New venture internationalisation and the cluster life cycle: insights from Ireland's indigenous software industry

CRONE, Mike

Published version

CRONE, Mike (2013) New venture internationalisation and the cluster life cycle: insights from Ireland's indigenous software industry. In: The changing geography of international business. Palgrave, Basingstoke, 1-8. ISBN 9781137277497

New Venture Internationalisation and the Cluster Life Cycle: Insights from Ireland's Indigenous Software Industry

Mike Crone, Sheffield Business School, Sheffield Hallam University, UK

INTRODUCTION

The internationalisation of new and small firms has been a longstanding concern of researchers in international business (Coviello and McAuley 1999; Ruzzier et al. 2006). This topic has been re-invigorated over the last decade by the burgeoning literature on so-called 'born globals' (BG) or 'international new ventures' (INV) - businesses that confound the expectations of traditional theory by being active internationally at, or soon after, inception (Bell 1995; Rialp et al. 2005; Aspelund et al. 2007). Until quite recently, this literature had not really considered how the home regional environment of a new venture might influence its internationalisation behaviour. However, a handful of recent studies have shown that being founded in a geographic industry 'cluster' can positively influence the likelihood of a new venture internationalising (e.g. Fernhaber et al. 2008; Libaers and Meyer 2011)[1]. This paper seeks to build on these recent contributions by further probing the relationship between clusters and new venture internationalisation. Specifically, taking inspiration from recent work in the thematic research stream on clusters (which spans the fields of economic geography, regional studies and industrial dynamics), the paper explores how the emergence and internationalisation of new ventures might be affected by the 'cluster life cycle' context within which they are founded. This issue is examined through a *revelatory* longitudinal case study of Ireland's indigenous software cluster. The study investigates the origins and internationalisation behaviour of 'leading' Irish software ventures but, in contrast to many

existing studies, it seeks to understand these firms within the context of the Irish software cluster's emergence and evolution through a number of 'life cycle' stages.

The empirical case study highlights differences between the origins and internationalisation behaviour of two cohorts of 'leading' new ventures, founded at different stages of the Irish software industry's cluster life cycle. These differences are attributed to two main factors. Firstly, the regional entrepreneurial environment in Ireland by the late 1990s - when the Irish software cluster had become more established - was significantly different and more favourable than that prevailing in earlier years. Thus, some of the resources that are known to be useful for early and rapid internationalisation (e.g. venture capital, experienced executives and supportive institutions) were relatively abundant by this time. Secondly, many of the leading firms founded in the established cluster of the late 1990s had superior internal resources and capabilities *at inception*, by comparison with firms founded in earlier stages of the cluster life cycle, due to the extensive prior experiences (primarily within the cluster) of their founding team members. Hence these firms were particularly well-placed to capitalise on the improved regional entrepreneurial environment and to identify and exploit emerging niche opportunities in global software markets. Consequently, the internationalisation of this latter cohort of new ventures was *qualitatively* different from that of firms founded during earlier stages in the cluster life cycle, being (generally) earlier, more rapid, wider in geographic scope and more 'multi-modal'. This evidence adds to recent work showing that the home regional environment (i.e. being located in a cluster) can influence new venture internationalisation behaviour, and further extends it by highlighting how this influence can change over time (i.e. at different stages of the cluster life cycle). Accordingly, future studies should probably pay more attention to the wider geographic context within which BG/INVs emerge and take a longitudinal perspective on their development in that context.

The structure of the paper is as follows. The next section reviews the most salient contributions from the (largely disconnected) thematic literatures on new venture internationalisation and clusters. The case study method and data sources are then explained. The fourth section of the paper introduces the case context before the fifth presents the case study evidence on new venture creation and internationalisation at two different stages in the Irish software industry's cluster life cycle. The conclusion then emphasizes the contribution, reviews the key findings and considers the study's limitations and wider implications.

KEY POINTS FROM THE LITERATURES ON NEW VENTURE INTERNATIONALISATION AND CLUSTERS

Resource-based perspectives on new venture internationalisation[2]

A key concern of the research stream on the BG/INV phenomenon has been to understand why some new ventures are able to rapidly internationalise, often to multiple global regions, contrary to the predictions of established internationalisation theories (e.g. Uppsala School). Traditionally, new and small firms have been seen to face multiple disadvantages that curtail or slow their international expansion, sometimes referred to as the liabilities of newness and smallness. From the resource-based perspective (RBV), new and small firms are often portrayed as resource deficient by comparison with larger and more established firms. Thus, studies of small firm internationalisation have sought to distinguish between non-exporters and exporters on the basis of their respective resource endowments (Westhead et al. 2001). This theme has been further developed in recent work on the BG/INV phenomenon, which has suggested such firms are distinguished from non-exporters and gradual internationalisers

by their possession of superior resources (including various types of knowledge) and capabilities at inception and by their subsequent ability to successfully acquire and mobilise external resources (Rialp et al. 2005; Coviello and Cox 2006; Gabrielsson et al. 2008).

Some explanations of the BG/INV phenomenon have pointed to the enabling role of structural changes in global markets or the rise of the Internet and e-business, whilst others have focused on the use of distinctive international marketing strategies and business models by these firms (Aspelund et al. 2007). However, it is the characteristics of BG/INV founding team members and top managers that have attracted the most attention, especially in studies adopting a resource- or knowledge-based perspective. Thus, Gabrielsson et al. (2008) observe that most of principal resources of these firms at start-up are likely to be 'embodied' in these key individuals. Importantly, these resources (including knowledge resources) have often been accumulated and developed during prior work experiences, especially overseas or with internationally-active firms (Bloodgood et al. 1996; Reuber and Fischer 1997).

Among the various types of 'embodied' resources and capabilities thought to be useful for early and rapid internationalisation are: knowledge of new and emerging technologies; deep familiarity with vertical markets and potential customers; entrepreneurial and leadership experience; and familiarity with effective business models and organisational routines. The role of networks is another recurrent theme in studies of BG/INVs. Coviello and Cox (2006, 117) have observed that "networks both generate resources and are a resource in their own right". Several studies have highlighted the way in which BG/INVs acquire crucial resources for early internationalization from external network actors, by using the existing network ties of their founders but also by effectively developing new networks (Laanti et al. 2007; Loane et al. 2007). Finally, financial resources have been found to be important in several empirical

studies of BG/INVs. Early and rapid internationalization is said to require significant 'up front' investment, for example to fund new product development and international marketing efforts. Thus, access to superior financial resources (via venture capital) has been found to distinguish firms who are 'born global' (rapidly expanding into global markets) from those who are 'born international' (Gabrielsson et al. 2004). Venture capitalists may also assist early internationalization by providing reputation resources, new knowledge and additional network ties (Fernhaber and McDougall-Covin 2009).

Insights from the clusters literature

Most studies in the BG/INV literature are silent on the geographical context for new venture creation and internationalisation (Crone 2012). In particular, the extant literature has not explored the geographical context for the resource inheritance and acquisition that is described in resource-based perspectives. However, the fact that recent studies have shown that a cluster location can positively influence new venture internationalisation (e.g. Fernhaber et al. 2008; Libaers and Meyer 2011) should encoruage international entrepreneurship scholars to take a closer look at clusters research stream, which has been one of the hottest areas in social science in recent decades. The discussion here focuses on four key themes from this literature that might provide useful insights for research on new venture internationalisation[3].

1. Knowledge and learning within clusters

Economic geographers' views on industry clusters traditionally drew upon Marshall's (1890) concept of agglomeration economies. Subsequent work in economic geography and regional studies has moved to a focus on knowledge and learning among clustered firms and the

associated benefits for innovation and competitiveness (e.g. Keeble et al. 1999; Malmberg and Maskell 2002). These approaches suggest clustered firms can benefit from knowledge dissemination and 'collective learning' which are fostered through various mechanisms, including: flows of professionals and "embodied expertise" through the local labour market; high rates of localised entrepreneurship (including spin-offs from existing businesses); formal and informal networking by professionals and managers; and demonstration/imitation effects. More recent studies have provided a more nuanced view of the benefits of clustering; for example, Hervas-Oliver and Albors-Garrigos (2009) have shown that certain firms are better able to capitalise on the knowledge spillovers and learning advantages available within a cluster due to their greater 'absorptive capacity'.

2. Clusters as 'habitats' for entrepreneurship

Another strand in this research stream has explored their role as beneficial environments for new venture creation and growth. Regions differ in the way they can sustain new businesses due to the uneven geographical distribution of information and other knowledge necessary for firm formation and business success (Malecki 2002). This point is illustrated in empirical research on successful high technology regions in the United States. For example, Feldman (2001) identifies a 'munificent entrepreneurial environment' - comprising the availability of venture capital, supportive social capital and an 'entrepreneurial culture', and entrepreneurial support services, such as intellectual property lawyers - as a key component in the emergence of new biotech ventures in the US Capitol region. Research on Silicon Valley also describes the fertile entrepreneurial environment or 'habitat' as a crucial component underpinning new ventures creation and growth in that region (Lee et al. 2000). Finally, Stuart and Sorenson (2003) have argued that entrepreneurs in the US biotech industry are attracted to establish their businesses in particular locations that are characterized by a concentration of 'critical

resources' such as highly-skilled labour and venture capital. These ideas have already been adopted by a handful of studies and suggest a possible link-up between the clusters literature and the resource- and knowledge-based views of new venture internationalisation.

3. Cluster life cycles

More recent contributions to the clusters literature offer several potentially useful insights that have not yet been incorporated into the BG/INV literature. First, research has highlighted that clusters have their own 'life cycles' and evolve through a number of stages (e.g. Bergman 2008; Menzel and Fornahl 2010). Studies of cluster evolution and clusters at different stages in their life cycle have observed that the presumed benefits of a cluster location (as discussed above) may be present when a cluster is fully established but absent during the early stages of its emergence (Bresnahan et al. 2001; Feldman 2001), and also that cluster advantages (such as agglomeration economies) may fade or even reverse if a cluster reaches maturity/stagnation (Potter and Watts 2010). This research cautions us to consider that the alleged beneficial impacts of a cluster location for new venture internationalisation may be contingent of the life cycle stage of the cluster – an issue that forms the central argument in this paper and a key focus in the empirical case study analysis. These studies have also highlighted the important role played by entrepreneurial agency in seeding clusters and driving the cluster through phases in its life cycle, noting that pioneering entrepreneurs can – through their business successes - bring about a transformation in the regional environment for entrepreneurship (Bresnahan et al. 2001; Feldman et al. 2005; Mason 2008).

4. Entrepreneurial dynamics within clusters

A final strand of interest in the clusters research stream is concerned with the micro-foundations of industrial dynamics. A number of 'genealogical' studies have highlighted the

important role of localised spin-offs from incumbent firms in the growth of clusters (Klepper 2001; Dahl et al. 2003). This spin-off process may become cumulative and reinforcing because most new firms are founded in the same geographical region as the firm that 'produced' the entrepreneur (Klepper 2001; Romanelli and Schoonhoven 2001; Dahl et al. 2003). This implies that spin-offs and other forms of 'experience-based' entrepreneurship may account for an increasing share of the total firm population over time. Since the BG/INV literature has shown that experience can be positively related to internationalisation, we might expect to find more firms with the necessary experience for (early) internationalisation as the cluster progresses through its life cycle. This point is taken up during the empirical case study, along with the other themes discussed above.

METHOD

The empirical part of the paper is based on a *revelatory, historical and longitudinal* case study of new venture internationalisation within Ireland's indigenous software cluster. This case resonates with both literatures reviewed in the preceding section, since Ireland has been recognised as an emerging software development 'hotspot' in work on entrepreneurial technology clusters (Arora et al. 2004; Roche et al. 2008) and software firms have been a focus for many empirical studies in the BG/INV literature (e.g. Bell 1995; Coviello and Munro 1997). A case study approach was deemed appropriate because the study sought to examine a contemporary phenomenon (new venture internationalisation) within its real-life context (the Irish software cluster) and because the study was concerned with a 'how' question (Yin 2009). Two of Yin's (2009, p.48-49) justifications for adopting a single case design are present, since the study is both revelatory and longitudinal.

Yin (2009) suggests a *revelatory case study* is justified when an investigator has access to a phenomenon previously inaccessible to scientific investigation. The potential relationship between new venture internationalisation and the cluster life cycle was viewed as a phenomenon previously 'hidden' from investigation, and the author's prior interest in the Irish software industry (as part of another project) had generated data that subsequently became useful for exploring this issue. The study is *historical* in nature in that is focuses on past events, going back up over 20 years and relies to a large extent on archival sources. Yin (2009, p.49) notes that *longitudinal* studies can be useful for studying how conditions change over time; this was deemed important in light of the study's interest in the cluster life cycle context. Thus, attention focused on both the evolution of the wider cluster over time and on the internationalisation behaviour on two cohorts 'leading' new software ventures, each founded at a different stage of the cluster life cycle (embedded units of analysis). The *Chronological analysis* allows events to be traced over time and permits causal inferences to be drawn (Yin, 2009, p.148). This approach was used to construct an account of the overall cluster life cycle 'story' and to draw inferences about the relationship between temporal changes in the cluster environment and the internationalisation behaviour of new ventures.

The case study is based largely upon in-depth, desk-based research using a wide array of secondary data sources, supplemented by a close reading of evidence in several previous studies of the Irish software industry (notably O'Gorman et al. 1997; Ó Riain 1999; Sterne 2004; Sands 2005; Roche et al. 2008)[4]. Secondary data sources included individual companies' web-sites, various sector-specific and general on-line news media, and other Internet sources. Keyword searches allowed the identification of news stories pertaining to specific companies. Several published interviews with key figures in the industry, including the founders of many leading firms, were also utilised. These secondary data were originally

gathered by the author between 2001 and 2003, as part of another project, and supplemented in 2009. Data were organised into a structured archive, comprising 'source files' about each company of interest, several key industry figures and various pervasive themes. Analysis was guided by theories and concepts from the two thematic parent literatures review above.

CASE CONTEXT: THE IRISH SOFTWARE CLUSTER

Ireland has been recognised - alongside other ICT hotspots such as Israel, Bangalore (India), Taiwan and Finland - as an example of a late-comer or emergent technology region (Arora et al. 2004; Sands 2005; Roche et al. 2008). In the Irish case, attention has often focused on the role of inward foreign direct investment, notably from the United States, in sectors such as ICT hardware manufacturing, software and pharmaceuticals (Coe, 1997; Ó Riain 1997). However, perhaps the most interesting aspect of the Irish experience is the emergence of a dynamic, entrepreneurial 'home grown' software industry (O'Gorman et al. 1997; Ó Riain 1999; Roche et al. 2008). This indigenous industry is distinguished by its focus on niche software product development and its high export orientation (HotOrigin 2001; Arora et al. 2004). It has noted strengths in the areas of telecommunications, open systems-based middleware and integration web technology, e-security and secure payment solutions, e-learning/computer-based training and financial services applications (HotOrigin Ltd, 2001).

According to statistics from Ireland's National Software Directorate, the indigenous software industry underwent a significant expansion during the 1990s and early 2000s. From a base of 290 companies with 3,800 employees and revenues of IR£150 million in 1991, the industry had grown to comprised over 700 firms with around 14,000 employees and annual revenues of €1.4 billion by 2000 (despite a number of leading firms being 'lost' to foreign

acquisitions). More significantly, the indigenous industry became more export-oriented over the decade, with the share of total revenues coming from exports increasing from 41% in 1991 to 62% by 1999 and 81% of companies being involved in exporting by 1997. The United States, UK and Continental Europe were all significant export markets by the late 1990s. Although the majority of firms in the industry are small and micro enterprises, firms with 50+ employees were always the major contributors to exports. An interesting feature of the industry's growth during the 1990s was an increase in the number of these 'larger' firms from only 4 in 1989 to 24 by 1995, 34 in 1998 and at least 60 by 2001. It is these 'leading' firms that are of particular interest to this study.

A cluster life cycle perspective

In keeping with recent evolutionary accounts of clusters, the Irish indigenous software industry can be said to have progressed through a number of 'life-cycle' stages. Table 1 give an overview of this life cycle in four major phases from the late 1970s to the mid 2000s, highlighting the key characteristics of both the industry and the regional entrepreneurial environment at each stage. This summary has been informed by the author's own secondary research and reading of existing studies. In particular, Sterne's (2004) delimitation of five 'entrepreneurial generations' of Irish software firms was adopted. The key points to note from Table 1 are as follows. First, an identifiable cluster of software firms only became evident in Ireland in the early 1990s but significant pioneering entrepreneurship was talking place as early the 1970s (Ó Riain 1999; Sterne 2004). Some important pre-conditions for future success were 'accidentally' sown in the regional environment around this time. Second, the focus on niche software products only became ingrained from the early 1990s after which the industry became increasingly export-oriented. Third, the industry seems to

have reached a kind of critical mass by the mid 1990s, marking the start of Stage III, when the rate of new firm formation, employment growth rate and export intensity all increased. The Nasdaq IPOs of CBT Systems in 1995 and Iona Technologies in 1997 could also be seen as watershed events, due to the international reputation effects this conveyed on the cluster and the demonstration effects for budding software entrepreneurs in Ireland. Fourth, Ireland began to resemble an entrepreneurial technology cluster with apparently self-reinforcing growth dynamics by the late 1990s, with many new ventures being formed via spin-offs from incumbent firms or by serial entrepreneurs. At this stage, the Irish State ramped up its support efforts, particularly for new high potential start-ups, an indigenous venture capital industry was seeded, and elements of a private sector 'habitat' of specialist business service firms began to emerge.

This chronological account leads to some important inferences and insights, which underpin the case study analysis that follows. Firstly, it seems neither the supportive regional environment observed by the late 1990s nor the deliberate policies and actions of the Irish State were significant factors in the cluster's initial emergence, since both developments came *after* at least two entrepreneurial generations. Rather, entrepreneurial agency seems to have played a crucial role in the evolution of the cluster by 'inducing' the emergence of a more supportive regional entrepreneurial environment. This scenario echoes several other accounts in the literature on cluster emergence, evolution and life-cycles (e.g. Bresnahan et al. 2001; Feldman et al. 2005; Avnimelech and Teubal 2006). It also suggests that a 'co-evolutionary' perspective is appropriate, since entrepreneurial activities in the software industry both influenced, and were influenced by, the wider regional entrepreneurial environment in Ireland.

CASE EVIDENCE ON NEW VENTURE INTERNATIONALISATION AT DIFFERENT STAGES OF THE CLUSTER LIFE CYCLE

Attention in this section focuses on the origins and internationalisation behaviour of two cohorts of 'leading' software ventures that became active in international markets at different times. Firms in the first cohort were founded in Stage II (late 1980s/early 1990s) and went on to become some of the 'leading lights' of the Irish cluster in the mid-to-late 1990s; these were mostly members of Sterne's (2004) 3rd Generation. Firms in the second cohort were founded in Stage III (late 1990s); these were members of Sterne's (2004) 4th Generation. They were successful internationally during the 2000s, several were touted as future IPO candidates before the dot.com crash of 2002 and many were nominated in the Irish Software Association's annual industry awards. The following evidence and interpretation also pays particular attention to changes in the regional entrepreneurial environment confronting these two cohorts, in order to illuminate the relationship between new venture internationalisation and the cluster life cycle in the Irish software case.

New venture origins and internationalisation in the embryonic/emerging Irish software cluster

Looking into the origins of the early Irish software product firms of Generation 3, it is clear that no single source of knowledge was being exploited and there was no dominant 'entry route'. The emergence of these firms can be attributed to the efforts of entrepreneurs who sought to capitalize on: (1) the knowledge and expertise they had gleaned from varied work experience in industry, academia and the public sector; and (2) the commercial opportunity presented by the newly-emerging global market for software products. Many early Irish software product firms began by providing 'bespoke' or custom services to businesses, then

expanded this business by making consultancy kits and subsequently packaged products (Ó Riain 1999). Early customers within Ireland (including some foreign multinationals) provided a catalyst for these firms by commissioning IT development projects. Other firms were created via spin-outs of the in-house software/IT divisions of firms in other industries, such as telecommunications or computer hardware, or semi-state bodies. A variation on this theme saw new firms emerge when users of software in vertical markets, such as banking and training, started ventures that capitalized on detailed market knowledge. Finally, a *minority* of firms were based on academic research, including some of the most technically-sophisticated firms (Ó Riain 1999; Arora et al. 2004). These various routes are illustrated using some specific examples of leading Generation 3 firms in Table 2.

The internationalisation behaviour and paths of these early software product firms are difficult to uncover in detail from secondary research. However, the available evidence tends to suggest that they either: (1) internationalised gradually, having initially focused on providing custom services to domestic customers; or (2) internationalised early due to a small or non-existent home market for their products, but progressed with a narrow geographical scope, typically focusing on the culturally-proximate UK or US markets. Thus, Sterne (2004, p.65) states, "the typical generation two company started as a service provider to *local* customers, wrote its first code as a sideline, re-positioned itself as a product developer after a few years" and generation three firms were "characterised by product specialisation, more frequent forays into America". Overall, there seem to be some similarities with the traditional Uppsala or stage models of internationalisation, and where firms were early internationalisers, the moniker 'born international' seems more appropriate than 'born global', since their exporting generally progressed quite slowly and narrowly. Certainly, the

experiences of three leading Generation 3 firms (Euristix, Iona and Quay) are consistent with this interpretation (Table 2).

The regional entrepreneurial environment in the embryonic/emerging Irish software cluster

New software ventures in Ireland faced a challenging regional entrepreneurial environment in the late 1980s/early 1990s and - viewed in the context of subsequent developments - this seems to have constrained or slowed the pace of their internationalisation. Seen from a resource-based perspective, the new Generation 3 start-ups look strikingly similar to the 'resource deficient' small firm of traditional portrayals; their founders typically had little capital and many had limited commercial experience, meaning they lacked the requisite financial resources and prior business experience to pursue an early and rapid international expansion strategy. However, these internal resource deficiencies were compounded by the absence of a supportive regional environment where external resources could be acquired or mobilised.

One problem within the regional environment was an under-developed labour market; there was a shortage of experienced software managers, sales personnel and, to a lesser extent, engineering talent. There was also an absence of supportive State institutions, at least until - and arguably beyond - the establishment of the National Software Directorate in 1991. Further, new software ventures had few local role models to imitate, since there was no precedent of an Irish technology firm breaking into the key US market and many firms from the early generations of Irish software had either failed commercially or been swallowed up then run-down by foreign multinationals (Ó Riain 1999). However, the most significant shortcoming in the regional environment of the late 1980s/early 1990s was the paucity of

external financing options: private investors were wary of technology firms after a number of high-profile failures in the 1980s; the major banks would not lend to software firms who had no tangible assets against which to secure a loan; there was no local venture capital industry; and the State development agencies were not yet enthused by the software industry. The absence of external finance meant many firms began by selling consultancy and training services to generate income to support product development and had to adopt a gradualist, low commitment approach to international market entry.

Dissimilar venture origins and qualitatively different internationalisation among leading firms founded in Stage III (the established cluster)

The Irish software cluster was characterised by faster growth during the second half of the 1990s, fuelled by increasing export intensity and a higher the rate of new firm formation. Survey evidence suggests fewer than 30% of the estimated 250 indigenous software product development companies in existence in 2001 were established before 1996, and almost half were less than three years old (HotOrigin 2001). There was also a notable change in the origin of new software ventures during this phase, as spin-offs from incumbent indigenous firms became commonplace and serial software entrepreneurship was observed. Even *bone fide* new entrants tended to have founders with extensive prior experience in relevant vertical markets or technological niches. As noted above, a majority of these new ventures were niche product specialists from the outset and founded with an explicit focus on international markets. Strikingly, many of the leading Generation 4 firms founded in Stage III had characteristics that justified the label 'true born global' (after Kuivalainen et al. 2007): high export-orientation (internationalisation intensity); active in internationally from the very outset and in multiple countries within three years (early and rapid internationalisation); won

contracts with major corporate customers in at least two major continental markets (bi- or multi-regional internationalisation); and engaged in 'multi-modal' internationalisation - by establishing overseas offices, acquiring firms outside Ireland, or forming international strategic alliances with channel partners and/or technology partners. Note that this type of internationalisation behaviour was rarely, perhaps never, observed among the leading Generation 3 firms of Stage II, hence it can be seen as *qualitatively different* in terms of precocity, speed, intensity and geographic scope.

The eight cases detailed in Table 3 exemplify this 'born global' tendency. All survived a global technology sector downturn as early-stage businesses and internationalised early and rapidly to distant markets and in multiple global regions, winning contracts with major 'blue chip' corporate clients. As of October 2009, three were still trading independently as 'micro-multinationals' (one publicly-listed, two privately-held) some 10 to 13 years after their establishment, whilst five had been acquired after between five and 12 years of independent trading. All eight firms were founded by teams (of between two and seven founders) with significant prior experience, most of which was acquired working for earlier generations of firms in Stages I and II of the cluster life cycle. The new venture origin in all eight cases was one of three types: entrepreneurial spin-offs from successful incumbent firms (including some of the leading Generation 3 firms); serial entrepreneurship; or new entrants with very experienced founding teams (Table 3). It is suggested here that these origins and antecedents were an important causal factor behind the internationalisation behaviour observed among the eight firms, since they conveyed a particular and significant 'resource inheritance' on these new ventures, embodied in their experienced founders. The resources in question were things like technological domain knowledge, managerial and entrepreneurial experience, international marketing and market development experience in a variety of countries, and

deep familiarity with particular vertical markets and end users – all of which might be useful for early and rapid internationalisation. Table 4 exemplifies this point for three of the eight cases from Table 3. Thus, seen from a resource-based perspective, the leading Generation 4 firms were in a superior position at inception compared to earlier generations of Irish start-ups and this partly explains why they were able to pursue a qualitatively different internationalisation trajectory to their predecessors.

A transformed region entrepreneurial environment in Stage III (the established cluster)

This section highlights some important contrasts between the regional entrepreneurial environment facing new software ventures in late 1990s, and that of the late 1980s/early 1990s (described earlier). The central point is that the regional environment had substantially improved by Stage III, as a result the gradual process of co-evolution described earlier in the paper and summarised in Table 1. This transformed regional environment provided many useful resources and supports for new ventures. In particular, some of the resources that are known - from the BG/INV literature - to be useful for early and rapid internationalisation (e.g. venture capital, experienced executives and supportive institutions) became relatively abundant by the late 1990s. Thus, the new software ventures of the late 1990s/early 2000s – including those cases in Table 3 - were able to (externally) acquire and mobilise some of the additional resources they required for early and rapid internationalisation from within the cluster. This undoubtedly encouraged and enabled several leading Generation 4 firms to pursue of a 'truly born global' strategy. Three of the many important changes in the regional environment are discussed here by way of illustration.

1. Development of a local venture capital industry

It was only around 1998/99 that private investment capital became abundant in Irish software (Ó Riain 1999). The modern Irish venture capital (VC) industry was 'kick-started' by an EU-funded Irish government programme, starting in 1996. Using matched public and private funds it aimed to stimulate investment in promising technology-based start-ups (Enterprise Ireland 2000). Thus, between 1998 and the early/mid 2000s, VC became a dominant source of external finance for 'build-phase' indigenous software companies (HotOrigin Ltd, 2001 and 2002). The example of VC provides the clearest illustration of how the transformed regional environment in Stage III influenced the internationalisation behaviour of Generation 4 firms. Recall that the use of VC has been linked in the literature to the pursuit of an early internationalization strategy, as it permits firms to rapidly build channels to market, make acquisitions and fund ongoing product development. In contrast to previous generations, who struggled to raise external funds, the leading Generation 4 firms could avail of a home grown VC industry (comprising firms like ACT, Delta Partners and Trinity VC) and, in some instances, attract investment from international VCs who were now showing interest in Ireland, following the IPOs of CBT and Iona. Thus, all eight of the BG cases in Table 3 received VC; together securing over €100 million in 18 separate deals, worth €2-15 million between 1999 and 2003. As an example of how this funding was useful for accelerated internationalisation, consider CR2's £8.1m acquisition of London-based Interlink, a global provider of software for ATM and point-of-sale devices, in June 2000. This deal, which would not have been possible without VC, instantly doubled CR2's size and gave it access to an infrastructure ideally matched to its global expansion plans; Interlink was already active in India, Africa, the Middle East and Asia-Pacific (Linnane 2000).

2. A maturing labour market

Venture capitalists often stimulate the 'professionalisation' of start-ups by encouraging them to recruit experienced executives and appoint non-executive directors (Hellman and Puri 2002). This became more possible in Ireland in the late 1990s/early 2000s due to the accumulation of experience within the cluster through the 1990s. Many of the leading Generation 4 firms enhanced their top management team by recruiting executives from within the cluster; a good example is Openet Telecom's appointment of former Insight Software MD and National Software Director Barry Murphy to its CEO position in 2000 (Tables 3 and 4). Other Generation 4 firms brought in experienced advisors and extended their network ties by appointed industry veterans like the former Iona CEO Chris Horn and Euristix founder Jim Mountjoy as non-executive board directors. Experienced marketing and sales executives were also becoming more common in the cluster by Stage III, and firms were able to tap into recognised technical communities, in areas such as telecoms software and middleware, when recruiting engineering talent (Ó Riain 1999).

3. Enterprise Ireland's active support of software firms

Another important development during late 1990s, triggered by the international entrepreneurial successes of Generation 3 firms, was improved support from the State. Enterprise Ireland (EI), the indigenous industry development agency formed in 1997, recognised the promise of the software industry and began offering a range of hard and soft supports to 'high potential start ups'. EI took direct equity stakes in many of these promising new software ventures, including Am Beo and Network 365 (Table 3). It was also facilitated firms' international market entry; for example, Cape Clear's first US presence was as a tenant in Enterprise Ireland's 'technology marketing centre' near San Jose, California, and mobile telecoms specialists Network365 and Xiam were among the first firms to use EI's Tokyo

incubator in 2001. Many Generation 4 firms also participated in EI's international trade missions or had their visits to key international trade fairs subsidised.

CONCLUSION

The paper makes a contribution to the burgeoning literature on the internationalisation of new and small firms, and the emerging sub-discipline of International Entrepreneurship. It adds to the handful of recent studies on the relationship between clusters and new venture internationalisation, and further extends this work by exploring how the emergence and internationalisation of new ventures can be affected by the cluster life cycle context within which they are founded. This issue was examined via a revelatory longitudinal case study that highlighted differences in the origins and internationalisation behaviour of two cohorts of new ventures founded at different stages in the life cycle of Ireland's indigenous software cluster. The internationalisation of leading firms founded during the later established cluster stage (in the late 1990s) was shown to have been qualitatively different – that is earlier, more rapid, wider in geographic scope and more multi-modal – to that of firms founded in the embryonic/emerging stage of the cluster life cycle (late 1980s/early 1990s). Taking inspiration from the resource-based perspective on the BG/INV phenomenon, this difference was attribute to two main factors: (1) Improvements in the regional entrepreneurial environment in Ireland (including the development of a local venture capital industry, a maturing of the labour market and improved policy support from Enterprise Ireland) that made it easier for firms to acquire useful resources; and (2) The emergence of a cohort of more 'sophisticated' and 'pre-experienced' new ventures - during the established cluster - that sought to capitalise on the accumulated knowledge resources embodied in their founding

team members. These resources had often been developed during prior experiences within the cluster, in earlier generations of internationally-active firms.

External validity is an inherent concern with all case study research, so we cannot be certain if these findings are specific to the Irish case or generalisable to other locations and industries. However, there do appear to be some parallels with the experiences of emergent technology clusters in Israel and Bangalore (Avnimelech and Teubal 2006; Nair et al. 2007). Also, following Yin's (2009) assertion that case study research is concerned with generalisation to theory rather than populations, the conceptual links made here between new venture internationalisation and the cluster life cycle may have wider relevance. Overall, the paper suggests that a more holistic understanding of the born global/INV phenomenon could be developed by paying closer attention to the geographical and historical context with which these firms emerge. A longitudinal or co-evolutionary perspective that gives greater consideration to these contextual factors - looking before and beyond the life of a single venture or entrepreneur - might be a fruitful avenue for future studies.

REFERENCES

Arora, A., Gambardella, A. and Torrisi, S. (2004) 'In the Footsteps of Silicon Valley? Indian and Irish software in the International Division of Labor', in Bresnahan T. and Gambardella, A. (Eds.) *Building High-Tech Clusters: Silicon Valley and Beyond*, 78-120 (Cambridge, UK: Cambridge University Press).

Aspelund, A., Madsen, T. K. and Moen, Ø. (2007) 'A Review of the Foundation, International Marketing Strategies, and Performance of International New Ventures', *European Journal of Marketing*, 41, 1423-48.

Avnimelech, G. and Teubal, M. (2006) 'Creating Venture Capital Industries that Co-evolve with High-tech: Insight from an Extended Industry Life Cycle Perspective on the Israeli experience', *Research Policy*, 35, 1477-98.

Bell, J. D. (1995) 'The Internationalisation of Small Computer Software Firms: A Further Challenge to Stage Theory', *European Journal of Marketing*, 29, 60–75.

Bergman, E. M. (2008) 'Cluster Life-Cycles: An Emerging Synthesis', in Karlsson, C. (Ed.) *Handbook of Research on Cluster Theory*, 114-132 (Edward Elgar, Cheltenham, UK).

Bloodgood, J. M., Sapienza, H. J. and Almeida J. G. (1996) 'The Internationalization of New High-Potential U.S. Ventures: Antecedents and Outcomes', *Entrepreneurship Theory and Practice*, 20(4), 61-76.

Bresnahan, T., Gambardella, A. and Saxenian, A. (2001) 'Old Economy Inputs for New Economy Outcomes: Cluster Formation in the New Silicon Valleys', *Industrial and Corporate Change*, 10, 835-60.

Coe, N. M. (1997) 'US Transnationals and the Irish Software Industry: Assessing the Nature, Quality and Stability of a New Wave of Foreign Direct Investment', *European Urban and Regional Studies*, 4(3), 211- 30.

Coviello, N. E. and McAuley, M. (1999) 'Internationalisation and the Smaller Firm: A Review of Contemporary Empirical Research', *Management International Review*, 39, 223-56.

Coviello, N. E. and Munro, H. (1997) 'Network Relationships and the Internationalization Process of Small Software Firms', *International Business Review*, 6, 361-86.

Coviello, N. E. and Cox, M. P. (2006) 'The Resource Dynamics of International New Venture Networks', *Journal of International Entrepreneurship*, 4, 113–32.

Crone, M. (2010) 'Geographical Context and the Emergence of Early Internationalizing Firms: Towards an Inter-Disciplinary Conceptualization', Presented at 37th AIB-UKI Conference, 8-10 April, Dublin, Ireland.

Dahl, M. S., Pedersen, C. Ø. R. and Dalum, B. (2003) 'Entry by Spin-off in a High-tech Cluster', Working paper No 03-11, Danish Research Unit for Industrial Dynamics.

Enterprise Ireland (2000) *2000 Report: Seed and Venture Capital Measure of the Operational Programme, 1994-99* (Dublin: Enterprise Ireland).

Feldman, M. P. (2001) 'The Entrepreneurial Event Revisited: Firm Formation in a Regional Context', *Industrial and Corporate Change*, 10(4), 861-91.

Feldman, M. P., Francis, J. and Bercovitz, J. (2005) 'Creating a Cluster While Building a Firm: Entrepreneurs and the Formation of Industrial Clusters', *Regional Studies*, 39(1), 129-41.

Fernhaber, S. A. and McDougall-Covin, P. P. (2009) 'Venture Capitalists as Catalysts to New Venture Internationalization: The Impact of their Knowledge and Reputation Resources', *Entrepreneurship Theory and Practice*, 33, 277-95.

Fernhaber, S. A., Gilbert, B. A., and McDougall P. P. (2008) 'International Entrepreneurship and Geographic Location: An Empirical Examination of New Venture Internationalization', *Journal of International Business Studies*, 39, 267-90.

Gabrielsson, M., Sasi, V. and Darling, J. (2004) 'Finance Strategies of Rapidly-Growing Finnish SMEs: Born Internationals and Born Globals', *European Business Review*, 16(6), 590-604.

Gabrielsson, M., Kirpalani, V. H. M., Dimitratos, P., Solberg, C. A. and Zucchella, A. (2008) 'Born Globals: Propositions to Help Advance the Theory', *International Business Review*, 17, 385-401.

Hellmann, T. and Puri, M. (2002) 'Venture Capital and the Professionalization of Start-Up Firms: Empirical Evidence', *The Journal of Finance*, 57(1), 169-97.

Hervas-Oliver, J-L. and Albors-Garrigos, J. (2009) 'The Role of the Firm's Internal and Relational Capabilities in Clusters', *Journal of Economic Geography*, 9, 263-83.

HotOrigin Ltd (2001) *Ireland's Emerging Software Cluster: A Hothouse of Future Stars.* HotOrigin Ltd, 64 Lower Mount Street, Dublin 2, Ireland.

HotOrigin Ltd (2002*) Ireland's Software Cluster: Innovation – the Fuel for International Success.* HotOrigin Ltd, 64 Lower Mount Street, Dublin 2, Ireland.

Keeble, D., Lawson, C., Moore, B. and Wilkinson, F. (1999) 'Collective Learning Processes, Networking and "Institutional Thickness" in the Cambridge Region', *Regional Studies*, 33(4), 319-32.

Klepper, S. (2001) 'Employee Startups in High-Tech Industries', *Industrial and Corporate Change*, 10, 639-74.

Kuivalainen, O., Sundqvist, S. and Servais, P. (2007) 'Firms' Degree of Born-Globalness, International Entrepreneurial Orientation and Export Performance', *Journal of World Business*, 42(3), 253–67.

Laanti, R., Gabrielsson, M. and Gabrielsson, M. (2007) 'The Globalization Strategies of Business-to-Business Born Global Firms in the Wireless Technology Industry', *Industrial Marketing Management*, 36(8), 1104-17.

Lee, C. M., Miller, W. F., Hancock, M. G. and Rowen, H. S. (2000) *The Silicon Valley Edge: A Habitat for Innovation and Entrepreneurship* (Stanford, CA: Stanford University Press).

Libaers, D. and Meyer, M. (2011) 'Highly Innovative Small Technology Firms, Industrial Clusters and Firm Internationalization', *Research Policy*, 40, 1426-37.

Linnane, C. (2000) 'CR2' (Interview with Cian Kinsella and Ron Downey), Business Plus Online, 1st September (http://www.bizplus.ie/bp_online/start_ups/?ns=62, accessed 20/03/03).

Loane, S., Bell, J. D. and McNaughton, R. (2007) 'A Cross-National Study on the Impact of Management Teams on the Rapid Internationalization of Small Firms', *Journal of World Business*, 42, 489-504.

Malecki, E. (2002) 'Entrepreneurship in Regional and Local Development' in Krueger, N.F. (Ed.) *Entrepreneurship: Critical Perspectives on Business and Management*, 329-64 (London: Routledge).

Malmberg, A. and Maskell, P. (2002) 'The Elusive Concept of Localization Economies: Towards a Knowledge-Based Theory of Spatial Clustering', *Environment and Planning A*, 34, 429-49.

Marshall, A. (1890) *Principles of Economics: An Introductory Volume* (London: Macmillan).

Mason, C. (2008) 'Entrepreneurial Dynamics and the Origin and Growth of High-Tech Clusters', in Karlsson, C. (Ed.) *Handbook of Research on Innovation and Clusters: Cases and Policies*, 33-53 (Cheltenham, UK: Edward Elgar).

Menzel, M-P. and Fornahl, D. (2010) 'Cluster Life Cycles - Dimensions and Rationales of Cluster Evolution', *Industrial & Corporate Change*, 19, 205-38.

Nair, A., Ahlstrom, D. and Filer, L. (2007) 'Localized Advantage in a Global Economy: The Case of Bangalore', *Thunderbird International Business Review*, 49(5), 591–618.

Ó Riain, S. (1997) An offshore Silicon Valley? The emerging Irish software industry, *Competition and Change*, Vol.2, 175-212.

Ó Riain, S. (1999) *Remaking the Developmental State: The Irish Software Industry in the Global Economy*. Unpublished dissertation, Department of Sociology, University of California, Berkeley.

O'Gorman, Colm, Eoin O'Malley, and John Mooney (1997) *The Irish Indigenous Software Industry - An Application of Porter's Cluster Analysis.* Research Series Paper No 3, National Economic and Social Council, Dublin.

Porter, M. E. (1998) 'Clusters and the New Economics of Competition', *Harvard Business Review*, 76(6), 77- 81.

Potter, A. and Watts, H. D. (2010) 'Evolutionary Agglomeration Theory: Increasing Returns, Diminishing Returns, and the Industry Life Cycle', *Journal of Economic Geography*, 11(3), 417-55.

Presutti, M., Onetti, A. and Odorici, V. (2008) 'Serial Entrepreneurship and Born-Global New Ventures: A Case Study', Working Paper, University of Bologna (available at: http://ssrn.com/abstract=1145202).

Reuber, A. R. and Fischer, E. (1997) 'The Influence of the Management Team's International Experience on the Internationalization Behaviors of SMEs', *Journal of International Business Studies*, 28(4), 807-25.

Rialp, A., Rialp, J. and Knight, G. A. (2005) 'The Phenomenon of Early Internationalizing Firms: What Do We Know After a Decade (1993–2003) of Scientific Inquiry?', *International Business Review*,14, 147–66.

Roche, F., O'Shea, R., Allen, T. J. and Breznitz, D. (2008) 'The Dynamics of an Emerging Entrepreneurial Region in Ireland', in Phan, P. H. C., Venkataraman, S. and Velamuri, S. R. (Eds.) *Entrepreneurship in Emerging Economies Around the World: Theory, Evidence and Implications*, 9-46 (Cheltenham, UK: Edward Elgar).

Romanelli, E. and Schoonhoven, C. B. (2001) 'The Local Origins of New Firms', in C. B. Schoonhoven and E. Romanelli (Eds.) *The Entrepreneurship Dynamic: Origins of Entrepreneurship and the Evolution of Industries*, 40-67 (Stanford, CA: Stanford University Press).

Ruzzier, M., Hisrich, R. D. and Antoncic, B. (2006) 'SME Internationalization Research: Past, Present and Future', *Journal of Small Business and Enterprise Development*, 13(4), 476-497.

Sands, A. (2005) The Irish Software Industry, in Arora, A. and Gambardella, A. (Eds.) *From Underdogs to Tigers: The Rise and Growth of the Software Industry in Brazil, China, India, Ireland, and Israel*, 41-71 (Oxford, UK: Oxford University Press).

Sternberg, R. and Litzenberger, T. (2004) 'Regional Clusters in Germany—Their Geography and Their Relevance for Entrepreneurial Activities', *European Planning Studies*, 12(6), 767-91.

Sterne, J. (2004) *Adventures in Code: The Story of the Irish Software Industry* (Dublin: The Liffey Press).

Stuart, T. E. and Sorenson O. (2003) 'The Geography of Opportunity: Spatial Heterogeneity In Founding Rates and the Performance of Biotechnology Firms', *Research Policy*, 30, 229-53.

Westhead, P., Wright, M. and Ucbasaran, D. (2001) 'The Internationalization of New and Small Firms: A Resource-Based View', *Journal of Business Venturing*, 16(4), 333-58.

Yin, R. K. (2009) *Case Study Research: Design and Methods*, 4th Edition (London: Sage).

FIGURES AND TABLES

Table 1: Key developments in Ireland's indigenous software industry during four stylised cluster life cycle stages

Cluster life cycle stage	Stage I: Pre-/Proto-cluster (1970s to late 1980s)	Stage II: Embryonic/emerging cluster (late 1980s to mid 1990s)	Stage III: Established cluster in expansionary/ accelerated growth phase (mid 1990s to 2001/02)	Stage IV: External shock, rationalisation and reinvention (2002 onwards)
Key industry characteristics and developments	• Small population of firms • Pioneering Generation 1 firms focused on services and custom development for mainframes • High profile failures and asset-stripping foreign acquisitions • Some innovative Generation 2 firms but they suffered from lack of commercial experience (e.g. Glockenspiel, Generics)	• Beginnings of critical mass? • Generation 2 firms begin exporting software products • Emergence of Generation 3 firms, including the 'leading lights' of Stage III • Industry moves to niche software product based business model • Recognised technical communities in middleware, courseware and telecommunications software	• Critical mass attained? • IPOs and acquisitions of leading Generation 3 firms (e.g. Aldiscon, CBT Systems, Euristix, Iona) • Increasing volume of start-ups, incl. spin-offs from incumbents • Internationalisation of many firms and growing export intensity • Emergence of 'true born globals' among Generation 4 firms • Some examples of outward FDI	• External shock: dot.com crash and global technology sector downturn • De-listing of several key players • Rationalisation and cost-cutting • Limited number of high-profile firm failures • Gradual return to growth
Developments in the regional environment (cluster habitat)	• 'Accidental' creation of pre-conditions for growth • University expansion plus establishment of Regional Technology Colleges in 1970s • Upgrading of national telecoms infrastructure using EU funds • IDA Ireland attracts FDI by leading US ICT multinationals • Net out-migration of graduates and skilled professionals	• State agencies slowly begin to recognise potential of indigenous software industry • Industry-specific institutions formed (e.g. National Software Directorate, Centre for Software Engineering) • Some internationally significant development work done by leading firms (e.g. Aldiscon, Iona)	• International recognition of leading firms and Irish software cluster as a whole • State agency Enterprise Ireland develops focus on software firms, providing hard and soft supports • Establishment of local venture capital industry, abundant angel investment, inflows of foreign VC • Establishment/attraction of private-sector support firms as part of developing start-up 'habitat'	• Harsher investment climate/funding crisis • Doubts about scale of firms and sustainability of cluster • Enterprise Ireland broadens focus to other indigenous industry sectors • Some software institutions disbanded or downgraded (e.g. CSE, NSD)

Note: entrepreneurial 'generations' are denominated according to Sterne (2004).

Source: author, based on own secondary research and reading of existing studies (Coe 1997; O'Gorman et al. 1997; Ó Riain, 1997 and 1999; Sterne, 2004; Sands 2005; Roche et al. 2008).

Table 2: Profiles of three 'leading' software firms founded in Stage II

Company	Specialism	Commentary (e.g. origins, key milestones)
Euristix	Telecommunication systems software (network/element management)	Founded in 1990 by former MD of Baltimore Technologies who had PhD in telecoms engineering and experience with State telecoms company; began selling consultancy services to government and commercial clients; first significant US contract in 1993; set up US office and introduced first product in 1995; acquired in 1999 by Nasdaq-listed Fore Systems for $81 million in stocks, when it had 170 employees
Iona Technologies	Standards-based component middleware (later web services integration)	Founded in 1991 on back of EU-funded research on distributed computing at Trinity College Dublin; sold training services to fund initial product development; led industry in implementing CORBA operating standard with its Orbix product; sold minority stake to Sun Microsystems in 1994 after struggling to secure venture capital; opened first US office in 1995; second Irish firm to list on Nasdaq in 1997 in $60 million IPO; revenues peaked at $180 million (two-thirds from USA) and workforce at over 800 in 2001; seen as industry 'bellwether' from late 1990s
Quay Financial Software	Financial services applications (information delivery and presentation for stock, bond and currency traders)	Founded in 1987; founder had worked in New York in early 1980s; products rode wave of PC adoption in financial services in early 1990s; angel investment from Dermot Desmond; early adopters of its products were in Ireland; used reference customers to secure sales in London and New York; ultimately gained 80 customer in 23 countries after granting global distribution rights to US vendor Micrognosis in 1992; revenues reached $19 million by 1995; acquired by CSK (Japan) in 1996, when it had over 80 employees

Source: author, based on own secondary research and reading of existing studies.

Table 3: Profile of eight 'born global' Irish software firms founded in Stage III of the cluster life cycle

Company (founded)	Business niche (circa 2003)	Venture origin	Known customer locations (circa 2003)	Example 'blue chip' customers (circa 2003)	Status as of October 2009
Am Beo (Mar 2000)	Rating and billing solutions for telecoms	ESO	Europe, North America	Lycos Europe, Western Wireless (USA), Sonera ZED (Finland)	Acquired by US Nasdaq-listed company in October 2005
Cape Clear (Aug 1999)	Web services integration technology	ESO	Europe, North America, South America	AT&T, Deutsche Bank, General Electric, Hewlett-Packard, Sky	Acquired by US company in March 2008
CR2 (Jan 1997)	Channel banking and card payment solutions	SE	Europe, Middle East, India, Africa, Caribbean, Oceania	Bank Muscat (Oman), LG Petro Bank (Poland), ANZ Bank (Aus)	Independent, privately-owned; founders were no longer on board
Macalla (Mar 1998)	Mobile commerce platforms and solutions	ESO	Europe, North America	ING/Postbank and Telfort/MMO2 (Neth), Dresdner Kleinwort (Germany)	Acquired by US company in September 2009
Network365 (Jun 1999)	Enabling technology for mobile services	SE	Europe, North America, Asia-Pacific	Hutchinson and CSL (Hong Kong), O2, NTT DoCoMo (Japan)	Acquired by Northern Ireland company in July 2009
Norkom (Mar 1998)	eCRM solutions and customer intelligence tools	EFT	Europe, North America	HSBC, Canadian Tire Financial (Can), KPNO (Belg), ING Direct (Neth)	Independent Plc after IPO on AIM & IEX in May 2006
Openet (Jul 1999)	Telecom billing software for real-time charging	EFT	Europe, North America	Orange, Telecom Italia Mobile, Verizon (USA), TMN (Portugal)	Independent, privately-owned
Xiam (Sep 1999)	Mobile middleware and application software	EFT	Europe, North America, Asia-Pacific	Vodafone, Orange, CSL (Hong Kong), Midwest Wireless (USA)	Acquired by US company in March 2008

Notes: ESO = Entrepreneurial spin-off from incumbent firm; SE = Established by serial entrepreneurs; EFT = New entrant with experienced founding team;IPO = initial public offering; AIM is the London Stock Exchange's international market for smaller growing companies and IEX is its smaller Irish equivalent.

Source: compiled by author using information from company websites and various secondary data sources.

Table 4: Antecedents, origin and 'resource inheritance' of three 'born global' software firms founded in Stage III

Company	Commentary
Cape Clear	Founded by three former executives of leading Irish middleware firm Iona Technologies (cross-refer Table 2). Subsequently recruited three other key executives from Iona. Like Iona, it initially specialised in middleware systems built to the CORBA industry operating standard. Embodied knowledge and expertise transferred in spin-off included experience of developing and marketing component middleware products at Iona, plus experience in various managerial roles with this leading indigenous software exporter.
CR2	Founded in 1996 by Cian Kinsella and Ron Downey after they resigned from Kindle Banking Systems, an Irish banking software firm that they had previously co-founded and grown before selling it to UK Plc Misys. Kinsella gained extensive experience during his 17 years at Kindle, including product development, consultancy, customer service and sales; he had served as Kindle's Technical Director and Sales Director. Downey led Kindle into its first export market (UK in 1994) and had established Kindle's regional offices in Singapore, Bahrain and Miami as its Worldwide Sales Director in the early 1990s. CR2 appointed several experienced entrepreneurs/executives from within the cluster to its board in the early 2000s.
Openet Telecom	Established in 1999 with a pre-selected, highly experienced, senior management team of software and telecoms industry veterans, who had worked - in Ireland - for firms like Euristix (cross-refer Table 2), Retix/Vertel, ISR Global Telecom and Sun Microsystems. This background gave the firm a deep understanding of its target customers and emerging trends in the telecoms market. Barry Murphy, founder of Insight (a leading Irish software firm in the 1980s) and Ireland's first National Software Director (1988-96), was recruited as CEO at an early stage.

Source: compiled by author using information from company websites and various secondary data sources.

Notes

[1] A 'cluster' is understood here as a geographic concentration of businesses, specialized suppliers and associated institutions in a particular field, which may confer competitive advantages on its constituent firms; i.e. broadly along the lines of Porter's (1998) definition.

[2] Due to space constraints, this section focuses on a limited selection of work. Wide-ranging reviews of the burgeoning literature on BGs/INVs are provided by Rialp et al. (2005) and Aspelund et al. (2007).

[3] Porter's (1998) ideas on clusters, which will be familiar to IB scholars, are overlooked here because the diamond model has limited utility in explaining emergent technology clusters (O'Gorman et al. 1997; Nair et al. 2007).

[4] John Sterne is a Dublin-based journalist who has written about the IT business in Ireland for 20+ years. His 2004 book provides an unparalleled source of insights on leading firms and entrepreneurs in the cluster.