The Celtic Tiger’s Tale:
Ireland’s Information and Communication Technology Cluster

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A. Executive Summary

This paper charts the roots, rise, and symbiotic struggle of the Irish economy and its most prominent sector. The first part of the paper explores the causes and consequences of Ireland’s economic miracle. It looks at how the coordinated efforts of society and government, European economic integration, a young and well educated population, favorable tax structure and macroeconomic stability underpinned an uninterrupted boom for decades only to stall in recent years. The section then outlines our thesis that Ireland’s current challenges requires refocusing its competitiveness agenda in innovation, improving coordination between actors in charge of R&D and its commercialization and moving into new activities of the value chain according to a redefined value proposition.

The second part of the paper focuses on the ICT cluster itself, outlining the global sector and players, tracing the roots of Ireland’s rise and looking at how the effects of the Celtic tech boom and current microeconomic challenges are undermining Ireland’s competitive position today. The section finishes with a series of recommendations on how the cluster itself can play a leading role in Ireland’s transition to an innovation-driven economy.

B. Ireland – Country Analysis

Ireland is the third largest island in Europe with a population of approximately 6 million people. In 1801 Ireland became part of the United Kingdom (UK), but a war for independence in the 20th century led to the partition of the island into two: The Republic of Ireland (from here on Ireland) and Northern Ireland, still part of the UK. Independence was followed by a period of low economic growth and political unrest. In 1988, The Economist described Ireland as “The poorest from the rich”. Ten years later, the same magazine coined Ireland: “The Celtic Tiger: Europe's shining light”.

B1.1 Development of Ireland's Economy
Ireland’s economy underwent a radical transformation in the last two decades. It went from being one of the least developed countries in Europe to having one of the most prosperous economies by leveraging export-oriented manufacturing and trade (See Figure 1 for a breakdown of Irish development focus).

Figure 1: Industrial Development in Ireland by Decade

Foreign direct investment (FDI) led the transformation of Ireland by providing capital and skills to move the country into more sophisticated sectors. Multinational corporations (MNCs) became attracted to Ireland because of the country’s favorable tax structure, the availability of a well-educated young population, the presence of relatively low wages, and the proximity to the European market.

Today, Ireland is one of the most open economies in the world with an unusually large manufacturing sector. Exports and imports represented almost 157% of GDP in 2009, almost 3 times as high as the average for OECD countries\(^1\). A significant portion of the economic activity in Ireland consists of importing goods from abroad, adding value to them through high technology infrastructure, and exporting those high-value goods in sectors like chemicals and pharmaceuticals, both of which represented half of the 2008 total export of goods.

\(^{1}\) Country Data – Annual Time Series. Economist Intelligence Unit. countryanalysis.eiu.com/countrydata
Although scaling and upgrading of the manufacturing industry has bolstered the development of indigenous firms, Ireland’s economy still relies heavily on MNCs. Today, Ireland’s GDP is approximately 15% larger than its GNP, the largest gap among OECD countries. Foreign capital dependency forces Ireland to constantly nurture an attractive business environment and to compete with the newly admitted EU members who are also seeking FDI.

**B1.2. Growth and Well-being**

Ireland’s structural transformation promoted GDP growth and created new employment opportunities. GDP per capita grew around 6% per year over the last decade, placing Ireland as one of the countries with highest income per capita within the OECD (Figure 1). In 2008, despite a 2.3% decrease due to the financial crisis, GDP per capita (at PPP, 2005 constant prices) stood at $39,253, above the OECD average of $34,963.

*Figure 2: Real GDP per Capita and Growth*

![Real GDP per Capita and Growth](chart)

Source: EIU

**B1.3. Growth and Productivity**

FDI in high-tech sectors was the main driver of improvement in productivity and economic growth. However, in recent years productivity growth has decelerated as a result of the exhaustion of the investment

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2 Country Data – Annual Time Series. Economist Intelligence Unit. countryanalysis.eiu.com/countrydata
3 Country Data – Annual Time Series. Economist Intelligence Unit. countryanalysis.eiu.com/countrydata
driven model. (Figure 3). Since 2004 the increase in labor force participation, due to inward migration and the entrance of a young population into the work force, has compensated for the low productivity growth. Nevertheless it is worth noting that, in the long-run, economic growth cannot be sustained by changes in the labor force participation alone.

Figure 3: Contribution to GDP per Capita Growth

In addition to low productivity growth, the labor market has tightened as a result of Ireland’s fast economic growth and inability to supply enough workers with the right skills for all its industries. The increase in wages has outpaced improvements in productivity (Figure 4), thus affecting Ireland’s competitiveness. Today, Ireland’s priority in its economic agenda is to attract high-skilled and highly productive workers rather than combating unemployment, which on average has been below 5% since 2001\(^4\).

\(^4\) Country Data – Annual Time Series. Economist Intelligence Unit. countryanalysis.eiu.com/countrydata
B1.4. Macroeconomic Stability

Macroeconomic stability gives Ireland an advantage vis-à-vis other manufacturing and technology exporting countries in Eastern Europe and Asia. Ireland’s entrance in the European Monetary System in 1979 allowed the country to achieve price stability, and helped it to attract more long term investments. Despite the pressure from skyrocketing property as well services prices in 2006 and 2007, inflation was kept below 5% (Figure 5).
In addition, the 10-year government bond yield, which to some degree reflects expectations of inflation and confidence on Ireland’s future performance, has been stable at around 4%. In 2009, the bond yield peaked at 4.88% as a result of the recent economic crisis. However, rather than having a permanent impact on the structure of the economy, the crisis simply led to pricing readjustments in the real estate and financial services sectors.

**Figure 6: 10-year Government Bond Yield**

![Bar chart showing the 10-year government bond yield from 2000 to 2009.](image)

Source: EIU

Historically, Ireland has had enormous fiscal deficits. However, Ireland has enjoyed a budget surplus in the last few years. The public debt, as shown in Figure 6, has fluctuated around a third of the GDP, except for the last two years when the crisis increased the debt ratio to up to 62% in 2009. Ireland’s government needs to tighten its expenditures as low economic growth rates are expected in the near future.

**Figure 7: Public Debt (% of GDP)**

![Bar chart showing the public debt as a percentage of GDP from 2000 to 2009.](image)

Source: EIU
The revaluation of the Euro in real terms has hurt Ireland’s capacity to compete in world markets. Rising prices of domestic goods combined with the nominal revaluation of the Euro against the Dollar and the Pound, have made Ireland’s goods more expensive in its two main markets: the U.S. and the U.K. This has exacerbated the need to move to the high end of the value chain.

![Figure 8: Public Debt (% of GDP)](source)

![Figure 9: Exports/Imports (% of GDP)](source)

**B2. Assessment of the National Business Environment**

**B2.1. Macroeconomic, Political, Legal, and Social Context**

Ireland is a Republic, with a parliamentary system of government. It has a well-managed economy, an independent judiciary, a strong Intellectual Property (IP) reputation, and low levels of bureaucratic red tape. Ireland joined the European Community in 1973. EU membership has enabled Ireland to have access to structural funds, which have been used to upgrade infrastructure, and prompted the Government to foster policies that keep inflation and interest rates low (Maastricht Treaty). In 2006, Ireland had the sixth highest GDP per capita and the fifth highest Human Development Index in the world. Ireland’s political and economic stability coupled with its highly educated workforce make the country an attractive destination for FDI. This enabled Ireland to have an impressive economic growth from the 1990’s until 2007, a phenomenon known as the “Celtic Tiger.”

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6 International Monetary Fund (IMF), 2006.
B2.2. Ireland's National Diamond Overview

The 2009-2010 Global Competitiveness Report ranks Ireland 25th in the world, or three spots below its 2008-2009 ranking of 22nd. However, despite the apparent insignificant fall in its overall ranking, it is important to point out that Ireland’s ranking is lower in all four sections of the diamond.

Figure 10: Country Diamond for Ireland

B2.3. Factor Conditions

Ireland has strong educational and research institutions. It has 9 world-renowned universities and 14 Institutes of Technology throughout the country. The strength of Irish educational and research institutions stems in part from the government’s commitment to investing in higher education, which has increased by an average of 10% per annum during the last ten years compared to a European average of 3%, and securing the highest-level research talent from Ireland and abroad. The quality of Ireland's educational system, the flexibility of a young, English-speaking workforce, and the low rate of employment turnover make Ireland’s

Source: Team Analysis

7 IDA Ireland
labor force one of the most skilled in the world. Also, Ireland boasts a highly developed credit and venture
capital markets. According to the 2010 World Bank’s Doing Business Report, Ireland ranks 5th in terms of
access to credit and 7th in terms of availability of venture capital. This facilitates investments and economic
growth.

Despite these advantages, Ireland has low levels of innovation when compared to other OECD
countries. For example, Ireland’s average number of patents per 100,000 inhabitants between 1999 and 2008
is one of the lowest in Europe and is significantly behind the United States, Japan, and Israel. This stems
primarily from Ireland’s relative low research and development (R&D) spending and few added incentives
such as tax subsidies.

Figure 12: USPTO Patents per 100,000 inhabitants (Average 1999-2000)

In addition, Ireland has an insufficient domestic labor supply. This is a consequence of Ireland’s relative
low birth rate, rising levels of outward migration, as well as low participation in the economy.\(^8\)\(^9\) Low labor

\(^8\) Annual Competitiveness Report 2009
force participation puts pressure on wages and hinders Ireland’s competitiveness. In addition, Ireland has relatively poor logistics and communications infrastructure. According to the 2009 Global Competitiveness Report, Ireland ranks 25th among OECD countries in perceived quality of infrastructure. Inadequate logistics and communications infrastructure hinders Ireland’s export capacity and thus competitiveness in world markets. While Ireland still enjoys a relative low administrative burden vis-à-vis its neighbors (e.g. Ireland’s procedures to start a business take 20% less time and cost less than one tenth than the average OECD country), it faces an increasing administrative burden which can hinder entrepreneurship.

B2.4. Context for Firm Strategy and Rivalry

Ireland’s regulations are perceived to facilitate business activity. For example, Ireland remains highly competitive in terms of both corporate tax (12.5% which is among the lowest in the EU) and personal taxes. Low distortion from taxes and other regulations stimulate investments at all levels, thereby promoting competition, innovation, and competitiveness.

One of Ireland’s biggest disadvantages in terms of Firm Strategy and Rivalry conditions, however, is its high wages compared to productivity. Ireland’s wages have risen significantly over the years, but labor productivity has not kept pace. The combination of the slowdown in productivity growth and faster wage growth in Ireland compared to its trading partners could discourage investments in the medium and long-term.

Yet another major challenge for Ireland in terms of Firm Strategy and Rivalry conditions is its low intensity of local competition. According to the 2009 Annual Competitiveness Report, Ireland’s legislations on competition ranks 14th among OECD countries. In addition, major incumbents dominate many of the local markets including utilities. Low intensity of local competition hinders innovation and keeps prices excessively high in certain markets.

B2.5. Related and Supporting Industries

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Thanks in part to Ireland's successful FDI policies, a number of important related clusters emerged throughout the country.\textsuperscript{11} The Information and Communications Telecommunications (ICT) is one of those clusters that emerged in Ireland. The country enticed leading computer hardware and software companies like Intel, Dell, IBM, Microsoft, and Apple to locate their European manufacturing and service operations in Ireland. The country has become a key global location for the pharmaceutical sector. Thirteen of the top fifteen pharmaceutical companies in the world have substantial operations in Ireland. Similarly, more than half of the world's top fifty banks and almost all major global insurers and mutual funds have a presence in Ireland. This cluster employs more than 40,000 people (including support services).\textsuperscript{12}

However, in terms of related and supporting industries, Ireland lacks local suppliers and has been unable to create strong linkages between its local and multinational companies. Given the importance of FDI to Ireland's economy, strengthening this link is essential to enhancing Ireland’s competitiveness, because it provides additional incentives for MNCs to remain in the country for the long term, all while developing the capabilities of other local supporting industries.

\textbf{B2.6. Demand Conditions}

The local demand in Ireland is small given the country’s limited population. The demand is also unsophisticated in many markets despite the country’s relatively high GDP per capita. This forces companies in Ireland to rely heavily on foreign markets. Ireland’s entrance into the European Union has been a key factor in improving the demand conditions and in attracting major international companies. It is worth mentioning though that Ireland has improved its regulatory standards and environmental regulations to allow consumers to make informed decisions, which forces companies addressing the local demand to improve their products.

\textbf{B2.7. Institutions for Collaboration (IFCs)}

Institutions for collaboration (IFCs) coordinate efforts between the public and private sectors and academia. Councils, universities, trade associations, and chambers of commerce help to bring together key stakeholders to develop a common competitiveness strategy and agenda. IFCs facilitate the flow of information, promote knowledge sharing and foster innovation, thus contributing to the competitiveness of a nation. In Ireland, IFCs are well developed and include all of the 9 universities and 14 Institutes of Technology and organizations such as the Irish Business and Employers Confederations (IBEC), the Irish Exporters Association, Irish Bio-industry Association (IBIA), ICT Ireland, and Financial Services Ireland (FSI).

B3. Ireland – Recommendations

Ireland needs to move from an investment-driven economy to an innovation-driven economy. Although the country’s reliance on its favorable business environment and incentives has been effective in attracting FDI, the recent crisis and the emergence of competitors such as Eastern Europe are challenging the current economic model. The public and private sectors in Ireland seem to recognize the need for change based on recent reports and initiatives, but more steps need to be taken before Ireland can truly leverage its innovation capabilities. This section suggests specific actions that Ireland needs to take in order to move into the next stage of its economic development.

B3.1. Improve Infrastructure

In order to fully leverage its innovation capabilities, Ireland first needs to improve its logistics and communications infrastructure which will allow better circulation of information and human capital. A major part of the economic activity in Ireland takes place in the main cities (Dublin and Cork), but there is significant potential in other parts of the country given the presence of universities, research institutions etc. Ireland is upgrading its broadband infrastructure and attracting FDI outside of the main cities, but it needs to accelerate the penetration in more rural areas. Other forms of communication such as the railroad system also need further investments.
The government needs to encourage more policies that intensify local competition. Ireland has taken steps to liberalize the electricity market, but the government needs to liberalize it further and divest from the National Grid Transmission Network. Ireland also needs to encourage more competition in other areas such as telecom in order to lower the cost structure for firms who use those services.

B3.2. *Encourage More Local Competition*

Ireland needs to reduce entry barriers and regulations for local industries such as professional services to encourage a larger number of firms. Many professions (e.g. law) are highly regulated in terms of requirements to enter these professions and in terms of restrictions on advertising and other tactics that could potentially allow companies to compete and differentiate themselves. While these rules were established to protect consumers in the past, many of them are no longer needed in this age of information. Ireland needs to strengthen its consumer protection agencies and legislation and lower the barriers to entry in its services. By encouraging competition among local companies, Ireland will encourage more innovations in those markets.

B3.3. *Address Mismatch in Human Capital*

Given the high unemployment level in Ireland, the FAS needs to revise the Community Employment Scheme and collaborate with industry associations to create specialized training programs to move the unemployed into sectors with labor shortages. The training programs will also help boost productivity to become in line with Ireland’s high wages. Ireland should also consider encouraging immigration of highly skilled workers in specific sectors.

B3.4. *Provide More R&D Incentives*

Ireland has taken steps to increase investments in R&D but it is still lagging other OECD countries. Ireland created a $500m Euro R&D grant scheme but it needs to increase its R&D spending and require that candidates for these grants be multi-party collaborations. The country also needs to create further formal collaboration between its universities/research institutions and other top counterparts throughout the world.

B3.5. *Link Local Companies with MNCs*
Ireland needs to strengthen the link between MNCs and local companies in order to drive the pass-through of innovation. The country needs to provide incentives for MNCs to use local suppliers and to help develop their capacity. This is more feasible now than before because Ireland has developed a large pool of management talent capable of starting viable enterprises. The country should encourage more joint-ventures and create additional local business councils (as opposed to national institutions which already exist) to help the local supplier base grow.

**B3.6. Move into New Activities of the Value Chain**

Ireland is currently the preferred production location for many firms but there is an opportunity for the country to learn to commercialize its innovations (through sales and marketing activities). Ireland should start developing these capabilities in order to capture a larger share of the value chain, be closer to the end customers, and make it more difficult for MNCs to leave the country.

**B3.7. Leverage Ireland’s Uniqueness**

Ireland is one of the few English-speaking countries in the European Union (EU) and one where the labor force is able to speak a multitude of languages. The workforce is young and highly educated and the country is strategically located between Europe and the United States. Ireland’s intellectual property laws are well enforced. Ireland should leverage these unique characteristics and position itself as the premier location for global knowledge-intensive companies to locate their headquarters and serve a multitude of markets in Europe.

**C. Irish ICT – Cluster Analysis**

**C1.1. ICT Size and Growth**

The Information and Communication Technology sector is large, global and highly influential. ICT spending is projected to reach US$4.4 trillion in 2011, accounting for 6-7.45% of GDP worldwide¹³ (Digital

¹³ Depending on which sub-sectors and services are counted
Planet 2008; Biggs 2009). The sector has itself grown at roughly 7-10% per year for the last decade in a lagging but pro-cyclical fashion: growth peaked at 12.3% in 2004 – finally catching up with the post-2001 recovery – and will likely slow from 10.3% in 2008 to 4% this year following the global economic downturn (Digital Planet 2008; OECD 2008a). The sector plays a major role in driving broader GDP growth, as ITC innovations boost productivity and efficiency in nearly every other sector of the global economy (Biggs 2009; ITU 2009b).

C1.2. ICT Sub-sectors

There are four main sub-sectors in ICT – communications, hardware, software and services – each with varying degrees of profitability (see Figure 13 for a breakdown of sub-sectors, margins and trends). Communications is by far the largest (just over 57% in 2007) and fastest-growing (at 7% per year) sub-sector (Digital Planet 2008).\(^\text{14}\)

The services sub-sector has the second largest share – at roughly 20% – but at 4.4% per year, is the slowest-growing\(^\text{15}\). It includes consulting, outsourcing, systems integration, custom software development, automation, maintenance, and data processing. The leading exporters are India (by a significant margin), followed by Ireland, the UK, the US, Germany and France. Recent years have seen fast growth from South Africa (Digital Planet 2008; OECD 2008a).

Hardware comprises nearly 13% of the sector and is growing at 5.3% per year (Digital Planet 2008). The sub-sector includes computer components, equipment, storage devices, memory, displays, and office equipment (printers, scanners, peripherals). China is by far the largest exporter, mainly due to growth in assembly-related manufacturing. The other major players are the US, the Netherlands, Germany, Japan and South Korea. The past ten years has seen fast growth from Hungary, Slovak Republic, Czech Republic and Portugal, each growing at roughly 30% per year (OECD 2008a).

\(^{14}\) However, it plays a minor role in the Irish ICT story, so for the sake of simplicity we have excluded it from the scope of this paper.

\(^{15}\) The growth picture is a bit muddy, as the most reliable numbers available for the sub-sector include telecommunications services. Telecommunications services are slowing due to flat growth or decline in mature markets (OECD 2008a), which is obscuring very fast growth in many services sub-categories, particularly web-based businesses.
The fourth major sub-sector, software, holds 9% of the global market and is growing at 6% per year (Digital Planet 2008). Software includes operating systems, database systems, programming tools, applications and utilities. The leading exporters are Germany, the US, Ireland, Sweden, Poland, Mexico, and Korea.

Figure 13: Top 250 ICT Firms’ Profitability by Sub-Sector, 2000 vs 2006

\[\begin{align*}
\text{Software} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\text{Internet} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\text{Semiconductors} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\text{Telecommunications} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\text{Communications equipment} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\text{Electronics} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\text{Services} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\text{IT equipment} & \quad \text{Profit margin, 2006} & \text{Profit margin, 2000} \\
\end{align*}\]

Source: OECD

C1.3. ICT Future Trends

ICT growth overall is increasing rapidly in non-OECD countries and favoring hardware. India, Russia, Brazil and China have grown at 30%, 28%, 24% and 20% per year since 2003, respectively. Compared to the OECD average, non-OECD growth is more heavily weighted toward hardware spending and less on software and services (OECD 2008a).

There is significant variance in ITC expenditure patterns across markets, owing to local economic growth patterns, endowments and local specialization further down the value chain. Hardware accounts for over 17% of total ICT spending in Turkey, the Czech Republic and Switzerland, but less than 10% in Mexico. Software accounts for over 15% of ICT spending in the Netherlands, Czech Republic, Switzerland and Finland yet less than 5% in Korea, Japan, New Zealand and Mexico. Computer services represent over 25%

\[\text{Calculated as average net income as a share of average revenues}\]
of total ICT spending in the US, UK, France and Canada, but less than 10% in Greece, Poland, Mexico, Portugal and Hungary. Communications hardware and services represent over 70% of ICT spending in Korea, Mexico, Spain, Greece, and Poland but under 45% in the US and Sweden (OECD 2008a).

Currently, the global crisis is favoring non-OECD ICT growth at the expense of more mature players. The economic decline and credit crunch in the US and Europe has led to many ICT projects being postponed or cancelled and the extension of technology replacement cycles has reduced intra-regional ICT trade in those areas. The BRIC countries appear to be recovering more quickly and credit for IT infrastructure is more readily available there, so overall ICT investment has not fallen off. Weaker currencies and low demand for US, Japanese and European components made ICT products cheaper in 2008, boosting the growth of ITC sub-sectors in Asia/Pacific, particularly those which are assembly-oriented. As a result, Asia Pacific and the Middle East will overtake Latin America and Eastern Europe as the fastest-growing regions and growth in North America and Europe will fall further behind (Digital Planet 2008).

C2. Historical Development of the ICT Cluster in Ireland

The development of the Irish ICT cluster, like that of the modern Irish economy in general, is intimately tied to FDI. The development of the modern ICT cluster began in the 1980s, when the Industrial Development Authority (IDA), a government entity focused on attracting FDI to help develop Ireland, had its first major successes in attracting world class software and hardware players to the country. Some, like IBM, already had sales offices in the country, but during the decade they began to move more of their value chain into the country. In 1981 IBM set up a small software development lab, followed by software manufacturing operations. In 1984, Lotus came and in 1985 so did Microsoft. The emerging cluster centered on software manufacturing (disk duplication, burning CD-ROMs, packaging, wrapping, etc.) and other basic manufacturing and assembly. Towards the end of the decade, firms began to pursue higher-skill activities like software localization (White 2003).
Importantly, while Ireland was working hard to improve both its macroeconomic conditions and its business environment to make them more competitive for many potential industries (for example, providing low taxes, creating very favorable FDI regulations, and increasing its integration with Europe), since the 1970s the IDA actively targeted foreign firms in high-tech sectors with a low weight-to-value ratio (Gleeson, et. al. 2005). That is, the cluster began with a blend of industry-agnostic reforms and targeted pursuit of leading companies in the sector.

The 1990s started with one of the greatest “wins” for the IDA: Intel opened a huge fab (the largest outside the US) in Ireland in 1990. IDA had been pursuing Intel since first contacting the firm in the late 1970s, and had remained engaged until conditions for investment became more favorable. A central problem was that Intel perceived Ireland lacked a sufficiently skilled workforce. Improving education programs, combined with the return of Irish ex-pats working in the US, convinced it otherwise, and the cluster began to shift towards more value-added manufacturing. Dell and Hewlett Packard followed shortly after. The 1990s also brought the creation of the single European market in 1992, which gave companies based in Ireland even better access to one of the world’s largest markets. Finally, the local software industry, while a small part of the overall cluster, grew rapidly throughout the decade. In 1997, 561 local software firms accounted for 9% of exports and 12% of sales, up from 291 firms, 4% of exports and 9% of sales in 1991 (Alfaro, et. al. 2009).

Over the course of the 2000s the cluster continued to grow through both additional FDI and the further development of the local software industry. Major FDI wins included Google setting up its European headquarters in Dublin in 2003. This investment was indicative of a trend for ICT firms to locate more of their administrative and management functions in the Irish cluster – as early as 1991, IBM had set up one of its two global treasury centers there. Companies also increased the development activities they performed in the country, and some began to do research in collaboration with Ireland’s universities and institutes of technology. On the other hand, over the decade basic manufacture and assembly shifted out of the Irish ICT cluster.
C3. ICT in Ireland Today

C3.1. Ireland’s ICT cluster

Today, the ICT cluster is one of the largest and most competitive clusters in Ireland. As of 2006, the cluster had over 5,200 firms: 183 in manufacturing and over 5100 between software and IT services (ICT Ireland 2007). In 2008 the cluster had over €75 billion in aggregate sales, with over €38 billion from manufacturing activities and over €37 billion in software and services, and accounted for nearly 9% of value added in the economy. Over 87,000 people, nearly 4% of the total Irish labor force, worked in the Irish ICT cluster as of 2008 (McSweeney 2010). In 2006, Ireland was the world’s largest exporter of software17. ICT activity in Ireland is concentrated around the country’s universities and institutes of technology, with the largest agglomerations around Dublin, Cork, Galway and Shannon / Limerick.

The Irish ICT cluster has four core areas: hardware, software, digital content and platforms, and IT services. There are linkages between players in these areas, but they vary in strength. Domestic software firms, which have much of their value chain in Ireland, benefit from the existence of sophisticated service firms which can support both their activities and those of their clients, and the presence of digital content firms like Google which increase the base of relevant skills in the labor pool. On the other hand, MNCs in software and hardware, which tend to integrate their value chain with other corporate divisions across geographies, have weaker linkages. Surrounding the cluster’s core are critical supporting industries like venture capital and internet service providers, as well as several strong related industries like the financial services, chemicals and biopharma clusters (see discussion on diamond for more information on the links with related industries).

The Irish ICT cluster benefits from an abundance of institutions for collaboration and dedicated government agencies. Because of the size and fragmentation of the cluster, institutions for collaboration and government agencies play a critical role in driving its competitiveness. As discussed above, IDA has been at

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17 Interview with Kevin Elliott, IDA VP and ICT Executive. April 7, 2010. Teleconference from Cambridge, MA.
the center of the cluster’s growth for year through its work attracting foreign direct investment, sustaining ongoing investment from MNCs already in Ireland, and working with them to move their activities in the country up the value chain. Enterprise Ireland, a spinoff of IDA designed to promote domestic firms, has been less successful overall, but has played a role in the growth of local software SMEs.

Other institutions have played critical roles as well. ICT Ireland, the central forum for the industry, runs a yearly process to determine key policy areas that would enhance the cluster’s competitiveness, then coordinates the industry and works with the government to enact these changes. It has had several successes over the years, including a recent change (early 2010) in the credit value of high school math and science courses to make it easier for students to specialize in those areas in university. On the skill-building and human capital front, ICT Ireland runs Skillnet, a network of companies that cooperate with Ireland’s institutes of technology and universities to develop courses relevant to their specific business needs.\textsuperscript{18}

\textsuperscript{18} Information on ICT Ireland from ICT Ireland website (www.ictireland.ie) and interview with Paul Sweetman, Director of ICT Ireland. April 8, 2010. Teleconference from Cambridge, MA.
Figure 14: Ireland ICTCluster Map

GOVERNMENT & INSTITUTIONS FOR COLLABORATION

IT Industry Associations
General Industry Associations
Economic Dev. Initiatives

University Initiatives
Informal Networks
Joint Research Initiatives

UPSTREAM

Human capital development
Marketing and PR
Finance
Logistics
Network infrastructure
Market intelligence
Technology standards

HARDWARE

Manufacturing
Assembly
Distribution

DIGITAL CONTENT/PLATFORMS

Content Generation
Translation & Localization

IT SERVICES

Customer Support
Consulting
Service and Maintenance

SOFTWARE

Research
Development
Localization
Packaging & Distribution

RELATED INDUSTRIES & CLUSTERS

ISPs
Education & training institutions
Tech incubators

Legal/IP protection
Venture Capital

SUPPORTING INDUSTRIES

ISPs
Legal/IP protection

Figure 15: ICT Cluster - IFCs and Gov't Agencies

Source: ICT industry publications, interviews, team analysis

ITC Industry Associations

• ICT Ireland
• Irish Software Association
• Regional IT Associations (e.g.: ITAG, Shannonsoft)

General Industry Associations

• Irish Business and Employers Confederation (IBEC)
• Forfás

Economic Development Initiatives

• Industrial Development Agency (IDA)
• Enterprise Ireland
• National Training & Employment Authority

Informal Networks

• Company alumni groups
• Venture capital community
• University alumni groups

Joint Research Initiatives

• Science Foundation Ireland

University Initiatives

• Technology Transfer Initiative (UCC and NUIG)
Since 2000, another institution, Science Foundation Ireland, has played a major role in the development of ICT cluster’s competitiveness. SFI has invested hundreds of millions of Euros to improve Ireland’s research capabilities. Over the last decade SFI has worked with Ireland’s universities to develop research centers, such as the Lero center for software engineering research at Limerick University and the Center for Next Generation Localisation. Critically, it has focused on strategic clusters like ICT and biopharma, and the many of the resulting centers collaborate with industry to develop highly relevant world class capabilities. The result has been a number of world-class SFI-funded research centers that focus on specific niches attractive to companies with significant operations in the country, like Intel and IBM. It is worth noting, however, that while these efforts to grow research activity in Ireland are beginning to gain traction, the ICT cluster overall has not reached the reliance on research and development of its counterparts in Silicon Valley or Route 128.

C3.2. ICT Cluster Diamond Overview

The Irish ICT Cluster has a strong business environment that has enabled it to compete:

Information on SFI from SFI website (http://www.sfi.ie/index/) and interview with Alex Ingle, Strategy, Development and Innovation Manager for IBM Ireland. April 29, 2010. Teleconference from Cambridge, MA.
C3.3. Factor Conditions

Ireland has thirteen institutes of technology covering the entire country, alongside nine universities. As discussed above, these education institutions have worked closely with government and the private sector to develop high quality courses in the areas of science and technology. They produce graduates with highly relevant skills for the development, high-end manufacturing, localization and service activities (among others) that ICT firms perform in Ireland. Further, as firms in the cluster have specialized over time, Ireland has developed world-class capabilities in specific niches within ICT, like software localization and unified communications. A third key positive derives from Ireland’s membership in the EU. Ireland has maintained an extremely open immigration policy, allowing flexible inward migration from other member states (including newer Eastern European members). The result is that Ireland has access to a multi-lingual labor force capable of serving all of Europe. Where once its advantage stemmed from being an English speaking country that could serve the US and the UK, today it is the cluster’s ability to cover Europe that matters most.

Ireland’s ICT cluster faces several challenges on factor conditions. Labor costs rose rapidly during the 2000s, outpacing productivity, and while the crisis of 2008 has lowered them somewhat, the cluster is no longer competitive at basic manufacturing and assembly or other activities that don’t require advanced skills. In part this reflects a long-term challenge: Ireland doesn’t graduate enough computer scientists and engineers to fuel the ongoing, rapid growth of the cluster. Indeed, during the 2000s the share of students in relevant courses declined: in 2005, only 4.1% of university graduates were in computing, down from a high of 9.3% in 2001 (OECD 2010). While the availability of talent from other EU countries mitigates the impact on MNCs like Google and IBM, local firms cannot easily find and recruit talent beyond Irish borders.

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20 Interview with Kevin Elliott.
21 Interview with Kevin Elliott.
22 This point was made repeatedly by our interviewees, like Paul Sweetman, Director of ICT Ireland, Kevin Elliott, IDA VP and ICT Executive and Paddy Meany, COO of FINEOS (March 12, 2010. Teleconference from Cambridge, MA.)
Separately, Ireland’s poor infrastructure, both in terms of logistics, where it ranked 46 of 133 in 2009, and telephone and broadband, are a drag on the competitiveness of the ICT cluster.

C3.4. Context for Firm Strategy and Rivalry

With over 5100 firms, domestic rivalry in the ICT cluster is fierce. It is particularly strong in application software and IT services, the most fragmented segments and the ones where local firms play a major role (According to ICT Ireland [2010] there are over 660 domestic software firms). The presence of world leaders with significant activities in Ireland – like Google with its European HQ, Intel with its largest fabs outside the US, and IBM with major software development operations – further strengthen the quality of competition in the cluster.

On the other hand, while the cluster leads Ireland in R&D expenditure (According to ICT Ireland [2007] over 50% of 2006 business R&D spend was in software, computer related products, electric or electronic equipment), firms have struggled to commercialize their innovation. Research activities haven’t reached potential, and even successful research performed in Ireland is often turned into marketable products or services, and rolled out, from other locations23. Additionally, few local firms actually reach the necessary scale to compete internationally.

C3.5. Related and Supporting Industries

The Irish ICT cluster benefits from a developed venture capital industry that can provide funding for startups and early stage growth (as noted above, later stage growth to scale has eluded most domestic players). A strong biopharma cluster has helped place R&D policies in the center of the national agenda and creates greater demand for science and technology courses and capabilities at educational institutions. Similarly, a strong financial services cluster provides access to capital and credit, and generates sophisticated demand (see below).

23 Interview with Kevin Elliott.
On the other hand, the linkages between MNCs and local firms, which could facilitate technology transfer and other improvements, are limited. This is not to say that the presence of MNCs doesn’t positively impact local firms; after all, the MNCs have created a talented pool of employees and executives who start or join domestic firms. However, their value chains tend to be integrated with corporate parents and other divisions outside of Ireland, and their main downstream interactions are with customers in export markets (Van Winden et al. 2003).

C3.6. Demand Conditions

Demand conditions are the weakest corner of the Irish ICT cluster diamond, but they are improving. There is increasing demand from sophisticated buyers for specialized software and services. For example, the financial services cluster increasingly demands more customized solutions, which in turn require companies in the cluster to develop greater capabilities for integrating both product development and client industry expertise[^24]. This said, firms in the cluster continue to rely primarily on remote foreign demand for their products and services.

C4. ICT Ireland’s Changing Value Proposition[^25]

Over time, the value proposition of Ireland for ICT firms has changed significantly. During the early years of the cluster, in the 1980s, Ireland was a country with low cost, English-speaking, basic labor. One factor was present then as it is now: Ireland’s low tax (10% before 2003, 12.5% since). The combination of low cost labor and a favorable tax regime made Ireland attractive for manufacturing, assembly, packaging and shipping and other such low-skill activities in the value chain.

During the 1990s this positioning changed. First, Intel’s investment in an enormous fab in 1990 proved that Ireland had a workforce skilled enough for high end manufacturing. Soon afterwards, the

[^25]: These reflect conversations with several interviewees, including Kevin Elliott of IDA, Alex Ingle of IBM Ireland, Paddy Meany of FINEOS, and Paul Sweetman of ICT Ireland (see prior citations).
Maastricht Treaty opened up the European Common Market in 1992. The growing ICT cluster became a low-tax location for centralized European operations with low-cost, relatively skilled labor.

During the 2000s, up until today, the Irish ICT cluster once again offers a different value proposition. Two critical factors remain: access to European markets and the favorable tax regime. On the other hand, cost is no longer an advantage, but the cluster has developed a pool of highly skilled labor, especially in specialized areas. One final characteristic of the cluster is the flexibility and responsiveness of policy – Firms perceive that they can influence regulations and policies to improve the cluster’s competitiveness. In short, today firms invest in the Irish ICT cluster because it is a low-tax location for their European operations with a highly skilled labor force and responsive government.

C5. A New Integrated Value Proposition

The Irish ICT Cluster has come a long way since its beginning as a stage for low-cost, low-skill manufacturing. It has the potential to evolve further, from a high-skill, low tax environment for development and manufacturing towards a world-class innovation cluster for ICT companies as it overcomes its challenges. To do so, it must continue to develop and expand its skilled labor pool, particularly in industry-relevant niches, strengthen domestic players, improve its infrastructure and – especially – improve its capability at R&D and commercializing innovation. On the way, the Irish ICT cluster should not lose the advantages that make it competitive: a multi-lingual labor pool, unfettered access to Europe, a friendly fiscal regime, and top-notch government responsiveness. Irish ICT should remain highly competitive as a cluster focused on research and development in specific areas (e.g.: localization, industry vertical solutions) with a sustainable low-tax environment, a highly skilled, multi-lingual labor force, and free access to Europe and the United States.

C5. Recommendations: Building a Stronger Cluster, and a Stronger Ireland
Ireland’s ICT cluster is highly competitive, with strong rivalry, skilled workers and world-class firms. Its current challenges – particularly input shortfalls and weak inter-firm context – are closely tied to Ireland’s larger struggle to transition its economy from investment-driven to innovation-driven. ICT firms and IFCs must now play a leading role in this complex transition by building consensus around national and regional strategies to address labor shortfalls, working with public and private partners to develop more effective policies to commercialize innovation and nurturing stronger related and supporting clusters via Irish entrepreneurship.

*Continue to develop and expand Ireland’s ICT labor pool* by increase the supply of computer scientists and engineers via targeted scholarships for high performing students to enter computer science and engineering degrees. Use ICT in the classroom initiatives to promote related skills and courses from primary education on. ‘Upskill’ job training programs by working with institutes of technology and universities to design and provide IT courses tailored to specific sectors.

*Promote the inward migration of skilled labor* by strengthening relations with other European employment authorities to market positions through the continent. Increase collaboration between IFCs, universities, placement agencies (e.g. CPL) and government to attract high-skilled foreign students to study and develop research in Ireland.

*Improve firms’ ability and tendency to commercialize innovation* by adjusting the R&D tax credit policy so that credit accrues to the local affiliate – rather than the multinational corporation – and provide incentives for commercializing innovation out of Ireland. Focus IDA and other agencies’ promotion efforts on areas where Ireland has built a world-class specialized skill pool – e.g.: software localization and unified communications (getting different IT systems to “talk” to each other). And work with universities and institutes of technology to improve licensing of research to entrepreneurs by strengthening licensing offices.
Address Weak Broadband Infrastructure by expanding the Metropolitan Area Network initiative to cover a greater percentage of Ireland’s towns (currently only 27 metro areas are covered). Encourage the Competition Authority to pay special attention to potential ISP antitrust violations.

Scale up domestic entrepreneurs to compete internationally by ensuring Irish businesses have access to similar factor conditions to foreign investors where possible. Currently, policies favoring MNCs allow the larger corporations to crowd local players out of broadband and energy markets. Finally, support serial entrepreneurs who have already successfully sold startups to help them “swing for the fences” in later ventures.
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