

15

FACTORS INFLUENCING IRELAND'S SOFTWARE INDUSTRY

Lessons for Economic Development Through IT

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Abstract: Although the Irish software industry has been in existence since the late 1960s, in the last ten years it has become an enormous success story and, by some estimates, is the largest exporter of software in the world. In this study, we derive a conceptual framework with which to investigate the emergence and evolution of the Irish software industry. In this framework endogenous factors – national, enterprise and individual – are examined against a backdrop of exogenous factors to explain Ireland's success in the software industry. Two important themes emerged from the study. One is the shift towards a risk-taking, entrepreneurial spirit in the software sector that had historically been absent in Ireland. The other is the long-standing government policy of intervention in the software sector, which became increasingly more focused throughout the 1990s. The framework and the lessons from the study should prove useful to researching other countries who are seeking to learn lessons from the Irish experience.

Keywords: Ireland's software industry, exogenous factors, endogenous factors, national, enterprise and individual.

1 INTRODUCTION

Ireland's software industry has been hailed in technology circles worldwide since the mid 1990s. It has emerged as a strong contender for multinational sites, along with Israel, India and Eastern Europe. Ireland's software sector employs 30,000 people in both indigenous and multinational operations and creates revenues in excess of €10 billion (Flood et al., 2002).

According to the OECD Information Technology Outlook 2000, Ireland has become the largest exporter of software goods in the world (IDA, 2002).

In the late 1990s Ireland emerged as an economic 'Celtic Tiger'. This has been the result of Ireland's openness to the global market coupled with the presence of heavy investment from multinational organizations. This rapid economic growth has enhanced employment levels and maintained low inflation rates (O'Riain, 1997). But this economic boom did not happen overnight. According to Trauth (2000: p.28), Ireland's development occurred in stages: the shift away from the protectionist policies of the 1950s, followed by recognition of the importance of information technology during the 1970s, and finally the realization of the information economy in the 1990s. Digital Equipment Corporation (DEC) was among the first multinational high tech companies to set up hardware operations in Ireland, doing so in Galway in 1971. While this government policy appeared to be the answer to Ireland's economic problems, O'Riain (1997: p.12) conveys the reality:

"This policy's success is questionable as companies created mainly low-skilled jobs, developed few linkages to the local economy, and often left once their tax breaks ended".

The emergence of the software industry in Ireland as a key component of the economic "Celtic Tiger" parallels the larger journey that Ireland took from an impoverished agrarian society to a significant post-industrial society in the second half of the twentieth century. As documented by Trauth (2000: Chapter 2), this transformation occurred in phases as the economic development vision shifted from industrialization by invitation, to the recognition of economic development through the IT industry, to the creation of a diversified IT sector. A key component that has emerged within this diversified IT sector is the software industry.

After 1973 using Digital as an example, the Industrial Development Authority (IDA) began to attract investment from foreign multinationals to Ireland. Analog Devices, Amdahl and Apple mark the first high profile technology based (hardware) multinationals to open operations in Ireland. These companies produced mostly hardware in the early stages of the high technology industry in the country but this was to change. As IBM took the steps in the early 1970s to unbundle software and hardware costs, it realized that revenue could be generated from software development, something that could be located overseas (Cochran, 2001). Additionally, early indigenous software firms were established. In the late 1980s, key industry players such as Kindle and CBT Systems emerged, supplying products to vertical markets in banking and training. Since then, the Irish Software Industry has grown in

prominence as Irish companies such as Iona Technologies, Baltimore and SmartForce Ltd. have become publicly quoted technical companies on the Nasdaq stock market.

Consistent with Trauth's broader analysis, contextual factors played a pivotal role in the evolution of the software industry in Ireland. Embedded in Ireland's transition from agricultural dependence through its quasi-industrial era of the 1970s, to the development of a software industry in the 1980s and 1990s is the picture of a rapidly changing societal context which facilitated this economic change and has felt its effects. This suggests the need for deeper investigation of this 'success story'. Such an investigation will contribute to a better understanding of the factors that have influenced the emergence of Ireland's software industry and can provide lessons for other countries/regions that wish to achieve a similar goal. Countries or regions that wish to pursue economic development through the creation of a software industry can benefit from a better understanding of the interplay between socio-cultural and policy factors. Ireland, itself, can benefit as well, from a better understanding of the uniquely Irish aspects that can be leveraged to ensure its continued success in this industry.

This paper is structured as follows. First, we present the conceptual framework that was employed in this research. This is followed by a discussion of the research methods, the research findings and the implications of this research.

2 RESEARCH FRAMEWORK

The purpose of this research was to investigate the emergence and evolution of Ireland's software industry since the 1960s and to identify the key contextual factors, which contributed to this growth. In order to do this, we first developed a research framework based on previous research. This framework is comprised of two parts; the exogenous factors that provide the background of societal factors in which the software sector was developed and the endogenous factors on which this study was based.

We drew upon three frameworks in the literature that consider the influence of societal context on IT industry success. These are: Ein-Dor's (1977) factors affecting IT industry success; Heeks' (1999) strategy for software success in developing countries; and Trauth's (2000) influence-impact model of society-technology interaction. The resulting conceptual framework accounts for contextual factors that could contribute to the development of a software industry. Our framework is presented in Figure 1, and its components and derivation are discussed below.

2.1 Exogenous Factors

Exogenous factors are those elements that may not be easily changed and that operate indirectly to influence IT success (Ein-Dor et al., 1997). They include demographic⁴ factors and cultural factors. Demographic factors include a country's population, location, size and available natural resources. In this study we have also categorized culture as an exogenous factor that may contribute to the development or growth of a software industry. The term culture in this case refers to factors such as language, literacy, attitude to education and religion.

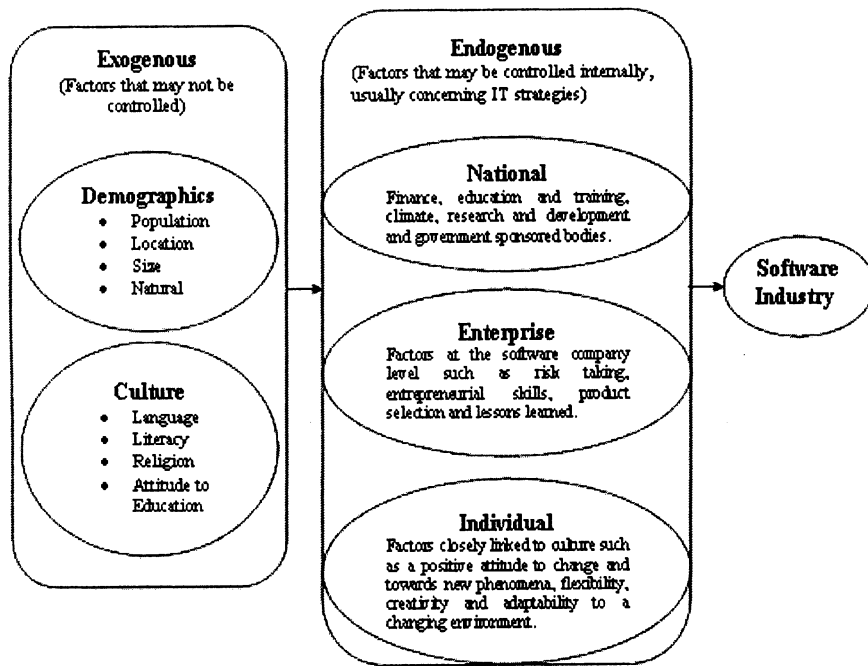


Figure 1. Contextual Factors Influencing the Development of a Software Industry
Adapted from Ein Dor et al. (1997), Heeks (1999), and Trauth (2000)

⁴ The term demographics has both a narrow definition as having to do with the statistics of population, and also a broad definition as having to do with the general condition of life in a community. We use the term in its broader sense here.

According to the latest estimates from the Central Statistics Office, Ireland's population is 3.8 million with 38 per cent of the population under the age of 25 years, giving Ireland one of the youngest populations in Europe (IDA, 2002). Given this population profile, Ireland may be classified as a small economy, similar to Israel, New Zealand and Singapore. Whereas small economies had been considered at a disadvantage, they now are perceived to have the ability to compete with their competitors in high technology sectors disregarding the capacity of their mass markets (Ein-Dor et al., 1997). Two reasons are suggested as an explanation for this. The first is that a change in value creation has occurred. Value is no longer primarily created from industrial production. In the IT sector it is mainly created in analysis and problem solving tasks, identifying a customer's problem and offering solutions to those needs. Secondly, small countries no longer have to consider the issue of geographic location. Vast improvements in telecommunications mean that a manufacturer can carry out research and development in one country and production in another (Ein-Dor et al., 1997). While Ireland's small size may have been problematic during its industrial era, it is not a disadvantage for an 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.

Over the last twenty years Ireland's young well-educated population has acted as a huge incentive for multinational organisations to set up operations here (Trauth, 2000). In fact, Ireland has successfully educated more graduates than could be employed in the domestic sector. Given that almost all other countries worldwide have experienced shortages of engineers and computer science graduates, the surplus in Ireland has provided a unique advantage for the software industry here. Finally, Ireland's limited supply of natural resources has acted as a motivating factor in the development of a software industry.

For the purpose of this study, culture has been identified as an exogenous factor that may not be changed, but it is fair to say that in the long term this may not be true. When considering Irish culture as it relates to the software sector, the language spoken, literacy levels, attitude to education and religion have been found to be important factors (Trauth, 2000). Undoubtedly, the fact that Ireland is an English-speaking country is a major benefit to the software industry, above all with regard to doing business in the lucrative US market. It also has been a highly influential factor in attracting many leading US multinational technology companies to set up in Ireland. The improved literacy skills since the availability of free secondary education in 1968 and the positive attitude to education in Ireland have brought many changes to the country's economic position.

There are different views on the exogenous factor, religion. According to Ein-Dor et al (1997), religion does not directly affect the growth of an IT sector. Trauth (2000: p.197), on the other hand, did see an influence of religion in Ireland. "Religion is woven into the fabric of Irish culture". This factor was not considered in our research.

2.2 Endogenous Factors

Endogenous factors are those that can be developed and controlled and used in strategic IT industry development. National factors play a considerable role in the development of a technological sector. One of these national factors, government policy, has been shown to have a significant influence on the development of a technology sector (Ein-Dor et al., 1997, p85).

"Differences in the policies of governments seem to be major explanatory factors in differences in IT industry development".

Government intervention may aid an industry expansion in areas that might be too difficult to deal with at an enterprise level.

With regard to enterprise factors, while the enterprise strategy and management tactics of software operations in developing countries may be unknown (Heeks, 1999), the evidence suggests that software companies are increasing their focus on choosing a niche product and market in order to avoid competing with Microsoft-type companies. The objective is to move away from the software localisation, software service, and traditional software application industry sectors. For example, in Israel software houses pursue the development of special purpose software such as computer systems management, data compression, encryption, virus detection and correction. They focus on particular product niches that, in turn, create a high level of value for the industry. In New Zealand software companies continue to produce a wide variety of software, yet focus their software domestically. In Australia the focus is on a specific market (Ein-Dor et al., 1997). These examples show that while it is difficult to pin down the various enterprise tactics, the enterprise factor plays a significant role in the development of the software industry.

At the individual level, the endogenous factors are closely linked to the exogenous factors. Trauth (2000) considers the Irish people involved in the information sector, their attitude to work, the quality of their work, the creativity that shapes the success of the sector and the society that surrounds the information economy. Undoubtedly, the individual element is an essential consideration when studying the development of a software

industry. Ultimately, innovation, strategy and motivation are characteristics that act as key individual drivers for industry.

3 RESEARCH DESIGN AND METHODS

In order to investigate the role that these endogenous 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 above. Interviews were chosen as a way of ensuring 'thick description' of the software industry's development since the late 1960s. In this way, firsthand insight was obtained about the facilitators and inhibitors as experienced by a cross-section of those involved in the emergence of the software sector.

Interviews with fifteen respondents from academe, industry and the government were carried out between March and May, 2002. During a taped interview of approximately one hour in duration the respondents discussed the interview questions related to three main endogenous factors: national, enterprise and individual. 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 key 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 pseudonyms to protect their privacy and opinions.

4 RESULTS

4.1 National

4.1.1 Government Intervention

There are conflicting views concerning the government's 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 in the early years.

The academic and industry interviewees support the view that the development of the software industry is reflective of the key players that were involved in the early days. As one academic with considerable industry experience put it: “Software grew from the grassroots up”. The government requested academic proposals with no real focus on software as an industry. During the late 1960s, it seems the government was interested in attracting any type of industry to Ireland, provided it was clean and created employment. While explicit foresight about the software industry was not in evidence, academics were confident in computers as the way forward.

“It was always believed that computers had a great future, people didn’t exactly see where the future lay”. [Pat, Computer Science Lecturer]

Champions of the government’s efforts believe that national policy for developing technology was conceived as far back as the 1960s through the industrialisation by invitation. This policy, then, became more focused as software began to naturally emerge as a potentially flourishing industry. The perception of a long-standing deliberate strategy by the Government for the software industry is not supported by the academic and industry-based interviewees, however. But it is acknowledged that the government’s intervention and support for the industry has been successful over the last ten years. This turnabout in the early nineties is evidenced in the shift in Irish industrial policy in the 1990s as a result of the Culliton Report (National Software Directorate, 1992). The policy moved from a preoccupation with attracting foreign direct investment to the promotion of indigenous firms with a particular focus on software as a potentially flourishing sector in the world economy (Labour Commission, 1996).

4.1.2 Government Agencies

The Irish government has provided a significant support structure for the software industry. One of the many objectives of The National Software Directorate (NSD), set up in 1991, was to align industry with education, thereby creating niches in the software market and creating value from relevant research in the area of software technology. The Centre for Software Engineering (CSE) was also set up in 1991 as a support service for the software development community within Ireland, with the aim of helping companies improve in areas of quality control and productivity by implementing software engineering best practice, offering advice on company strategy and providing training.

Another important initiative has come from the Industrial Development Authority (IDA). The objective of this Government body is to create a dynamic by which Ireland increasingly sets the agenda and attracts other serious players in a small number of niche areas to emerge from clusters of technology based companies. The IDA is currently researching other areas that might create a new competitive advantage for the Irish software industry. In 2002, a Strategic Business Group (SBG) was set up within the (IDA) with the explicit remit of developing a new niche software position for Ireland “distinct from the nation of broad shoulders and smart people” [Andrew], as a government interviewee involved in developing the national software strategy put it.

4.1.3 Finance

One of the most limiting and contentious factors with regard to the development of an indigenous software company in Ireland, is that of funding. Ireland had virtually no venture capital until the 1990s. The National Software Directorate (1992) documented the problem at the time, suggesting that “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”.

The NSD established a state sponsored venture capital fund in 1996. It comprised 50 per cent Government money, with the remaining 50 per cent made up of investments acquired from a number of sources. Ironically when this fund became operational in 1996 other funds also appeared. After twenty years, private investment suddenly increased considerably. In trying to understand this phenomenon, one theory is that the mystery surrounding the software industry had dissipated even as investors were more confident backing software knowing that the government was also investing heavily in it (Keogh, 2000).

Undoubtedly, the availability of venture capital for software funding has acted as a significant enabler for the industry. While investment is more easily obtained, without a solid business plan and a quality product with a potential market, investment remains difficult to acquire.

4.1.4 Education

Ireland's education system has acted as a pivotal contributor to the development of the software industry. It has emerged as an undisputable factor influencing the growth of the industry. Since the availability of free secondary education under state legislation in 1968, a culture has developed in Ireland where the expected standard and quality of graduates each year remains high.

“The education system provided the seeds for the industry to grow”.
[Paul, Software CEO]

One of the key educational contributions to the development of Ireland’s software industry, frequently cited during the course of the interviews, is the Computer Science department at Trinity College Dublin (TCD) and its inspirational head of department, Professor John Byrne. This department initiated the first Masters in Computer Science at Trinity in the late 1960s and had a significant impact on the embryonic software sector. This programme has acted as an incubator for young software companies and has been the origin of many successful software producers such as SoftTech, Mentec and Iona Technologies. These campus-led initiatives are commended by several of the interviewees as incubators for Ireland’s software industry.

Examining the IDA statistics for 2002, it is evident that Ireland continues to improve its education system and it is clear that educational qualifications are valued highly. The number of students entering third level education in Ireland has increased by 25 per cent since 1992. There has as been a 35 per cent increase in the number studying engineering/technology courses. Irish education is considered quite high by international standards. According to the 2001 independent IMD World Competitiveness Report, Ireland boasts the highest public expenditure on education at 13.5 per cent, equaled in Europe only by Portugal (OECD, 2001). These data are consistent with interviewees’ belief that the education system has significantly contributed to the growth of the software industry and on a larger scale the Irish economy as a whole.

4.1.5 The Climate for Development

With the closure of IBM operations in India in 1978, many ex-employees went on to set up their own indigenous software organizations (Heeks, 1996). In Ireland, there is a similar scenario whereby the software industry developed through the presence of multinational software companies. A number of the interviewees believe a turning point for the development of the industry came with the shutting down of a number of multinational operations. For example, while the closure of Digital Equipment Company (DEC) in 1993 may have been seen as disastrous at the time, the closure resulted in a new set of entrepreneurs who could use the software expertise they had developed to go into business for themselves. While there is no clear evidence to document this, Gallen (2001) suggests

that the employees who worked with multinational companies have moved to work at indigenous operations.

“Staff who worked in multinational companies were, at one stage, more likely to have experienced structured approaches to software development, and this would be an asset to a small Irish company.”

4.2 Enterprise

Ireland has historically not been renowned for its entrepreneurial expertise and risk-taking ethos. A number of reasons have been suggested as to why this might be the case. According to Trauth (2000: p.321),

“Ireland did not have a significant economic infrastructure including venture funding...there wasn't economic payback for taking risks”.

There was also a belief among a number of the interviewees that Ireland is severely lacking in entrepreneurial history. This stems from the lack of industrialization experienced by the country up until very recently. It was not the done thing to start a business in Ireland during the 1970s and 1980s. It was considered “common” by the middle classes in Ireland to be involved in entrepreneurial business ventures. One software company founder, captured the essence of this feeling:

“Once upon a time in the early nineties if you were an entrepreneur you were a hustler”. [Donal]

Business failure is not readily accepted in Ireland and there tends to be a widespread feeling that when a business does fail the individuals involved tend not to be trusted to start again. The interviewees agree that Irish software companies need to accept failure before the industry can mature. The US software companies are more mature, and in US society, failure is not viewed entirely negatively, but rather as denoting experience in the industry and the ability to learn in order to succeed the next time. At the same time that business failure is not acceptable in Ireland, business success may also incur a negative reaction. Sometimes people who display initiative are resented for their success:

“People who go out and try to do things are knocked and begrudged for it, they are not complimented for it”. [Donal]

In the early years, software entrepreneurs in Ireland experienced considerable difficulty. That the software industry was poorly understood, contributed to a lack of confident investment.

“There was a mystery about software that would resist any investment by outsiders”. [Dave, Software CEO]

The former Irish Prime Minister, Dr. Garrett Fitzgerald, expressed concern that since Ireland’s culture is not traditionally entrepreneurial not enough people graduating university were prepared to set up in business. As one government based interviewee remarked, the Prime Minister felt that the young educated population lacked initiative and a sense of entrepreneurship. However, since the mid 1990s the opposite seems to be the case and now people are focused on setting up what are known as “High potential startups”.

Irish software companies quoted on the Nasdaq have created increased confidence in the industry. The software entrepreneurs of the early to mid-nineties are credited for their confidence and entrepreneurial expertise that has aided the evolution of the strong software industry that Ireland boasts today. One government interviewee put it:

“It is individual, maybe it’s luck, and maybe it’s genius”. [John]

Entrepreneurial Irish companies seem to have developed a winning formula: pursuing a market niche rather than competing with companies such as Microsoft, combined with the ability to develop a quality product that can be exported profitably. With the contribution of smart, enthusiastic individuals, a number of key companies such as Iona Technologies, SmartForce and Baltimore have emerged to challenge the non-entrepreneurial stereotype.

“It has spurred people on to see their next door neighbours doing all sorts of things, people are pushing themselves to keep up”. [Donal]

The importance of a spirit of entrepreneurship was mentioned by all interviewees. They identified a combination of a well thought out business plan, a quality product with a market, a sensible business model, tight control on company growth and relating employee pay to shareholder wealth as a set of determinants for growing a successful software producing operation.

4.3 Individual

Ireland's technology industry has come a long way since the initial plan for industrialisation by invitation in the late 1950s. Irish culture has influenced this shift away from the land and towards the development of one of the most successful software industries in the world. One respondent with considerable experience in the software sector from both a government and industry perspective commented:

"People wanted to find their crock of gold at the end of the software rainbow". [Barry, Software Entrepreneur]

Multitasking within an organisation has been identified as a predominant feature in smaller software development operations in Ireland. It seems that while other nationalities tend to adhere closely to their job descriptions, the Irish attitude "to get the job done" prevails when problems arise.

"A project won't stop dead if the operating system stops dead, they'll kick start it or something". [Sean, Software CEO]

A number of the interviewees coupled flexibility with creativity as an individual contributor to the development of the Irish software industry. They believed that Irish people are imaginative software developers while other nationalities tend to be far more mathematical in their approach to software development. However, one industry interviewee felt that this creativity could lead to a tendency to be sloppy in an effort to succeed at a project. While the software product may be high in quality some developers do not appreciate the subtleties of jobs such as backing up work and security issues. One respondent drew a comparison between this 'wing and a prayer' mentality and that of an artist:

"It's a bit like Picasso, he paints a masterpiece and then forgets to put a frame on it". [Sean]

However, this nonchalant attitude may have created considerable goodwill towards the country which has, in turn, benefited the software industry. The global recognition of the Irish culture means it is easy to attract well-educated foreign people to Ireland for the 'craic'⁵. Further, the progress of the Celtic Tiger, has encouraged many of those who emigrated during the slump times to consider returning to Ireland.

⁵ This is an Irish word for 'good times'.

“The home call is quite strong, the result is experienced people returning”. [Paul]

Trauth’s (2000) findings reinforce the individual impact of the IT industry in Ireland. She considers Ireland’s long-standing reputation as a laid-back, easy-going workforce and found that the information economy has altered this mentality, with a balance achieved between being relaxed and being productive. The quality of the individuals in Ireland has been earmarked as the key to its successful software industry. Beyond the Irish ability “to muddle through”, the consensus is that the individual factor has provided a sizable contribution to the growth of the Irish software industry. The creativity, flexibility and innovativeness of the individual has driven the sector forward and inspired confidence among home-grown software entrepreneurs in the global software market.

5 CONCLUSION

The endogenous factors identified in the conceptual framework have been discussed and supported in varying degrees through the 15 interviews. While the interviewee opinions regarding each of these key issues differ in many aspects, there was consensus that, in general, the national, enterprise and individual factors have significantly influenced the development of Ireland’s software industry since the late 1960s.

A number of suggestions were proposed by the interviewees as additional factors to consider. While each of these was carefully considered in relation to the model, the responses did not converge in a manner that strongly pointed to any significant alteration to the initial conceptual framework. Some of these suggestions included profit as a significant driver for the industry, and the presence of multinational organisations in Ireland. While we recognise that these factors have been important issues in the developing industry, they did not emerge strongly enough from the interviews to merit their addition to the model. As a result, we are confident that each of the factors identified merit their inclusion in the conceptual framework. Following analysis of the data in this study the model has been revised in order to allow for inter-dependency or overlapping between each of the endogenous factors (see Figure 2). While each of the factors has been confirmed as influencing the development of the software industry, it is evident that each of the factors does not fulfill its potential without the others.

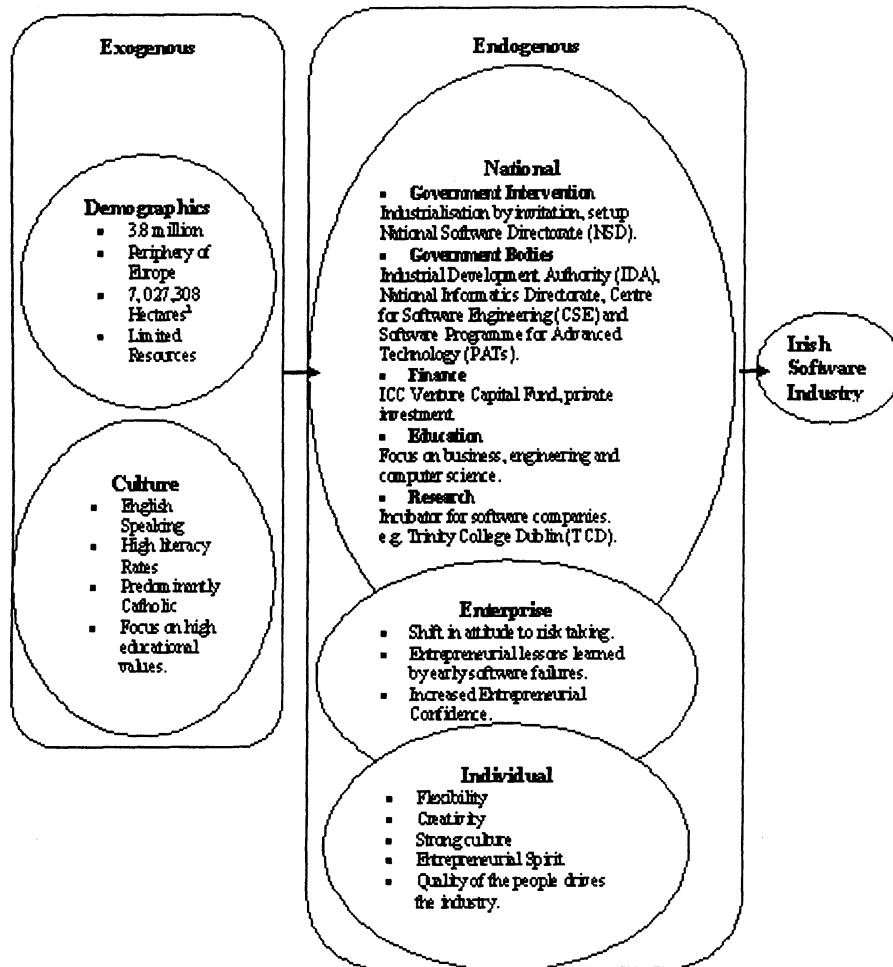


Figure 2: Summary of Factors Influencing the Development of Ireland's Software Industry

While the interviewees confirmed that these factors have driven the growth of Ireland's software sector, the degree to which they support these factors varies. Two areas of focus emerge from the interview analysis. These factors are the government's support for the industry over the last decade and the quality of the Irish individual, which has resulted in significant Irish entrepreneurial success in the software sector. The government's input since the early 1990s has shaped the way forward for the industry. With the provision of finance and extensive support from a variety of support agencies such as the National Software Directorate, the software Strategic Business Group at the IDA, the National Software Centre, Enterprise Ireland

and the Centre for Software Engineering, the industry has enjoyed the expertise, opportunities and strategies from these software think-tanks and support agencies. The second factor significantly emerging from the findings is that of the individual. The quality of the individual in Ireland has supported the Celtic Tiger through the late 1990s.

While there was a clear consensus of opinion on the emergence of the software sector since the late 1960s, the direction of the future strategy seems to be uncertain for Ireland and other software industries across the globe. The lessons from this study would suggest that the key for continued success of the software sector lies in the development of niche products, in an industry with infrastructural support in industry clusters and telecommunications, focusing on a profit-oriented business model, geared towards global markets.

While the multinational presence creates revenue for the industry as Ireland has experienced, the primary focus is the development of innovative indigenous software operations that will have the market-driven force to potentially flourish in the global marketplace. While it is not clear exactly what the future holds for the Irish software industry, one can certainly conclude on a positive note, well expressed by Ryan (1997):

“The overall lesson is one of hope. Given sufficient vision, direction and determination, a small country with limited industrial experience can establish itself as a significant player in a high-tech field within a relatively short period. This lesson is surely one worth learning by policy makers in all the aspiring countries of the world”.

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