December 2003

# Strategically Planning IT: Institutional Influences Shaping a Software Sector

Ciara Heavin
*University College of Cork*

Brian Fitzgerald
*University of Limerick*

# Strategically Planning IT: Institutional Influences Shaping a Software Sector

**Ciara Heavin**
University College Cork
**c.heavin@ucc.ie**

**Brian Fitzgerald**
Frederick A. Krehbiel II Chair in Innovation
in Global Business and Technology
University of Limerick
**Brian.Fitzgerald@ul.ie**

## Abstract

*According to the Organization of Economic Cooperation and Development (OECD) Information Technology Outlook 2000, Ireland is the largest exporter of software goods in the world (IDA, 2002). Since the industrialisation policy was introduced in 1968, Ireland has moved from agriculture towards a technology-based industry. While some may argue this was fortuitous, it appears that the Irish government's efforts to industrialise the country has led to significant software developments. The author proposes a conceptual framework of factors that identify the key facets of government involvement that influence this software growth. This study investigates the extent to which institutional influence has contributed to the growth and development of Ireland's software industry. As a result, it seems that considerable government involvement in industrial development in the late 1960s became far more focused on software in the early 1990s, as Ireland began to emerge as a post-industrial society. In order to identify this governmental impact on the software sector, the author has identified four countries that have experienced significant IT industry growth, highlighting the varying levels of government intervention in each country and indicating the importance of national involvement in IT industry development.*

**Keywords:** Ireland's software industry, institutional influence and national factors

## Introduction

Smaller countries suffer from economic disadvantage, but with the recent rapid development of IT sectors, a country that is both small geographically as well as demographically may facilitate increased per capita levels of IT infrastructure built and used within that country (Dedrick *et al*., 1995). With a population of under 4 million and producing software sales worth  10,150 billion,  8,500 billion of which is software exports indicates that Ireland's software industry has experienced significant success in producing and exporting software (IDA, 2002). Ireland's emergence as an economic 'Celtic Tiger' has evolved as a result of Ireland's openness to the global market and to increased overseas investment. This rapid economic growth has enhanced employment levels and maintained low inflation rates (O'Riain, 1997). Currently, Ireland's software sector employs 30,000 people in both indigenous and multinational operations and the industry's employment rate has increased by twenty per cent over the last five years (National Informatics Directorate, 2002). The software industry is a major contributor to the Irish economy, it is important to identify the extent of institutional involvement in how government policy and strategy has shaped the growth of the sector and how it continues to do so for future industry development.

## Empirical Examples of Institutional Influences on IT Industries in Four Small Developed Countries

The four country-level, mini-cases considered in the following section detail the extent to which institutional influences have shaped the growth of IT sectors worldwide. The countries under consideration include Finland, Israel, New Zealand and

Singapore, while their location, culture and IT focus differ significantly; government intervention is identified as a key catalyst in the growth and development of their IT industries in each case.

## *Finland*

One of the poorer Nordic countries, Finland now has one of the highest per-capita consumptions of IT in the world (Dedrick *et al.*, 1995). Remarkably, Finland and Ireland are the only two countries in Europe that boast positive trading balances for IT products and services (Watson, 2000, Lyytinen and Goodman, 1999). Finland's government has played an active role in the evolution of the IT industry and its progression as an economic sector. For example, the Finnish government promotes IT positively; the Information Technology Advisory Board met from 1976 and until 1991, its objective was to advocate a "national information society" strategy (Watson, 2000). Additionally, the government contributed to the establishment of Technopolis, the world's most northern science park, home to the leading telecommunications and electronic firms in the industry including over 100 technology focused organisations (Edmondson, 1995). Considering government involvement in the education system, each year, Finnish universities produce approximately 600 IT graduates and while the polytechnics produce over 2000 computing and engineering graduates. The Finnish government recognises the demand for trained IT professionals, and IT-related courses have been expanded over the last few years to produce five times more IT than law graduates (ITAG, 1999).

## *Israel*

In 1948, the Israeli military developed a branch of the defense forces called the Science Corps. This division developed new arms, electronics and technology at a rapid pace. Since then, Israel has established its high technology industry with a particular focus on software (Cohen, 2001). Between 1984 and 1992, Israel's software industry tripled; its software sales and increased and its exports by 2700 per cent (Ariav and Goodman, 1996). By 1992, 150 indigenous software companies were set up, with sales of over $600 million, employing approximately 5,500 of the 12,000 computer professionals in the country. Ariav and Goodman (1996) comment on Israel's positive attitude to IT adoption and development viewing it as the way *"to maintain a qualitative edge in the light of numerical inferiority"*. In Israel, the IT sales industry accounts for $4.15bn in revenue, amounting to 6 per cent of the country's GDP (Ein-Dor *et al.*, 1997). The Israeli government's policy in the IT industry has been remarkably inconsistent over the last number of years (Ein-Dor *et al.*, 1997). While Research and Development support has never faltered, the software industry has been placed into the forefront of government policy. The Israeli government realise the high value of software and intend to exploit its worth. While the IT industry continues to create revenue in the Israeli economy, the education bodies maintain a substantial level of IT related graduates. This strict regime means that Israel boasts the highest percentage of engineers in the world, with 27.4 scientists and engineers per 10,000 population (Ein-Dor *et al.*, 1997).

## *New Zealand*

Historically an agrarian economy, New Zealand that has grown since the development of refrigerated ships in the late 1880s. In the 1980s, New Zealand's government has introduced a number of deregulated policies restructuring the economy into a more industry and technology based one (Watson, 2000). Although New Zealand has achieved considerable success in the area of IT, it is evident that agriculture is still a major part of New Zealand's economy. New Zealand's IT sales revenue amounting to 4 per cent of GDP significantly less than that of Finland, the country fears that they will lose out to more technically developed countries such as Ireland, Finland, Australia and the US, if a greater effort to adapt and develop a solid information based industry is not made (Watson, 2000). New Zealand's government show conservative support for their growing information sector, alternatively pursuing a non-interventionist policy with respect to all industry development. New Zealand takes a broad approach to government policy. The *"Asia 2000 Strategy"* aims to place New Zealand's exporters in the top position within the Asian market (Ein-Dor *et al.*, 1997; Myers, 1996). With the restraint shown in government support and finance the adoption of IT in New Zealand may be severely curtailed.

## *Singapore*

Singapore's IT industry has emerged as a significant IT force, providing low-cost assembly and manufacturing location for multinational operations. In recent years, Japanese multinationals have established considerable research and development centers in Singapore and indigenous IT companies concentrate their efforts on R&D to such an extent that two of them have almost an

80 per cent share of the world market for PC sound cards (Ein-Dor *et al.*, 1997 and Dedrick *et al.*, 1995). Singapore's IT sales make up 3.8 per cent of their GDP (Ein-Dor *et al.*, 1997). As a result, Singapore's higher-end IT production has continued to grow reaching $10.9 billion in 1993 (Dedrick *et al.*, 1995). Singapore has enjoyed the powerful effects of government promotion of IT in both the public and private sectors since 1981. Singapore's government intervened to attract multinational companies to the country (much like Ireland's industrialisation by invitation (Trauth, 1999)) creating a climate for the development of a domestic IT industry and the extensive application of IT in all sectors. During the mid 1990s Singapore boasted the largest production of IT and the second largest investor in IT among all the small countries (Dedrick *et al.*, 1995). Table 1 illustrates the historical IT industry growth in four small countries across the globe, including Scandinavia, the Middle East, and the Pacific Rim. Table 1 identifies statistical data captured at varying cycles of IT development in the global economy.

**Table 1 Comparison of IT Industries in Four Small Countries**

|  | Finland | Israel | New Zealand | Singapore |
|---|---|---|---|---|
| **Demographics** |  |  |  |  |
| Population (million) | 5.0 | 4.9 | 3.4 | 2.8 |
| Country Size (km²) | 338,145 | 21,950 | 267,800 | 621 |
| Language | Finnish, English widely used | Hebrew, Arabic, English widely used | English, Maori | Chinese, Tamil, Malay, English |
| **IT Industry Development** |  |  |  |  |
| IT Sales/GDP | 9% | 6% | 4.1% | 3.8% |
| **S/W Exports** |  |  |  |  |
| Year | 1998 | 1990 | 1998 | 1990 |
| US$ million | 488 | 79 | 123 | 89 |
| Growth Rate | - | 39% | - | 43% |
| **Education and Training** |  |  |  |  |
| S/W Graduates p.a. | 2,000 | 4,700 | - | 4,000 |
| S/W Professionals per 1,000 people | 6.94 | 7.54 | 7.21 | 4.11 |
| **Telecommunication** |  |  |  |  |
| Phone lines per 1,000 people | 542 | 343 | 439 | 365 |
| **Level of Government Intervention** | High level Intervention | Inconsistent (High-low) | Non-interventionist Policy | Industrialised by invitation |

Evidently, Finland, New Zealand, Singapore and Israel have all enjoyed varying levels of IT growth and development in recent years, clearly, each of these countries have responded to different levels of government intervention. There may be a weakness in some of the statistics in this table as the level of data in IT related areas is quite poor. The Organization of Economic Cooperation and Development (OECD) tell us that, *"IT statistics remain a new and challenging area at work…available data is very scattered and generally inadequate".* It is the authors' intent to evaluate the extent to which Ireland's software sector has been shaped by government policy, identifying the importance of this intervention and its significance in the future development of the sector.

## Developing a Conceptual Framework

The conceptual model used in this study is derived from well-known research: (a) Institutions Influencing IT Innovation (King *et al.*, 1994), (b) Factors Affecting IT Industry Success (Ein-Dor *et al.,* 1997), (c) A Strategy for Software Success in Developing Countries (Heeks, 1999) and (d) The Influence-Impact Model of Society-Technology Interaction (Trauth, 2000). This integrated model identifies institutional factors influencing the development of an IT industry (Figure 1). Ein-Dor *et al.*, (1997) identifies

two headings, endogenous and exogenous factors as contributors to IT development, factors that may and may not be controlled respectively. In this study, the author takes a similar approach splitting the key drivers into external institutional factors and the institution. External institutional factors have been identified as contributors to the development of an industry. These factors include culture (such as languages spoken, workforce literacy, religion and attitude to education) and demographic[1] factors (such as population, geographic location, access to natural resources). While not extensively explored in this study, Ein-Dor et al. (1997) identifies these factors as indirectly influences to IT success, they offer an insight into the environment in which Ireland's software sector emerged.

In contrast, the institutional factors, in particular, government policy, have been identified as having a significant impact on the development of technology sector (Ein-Dor et al., 1997, p85); it is this aspect of the model on which this research focuses. *"Differences in the policies of governments seem to be major explanatory factors in differences in IT industry development"*. Additionally, Weiss (1988:284) states that the responsibilities for industrial development should rest at a national level. Heeks' (1999) model of IT industry success identifies -- national strategy -- as an essential component for the development of a software industry. King *et al.* (1994) suggest a framework emphasizing a number of institutional facets that influence IT innovation. The author has drawn on these suggestions to develop a range of key institutional influences focusing on the emergence of Ireland's software sector; they include finance, education, and training. The author recognises that each of these key aspects are directly related to and influenced by government policy and national strategy. Trauth's (2000) study of Ireland's Information Society considers the evolvement of Ireland as an agriculturally dependent country to a developing post-industrial economy and the changes that this emergence has brought about. Trauth primarily considers socio-cultural factors that have been influenced by Ireland's shift from an agrarian to information-based economy. Trauth accounts for the extent of government involvement in shaping the transition to an information society considering the policy of industrialization by invitation in the 1960s up to the government's intervention in shaping the growth of Ireland's Software Industry during the 1990s. The author has gained insight into the cultural effect of the information economy on Irish society.
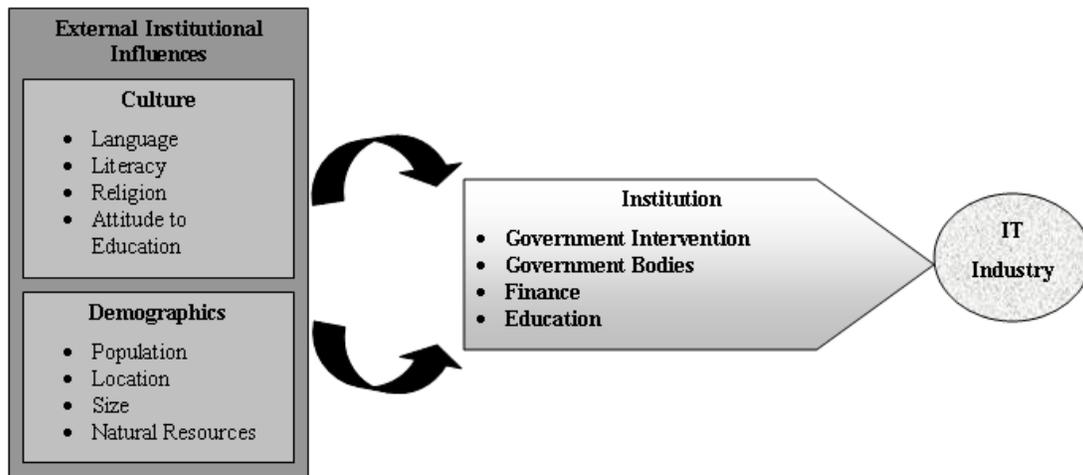


Figure 1 Institutional Factors influencing IT Industry Development

## Research Approach

The aim of this study is to identify the extent to which the Irish government contributed to the development of the software sector. Given the qualitative, exploratory nature of this research, a country-level case study of Ireland's Software Industry was employed as the most fitting research approach. This strategy reflects Trauth's (2001) study of Ireland's Information Society, where she pursued policy analysis using an interpretive approach to qualitative research methods in theory development. This marks a transition from the typical statistical positivist type IS industry research studies to an increasingly qualitative approach to research

---

[1]The term demographics has both a narrow definition as having to do with the statistics of population, and also a broad definition concerning the general condition of life in a community. In this instance, we use the broad sense of the word.

at this level of analysis. Fifteen interviewees were selected based upon their level of involvement with the software industry. A number of advantages have been identified in the use of elite interviews for qualitative research, *"Valuable information can be gained from these respondents because of the positions they hold in social, political, financial or administrative realms"* (Marshall and Rossman, 1989). In order to investigate Ireland's Software Industry it was necessary to identify a sample of perspective interviewees who were able to offer insight into the history of the industry, the public policies that have effected its development and future plans that may be undertaken. In order to investigate the role that these institutional factors have played in the emergence of Ireland's software industry, a two-phased study of the Irish software industry was conducted. Initial data collection and analysis focused on document analysis of government documents, research papers and reports by the National Software Directorate and the Industrial Development Authority (IDA). This was used to inform the development of an interview guide that was developed in conjunction with the conceptual framework presented in Figure1. Interviews with fifteen respondents from academe, industry and the government were carried out between March and May, 2002, each interview was taped and approximately one hour in duration. With regard to this study, the researcher has benefited by the use of coding techniques drawn from the conceptual framework. This model (Figure 1) identifies the external and internal institutional factors influencing the growth of a software industry. From this, the researcher derives eight code labels from the framework and assigns them to chunks of categories of data derived from the interview tapes. Interviewees were selected based upon their level of involvement with the software industry. Five of the interviewees represent academe, four represent government and six represent the software industry. In total, these interviewees offered insights into the history of the industry, the public policies that have affected its development, and future plans that may be undertaken. The interviewees have been represented in this study with the use of aliases to protect their privacy and opinions.

## Ireland's software growth through institutional intervention

Institutional factors are *"ubiquitous and essential components"* that lead to the understanding and explanation of IT innovations (King et al., 1994). It is necessary to evaluate the institutional impact on the growth of Ireland's software industry considering the fifteen interviewees' opinions and insights into government strategy, industry financing, support from government sponsored bodies and educational change as contributors to the growth of Ireland's software sector.

### *Government Involvement: Proactive or Reactive*

There are conflicting views concerning the institutional involvement in the development of Ireland's software industry. While the government undertook the policy of industrialization by invitation at the close of the 1950s, there is no clear evidence to support the deliberate strategy of intent for the cultivation of a software industry. From the interviews, the authors uncovered a wide spectrum of opinion with regard to government strategy for the development of a software industry in Ireland. There are champions for the government's efforts and others who felt that the government's strategic attempt to develop a software industry occurred by chance. One academic in the IS field states that, the government's steps in the late 60s and 70s were not deliberate.

> "The government didn't see software as a strategic area, not in any targeted fashion."

He strongly commends the individuals at that time studying maths, physics and engineering. He believes it was those people who carved a software industry for themselves, these people had the foresight and ability to make something of software.

> "Software grew from the grassroots up."

It has been suggested the government's policies were not deliberate in the early days but the government saw the general need to improve the economic situation in Ireland, this included changing the education system. At the time, literacy rates were extremely low and many failed to complete second level education. One interviewee from the National Informatics Directorate agrees with this view, he believes the development of the industry had no clear strategy but there were individuals who wanted to take a risk on technology.

> "It was really down to individuals with ideas and the nerve to pursue the idea and no amount of intervention or government agencies can produce that" (Sean, National Informatics Directorate).

While the extent of the foresight for the software industry wasn't there, there was a growing confidence that there was a future in IT.

> "It was always believed that computers had a great future, people didn't exactly see where the future lay" (John, former Computer Science Lecturer).

## *Formal Government Strategy*

In contrast, a number of interviewees support the government's deliberate strategy towards developing a software sector. Paul (Software CEO) is a champion of the institution's efforts. In his opinion, the evolvement of the software industry featured in government strategy at an early stage. One Israeli IS academic interviewed supports the government's industrialization by invitation policy as Ireland's "special factor" contributing to the development of the software industry. Software industry growth may stem from a factor that is unpredictable, earmarking this unknown factor as the source of technological development in other countries. He identifies Nokia's significant growth in Finland as a "special factor", while Israel's defense forces have driven the Israeli IT industry through R&D development. Trauth (2000) recognizes the "visible hand" that has guided Ireland's economic progression.

> "Ireland has achieved this economic transition by employing a comprehensive industrial policy framework to guide societal, industry and government behaviour" (Trauth, 2000).

## *Incentives for Industrial Development*

The respondents commend the government's actions in developing a potentially flourishing industry during the early eighties. Through their policy of industrialization by invitation the government offered a fifteen-year full tax exemption for companies that chose to locate in Ireland. This altered in 1981, when the government offered a corporate tax rate of 10 per cent and additional grants to export focused companies until 2010. In the same year the International Services Program was established marking a shift from the old Industrial Development Authority, whose focus was predominantly manufacturing – plant and machinery, capital investment to a  new program focusing at service industries such as software.

> "This shifted the emphasis for supporting capital investment to supporting investment in people" (Sean, National Informatics Directorate).

The Industrial Development Authority (IDA) introduced the employment grant during the early eighties; this meant that a company employing a certain number of people would receive a lump sum per employee. This motivator acted as yet another incentive to multinational investment in Ireland.  The fact that the Irish wage rate was among the lowest in Europe acted as a driver for foreign investment. When the global economy experienced an economic downturn during the eighties, Paul (Software CEO), remarks how the Irish economy was no different. He states that the IDA was extremely proactive in their thinking and commends them on attracting a number of electronics based companies to the country. These companies were primarily American who had advanced in the utility of PC based applications, creating additional knowledge within the industry by bringing computers to the factory floor. These companies extended the software industry early on by using desktop applications in day to day running of the manufacturing plant, although they were not inherently software companies.

> "All of a sudden we had the applications that were readily understood, the desktop was no longer a mystery and you had a growing demand of industrialization in Ireland" (Paul, Software CEO).

Accordingly, the market opened to companies that could provide more specialized computer application services.

## *Government Bodies*

The Irish government unlike most other countries has provided a significant support structure for the software industry. The author contemplates the objectives of these groups and how they have contributed to the establishment of the software sector. The National Software Directorate (NSD) was set up in 1991 and was renamed the National Informatics Directorate (NID) in 2001. It was established to provide coordinating services to the industry. The National Software Directorate is responsible for the software Programmes for Advanced Technology (PAT). According to the National Software Directorate (1992), the aim of the software PAT was to align the industry with education, create niches in the software market and to create revenue from relevant research in the area of software technology. Additionally, the Centre for Software Engineering was set up in 1991 as a support

service for the software development community within Ireland. The aim of the centre is to help companies in Ireland to improve its quality and productivity and to implement software engineering best practice by offering advice on company strategy and providing training. The Strategic Business Group (SBG) has been set up within the IDA; part of their objective is to consider developing a new niche software position for Ireland. One government-based interviewee who works for the unit identified the fact that Ireland can no longer plug the young educated population as our main edge for competitive advantage. Countries such as India and Israel boast of the same young educated graduates and this factor no longer gives Ireland the edge that has been enjoyed up to now.

### Finance: Venture Capital

One of the most limiting and contentious factors with regard to the development of an indigenous software company in Ireland is that of funding. While many have developed solid business plans and quality products, the availability of venture capital has been problematic from the early days of the industry.

> "The lack of available finance is proving to be a real barrier to growth and is the single greatest problem facing high-tech industries today" (National Software Directorate, 1992).

The National Software Directorate established a state sponsored venture capital fund in 1996 called the ICC Venture Capital Fund. It comprised 50 per cent state money, which was European funded money and the other half was investments acquired from a number of private sources. One software entrepreneur interviewed commented on the government's conservative view of venture capital. Government sponsored investment was not aligned with the same view of risk as the NSD had hoped. While the National Software Directorate was extremely confident in the future of software, the state venture capital bodies such as ICC were conservative in their financial support for software producing companies. The fund has grown considerably; ironically when this fund became operational in 1996 other venture capital funds appeared. The mystery surrounding the industry disappeared and investors were more confident backing software knowing that the government was investing heavily in it. Entrepreneurial culture began to change; entrepreneurs were no longer "hustlers", people setting up small firms gained confidence in a new and exciting industry. Venture capital is no longer the issue it was, especially for a software company that is already up and running and seeking to expand their operation. In 1999, indigenous venture capital was 90 per cent of internal investment and external investment almost negligible, while in 2001 indigenous investment had dropped to 30 per cent and external investment has significantly improved to 70 per cent. Undoubtedly, the availability of venture capital for software funding has acted as a significant enabler for the industry. While investment is increasingly obtainable, without a solid business plan and a quality product with a potential market, investment remains difficult to acquire.

### The Government and the Education System

Ireland's education system has acted as a pivotal contributor to the development of the software sector, it has emerged as an undisputable factor contributing to the growth of the industry. Since secondary education was made freely available under state legislation in 1967, a culture has developed in Ireland where the expected standard and quality of graduates each year remains increasingly high. One academic respondent earmarks the availability of free secondary education as a turning point in the industry's development. In agreement, Sean (National Informatics Directorate) comments that the education system has played a definite role in the development of the software industry. While the education system was not set up with the development of a software industry in mind, there was definitely a bias toward the more technical areas from the outset. Early on, it may not have been a deliberate strategy on the government's behalf; the institutions have supported the technical courses and pushed the government in the direction of technology. Trauth (2000) considers Ireland's move in education. *"In the 1970s and 1980s, two new universities were established and the traditional universities were adapted to incorporate business and IT skills in their curricula"*. The University of Limerick was established in 1971 and Dublin City University was set up in 1980. In addition, the Regional Technical Colleges (renamed Institutes of Technology) were opened placing yet another focused step towards technology.

## Discussion

The government's "visible hand" of influence since the 1960s has acted as a major contributor in developing the software sector. While, government involvement in the software industry may have been more accidental than deliberate during the early days

of industrial development in Ireland, the foresight of the government's industrial policy of industrialisation by invitation is commendable in its efforts. Figure 2 identifies the institutional factors both directly and indirectly influencing the growth of Ireland's software sector. External institutional influences such as culture and demographics while not considered direct influences on the development of the software sector have acted as key industry drivers. The slow cultural change since the 1980s has transformed Ireland's attitude to entrepreneurship, risk taking and investment. Although there have been dramatic highs and lows in the industry, in particular the adverse affect of the 'Dot Com' turnaround, a new founded entrepreneurial ethos is derived from Irish Software houses being quoted on the Nasdaq. Companies such as Iona Technologies, Baltimore and Smartforce have given others the confidence to develop software and test the market. With a population under 10 million, Ireland is considered a small country. While population size has been problematic during the heavy industrialization period it is not a disadvantage in the age of the Information Economy. Ireland's location has also acted in its favour, being close to the European market, a member of the European Union and maintaining links with the US market has enabled Ireland to create an international software market. Finally, the institutional input since the early nineties has shaped the way forward for the industry. While a number of interviewees argue the contrary, the author feels that without strategic government focus, the industry may not have reached its true potential on a natural path of development. After carefully analysing the interview content, the interviewees and their respective backgrounds the researcher generalized the key findings, grouping the respondents by their backgrounds, Table 2 summarises the respondent views considered in this research.

**Table 2.  Summary of Interview Responses**

|  | NATIONAL |
|---|---|
| Academic | Evolved-<br>• Government prodded by academia initially.<br>• Adopted deliberate strategy in 1990s. |
| Government | Proactive-<br>• Government's deliberate strategy and foresight in developing Ireland's Software Industry. |
| Industry | Supporting Role-<br>• Primarily Financial |

With the provision of finance and extensive support from the National Informatics Directorate, Enterprise Ireland and the Centre for Software Engineering the industry has enjoyed the expertise, opportunities and strategies derived from this software think tank. The development of the sector has been tangible, according to the National Informatics Directorate (2002), the Irish software industry generated revenue of  2,198 million in 1991 this has increased exponentially to  10,150 million in 2000.
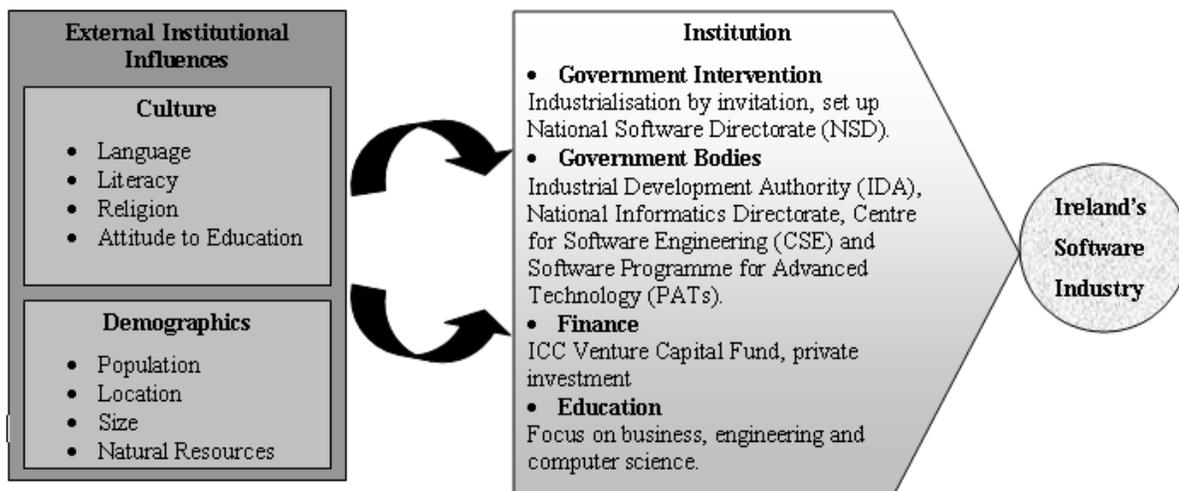


**Figure 2 Institutional Factors influencing Ireland's Software Industry**

# Conclusion

Evidently, the national factor has been identified as playing an influential role in the development of Ireland's Software Industry. The importance of the government's involvement in the development of the industry is clearly supported by Weiss (1988:284) who comments that the responsibilities for industrial development should rest at a national level. In addition, Ein-Dor *et al.* (1997) backs this view noting that the high level of government intervention in the case of Singapore has contributed to the development of their IT industry. While on the other hand, New Zealand's lack of governmental direction for the technology sector has meant that the development of its technology sector has been less rapid. Finally, Trauth (2000) comments that the conscious role played by the Irish government in the development of the software industry has resulted in the successful transition of Ireland as an agricultural state to a technology driven Information Society. While this study uncovers varying views with regard to the institutional impact on the software industry, the researcher acknowledges that the future of Ireland's software sector is grounded in significant institutional support.

## *References*

Ariav, Gad & Goodman, Seymour. (1996). *Israel: Of Swords and Software Plowshares.* Values and Conflicts, 2nd edition, Academic Press, 133-140.

Bagchi, Subroto. (1999). *India's Software Industry: The People Dimension.* IEEE Software May/June, 62-65.

Cohen, Nisso. (2001). The Israel High-Tech Industry – Fifty Years of Excellencem **www.mfa.gov.il/mfa/go.asp?MFAH01vu0**.

Dedrick, Jason L., Goodman, Seymour E., & Kraemer, Kenneth L. (1995). *Little Engines that could: Computing in small energetic countries.* Communications of the ACM, 38(5), 21-26.

Edmondson, Gail. (1995). *Oulu, Finland: In the Cold and Dark, High-Tech Heat.* Business Week.

Ein-Dor, Philip, Myers, Michael D., & Raman, K.S. (1997). *Information Technology in Three Small Developed Countries.* Journal of Management Information Systems, 13(4), 61-89.

Gallen, S. (2001). *"The Development of the Irish Software Industry,"* **www.nsd.ie**.

Grossman, G., and Helpman, E. (1991). *Innovation and Growth in the Global Economy.* Cambridge, MA: MIT Press.

Heeks, Richard B. (1999) *Software Strategies in Developing Countries.* Communications of the ACM, 42(6), 15-20.

Industrial Development Authority (IDA). (2002). *Ireland: Vital Statistics, April.* Dublin: Industrial Development Authority.

ITAG. (1999). *The Knowledge Economy.* Wellington, NZ: August 1999, **www.moc.gvot.nz/pbt/infotech/itag/publications.html**.

King, J.L., Gurbaxani, V., Kraemer, K.L., Raman, K.S, Yap, C.S (1994). *Institutional Factors in Information Technology Innovation, June 1994.* Information Systems Research 5:2, 139-169.

Lyytinen, Kalle & Goodman, Seymour. (1999). *Finland: The Unknown Soldier on the IT front.* Communications of the ACM, 42(3), 13-17.

Marshall, C., Rossman, G., (1989) *Designing Qualitative Research,* Sage Publications Inc., California.

Myers, Michael D. (1996). *Can Kiwis Fly? Computing in Finland.* Communications of the ACM, 39(4), 11-15.

National Informatics Directorate, (2002), **www.nsd.ie**.

National Software Directorate, (1993). The Software Industry: A Directory of Products and Services, Dublin: Industrial Development Authority.

National Software Directorate, (1992). The Software Industry in Ireland: A Strategic Review, Dublin: Industrial Development Authority.

O'Riain, S. (1997). *"The Birth of a Celtic Tiger".* Communications of the ACM, 40(3), 11-16.

Trauth, E.M. (1999)."Leapfrogging the IT Labor Force: Multinational and Indigenous Perspectives," Journal of Global Information Management, 7(2), 22-31.

Trauth, E.M. (2000). *"The Culture of an Information Economy".* Kluwer Academic Publishers.

Watson, Rebecca. (2000). *The Great IT race: New Zealand lags well behind Finland.* University of Auckland Business Review, 2(1), 67-77.

Weiss, J. (1988). *Industry in Developing Countries.* Croom Helm, London.