheless allow Ireland to develop competencies in international IT services which will ultimately generate economic benefits independent of IT production. In addition, production close to use can act as a catalyst for greater use of IT throughout the economy by introducing IT services into government, businesses and education, creating a virtuous cycle of diffusion and learning.

Finally, Ireland illustrates that success in IT production does not automatically lead to high levels of IT use, as the majority of Ireland's indigenous firms have remained isolated from the MNCs that are responsible for Ireland's economic success. Therefore, while a focus on MNCs might lead to the creation of an IT industry, there is still a need for an IT policy to promote internal growth through IT use and production close to use.

## **5. Conclusion**

Ireland's experience with IT-led development parallels that of many developing nations. When Ireland's indigenous industries failed to provide adequate employment opportunities during the 1960s, Ireland pursued a policy of "industrialization by invitation" with the aim of encouraging MNCs to invest in Ireland. From the 1970s onwards, this policy was used to target individual firms in the high-tech computer sector. This emphasis on "picking winners" has allowed Ireland to attract many of the world's leading IT companies. In the belief that what was good for overseas investment was good for Ireland, the Irish government has consistently implemented policies that support this factor-based model. In addition, Ireland supported its industrial policy with a variety of financial and tax-based incentives. Ireland's education policy was also directed towards the creation of a multilingual workforce with technical expertise in areas that would appeal to overseas firms.

This research supports the linkage between IT investment and economic growth and development. In this context, Ireland serves as a valuable benchmark for developing countries seeking to

join the *IT production* bandwagon. While IT production is capable of generating economic benefits, Ireland's experiences reveal that such benefits (particularly when based on cost-competitiveness) are unlikely to be sustainable in the long term. Instead, policies that promote IT use and production close to use, offer a basis for sustained economic growth and development.

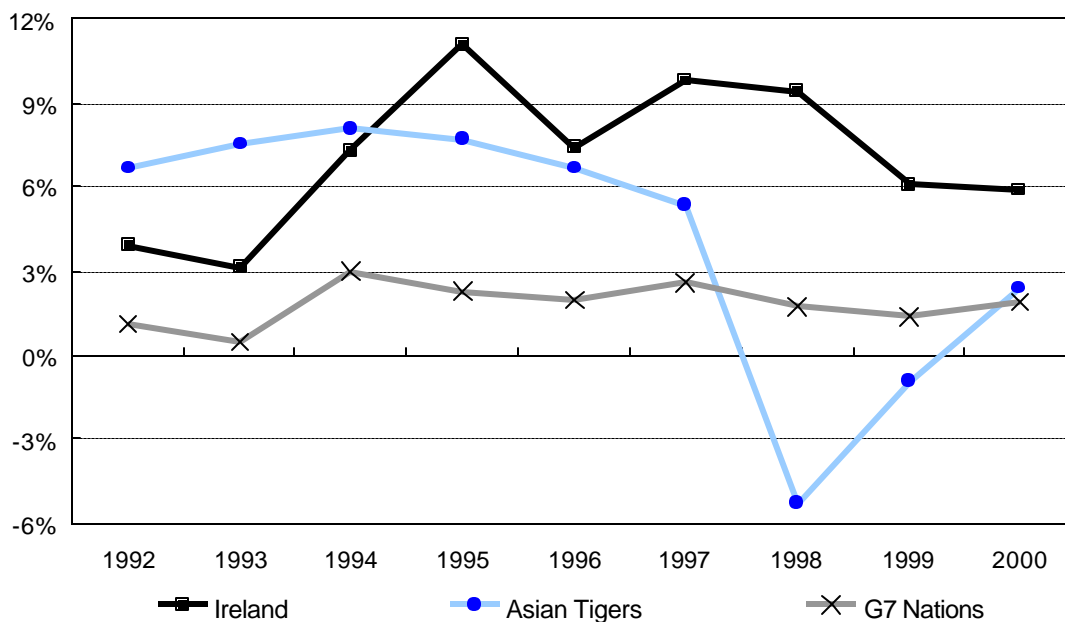
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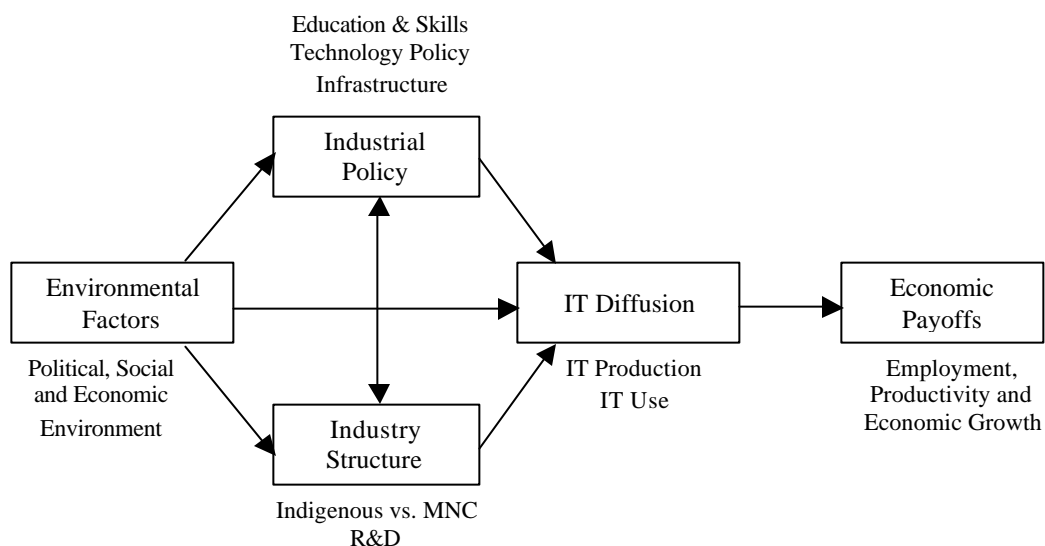
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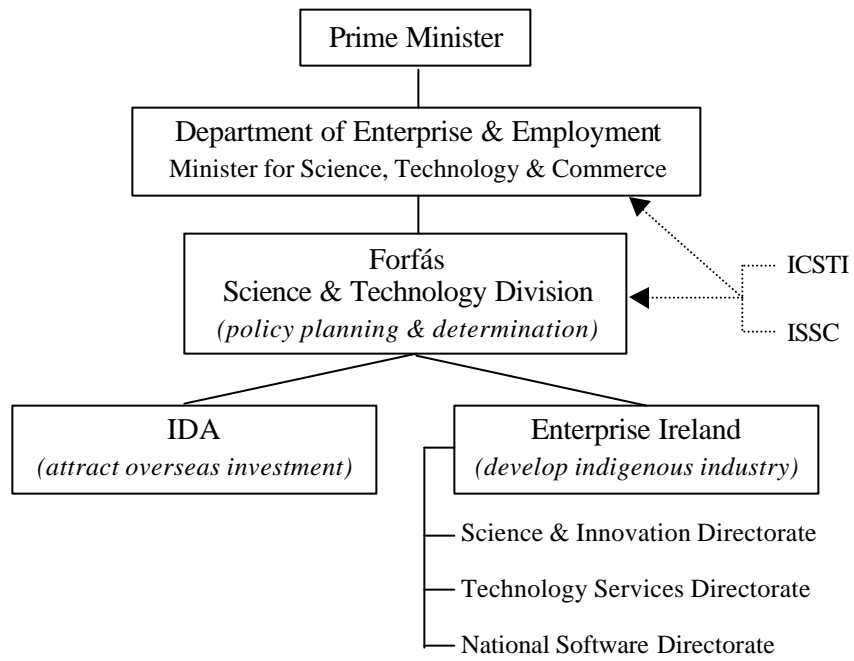


**Figure 1. Comparative Rates of Real GDP Growth**

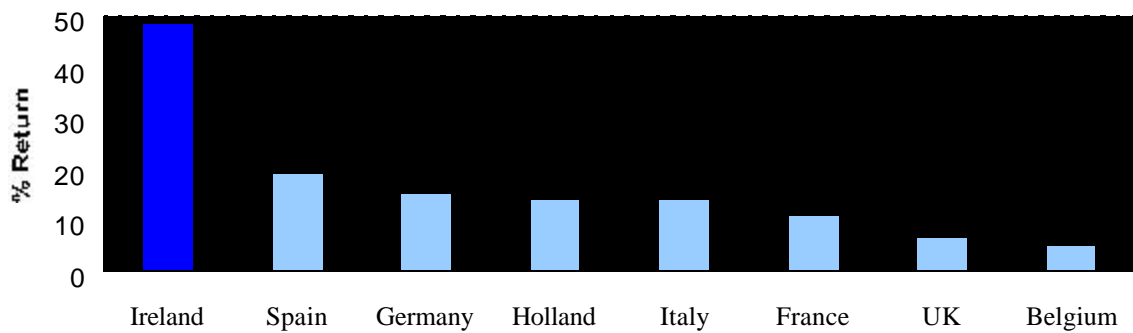
Source: EIU (1998). “Asian Tigers” include Hong Kong, Indonesia, Malaysia, Singapore, South Korea, Taiwan and Thailand. Data for 1998 through 2000 are based on EIU projections.



**Figure 2. Framework of IT-led development (Adapted from Dedrick & Kraemer 1998)**

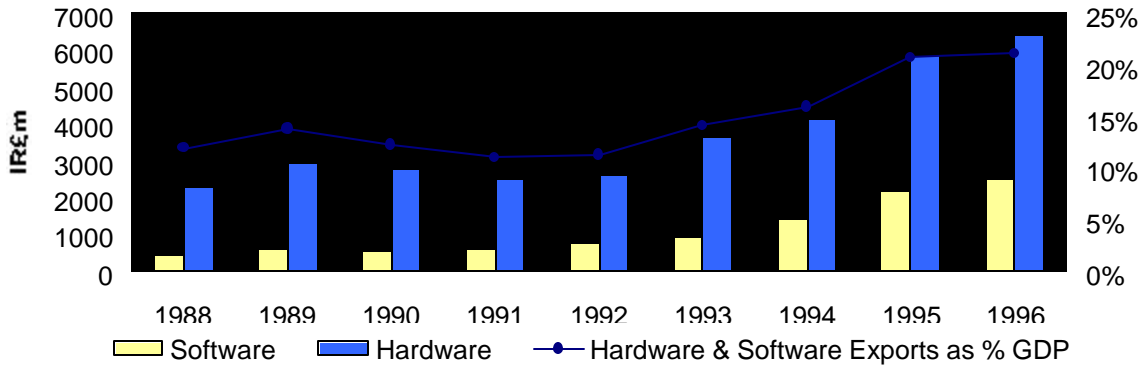


**Figure 3. Structure of Industrial Policy Institutions in Ireland**



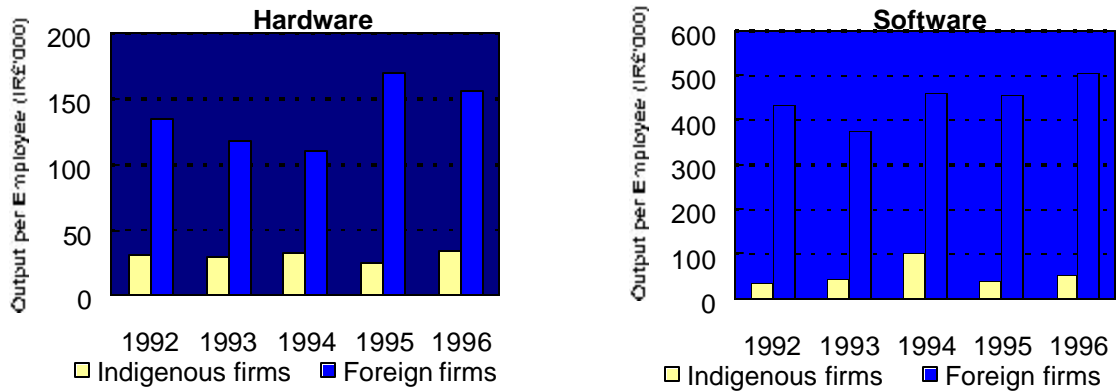
**Figure 4. Average annual rate of return on U.S. foreign direct investment (1994-1997)**

Source: U.S. Bureau of Economic Analysis, 1998.



**Figure 5. Exports of hardware and software (1988-1996)**

Source CSO (1998b).



**Figure 6. Productivity in hardware and software production (1992-1996)**

Source: CSO, Census of Industrial Production 1994-1998.

**Table 1. Software industry details (1991-1997)\***

	1991	1993	1995	1997
Number of Firms:				
Irish Owned	291 (80%)	336 (81%)	390 (81%)	561 (82%)
Foreign Owned	<u>74</u> (20%)	<u>81</u> (19%)	<u>93</u> (19%)	<u>118</u> (18%)
Total	365	417	483	679
Employment:				
Irish Owned	3,801 (49%)	4,495 (50%)	5,773 (49%)	9,200 (50%)
Foreign Owned	<u>3,992</u> (51%)	<u>4,448</u> (50%)	<u>6,011</u> (51%)	<u>9,100</u> (50%)
Total	7,793	8,943	11,784	18,300
Revenue (\$M):				
Irish Owned	234 (9%)	368 (12%)	610 (13%)	739 (12%)
Foreign Owned	<u>2,465</u> (91%)	<u>2,739</u> (88%)	<u>4,125</u> (87%)	<u>5,506</u> (88%)
Total	2,701	3,107	4,735	6,245
Exports (\$M):				
Irish Owned	95 (4%)	181 (6%)	357 (8%)	511 (9%)
Foreign Owned	<u>2,415</u> (96%)	<u>2,691</u> (94%)	<u>4,085</u> (92%)	<u>5,397</u> (91%)
Total	2,510	2,872	4,442	5,907

Source: NSD 1997.

\* NSD conducts bi-annual surveys of the Irish software industry.

**Table 2. Industry structure in computer hardware production, 1996**

Country of Origin	Number of Firms	Revenues \$M	Number of Employees	Average Firm Size
Ireland	35 (50%)	267 (3%)	1,962 (13%)	56
U.S.	21 (30%)	8,251 (85%)	10,123 (66%)	482
Other	<u>14</u> (20%)	<u>1,157</u> (12%)	<u>3,154</u> (21%)	<u>225</u>
All Firms	70	9,675	15,239	218

Source: CSO (1998b).

**Table 3. Analysis of IT Spending, 1992-97**

	IT as % of GDP 1992-97	Components of IT Spending		
		Hardware	Software	Services
G7 Nations	2.6	43%	16%	41%
Ireland	1.6	52%	14%	34%
Developing Countries	0.9	70%	9%	23%

Source: WITSA (1998). Developed countries include Argentina, Brazil, Chile, China, Columbia, Egypt, India, Indonesia, Korea, Malaysia, Mexico, Philippines, Russia, Taiwan, Thailand, Venezuela and Vietnam.