The Internationalisation of Indigenous Irish Software Technology Companies: An Exploratory Study

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ABSTRACT

In the context of Ireland's increasing levels of outward foreign direct investment (FDI), the strategic importance of the indigenous software technology sector and increasing levels of globalisation, this paper describes an exploratory study of the internationalisation of the indigenous Irish software technology sector. Recent research has challenged the stage theories of internationalisation and suggests that small firms in knowledge-intensive industries are internationalising more rapidly and from inception. A different view of the role of knowledge is provided in this emerging pattern of internationalisation – knowledge as a driver of internationalisation rather than a barrier to be overcome in an incremental process. The paper concludes by comparing and contrasting the findings across research on the high-technology sector in other countries.

BACKGROUND

Ireland's changing levels of FDI

Ireland has been very successful in attracting foreign direct investment (FDI). In 1998 Ireland's level of inward investment as

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a percentage of Gross Domestic Product (GDP) was 32.7 per cent in comparison of a European Union (EU) average of 17.3 per cent. However, this situation is changing and in 2001 Ireland's inflow of FDI fell by 60 per cent (Forfás, International Trade and Development Report, 2003). As the level of inward FDI into Ireland has fallen since 2000, the nature of FDI has also changed (International Trade and Investment Report, 2003). While Ireland's outward FDI level as a percentage of GDP is well below the EU average, 22.5 per cent (EU average was 39.6 per cent in 2003), it has increased significantly in the past fifteen years (UNCTAD, *World Investment Report,* 2004). According to national data sources, outward FDI increased 30 per cent as Irish businesses increased the pace of their internationalisation (Forfás, 2002). However, published data on direct investment flows between Ireland and the rest of the world does not provide a comprehensive breakdown by sector of origin or country of destination (Forfás, *Statement on Outward Direct Investment,* 2001).

Dunning (1996) in his 'Investment Development Path' (IDP) examines the relationship between the development of an economy in stages, and inward and outward FDI. At stage three of the IDP, the original advantage of low cost is being eroded and is being replaced with technological advantages, managerial and marketing know-how. There is a slowdown of inward FDI at this stage and outward FDI starts to develop. The strategic outlook for companies in the economy at this stage is increasingly global. Görg (2000) classifies Ireland as approaching stage three of Dunning's IDP. Similarly to Görg's analysis, Porter et al. (2002) describe Ireland in the *Global Competitiveness Report* (2002), as being on the cusp of innovation driven growth.

The importance of the indigenous software technology sector

In 1992, it was identified in the Culliton report that while attracting FDI has been a successful policy in the past, in future Ireland must focus on developing its indigenous sector. Ireland's indigenous technology sector was identified at that stage as having significant potential to contribute to the growth of Ireland's economy. Ireland's dependence on inward FDI has been associated with the use of imported rather than locally generated technologies – this has left a

large deficit in Ireland's technology 'balance of payment' (Green, 2000: 3). This gap is now being addressed by the growth of Ireland's indigenous software industry.

Using the measure of Gross Expenditure on R&D as a percentage of Gross National Product, Ireland is below the EU average of 1.9 per cent, at 1.4 per cent (OECD, 2001 cited in Forfás, 2004). It lags behind the leading knowledge-driven economies of Sweden (4.27 per cent) and Finland (3.49 per cent). While Ireland's public R&D expenditure lags behind the European average, its business R&D expenditure is in a better position and has more than doubled over the past decade as indigenous technology companies allocate over 20 per cent of value of sales to R&D. Over the past ten years, seven indigenous Irish software companies have listed on major international stock exchanges. Indigenous Irish software companies had a combined turnover of over €1.4 billion (HotOrigin, 2002) and are described by National Software Directorate (NSD) as export-oriented, with 70 per cent of their products going to international markets. Enterprise Ireland's Overseas Incubator Facilities state that over 220 Irish high-technology companies are currently active in the US and have set up US headquarters and local offices (National Software Directorate, 2004). However, in a study completed by PricewaterhouseCoopers (1999) of Ireland's high-technology internationally traded services sector, it was highlighted that establishing a global position for their products and services is a key challenge facing Irish software companies. Research by HotOrigin (2002) on the indigenous Irish software sector also found that entering international markets is one of the biggest challenges faced by these companies and describes the need for companies to 'internationalise fast and smart' (2002: 39).

Global integration

Globalisation is defined as the process by which the world's economy is transformed from a set of national and regional markets into a set of markets that operate without regard to national boundaries (Fraser and Oppenheim, 1997). A 1997 McKinsey report highlighted that there is nothing new about globalisation – it has been happening for decades. However, the pace has suddenly changed from a gradual one to a much faster pace. It is estimated that the size of the

global arena will have increased twelve-fold by 2027 and that more global integration will occur in the next 30 years than has done in the previous 10,000 years (Bryan and Fraser, 1999). According to *Foreign Policy*'s Globalisation index (Kearney, 2002), small trading nations tend to show higher levels of integration with other countries than their larger neighbours. In 2000, Ireland was described in the report as 'one of the largest beneficiaries of the global boom in high tech and information technologies' (Kearney, 2002: 44). Investment in technology-related assets is seen as one of the key drivers of internationalisation (Kogut and Chang, 1991; Kogut and Zander, 2003). In the context of:

- the changing nature of Ireland's FDI levels and the lack of sector-specific data in relation to this;
- the strategic importance of the software technology sector to Ireland's economic development and its high international growth levels in recent years;
- the overall increased level of global integration, particularly in small trading nations, an initial exploratory study was carried out on the indigenous Irish software technology sector. The overall objective of the study is to develop some insight into the factors influencing the internationalisation of indigenous Irish software technology companies.

MODELS OF INTERNATIONALISATION

Internationalisation is defined as 'the increasing involvement in international operations' (Welch and Luostarinen, 1988). At the firm level, two somewhat similar models have emerged in Europe and the US. Andersen (1993) has termed these as the Uppsala Internationalization Model (U-Models) (Johanson and Wiedersheim-Paul, 1975; Johanson and Vahlne, 1977) and the Innovation-Related Models (I-Models) (Bilkey and Tesar, 1977; Cavusgil, 1980). Both models view internationalisation as a gradual incremental process.

U – Models

Based on a case study of four Swedish firms, Johanson and Wiedersheim-Paul (1975) found that firms internationalise according to a chain of establishment. They distinguish four stages: from no regu-

lar export activities, to export via agents, to establishment of an overseas subsidiary, to finally an overseas manufacturing plant.

Based on their study, they conclude that these firms enter new markets with successively greater psychic distance in a series of stages. The concept of 'psychic distance' has been defined as factors preventing the flow of information between firm and market, including such factors as language, culture, political systems, level of education and level of industrial development (Johanson and Vahlne, 1977). The basic assumptions of the Johanson and Vahlne model (1977) are that lack of knowledge about foreign markets is an important obstacle to the development of international operations and that the necessary knowledge can be acquired mainly through operations abroad. It is based on a study of large Swedish manufacturing firms in 1977. They present internationalisation as a result of a series of incremental decisions. These incremental decisions are affected by market commitment and market knowledge. The model is a dynamic model in which there are state and change aspects of internationalisation variables. The state aspects are market commitment – resources committed to foreign markets. The change aspects are the decisions to commit resources and the performance of activities. They highlight the type of knowledge as experiential knowledge, being 'the critical kind of knowledge' (Johanson and Vahlne, 1977: 29) in the international context and a driving force behind the process. It views experiential knowledge as not only a method of reducing risk but as a vehicle for acquiring information and for generating opportunities abroad. The Johanson and Vahlne model implies that market commitment will be made in small incremental steps as firms gain experiential knowledge. The model is presented as a dynamic approach as market knowledge and commitment change. They also note that firm size, technology, product line and home country affect the characterisation of internationalisation in different ways.

I - Models

The innovation-related models of Bilkey and Tesar (1977), Cavusgil (1980), Czinkota (1982) and Reid (1981) are similar in assuming internationalisation as an incremental process although varying in the number of stages. Internationalisation is presented

in these models as an innovation of the firm, a learning approach. The innovation related models highlight that there are differences between the internationalisation process in large and small firms. For example, Cavusgil (1982) puts forward a three stage process of internationalisation from an initial 'experimental stage' where exporting is marginal and intermittent, to an 'active involvement stage' to a 'committed involvement' stage where the firm has a long-term commitment to international markets. Reid (1981) notes that the export behaviour in small firms is likely to be influenced by the individual decision-maker whereas in the large firm it is likely to be more structurally determined. Andersen (1993) highlights that while the U-Model is assumed to be valid for firms of any size, the I-Models may be applicable to small firms only. Andersen (1993) describes both U- and I-models as behaviourally oriented and that the gradual pattern of internationalisation is attributed to the lack of experiential knowledge and the uncertainty relating to the decision to internationalise.

Other studies have supported this incremental process; Luostarinen (1980) and Larimo (1985) have produced similar evidence for Finland and Buckley (1982) in the UK. Coviello and McAuley (1999) identified eight different studies supporting an incremental internationalisation process for small firms.

CHALLENGES TO MODELS OF INTERNATIONALISATION

Despite the support for the above models, since the 1980s the stage theory of internationalisation has been challenged. These challenges have been specifically in relation to the process and pace of internationalisation, knowledge as a barrier to internationalisation, the role of the founder and network relationships.

Knowledge as barrier to internationalisation

Andersen (1993) challenges the assumption of experiential knowledge of the U-Models, highlighting that when market conditions are stable and homogenous, relevant market knowledge can be gained in ways other than experience. Similarly, Young (1987) notes that specifically in relation to high-technology firms, as firms learn from the experience of others that some of the barriers to internationalisation should be reduced. Erkko et al. (2000) note that knowledge

about international markets and operations and the efficiency by which the knowledge is learned, is an important determinant of international growth for entrepreneurial firms. Research by Eriksson et al. (1997) confirms that there is a cost associated with experiential knowledge in the internationalisation of the firm. However, their findings indicate that accumulated internationalisation experience is not related to specific country markets (as assumed in U-Models) but is ***firm-specific*** knowledge related to all markets.

Christensen and Jacobsen (1996) in their study of newly established international firms in Denmark, conclude that firms have different routes to internationalisation based on 'knowledge acquired prior to the initiated new business'. This is closely related to the role of the founding entrepreneur(s). They also note that market knowledge and the international skills and experience of the founder may also have been obtained before the birth of the firm.

The role of the founder

The education level of the high-technology entrepreneur is thought to overcome some of the psychological barriers (Young, 1987) perhaps reducing the effect of psychic distance assumed in the U-Models. According to Reuber and Fischer (1997), firms with an internationally experienced management team can skip the first two stages of Cavusgil's internationalisation model. Jones (1999) highlights that there is a body of work to suggest that the orientation and experience of the entrepreneurs influence the speed and nature of internationalisation – in addition to the nature of the product and the industry itself.

Changing pace and process of internationalisation

Hedlund and Kverneland (1985: 56) highlight that the 'establishment and growth strategies on foreign markets are changing towards more direct and rapid entry modes than those implied by theories of gradual and slow internationalisation process'.

THE 'BORN GLOBAL' PHENOMENON

Oviatt and McDougall (1994) highlight that organisations which are international from inception, termed International New Ventures (INV) are an increasingly important phenomenon. Research has

focused specifically on the change from a gradual internationalisation process to a more rapid one: 'Born Global' firms (Rennie, 1993; McDougall et al., 1994; Knight and Cavusgil, 1996; Madsen and Servais, 1997; Erkko et al. 2000; Moen and Servais, 2002; Chetty and Campbell Hunt, 2003; Knight and Cavusgil, 2004).

This accelerated pace of internationalisation is associated most with 'high technology, knowledge-based and service intensive firms' (Coviello and Munro, 1997: 362). Knight and Cavusgil (1996: 11) define 'born globals' as 'small technology oriented companies that operate in international markets from the earliest days of establishment'. They characterise a 'born global' firm as small (less than 500 employees), with an annual turnover typically under $100 million, possessing leading edge technology and developing products for niche international markets.

Firms engaging in international activities 'from inception or soon thereafter' (Oviatt and McDougall, 1994: 49) very clearly challenge the stage models of internationalisation. In their study of 24 case studies, McDougall et al. (1994) conclude that existing theories from international business failed to explain the 'born global' phenomenon. In addition to the inability of stage theory of internationalisation to explain the 'born global' phenomenon, Oviatt and McDougall (1994) also dismiss the idea that large size of the organisation is a requirement for internationalisation. They fail to explain it because of the assumptions of the existing models of a gradual process of internationalisation over time developing the organisation to a certain scale and also because they largely ignore the founding individual influences or the individual's network of alliances. None of the cases in the research of McDougall et al. (1994) followed the incremental process of internationalisation. The 24 cases of their study are present in at least ten countries, indicating that it is not a local phenomenon and many of the firms have formed in recent years indicating as they describe, 'a relatively new phenomenon'. They also note that although the companies are primarily high-tech businesses, they believe this phenomenon is present in a variety of industries.

Rennie's (1993) comparative study of Australian 'high value-added manufacturers' traditional firms and 'born global' firms concurs with this. He defined traditional firms as those having been

well established in the home market before exporting and found that the average age of these companies when first exporting was 27 years whereas the 'born global' companies starting exporting on average of two years after formation. He also notes that 'born global' firms are not only in technology sectors but describes that they were found 'in all industries' (p. 49). Research completed in the Nordic countries by Linkmark (1995) also demonstrates the existence of 'born globals'. From Canada, Preece, Miles and Baetz (1999) also report a tendency towards an increasing number of 'instant internationals'. In a longitudinal study of over 900 firms in Denmark, Christensen and Jacobsen (1996) report that there is a rising number of firms exporting within the first year of existence.

Jolly et al. (1992) have a somewhat different view on this: they conclude that high-technology start-ups must choose business areas with homogenous customers and minimal adaptation because they do not have sufficient scale in operations worldwide. They believe that the high fixed cost of these companies and the need to have broad market access reduces the importance of psychic distance as a market selection criterion. Bell (1995) in his study of small computer firms found limited evidence of psychic distance but rather that the internationalisation process was strongly influenced by domestic and foreign client followership. He also found that the process was strongly influenced by the targeting of niche markets and industry specific considerations.

Cantwell's (1999) technology accumulation approach claims that the growth of international production has been associated with sustained technological competitiveness between Multinational Enterprises (MNEs) in manufacturing. He highlights two points in relation to this: firstly, internationalisation has supported technological diversification as firms' technological development varies between locations, therefore firms expand internationally to gain access to new but complementary areas of technological development; secondly, there is a growing number of connections between technologies that were formerly unrelated, thereby attracting companies to certain centres of innovation. Research by Bell (1995) and Lindqvist (1997) examining high technology industries has found that the pace and pattern of internationalisation is influenced by customers (Lindqvist) and suppliers and customers (Bell).

Madsen and Servais (1997) note that while there is general agreement about the fast and immediate pattern of 'born globals', there are disparate opinions about other characteristics of the situation. They believe the rise of 'born globals' may be attributed to at least three important factors:

- New market conditions – specialisation and the number of niche markets;
- Technological developments in the areas of production, transportation and communication;
- More elaborate capabilities of people, including the founder.

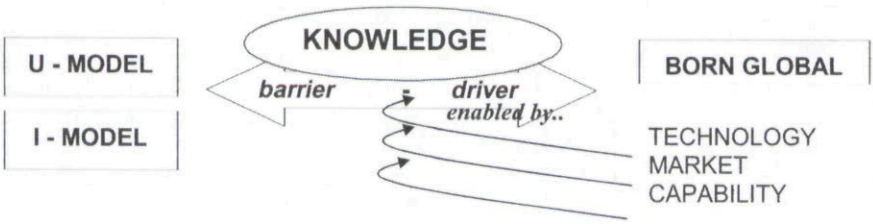
Oviatt and McDougall (1994) concur, in that existing theories are less applicable in a number of situations where technology, specific industry environments and firm capabilities have changed.

There are a number of knowledge related issues emerging from the literature to date. This is somewhat consistent with Grant's (1996) knowledge-based view of the firm as an institution for the 'creation, transfer and integration of knowledge' (Almeida et al., 2002: 149). In comparison with traditional definitions of the multinational enterprise, Oviatt and McDougall (1994) highlight that INVs (or 'Born Global' firms) are not concerned with assets-owned (foreign direct investment) but with value-added. The nature of these assets are intangible, knowledge-based assets and some research to date suggests that this is also an influence on the internationalisation of the firm. Kotha et al. (2001) describe how Internet firms experience less the 'liability of foreignness'. Kotha's research also found that the intangible assets of Internet firms in the US were important predictors of the propensity to internationalise. He notes that the greater the value of the intangible asset in the domestic market, the more likely the firm was to deploy these in foreign markets. (Intangible assets being defined by Steward (2001) as human capital, structural capital and customer capital.) Autio et al. (2000) also note that as knowledge is inherently mobile, it can be combined with fixed assets in foreign markets at relatively low costs. They conclude that knowledge-intensive firms are less constrained by distance and national boundaries, thus can exploit international opportunities more flexibly than firms dependent on fixed assets alone.

The following diagram summarises some of the knowledge related issues underpinning the U- and I-models and what emerges from some of the research in this area as the inter-related factors fuelling the current internationalisation process. While the earlier models (U-Models and I-Models) have viewed knowledge as a barrier to internationalisation, in that acquiring market knowledge or the firm developing knowledge as an innovative process, influences the internationalisation process in an incremental way, the 'born global' phenomenon is being driven by knowledge, in that it is largely present in knowledge-based industries and competitive R&D levels are driving a faster and earlier internationalisation process. In addition, research to date has found a positive correlation between the accumulated international knowledge in the firm and the level of internationalisation.

The three drivers identified by Madsen and Servais (1997) above – market conditions, technological developments and capabilities – are enabled by knowledge at institutional, individual and organisational level.

Figure 5.1: Impact of Knowledge on Internationalisation (Brennan and Garvey, 2004)



METHOD

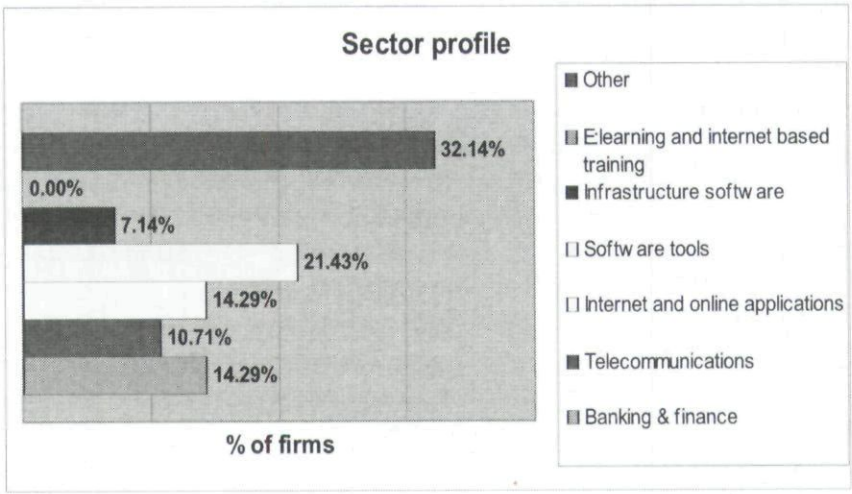
The study was done on the population of Irish-owned software companies listed by Enterprise Ireland and The National Software Directorate, 2003. An electronic survey was distributed by e-mail to the main contacts of the initial 350 companies. Due to either incorrect contacts or because the company had ceased trading, 71 mail surveys were returned, which left a study of 279. Surveys not returned in the initial timeframe were followed up again with a second e-mailing of the survey. The overall response rate was 10 per cent, although this is a low response rate, it is a typical response rate for electronic surveys. However, given the

exploratory nature of the study it still allowed us to develop some insight into the internationalisation of the sector.

The survey sought information on three inter-related factors – institutional, organisational and industry factors influencing the internationalisation of firms. The firms were from the industry sectors as shown on *Figure 5.2: Sector Profile.*

Classifications of companies as small or medium sized varies from country to country. We are using the framework provided by the European Commission (1996) which provides a common definition across markets using criteria of number of employees and revenue or balance sheet total. Using the combined headcount and revenue criteria above, 48 per cent of companies were micro-enterprises and 41 per cent of companies were small enterprises, with the remaining 11 per cent being medium sized enterprises.

Figure 5.2: Sector Profile



FINDINGS

The findings of this exploratory study of the indigenous Irish software sector are discussed below in relation to similar, although not directly comparable, studies of the software technology sectors in Finland, New Zealand, UK and Canada. While the studies may not be directly comparable, it is possible to develop some additional insight into the drivers of the internationalisation process of firms (Madsen and Servais, 1997).

The internationalisation process

Born global or incremental?

Reuber and Fischer (1997) note in their study of Canadian software companies that what is of interest here is not how long a firm has been selling into international markets but rather for how long the firm delayed before selling in foreign markets. The survey of Irish firms poses the questions as to what year the company was formed and what year it first engaged in international activities. The average time it took for companies to engage in international activities after their business formation was 3.66 years. However, there were two companies in the study 24 and 17 years in existence. These took 15 and 10 years respectively to engage in international activities. If these are excluded the average time is 2.56 years that it took companies to engage in international activities. 14 per cent of the respondents could be classified as 'born globals', having engaged in international activities from inception. 29 per cent of respondents engaged in international activities within two years or less after formation. The average age of these 'born global' companies was 3.5 years. There is an indication from this that younger firms (new ventures are defined by Brush (1995) as six years or younger) are internationalising early on in their existence. This is consistent with the finding of Jones's (1999) study of small high-technology firms in the UK that 'in general, younger firms progress more rapidly from one event to the next' (p. 18) in relation to cross-border activities. Also, in Reuber and Fischer's (1997) study of Canadian software companies, 14 per cent of companies had international sales from their first year of operation. They also noted that 'older firms delayed longer in obtaining foreign sales' and highlight that this might reflect the increased globalisation of the software industry in recent years. This is consistent with the findings above of the Irish companies.

Type of international activity

The type of international activity that firms engaged in was primarily product export (58 per cent), but also involved in provision of software related services (21 per cent) and setting up of

sales offices (10 per cent). There was also an indication that this was a serial rather than parallel process as 79 per cent of respondents said that they did not engage in international activities in more than one market at a time. Coviello and Munro's (1997) study of New Zealand software companies found that these small firms make simultaneous use of multiple and different modes of market entry mechanisms which they describe as part of the firm's larger international network. It is not possible to conclude from the exploratory nature of this study that there was an evidence of this in the Irish sector. However, Irish firms may well have used their international network in the provision of software-related services noted above.

Gankema et al. (2000) completed an in-depth study of European manufacturing Small and Medium Sized Enterprises (SMEs) using five-year data. They concluded that there is a growing degree of internationalisation of SMEs over time but that there is huge variation in the pattern. In the majority of cases, a gradual stage process was evident but they describe leapfrogging of stages and gaps in the process before a committed internationalisation stage.

The level of internationalisation

A simple measure of *international revenue: overall revenue* ratio was used to assess the current level of internationalisation. 41 per cent of respondents had international revenues of over 50 per cent. 22 per cent of respondents had no revenue at all from international markets. Of those companies not currently engaged in international activities, 80 per cent of these companies plan to get involved in international activities in the future. This confirms further the growing importance of internationalisation to the indigenous industry sector at this point in time.

If we compare this with Reuber and Fischer's (1997) survey of 132 Canadian software SMEs, 10 per cent of firms had no foreign sales, 20 per cent of companies had 90 per cent of their revenue from international trade. The profile of both sectors is somewhat similar in relation to the level of internationalisation.

There is much debate about the appropriate way to measure internationalisation. Sullivan (1994) argues that multiple item measures

Table 5.1: Level of Internationalisation

Percentage (%) of Revenue from International Markets	Percentage (%) of Respondents
None	22
1–5	15
6–10	4
11–20	7
21–30	4
31–40	0
41–50	7
>50	41

should be used rather than just foreign sales as a percentage of the total. He constructed a five-item measure that reflects performance aspects, structural aspects and attitudinal aspects of internationalisation. Reuber and Fisher adapted two of those measures – performance (foreign sales as percentage of total) and structural (percentage of employees that spend over 50 per cent of time overseas) and geographic scope of sales. More in-depth case research would enable the use of multi-dimensional measurement and gain a more comprehensive understanding of the level of internationalisation.

The importance of psychic distance

The first country in which these companies engaged in international activities is indicated as follows:

Table 5.2: Importance of Psychic Distance

First Country in which the Firm Engaged in International Activities	Percentage (%) of Respondents
United Kingdom	68.4
United States	21.1

Given the similarities of language, culture, political systems, level of education and level of industrial development, this would suggest that these companies focused internationally on markets within a

close psychic distance. This is consistent with the findings of Bell's (1995) research of computer software firms in Finland, Ireland and Norway. He found that 50-70 per cent of firms entered 'close' markets in the initial stages of export development and specifically that Irish firms tended to target the UK first. Research by Coviello and Munro (1997) into the international growth patterns of Canadian small firms in the software industry found three stages of international activity over a specific timeframe. In the initial stage (year 0-1), firms had largely a domestic focus but clear intentions to internationalise. The second stage (year1-3), the firms became actively involved in psychically close markets. The third stage (year 3 onwards) indicated committed involvement across multiple markets including psychically distant markets.

In our study, when asked to rank the countries viewed as the most strategically important market for the future, the respondents ranked the countries as follows:

Table 5.3: Strategically Important Markets for the Future

Country	No. 1 (%)	No. 2 (%)	No. 3 (%)
United Kingdom	58	21	
United States	21	14	2
China			18

This may indicate a similar pattern as outlined by Coviello and Munro (1997) above, in that Irish firms may be moving towards psychically distant markets from stage three (year 3 onwards). It is related to the findings on the process of internationalisation, in that there is an indication that the process, while still a gradual one, is happening in a 'compressed timeframe' (Coviello and Munro, 1997).

A study of the internationalisation strategies of 'technology based new-firms' by Erkko et al. (2002) in Finland, concluded that there is much diversity of 'born global' strategies. Their study included software and hardware technology companies of less than three years old. They found that the pattern of internationalisation reflected a gradual one (internationalisation starting in year 2) but early in the existence of the firm. They also noted that the first markets were new

countries but within the same geographical region and entry to more distant country cultures started to happen between years 3 and 4.

The role of knowledge

Firm internationalisation knowledge

37 per cent of companies indicated that 0-10 per cent of their employees had international experience prior to joining the company. 26 per cent of companies indicated that over 50 per cent of their employees had international experience prior to joining. Looking further at this in relation to their level of internationalisation, of this 26 per cent, 71 per cent of these companies had also greater than 50 per cent of their revenue from international markets. While it is not possible from the exploratory nature of this study to say that a higher level of international experience within the company is positively related to a high level of internationalisation, it does concur with the findings of some other studies in this way. Reuber and Fischer (1997) completed a study of Canadian SME software companies to understand the influence of the management team's international experience on internationalisation behaviours. They found that internationally experienced management teams have a greater propensity to develop foreign partnerships and delay less in obtaining foreign sales and that these behaviours are associated with a higher degree of internationalisation. Erkko et al. (2002) in their Finnish study also found that the contacts and experiences of the management team had a positive effect on the 'development of the distance of internationalisation' (p. 6).

Knowledge intensity

Our survey of the Irish sector also sought to understand the level of R&D spending among these companies, detailed in Table 5.4 – R&D expenditure as a percentage of total expenditure. We found that 16 per cent of companies had R&D expenditure of greater than 40 per cent, 23 per cent had R&D expenditure of between 21 and 30 per cent and 54 per cent had R&D expenditure ranging from 1 to 20 per cent. The R&D intensity of high-technology sectors is much cited in the literature (Young, 1987; Barkema and Vermeulen, 1998) as one of the key factors accelerating internationalisation. Karagozoglu and

Lindell (1998) in their study of small technology companies (small defined as having less than 99 employees) in the US, found that the third most important reason for the US companies to internationalise was the size of the domestic market to sustain competitive levels of R&D, which they define as 35 per cent of expenditure. One could conclude that to sustain *competitive* levels of R&D, Irish companies need also to sustain levels of international growth.

Table 5.4: Levels of R&D

Percentage (%) of Expenditure on R&D	Percentage (%) of Respondents
None	4
1–10	27
11–20	27
21–30	23
31–40	4
> 40	15

Firm motives for internationalisation

The most important reasons for companies to expand internationally were rated as follows:

1. Market growth/access to new country markets (75 per cent ranked this no. 1);
2. International customer requirements (50 per cent ranked this no. 2);
3. International competition (44 per cent ranked this no. 3).

Given the small size of the Irish domestic market and the R&D intensity of this sector, it is not surprising that market growth should rank as the most important motive for internationalisation. In the above mentioned US study, Karagozoglu and Lindell (1998) found that the opportunities in foreign markets and following inquiries from foreign buyers were the key motives for small US technology firms to internationalise. The high ranking of 'international customer requirements' is consistent with the findings of Bell's study of Irish, Finnish and Norwegian software companies. He found for

62.5 per cent of firms, that client international requirements had influenced both the initial decision to export and the choice of foreign market. He concludes that there is strong evidence that the internationalisation process for small computer software firms is influenced by domestic and client followership as opposed to the psychological or geographical proximity of export markets. He refers to Czinkota and Ursic (1987), in that they do not believe those firms undergo a complex systematic analysis of geographical, cultural and political factors. From our study, there is evidence of psychic distance being a factor in the first internationalisation decisions and the influence of client international requirements. The two are not necessarily mutually exclusive and while firms might not undergo complex systematic analysis, perhaps it is an implicit bias in decision-making on international markets. It is possible also that previous experience, knowledge and connections relating to prior international experience can also explain it.

Two reasons for expanding internationally which were ranked the lowest were 'access to technology' – 45 per cent ranked this as 10 out of 11 in order of importance and 'access to skill or knowledge base' – 30 per cent ranked this as 10. Given the strategic importance of the US market in the software industry and the No. 2 ranking of this market in the study, one might have expected that software technology companies are moving to critical strategic arenas of their industry. For example, Bell (1995:66) found that 'industry-specific factors were much in evidence' – in that markets where software development was concentrated, that this was a factor in the decision. While one cannot conclude that small firms are primarily following larger international clients or competition, as opposed to developing a presence in strategic locations of the industry, it is possible that this is related to the small size of the companies.

Barriers to internationalisation

Those firms who have not yet engaged in international activities were asked to rank in importance 1 to 6 the key reasons why they have not done so to date.

Ranking highest were 'sufficient growth in domestic market' – 50 per cent ranked this as No. 1 and 'lack of financial support' –

50 per cent also ranked this as No. 1. This may indicate support for a gradual but quickened pace of internationalisation process as noted in the above studies, in that years one to two of existence are focused on domestic growth. In contrast, in a study of the US software technology SMEs, only 9 per cent indicated that funding was a barrier to internationalisation. The lack of financial support in the Irish companies may be related to a number of institutional and organisational factors, which are also self-perpetuating in relation to the growth of the company.

The issue that 'the nature of the product or service is tailored to the local rather than international market' was ranked by 40 per cent as the No. 1 reason. And although lack of international experience was not ranked as a key barrier, with 60 per cent of companies ranking this as No. 4, product internationalisation or localisation knowledge could be classed as implicit knowledge gained by experience. Therefore, one could argue that although firms, when not engaging in internationalisation, don't see their lack of experience as a barrier, it may become more evident as a factor when they start internationalising. This is also related to the role of psychic distance as noted earlier.

CONCLUSION

This study has been exploratory in nature and, in common with other e-surveys, has had a low response rate. Nonetheless, it does provide insight into the internationalisation of the indigenous Irish software sector and highlights some interesting areas for further study. We believe it is possible to conclude from this some key findings in relation to the pace of internationalisation, the factors influencing the process and the profile of internationalisation as follows:

Pace and pattern of internationalisation

Internationalisation of the indigenous Irish software sector follows a gradual process but this is at an accelerated pace. There is evidence of 'born global' companies within the sector, i.e. internationalising early (within the first 2 years of their existence). The pattern of internationalisation – the use of multiple modes of market entry and the timing of the stages of entry, appears to be diverse across micro, small and medium sized enterprises in the study.

Influencing factors

What are of particular interest are the factors driving the process and the inter-relatedness of the factors. There was evidence of psychic distance influencing the early internationalisation decisions. There was also evidence of international clients and competition influencing the decision to internationalise. The study findings did not suggest that firms internationalise to access technology or knowledge in specific markets, although the findings did show that firms viewed the US market as one of strategic importance. By following international clients and competitors, companies are moving to strategic locations of the industry like the US, albeit not explicitly stated in the study.

Underpinning many of these inter-related influences in the context of the internationalisation of the indigenous high-technology sector is the role of knowledge.

The role of knowledge

The role of knowledge and in particular experiential knowledge has been one of the key assumptions underlying the internationalisation models to date. What has emerged from this exploratory study and review of the literature to date in this area is the role of knowledge in perhaps a different way. This role may be seen as an influence from two different but related perspectives – knowledge intensity and knowledge accumulation.

- Knowledge intensity – Stewart (2001) provides three measures of the knowledge intensity of a business, one of which is the R&D spending as a percentage of the revenues. We have contrasted the study findings with a US study in relation to the motives to internationalise being driven by the need to sustain competitive levels of R&D. This is of significant importance in this industry sector study. Given the R&D levels indicated by the study and the wider software industry R&D levels reported by ICT, 2000 – this competitive level of R&D is likely to be a key driver of internationalisation going forward.
- Knowledge accumulation – While experiential knowledge is still of key importance, the role played by other types of knowledge emerges from this exploratory study. The influence of psychic

distance may be related to the tacit knowledge (Nonaka, 1991) that the firm possesses, not necessarily gained by experience about a specific market but as a result of the collective individuals' knowledge. This also relates to the tendency in the study for firms to follow international clients or competitors. The level of employee international experience in the companies that had a greater degree of internationalisation, together with the similar findings of studies in Canada and Finland would indicate that there is a positive relationship between the two. Therefore, it would suggest that the stock of knowledge already accumulated in the firm plays an important role in internationalisation.

Eriksson et al. have extensively researched different aspects of internationalisation knowledge accumulation – the effect of variation on knowledge accumulation in the internationalisation process (Eriksson, Johanson et al., 2000), experiential knowledge and cost in the internationalisation process (Eriksson, Majkgard et al., 1997), the perceived usefulness of network experiential knowledge in the internationalising firm (Blomstermo et al., 2004) and path dependence and knowledge development in the internationalisation process (Eriksson, Majkgard et al., 2000). Eriksson's differentiation of the various types of knowledge accumulated in firms – internationalisation, business and institutional knowledge – provides a wider framework for understanding this at firm level, while at the same time including the role of experiential knowledge in the internationalisation process.

Recommendations for further study

Coviello and Munro (1997: 383) note that case research provides 'richness and depth of understanding to internationalisation which is not possible with survey data'. We recommend further in-depth case analysis to explore in more detail the issues that have arisen from the study. Specifically the role of knowledge – knowledge intensity and knowledge accumulation in influencing the pattern, pace and level of internationalisation in this sector.

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