Networks Among Irish Information
Communications and Technologies (ICT) Firms

Ann M. Torres
National University of Ireland, Galway

Martin A. Whyte
Business School
Dublin City University

Abstract: This paper explores how Irish information, communication and technologies (ICT) firms use networks to achieve objectives and commercialise technology. The research availed of Heracleous and Murray’s (2001) taxonomy of networks, based on the dimensions of interdependence and durability, to classify and provide insight into the nature of networks. The benefits accruing from network participation are reputational benefits by association, learning and informational advantages, as well as shared resources. The research surveys members of the Information Technology Association of Galway (ITAG), an ICT network in Galway, Ireland. The findings indicate ITAG members participate in various networks simultaneously and there are different motivations and drawbacks associated with each network type. The preference is for short-term collaborative forms, which provide immediate returns.

Key Words: Networks, Software and ICT Firms, SMEs

INTRODUCTION

The resource-based view of the firm has been revised, where the value-creating resources and activities can be found not only inside, but outside the boundaries of the firm, leading to what has been termed the ‘relational perspective’ (Van Laere & Heene, 2003). The contemporary competitive environment requires coordination more than functional specialisation (Lambert & Peppard, 1993) and “the days of flat-out, predatory competition are over” (Bleeke & Ernst, 1998, p. 353). As a result, “the ‘locus of production’ has shifted from within the firm to being at the nexus of the multiple relationships that exist in the network” (Schilling & Steensma, 2001, p. 1149). An organisation’s portfolio of network relationships can represent a key strategic asset and serve as a possible source of competitive advantage. “There is strong evidence internationally that a firm’s competitive advantages, particularly in innovation driven industries, often lie outside the firm itself” (Forfás, 2003, p. 37).

This paper begins by reviewing the literature on networks and network typology and their strategic importance for small and large organisations in fast moving, high intellectual capital
sectors such as the information, communication and technologies (ICT) sector. Members of the Information Technology Association of Galway (ITAG) are surveyed as a means to examine inter-firm behaviour within a network where there is a mix of entrepreneurial and less entrepreneurial SMEs and MNCs. ITAG is typical of Irish networks which aim to cultivate economic and technological clusters within a given geographical location by fostering strategic business partnerships. Examining such a network as ITAG affords the opportunity to observe entrepreneurial behaviour and to consider the extent to which networks contribute to entrepreneurial activities among participating firms.

Networks

The term ‘network’ has become the umbrella name for all types of relationships among organisations (McCarthy & Torres, 2004). In the management and strategy literature, networks are a type of collaboration where organisations with a common interest, work together to exchange ideas, knowledge and/or technology in some areas (Dean et al., 1997), but still maintain their autonomy in other areas (Kosa & Lewin, 2000). Networks provide the opportunity to gain access without the costs associated with owning scarce resources (Drago, 1997; Elmuti & Kathawala, 2001). A firm may have multiple reasons for participating in a network. It has been suggested they have a role spurring innovation (Chesbrough & Teece, 1996; Powell, 1998); adapting to environmental change (Kraatz, 1998); increasing flexibility and efficiency (Lorenzoni & Baden-Fuller, 1995; Dyer & Nobeoka, 2000); and facilitating access to resources at low cost (Gulati et al., 2000). Networks also have a role in gaining access to new markets, reducing cycle times, decreasing transaction costs and managing uncertainty (Heracleous & Murray, 2001). Moreover, there are less tangible benefits such as the generation of power, influence, credibility, favours and opportunities (Giuffre, 1999).

Despite the potential benefits there are costs attached to participating in networks, such as the possible reduction in organisational flexibility and independence (Drago, 1997; Kosa & Lewin, 2000; Elmuti & Kathawala, 2001). Maintaining healthy, co-operative relationships among participants is of paramount importance to success. However, network relationships are complex, multifaceted, and highly dependent on the context in which they are embedded. Due to these complexities, networks may not bring about the performance results envisioned and consequently may fall-short of expected benefits. Findings indicate two-thirds of all alliances experience severe problems in the first two years and between 50% and 70% of alliances fail or under perform (Accenture, 2001; Kosa & Lewin, 2000).

Taxonomy of Networks

Networks are not homogenous. Heracleous and Murray’s (2001) taxonomy of five network types (see Exhibit 1) is based on the dimensions of interdependence and durability. Interdependence refers to the extent to which firms in the network use each others’ outputs and resources in their own operations. The dimension of durability refers to the extent to which networks persist in the longer term with broadly similar participants, structure and content. The five network forms, as
outlined by Heracleous & Murray (2001) are: atomistic, edge of chaos, association, embedded and brokered.

The **atomistic network** has negligible interdependence other than through independent transactions and no durability of relationships beyond the individual transaction. An **edge of chaos network** has extensive operational and strategic interdependence, but does not persist for long or require dense ties in order to function. Research consortia best exemplify an edge of chaos network, in which a project manager assembles temporary coalitions of actors. The **association network** has a high degree of durability, but limited interdependence and is best exemplified by industry associations. Industry associations are formed for the purpose of regulatory lobbying, the institution of self-regulation, or promoting professional education and regulating a specialist labour supply. An **embedded network** has a high degree of durability as well as an extensive level of inter-organisational dependence. Japanese Keiretsu, which reflect deeply entrenched institutional features derived from the structure of kinship and family best exemplify embedded networks. In addition, long-term strategic alliances may be classified as embedded networks. A **brokered network**, located in the centre of Exhibit 1, has moderate levels of interdependence and durability and may be exemplified by short-term strategic alliances. Brokered networks include hub-and-spoke network structures and often involve a strategic centre, which acts as the network co-ordinator.

**Exhibit 1: Collaborative Forms within ITAG Derived from Heracleous and Murray’s Taxonomy of Networks**

The network forms identified by Heracleous & Murray (2001) represent analytical distinctions, which in practice, may not be clear-cut. Moreover, “firms may, at the same time, be involved in different types of networks, features of networks may change over time, and networks can form at intermediate positions” (Heracleous & Murray, 2001, p. 145). Hence, the location of networks within the taxonomy is not static. Over time, endogenous and exogenous factors may compel networks to transform from one type to another.

**Marketing-Entrepreneurship Interface and Networks**

The importance of networks for entrepreneurs has been established for some time. Greve and Salaff (2003) found entrepreneurs build a variety of social networks that systematically vary by the stage of entrepreneurship. Networks can be especially important for micro enterprises (i.e. less than ten employees) faced with “insufficient resources, inadequate specialised expertise and limited opportunities to make an impact on the marketplace” (Torres, 2001, p. 229). Networks may also be a means for smaller players to address issues of economies of scope or experience, especially in oligopolistic markets. Brown and Butler (1995) examined the US winemaking industry and concluded, in situations where there are a small number of well-established competitors, entrepreneurs need to co-operate to compete effectively.

Generally, smaller entrepreneurial firms are relational in their approach to the market and rely on interaction and network marketing (McGowan & Durkin, 2002; Coviello et al., 2000). Networks have been shown to partially compensate for explicit marketing information and knowledge (Chaudhry & Crick, 2004). Examining the network in which entrepreneurial firms are embedded is a typical approach to understanding how entrepreneurs market their products and services (O’Donnell, 2004). To be worthwhile, networks must be aligned with marketing objectives. O’Donnell (2004, p. 213) found “owner-managers are generally engaged in extensive and proactive networking and generally maintained strong ties …, [however, there are certain circumstances where] extensive networking is neither necessary nor desirable.” Casson (1997, p. 811) concluded “the question is no longer whether networks are required for coordination, but simply under what conditions they work best.”

**The ICT Sector in Ireland**

The ICT sector is one of the more important industrial sectors to the Irish economy; 60% of all software sold in Europe originates in Ireland (Enterprise Ireland, 2004). In 2002, total exports of ICT products and services were worth almost €30 billion, representing 34% of all Irish exports while sales amounted to over €50 billion. “Approximately 900 indigenous [Irish] firms and 400 foreign direct investment firms contributed to this performance” (HotOrigin, 2004, p. 8). Amongst ten OECD nations, Ireland has the largest share of industrial R&D accounted for by foreign affiliates, with 68% of national industrial R&D accounted for by foreign firms (OECD, 1998 cited in Kearns & Ruane, 2001).

Although indigenous ICT firms have existed since the 1970s, the Irish government did not recognise the Irish industry as a separate sector until 1989, primarily due to a campaign led by the Irish Software Association (ISA) (Gallen, 2001). Since then, the ICT industry has accelerated
significantly, developing into a robust, flourishing sector. Between 1997 and 1999, venture capital investment in all high technology companies increased five fold (Doyle, 2000). The ‘celtic tiger’ of the 1990s saw Ireland emerge as a hive of ICT development activity and a key hub in the global industry (Crone, 2003). Central to the successful growth of this sector was the participation of venture capitalists; in 2001 the ICT sector represented 77% of total venture capital investment (€95.3m) in Ireland (Doyle, 2002).

Irish ICT firms are either very large or very small. Ireland has long been an attractive location for foreign direct investment by ICT multinationals. “In the 1990s, the indigenous [ICT] segment [was] characterised by a particularly high start-up rate as well as a low closure rate among established companies” (Crone, 2002, p. 8). HotOrigin (2004) found 70% of indigenous Irish firms had sales under €1 million with only 55% of firms being profitable and concluded there is a clear need for consolidation in the Irish marketplace. Only 24 out of 700 Irish ICT firms in Ireland have a turnover greater than €2 million (Clark, 2003). Although reports observe ICT spending, merger and acquisition activity and venture capital investment increased in 2004, it is difficult to close sales and exits, through initial public offerings or mergers and acquisitions (HotOrigin, 2004).

Network Participation in the Irish ICT Sector

Networks are particularly important in dynamic industries such as ICT and in Ireland, networks have played an important role in the bringing about innovation (Forfás, 2003). Chatterjee (2004, p. 714) observes “given the rapid pace of technology obsolescence, lack of dominant standards, global price transparency and competition, and high burnout rate of firms, alliances are critical to making value chains efficient and necessary for survival.” Coviello and Munro (1995, p. 49) state “networks have come under examination as a clearly emerging organizational design appropriate to the global high-technology industry which is characterized by high-growth, entrepreneurial ventures.”

The Irish Software Association (ISA, 2003) noted Ireland’s relatively small size on the global stage means the Irish industry does not require thousands of firms to be successful. Instead, the focus should be on building barriers to entry by “developing … knowledge and expertise in domain clusters” (Clark, 2003, p. 1). Achieving domain clusters is a challenge considering “the contracts available from lucrative overseas markets can be significantly larger than the turnover of the companies bidding for the contract” (Daly, 2004, p. 1). Firms within the Irish ICT sector may be better served by collaborating as a means to address the problem of scale. “While start-up costs in software may be very low, the costs of expanding beyond this may be very high with the result that many companies may go out of business at this stage” (O’Riain, 1997, p. 202). Irish government sponsored development bodies, such as Enterprise Ireland, encourage Irish ICT firms to form consortia or partnerships to bid for large contracts (Daly, 2004). However, despite this encouragement, many Irish start-ups are technology driven rather than sales and marketing driven.

The strategic potential of short-term alliances and their potential to morph into longer-term arrangements affords SMEs to have the confidence to ‘punch above their weight’. Indigenous
Irish ICT firms have been advised to “build relationships with potential buyers over time and then develop the most promising potential buyers into strategic partners” (HotOrigin, 2004, p. 27). As Irish ICT firms have to export to survive, networks are a key component of an export strategy. Knowledge gained through network participation may provide the competitive advantage the sector needs to survive and progress (Reed & Kelly, 2002).

**The Information Technology Association of Galway (ITAG)**

The Information Technology Association of Galway (ITAG), established in 2000, is a network of 40 firms, encompassing start-up and multinational enterprises, offering software, telecommunications, computer, internet, online and systems integration products and services. ITAG’s mission is to advance ICT networking and business opportunities in Galway by fostering strategic business partnerships. ITAG is a young association network, established for the purpose of regulatory lobbying, self-regulation, promoting professional education and stimulating a specialist labour supply. Encouragingly, ITAG has passed the critical two-year mark where many alliances experience severe problems or disassemble.

Although Galway is regarded as an attractive place to start and grow a business, only 9% of indigenous Irish ICT companies (about 80 firms) have their head offices in Galway city (HotOrigin, 2004). ITAG is representative of the kind of networks emerging among technology firms, located outside of Dublin, Ireland’s capital, with a view to fostering the development of economic and technological clusters within a given geographical location. Examining such a network as ITAG affords the opportunity to observe entrepreneurial behaviour and to consider the extent to which networks contribute to entrepreneurial activities. Among ITAG’s membership there is an opportunity to find a mix of firms with respect to size, length of establishment, intensity of technological initiatives, and degree of entrepreneurial orientation. Although ITAG is entrepreneurial in its mission as a means to attract investment and economic development, not all of its members are entrepreneurial. Nevertheless, it may be possible to observe whether network participation influences entrepreneurial activity among ITAG members.

**RESEARCH OBJECTIVES AND METHODOLOGY**

The research observes networks within Heracleous and Murray’s (2001) taxonomy and explores its validity in explaining the nature of networks. It builds on earlier research, which explored how Irish software start-ups use networks to achieve objectives, primarily in commercialising emerging technology (Torres & Murray, 2003). The earlier research was exploratory and, as a means to examine network structures, availed of in-depth interviews with CEOs of start-up software firms, with senior executives from venture capital firms, and with individuals whose organisations are influential within the software industry (e.g. Enterprise Ireland, the National Informatics Directorate, Irish Software Association).

The aim of this research is also exploratory and aims to examine further, how firms use networks to achieve objectives and gain advantage, by surveying members within an association network. The co-operation of an ICT network, ITAG, was secured. Although, ITAG is only one of about a
dozen technology networks operating within Ireland, ITAG is similar to many of these networks, where the aim is to encourage the establishment of economic and technology clusters. Consistent with scholars engaged in entrepreneurial research and who advocate empirical research of a phenomenological nature (Churchill et al., 1986; Brockhaus, 1987; Bygrave, 1989), this research aimed to be sensitive to firms’ characteristics. Moreover, qualitative approaches that aim to explain, rather than predict phenomena are considered appropriate (Leavy, 1994; Gordon & Langmaid, 1988). Although a questionnaire was chosen to gather data, the analysis is largely qualitative as it aims to describe and profile the nature of network activity within ITAG and to establish a benchmark against which further surveys on ITAG’s members may be compared.

The questionnaire was distributed on-line to the CEO or a senior executive from each of ITAG’s member firms. Two further e-mails were sent to these executives over a four-week period to encourage survey participation. A usable response was achieved from 24 of the possible 40 member firms, which translates into a rate of 60%. The survey sample is small, which does not allow for parametric testing and limits the generalisability of the results. Statistical analysis is limited to averages and frequencies to provide a general profile and to identify the broad trends emerging among respondents about their use and perceptions of networks. Another limitation to the survey is that it does not afford the opportunity to probe the motivations and reasons behind respondents’ answers. Thus, in future investigations, it would be desirable to couple in-depth interviews with the questionnaire to add depth and insight to survey responses. Based on the literature and earlier research data, the questionnaire aimed to address the following propositions:

**Composition and Nature of Technology Clusters**

1(a) Irish technology clusters comprise of many small, young firms and many well-established MNCs, with few medium sized firms in operation for a moderate length of time. Hence, this kind of cluster profile leads to brokered networks where larger firms co-ordinate relationships with several smaller firms and/or to edge of chaos networks where a number of smaller firms agree to collaborate for a short period to achieve key objectives.

1(b) Participation in association networks lead to embedded networks, along the lines of long-term collaborations and joint ventures.

1(c) Venture capital firms are actively involved in network establishment and/or maintenance.

**Heracleous & Murray’s (2001) Taxonomy**

2(a) Firms participate in a number of networks simultaneously.

2(b) Different motivations and drawbacks are associated with each network type.

2(c) The main benefits accruing from network participation are reputational benefits by association (e.g. industry credibility and indirect selling as a result of being well regarded), learning and informational advantages (e.g. market intelligence and identifying potential partners/customers), as well as shared resources (e.g. access to
blue chip clients and their resources and developing collaborative relationships among competitors with complementary products.)

2(d) The main drawbacks associated with network participation are difficulty in managing relationships, costly in terms of commitment and time, strategic and/or cultural mismatch, as well as insufficient support and cooperation.

2(e) There is a progression of network participation from association, to brokered, to edge of chaos, to embedded networks.

The experiences of CEOs and senior executives of ITAG member firms were sought through a web-based questionnaire. The first section of the questionnaire aimed at profiling ITAG’s member firms. For example, to identify whether a firm was indigenous or a MNC subsidiary; years in operation; number of employees; principal industry sectors in which the firm operates; and customer groups to which the firm sells (i.e. business, consumer, government). The second section of the questionnaire addressed network participation to examine whether there is support for Heracleous & Murray’s (2001) taxonomy of five networks. Respondents were asked to identify types of networks in which their firm participates (i.e. association, brokered, embedded, and edge of chaos), the benefits and drawbacks associated with each network type. The third and final section of the questionnaire focused on VC investment. Although, ITAG does not have VC firms among its membership, it was expected that VC firms would have invested in some of ITAG’s members. Hence, it was an opportunity to explore to what extent VC investment influenced network participation and entrepreneurial activity. Respondents were asked if their firm had received VC investment in the last 5 years and, apart from the financial gain, what were the benefits and drawbacks in working with venture capital firms.

Composition and Nature of Technology Clusters

The web-based questionnaire resulted in a useable response of 24 firms out of ITAG’s 40 members. Of the CEOs and executives who replied to the web questionnaire, eleven are from indigenous start-ups, while the remaining thirteen are from MNC subsidiaries. Within the MNC subsidiaries, in addition to their Galway location, six MNCs have other subsidiaries in Ireland. The industry sectors represented in ITAG are predominantly software and web technology, followed by IT consulting and training, telecommunications, and medical devices (see Exhibit 2). Respondents identify business to business (B2B) as the most important customer group, followed by consumers (B2C) and the government (B2G).
**Proposition 1(a)** Irish technology clusters with many young SMEs and many well-established MNCs lead to brokered networks where larger firms co-ordinate relationships with several smaller firms and/or to edge of chaos networks among a number of SMEs.

With respect to length of establishment and size, similar to many Irish technology clusters, ITAG is comprised of many young micro and small enterprises, few medium sized firms, and a substantial number of well-established MNC subsidiaries (see Exhibits 3 and 4 below). The findings plausibly support proposition 1(a) as there were a number of brokered networks between larger firms and smaller firms and edge of chaos networks among smaller firms. Although the sample mirrors the national ICT sector, the lack of medium sized enterprises in the sample may be a limitation. Further research is required to examine the networking activity of medium sized firms.

**Exhibit 3: ITAG Members’ Length of Establishment**
Proposition 1(b) Participation in association networks lead to embedded networks, along the lines of long-term collaborations and joint ventures.

The questionnaire data indicates there are hardly any embedded networks, as only two firms participated in embedded networks along the lines of long-term collaborations and joint ventures (see Exhibit 5). This finding does not adequately support proposition 1(b) where it was expected that participation in association networks led to more durable-interdependent networks. This finding is disappointing, as it suggests ITAG members are missing opportunities that embedded networks may provide. It also suggests firms may fail to identify opportunities for mutually beneficial mergers or acquisitions. It is unlikely the many small and micro enterprises making up ITAG’s membership will build scale fast enough, through organic growth alone, to enable them to achieve critical mass. However, ITAG is a young association network and embedded networks may emerge among its members over time.
**Proposition 1(c)** Venture capital firms are actively involved in network establishment and/or maintenance.

While more than half of the respondents are small and micro enterprises, only two firms have received VC investment over the last 5 years. Moreover, respondents did not believe venture capital firms were highly involved in network establishment and maintenance. This finding does not support proposition 1(c) where it was expected that venture capital firms would be actively involved in network establishment and/or maintenance. This low level of VC investment reflects the challenging fundraising climate in Ireland at present. Although funding was difficult to achieve in 2003, there are signs VC investment will improve in 2004 (HotOrigin, 2004). Those respondents receiving venture capital funding value the mentoring support venture capitalists provide and, by virtue of VC investment, the public recognition and endorsement that flows from the receipt of funds. Venture capitalists are least valued for the time and commitment required in managing the relationship and meeting investment targets.

**Heracleous & Murray’s (2001) Taxonomy**

**Proposition 2(a)** Firms participate in a number of networks simultaneously.

**Proposition 2(b)** Different motivations and drawbacks are associated with each network type.

The findings indicate ITAG members participate in a number of different networks simultaneously (see Exhibit 5) and supports proposition 2(a). Moreover, different motivations and drawbacks are associated with each network type, which supports proposition 2(b). Even where similarities persist, the ranking of benefits and drawbacks differ with each network type.

**Exhibit 5: ITAG Members’ Network Participation**

![Exhibit 5](image)

**Proposition 2(c)** The main benefits accruing from network participation are reputational benefits by association, learning and informational advantages, as well as shared resources.
In exploring the types of networks in which ITAG firms participate, the preference is for short-term collaborative forms such as brokered networks and edge of chaos networks for research consortia, which provide relatively immediate returns. The main benefits ITAG firms seek from brokered networks, in order of priority, are: business referrals, access to potential clients and suppliers, as well as market intelligence, public recognition and endorsement. With respect to edge of chaos networks, these research consortia are important in cultivating clients and suppliers, developing new technology, and accessing skilled personnel and business referrals. The main benefits firms seek from association networks relate primarily to market intelligence by identifying new technology, sources of funding as well as potential mentors and partners. There were only a few embedded networks within ITAG; the benefits associated with these durable-interdependent networks are: access to funding, business referrals through established relationships, as well as public recognition and endorsement. These findings confirm the main benefits accruing from network participation and support proposition 2(c).

**Proposition 2(d) The main drawbacks associated with network participation are difficulty in managing relationships, costly in terms of commitment and time, strategic and/or cultural mismatch, as well as insufficient support and cooperation.**

The drawbacks associated with all network types are: the complexities in managing relationships as well as network participation being time consuming and costly in terms of the commitment required. With respect to edge of chaos networks, there are supplementary concerns of strategic and/or cultural mismatch as well as insufficient support and co-operation. Additional shortcomings associated with brokered networks are loss of organisational independence coupled with inadequate advance planning. These findings confirm the main drawbacks associated with network participation and support proposition 2(d). The relatively small business environment in which ITAG operates may influence the drawbacks associated with network participation. Galway city has only 60,258 inhabitants (CSO, 2002), when the population of the surrounding population centres are included, the total population is less than 200,000. Further research is required to determine whether this relatively small urban size exerts a significant influence on network development.

**Proposition 2(e) There is a progression of network participation from association, to brokered, to edge of chaos, to embedded networks.**

Research findings are inconclusive with respect to the progression of network participation and do not support proposition 2(e). It was expected, as firms evolve, different networks become important. The importance placed on industry association participation is believed to be higher at the early stages of the firm than at the later stages. Forms of brokered networks generally emerge as firms become more established and are able to establish relationships with ‘blue chip’ customers and gain ‘reference clients’. Forming these relationships are especially significant in the business-to-business sector, where a start-up’s first few well-known clients are crucial for establishing credibility. Over time and with industry experience, CEOs become more efficient in making contacts, building relationships and finding networks in which to participate. Thus, regular participation in personal, association and other forms of low interdependence/moderate durability networks, lead to forms of brokered networks, which in turn lead to edge of chaos and
embedded networks. It was postulated there is a step-progression of network participation from atomistic, to association, to brokered, to edge of chaos, and ultimately to forms of embedded networks. This progression of network participation makes an interesting proposition for testing, in applying and extending, the Heracleous & Murray (2001) framework and merits further research. Another questionnaire could be administered in two to three year’s time to gauge more effectively, whether there is a pattern of network participation.

**CONCLUSIONS**

The research findings supported Heracleous and Murray’s (2001) taxonomy of five network types based on the dimensions of interdependence and durability. The findings revealed firms used networks in a variety of contexts to facilitate success. The firms pursued a number of networks simultaneously and there were different motivations and drawbacks associated with each network type; even where similarities persisted, the ranking of benefits and drawbacks differed. Firms pursued perceived network participation pragmatically and with a specific strategic intent. Consequently, firms sought networks that provided immediate benefits along the lines of reputation, credibility, organisational learning, information exchange, and shared resources. The lack of embedded networks suggested ITAG members might miss opportunities made possible through longer-term collaborations. It also suggested firms may fail to identify opportunities for mutually beneficial mergers or acquisitions. The questionnaire did establish a benchmark of network activity, whereby if another survey were administered, the progression of network participation may be explored further.

Overall, the findings demonstrated network-inclined firms allocated resources toward network participation as an important business function. Even though network participation required significant organisational effort, the returns were cumulative and substantial, particularly as a way of overcoming Ireland’s geographic remoteness. Firms successful in their network participation were expected to prosper and expand, while firms that did not optimise their networking opportunities were expected to be bought-out or cease to exist. Furthermore, a shakeout of the Irish ICT sector may result in more varied forms of networks, in particular edge of chaos and embedded networks for achieving scale for export markets. By administering the survey again, it will be possible to gather data describing the direction of change and evolution of the network relationships within ITAG.

**REFERENCES**


Information Technology Association of Galway (ITAG) available at http://www.itag.ie/.


