THE ROLE AND EFFECTIVENESS OF NATIONAL SUPPORT NETWORKS IN STIMULATING ENTREPRENEURSHIP: THE CASE OF CONNECT SCOTLAND

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ABSTRACT
This paper offers new insights on the role and effectiveness of entrepreneurial networks in stimulating entrepreneurship and supporting new technology-based ventures at the regional and national levels. The paper highlights key findings from a longitudinal study of a national entrepreneurial network - Connect Scotland - from its creation in 1996 to its cessation of activities in 2008. The paper examines the origins and development of the network-based programme, how it generates value and manages social, knowledge and financial value flows amongst its stakeholders (private and public sponsors, entrepreneurs, technology companies and universities) and assesses how this value evolves over time. The paper then considers the lifecycle of such entrepreneurial networks by examining the factors leading to the Connect Scotland’s gradual decline and ultimate cessation of activities after 12 years.

INTRODUCTION
This paper is based on a longitudinal study of Connect Scotland, a network-based support programme created to stimulate entrepreneurship and support the creation and development of new technology-based ventures throughout Scotland. To date, few studies have examined over time the role and effectiveness of entrepreneurial networks, particularly those with a regional or national mandate. The paper offers a review of relevant literature and makes explicit the methodological approach developed to accommodate the evolutionary dynamic of the entrepreneurial network, of changing network actors, expectations, motivations, value flows and external program influences. The paper then discusses findings and offers conclusions and recommendations and proposes further research on the topic.

LITERATURE REVIEW
Entrepreneurial networks are identified as a popular strategic intervention for many policy-makers around the world aspiring to emulate successful ‘entrepreneurial regions’ such as California’s Silicon Valley, Route 128 around Boston, MA. and Cambridge, UK (Rosenberg 2002; Cooper and Folta 2000; Shahidi 1998; Saxenian 1990, 1994). An extensive literature suggests that the spread of innovations and commercial success is a function of the support that innovators and entrepreneurs can draw from the larger community as well as industry conditions (Porter 1990, 1998; Saxenian 1994; Van de Ven 1993; Ruttan and Hayami 1984; Vaughn 1983; Pfeffer and Salancik 1977). Literature on the resource-based view of the firm (e.g. Teece, 1996; Nelson 1993; Penrose 1959) suggests that survival, growth and competitiveness are optimised when firms are able to identify and utilise local knowledge-based resources that include competencies, skills, routines and capabilities.

Literature on agglomeration economies, national and regional systems of innovation and studies of technology clusters and regional innovative milieu provide the relevant context at the ‘regional networks’ level (Lundvall 1994; Cooke 1996). The concept of the ‘entrepreneurial infrastructure’ (Vaughn 1983; Porter 1990) emphasises the convergence of different roles and activities that contribute to the creation, development and growth of enterprises. This wider community is described in the literature by various terms: the ‘evolutionary environment’ (Dosi 1988), the ‘infrastructure for entrepreneurship’ (Van de Ven 1993), the ‘sociotechnical constituency’ (Molina 1990), the ‘techno-economic network’ (Callon 1987) and the ‘value network’ (Christensen, 1997).

Literature on networks identifies flows of value that can derive from exchange between network participants (Larson and Starr 1993; Starr and MacMillan, 1990) and the importance of personal and business networks to the entrepreneur in accessing resources, knowledge and other capabilities and gaining legitimacy for the new company (Birley and Stockley 2000; Johannisson 2000). Theoretical...
and empirical distinctions between formal and emergent networks in the literature (Aldrich 1976) suggest that naturally occurring networks capture more important aspects of communication rather than imposed or managed networks. Granovetter’s theory of network ties (1982) suggests that people with ‘weak ties’ are less likely to be connected to others and able to access network flows of information and exchange opportunities. However, Granovetter (1985) and Burt (1992) suggest that information obtained from weak ties is more likely to be unique and less likely to be redundant. This diversity of information from weak ties is identified as a factor in the successful introduction of innovations into organisations and may have important implications for this study.

A number of methodological challenges to the study of entrepreneurial support networks are suggested. Challenges for evaluating intervention programs in general include attribution of cause with effect, lack of available primary data and poor monitoring of results, assessing program ‘success’, costs-benefits and value for money and accommodation of program changes (Patton 1990; Gregory and Martin 1996; Lalkaka and Abetti 1998). The primary social or informal nature of networks increases the difficulty in tracking and measuring how local supportive mechanisms allow new companies to assemble resources and capabilities (Johannisson 2000). Another challenge is need for a longer evaluation time frame to identify tangible network effects on companies (Segal et al 1990; North and Smallbone 1996).

METHODOLOGY
This study examines Connect Scotland as a regional entrepreneurial support network - from its creation in 1996 to its cessation of activities in 2008 - that includes its transition from a public non-profit program to a private not-for-profit program in year 5 (2001). Five sets of related research questions guide the study. The first set of questions focus on the network itself as a unit of analysis. What defines a regional entrepreneurial support network, how are they created (Grandori and Soda 1995) and what are their management and operational characteristics (Gibb and Davies 1991; Casson 1997)?

The second set of questions relate to how a support network generates value and ‘makes a difference’ (Chu 1996; Rangan 2000); in other words, what value can be attributed to Connect Scotland from its stakeholders and to what extent? Further, how does network value change over time and what is the relationship between types of network value, i.e. social, knowledge, resources, etc. (Butler and Hanson 1991; Larson and Starr 1993)? The third set of research questions relate to network effects on technology start-ups, the primary intended target of Connect’s network activities. Are benefits in this study similar to network benefits as identified in other studies, e.g. social capital effects, knowledge flows, business credibility, access to resources not held internally (e.g. Dubini and Aldrich 1991; Johannisson 2000).

The fourth set of research questions considers Connect Scotland as a regional network amongst other regional support initiatives, e.g. university technology transfer offices, public support agencies, and influenced by changing sectoral and economic conditions. How does Connect Scotland function as one element within a regional or national system of innovation and what external factors influence its role, evolution and impact (Malecki 1997, Freeman 1995, Nelson 1993, Lundvall 1992, 1994; Rosenberg 2002)? Finally, given the opportunity for a post-mortem evaluation in this study, the fifth question considers whether or not Connect’s development and demise reflects a definitive ‘lifecycle’ as suggested by evolutionary network theories (Gulati et al 2000; Bhide 2000; Mount et al 1993)? Figure 1 summarises the research themes into five levels of analysis.
Network analysis (1) examines the origins and development of Connect and describes its activity and management mechanisms. Empirical data includes network membership and event attendance data and interviews with Connect management, board and stakeholders.

Network value to stakeholders (2) assesses the perceptions of stakeholders of the value of the Connect network. Knowledge value is an overriding expectation of all Connect events, with financial value also pursued explicitly. At the same time, social value is central to Connect’s mandate with the expectation that interactions, social contacts and the building of relationships between people are the starting point for business-focused activity and outcomes. Each of the three value flows is decomposed into topics aimed at capturing a gradation of impact or value added by Connect as perceived by network stakeholders. A total of 20 indicators were piloted and chosen for the three value dimensions, with each indicator rated using a Lickert scale. A further intention of the value survey is to assess whether or not this value is changing over time. Empirical data includes stakeholder membership data, two value surveys from stakeholders, stakeholder interviews and an investment survey.

Network value to technology companies (3) examines six company members chosen from a cross-section of technology sectors to capture evidence of commercialisation challenges, actual effects of the Connect program on early-stage formation processes and to provide some cross-industry validation of network effects. Each company’s founder(s) were interviewed as well as other senior managers to present as accurate a picture of the early development of these case companies as possible. Cases and their commercial sectors were as follows:

♦ Case A   Computer Software
♦ Case B   Biotechnology; Testing Kits
♦ Case C   Microprocessor-based Electronics
♦ Case D   Data Storage
♦ Case E   Diamond Coating - Materials
♦ Case F   Specialised molecular technologies

The role of Connect in the Scottish innovation system and external factors affecting the network (4) examines survey and case data and interviews with directors of 5 identified complementary support initiatives. Network lifecycle and post-mortem analysis (5) consolidates findings from ongoing stakeholder interviews during the study with findings from the other levels of analysis to suggest factors contributing to a diminishing role for Connect and to consider the lifecycle of such regional entrepreneurial support networks.

In summary, the empirical data for the study includes network event attendance and network membership data during Connect Scotland’s first 5 years, results from two survey questionnaires of stakeholders (years 3 and 5) to determine perceived value (social, knowledge and financial) arising from network activities and how this value changes over time (n=116), six case studies of new ventures created during the network’s first 5 years, assessment of results of a survey of new ventures (n=35) seeking investment from Connect’s first 5 annual Investment Conference (1997-2001), an assessment of 5 other entrepreneurial support programs to qualify the role of Connect Scotland within the Scottish innovation system (1996-2008) and semi-structured interviews from amongst a sample of survey respondents (n=52) during the Connect program (1996-2008). It should be noted that access to attendance and membership data and ongoing survey opportunities became more difficult following Connect’s transition to a private company in 2001. The study therefore relies more on interviews with survey respondents and insights from the researcher’s role as participant observer within the Connect network up to 2008.

Over half of the Connect network was assessed during the study. Ensuring a strong representation of stakeholder views acknowledges the claim by Karl Mannheim, considered the father of sociology of knowledge (Loader and Kettler 2001), that one cannot understand the diversity of beliefs and standpoints in society unless one explores and analyses the range and diversity of its group life (Levine 1959). This approach also acknowledges guidelines for descriptive social science research: “the research process then, is not a clear cut sequence of procedures following a neat pattern, but a messy interaction between the conceptual and empirical world, deduction and induction occurring at the same time” (Bechhofer 1974:73).

The research approach also acknowledges a number of methodological difficulties for evaluators of networks identified in the literature and partitions a complex area of study into manageable elements.
The study draws upon process evaluation guidelines, described as most appropriate for ongoing assessment of perceptions of people, the context or milieu where they are found and the less understood social processes in operation (e.g. Rossi et al 1979; Bulmar 1986; Patton 1987; Silverman 1993; Gregory and Martin 1996). The study also deploys an action research approach to data collection that is identified as most appropriate when studying change, when the researcher is a participant in the change process and when an intervention technique is being evaluated (Foote Whyte 1991; McKernan 1991). The researcher was actively involved in attending Connect events during the study and had access to Connect management and stakeholders on request.

RESULTS

Network Origins, Mechanisms, Management

Findings show that the creation of Connect Scotland cannot be traced to one single factor, such as a policy decision, common in public programs, to 'correct' a perceived market problem or market failure but rather is traced to a combination of factors. A key formation factor and advantage over nascent support programs was the adoption of a network management model from Connect San Diego (many features of which Connect retained until 2008) championed by Connect’s first CEO, who envisioned creation of a Scottish Connect. A model was piloted in the Edinburgh region to ‘prove the concept’, and a successful pilot generated further support to duplicate program delivery across Scotland.

What distinguishes Connect from other network-based support initiatives is that it was primarily private-sector supported, with over 50 of Scotland’s leading companies, many of these professional service providers, joining as sponsors by 2001. In addition, all thirteen of Scotland’s universities and Scottish Enterprise, the government agency providing business support throughout Scotland, became public sector sponsors. This private-public mix of sponsors combined with over 100 early-stage (less than 5 years) technology-based member companies at various stages of development and other interested parties to make up the Connect network.

Connect’s mission and objectives would be achieved through a program of activities and events facilitating and encouraging interactions between a wide variety of communities, including entrepreneurs, technologists, scientists, banks, equity capital providers, business consultants, accountants, lawyers and policy-makers, helping to bridge the knowledge gap existing between these communities. To achieve its aims, Connect designed an evolving program of 6 events. Each event in Table 1 is expected to play a specific purpose for specific target audiences and they combine to fulfil the targets of the overall program. Three recurring types of events are central to Connect’s national mandate: technology briefings, enterprise workshops and meet the entrepreneur events. This is because the majority of the Connect stakeholder network comes together at these three events.

<table>
<thead>
<tr>
<th>Event Type</th>
<th>Description</th>
<th>Objective</th>
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<tbody>
<tr>
<td>Technology</td>
<td>For institutional researchers to present their work and research activities to Connect sponsors and tech companies.</td>
<td>To enhance understanding and facilitate technology transfer</td>
</tr>
<tr>
<td>briefings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enterprise</td>
<td>Workshops bringing together technology companies and researchers with advisors and business professionals.</td>
<td>To develop general mgmt. skills of scientists and technological entrepreneurs</td>
</tr>
<tr>
<td>Workshops</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meet the</td>
<td>Technology entrepreneurs discuss the development of their businesses, their successes and failures and their views of what it takes to succeed.</td>
<td>Learning from the experience of others and discussing development of their own businesses</td>
</tr>
<tr>
<td>Entrepreneur</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Investment</td>
<td>Annual venture capital investment conference.</td>
<td>To provide the opportunity for technology companies seeking finance to present to audience of international investors</td>
</tr>
<tr>
<td>Conference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Springboard</td>
<td>Forum for individual/businesses to present, in confidence, their technological concepts, proposed business strategy or business plans to an expert panel.</td>
<td>To provide the entrepreneur or academic with practical, realistic and expert advice and recommendations</td>
</tr>
<tr>
<td>Boot-Camp</td>
<td>Two-day course providing preparation for the investment conference.</td>
<td>To provide a series of experts to discuss core subjects</td>
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A summary of key creation and formation factors of Connect Scotland are shown below:

♦ Network champion; providing the idea, entrepreneurial vision and drive;
♦ Compelling regional need for intervention; consensus that there is a ‘problem’ and actual absence of social capital and networking;
♦ Relevant network management model; transferability of Connect San Diego model and operational structure;
♦ Activating high profile public and private sector ‘legitimisers’;
♦ Network targets for stakeholder mix and suggested performance targets;
♦ Explicit identification of network stakeholders and benefits;
♦ Dedicated and competent management team; consistent personalities (high retention) to interface with network participants and ability to promote concept regionally; and
♦ Regional representation and inclusion of stakeholders; people and institutions.

Connect’s development can be seen as a process of constituency-building targeted on specific stakeholders and intent on achieving defined targets through the implementation of an integrated set of mechanisms and activities. Network actors are identified as constituents seeking interaction to provide and acquire a variety of resources and capabilities, with the network itself shaping and being shaped by the actors and their interactions. Initial findings led to adoption of a well-developed sociotechnical constituency theory (Molina 1990, 1993, 1995) to further examine the Connect programme.

Figure 2 shows a “constituency building model” or “conceptual lens” developed for the study that maps out key elements of the Connect constituency-building process.

The constituency-building model addresses what Tichey et al. (1979:507) describe as the key
methodological challenge to evaluating business networks: “…a coherent framework and accompanying methods of analysis that are capable of capturing both prescribed and emergent processes.”

Positioning Connect as the central unit of analysis acknowledges its role in constituency-building for the purpose of supporting the creation, development and growth of technology-based enterprise throughout Scotland. The first layer around the core in Figure 2 shows the main activities, events and mechanisms through which the Connect constituency-process is realised, as described in Table 1. The second layer around the core shows the key constituents or stakeholders expected to be represented in the network and to benefit from the network.

The third and final layer around the core shows target results expected to lead to the ultimate mission of growth of Scottish technology ventures and related national targets. Connect established its own quantitative 4 year targets (1997-2000), but early evaluation of targets did not find ‘direct’ evidence of collaborative projects, spin-outs, funding and employment being directly attributed to Connect. This difficulty identified the need for a more longitudinal, in-depth analysis to capture network effects over time and as perceived by network stakeholders.

Connect’s network governance involved first identifying attributes of each stakeholder category (private and public sector sponsor, university, technology company, others) and promoting explicit benefits to attract them to the network. Sponsors contribute funding - £3000 fee per year - while members are companies/individuals paying an annual fee of £100 to attend events, receive the newsletter ‘Jargon’ and potentially present their ideas at the Springboard event and Investment Conference.

Payment of an annual membership to join the network implies that a decision to become a sponsor or member involves a level of cost-benefit analysis, particularly for sponsors. Theories of social capital (Granovetter 1982; Burt 1992) argue that people invest in social opportunities from which they expect to gain or profit. Williamson (1985) suggests that transaction cost economics motivate enterprises to minimise communication, information search and other costs associated with seeking resources, capabilities and customers. On the other hand, Zajac and Olsen (1993: 137) argue that transactions involve a ‘joint value maximisation principle’ whereby the focus is on exchange partners and the emphasis on collective value. Stakeholders bring to the network a history of business transaction relationships and associated expectations with regard to future business transactions, referred to by Berger et al (1995: 1999) as ‘temporal embeddedness’. As individual or institutional interests are presented and the potential for mutual exchange explored, stakeholders cannot help but consider the costs and benefits of exchange.

For sponsors and investors, identifying potential future clients and promising new technologies is available with the presence of academic entrepreneurs from all Scottish universities and research institutions, nascent entrepreneurs and those emerging from industry. Conversely, access to commercial advice, services, investment, mentors, potential board members, etc. is available for technology entrepreneurs with the presence of public and private sponsors, technology transfer personnel and individual (independent) members.

Connect manages what network theorists argue is the fundamental benefit of networks - the linkages and contact among people and institutions that provides opportunities for exchange of valued resources, including information, knowledge, skills, expertise and investment (Starr and MacMillan 1990). Connect’s ongoing program of recurrent events reinforces interaction, knowledge transfer and reciprocal value exchange between and among Connect’s multi-stakeholder constituency. Recurrent events can be thought of as channels for migratory knowledge (Badaracco 1991); knowledge that is easily transferable within a region to various locations (e.g. Edinburgh, Glasgow, Aberdeen, Dundee) and to a similar set of stakeholders.

Replicating this knowledge transfer mechanism to four locations in Scotland provides a representative linkage (Eisenberg et al 1985) for Connect in promoting the network but also creates consistency of information flow throughout the country to similar categories of stakeholders, i.e. sponsors, universities and technology entrepreneurs and companies. Each of these regional events, involving a similar stakeholder audience mix, provides a level of institutional linkage (Eisenberg et al, 1985) where information and potential resources are exchanged without the involvement of the same...
representative personalities. Stimulating institutional linkages is an explicit objective for Connect, particularly between research institutions and industry, as reflected in event objectives and participant ‘mix’ targets.

Over its first 5 years, Connect saw its constituency grow to 169 organisations (63 sponsors and 106 member companies) and 35 individual members. The significant five-fold increase in ‘subscriber’ stakeholders of Connect over this period suggests that Connect delivered benefits to each category. The level of renewals among sponsors, in particular, was almost 100%. Maintaining Connect’s multi-stakeholder constituency appears contingent on a relatively stable sponsorship base to provide a level of ‘embeddedness’ (Granovetter 1982) that reflects established social capital, resources and capabilities available in the network. In return for sponsor support, Connect is expected to generate an appropriate flow-through of technology companies able to access these resources. Although universities represented the largest category of sponsors in Connect’s first 5 years, professional services (legal, consulting and investment agencies) comprised approximately 75% of the sponsor membership base.

**Network Value to Stakeholders**

Findings identify that the most important network benefits for all stakeholders during Connect’s first 5 years are perceived to be social networking opportunities among institutions and people, the delivery of high-quality business-orientated knowledge and preparing and exposing promising technology companies to investors.

Figure 3 shows that financial and knowledge value flows have significantly increased between years 3 and 5 while maintaining a consistent level of affirmative social value. Findings identify that social value is evolving from social ‘business-inclusion’ indicators of ‘meeting interesting people’ and ‘feeling part of a network’ to more ‘business-generating’ social indicators of ‘meeting potential backers of one’s idea’ and ‘receiving valuable advice’. Findings suggest Connect is improving the level of social capital regionally and the quality of social exchange between entrepreneurs, investors and others and the provision and receiving of valuable financial information. Findings also identify collaboration being stimulated among institutions through development of client, service provider and partner contacts.

![Figure 3: Changes to Value Dimensions in Connect Network: Year 3 to Year 5 (n=116)](image)

An interesting finding is an increase in social value in survey 2 by university stakeholders, with all other stakeholder categories showing a slight decrease in social value. One explanation is that low levels of financial value as perceived by university respondents, seen in survey 1, are stimulating technology transfer personnel to more actively engage in social interactions with investors at events.

Connect’s value as a knowledge network for all stakeholders is most importantly in its provision of relevant business commercialisation knowledge and technical knowledge. All commercial-related knowledge indicators have increased over the two years between survey 1 and 2, and this increase is primarily from sponsor and university respondents. A significant increase in perceived knowledge value is much more extensive among sponsors and universities than expected. Indeed, the expectation was that technology transfer personnel at universities and private sector service providers would already possess a high level of commercial knowledge compared to entrepreneurs and new companies.

Indeed, private sponsors identify their ‘use’ of recurrent events as an informal educational forum particularly for new staff or those seeking a greater awareness of local technologies and service...
provision to particular technology sectors. This knowledge includes many issues not traditionally offered within the legal and accounting communities, such as business planning, structuring a financial deal, protecting or licensing a technology. Keeping abreast of the latest in technology due diligence and interacting with a large Scottish science base represented in the network also provides management consulting companies with a forum for their technology-specialists. The lack of new client deal flow for private sponsors identified in the study reinforces the importance of social and knowledge provision to sponsors.

While social and knowledge value is identified as important to sponsors, findings from interviews also suggest that larger public and private sector sponsors have developed strong intermediary ties with Connect given their high profile roles in the national economy (e.g. Scottish Enterprise, Royal Bank of Scotland, HBOS). As well, private service providers identify their commitment to support Connect’s national mandate to stimulate technology entrepreneurship alongside their competitors (e.g. Ernst & Young, KPMG, Accenture). These findings lend support to Zajac and Olsen’s ‘joint value maximisation principle’ and the notion of collective value in explaining sponsor retention.

Figure 4 shows affirmative responses to the social indicator of ‘meeting potential clients, partners and service providers’ from survey 2. Results suggest a high level of social interaction amongst network participants that also reflect different engagement activities by stakeholder group.

Figure 4: Building Social Capital amongst Network Stakeholders: “Meeting Potential Clients, Partners and Service Providers” at Recurrent Events (n=116)

“Client contacts” are rated highest by public and private sponsors, while “partner contacts” and “service provider contacts” are rated highest by universities and technology companies. Results suggest that for sponsors and universities, potential clients and partners are well represented at events. However, the low rating of ‘service provider contacts’ by technology companies is identified as a factor in weak new client deal flow for sponsors. Case findings identify high costs of professional services likely to deter use of such services, although sponsors in the study indicate an expectation that early engagement and ‘free advice’ will more likely lead to future deal flow.

Findings confirm technology companies as the most instrumental users of the network, such as in their perceptions of social value leading to financial value. Table 2 shows a significant correlation between social and financial indicators from the value survey.

<table>
<thead>
<tr>
<th>Variable 1</th>
<th>Variable 2</th>
<th>Correlation (Pearson’s PM)</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Social) Made good contacts with investors</td>
<td>(Financial) Obtained investment for my business</td>
<td>.546</td>
<td>.01</td>
</tr>
<tr>
<td>(Social) Met potential backers of my idea/product</td>
<td>(Financial) Obtained investment for my business</td>
<td>.497</td>
<td>.01</td>
</tr>
<tr>
<td>(Social) Introduced my technology to a highly relevant audience</td>
<td>(Financial) Obtained investment for my business</td>
<td>.450</td>
<td>.01</td>
</tr>
<tr>
<td>(Social) Made good contacts with entrepreneurs</td>
<td>(Financial) Invested in a new technology or business</td>
<td>.366</td>
<td>.01</td>
</tr>
</tbody>
</table>

The strong correlation between social and financial indicators suggests that development of positive social relations is important for both investors and those seeking investment and that high levels of
social value identified in survey 1 have evolved into business relationships and investment. Findings suggest an evolving level of exchange between entrepreneurs, investors and others and the provision and receiving of valuable financial information that are explicit components of financial value indicators. A related factor is the identified importance of introductions by third parties that initiate contacts with investors at recurrent events and also introduce investors to new business prospects. Search motivations for universities, on the other hand, have been identified with securing investors for the technologies they represent.

Influencing the results shown in Table 2 is the role played by Connect’s three investment events, Investment Conference, Springboard and Bootcamp that are focused on linking different Scottish technology sectors (e.g. bio-technology, medical, industrial, electronics, software, others) with investors. The study identifies significant tangible benefits gained by those companies presenting at the Investment Conference (n=35): directly attributed investment by 23% of respondents (with a further two companies indirectly attributing raising of £2.35 million from the Conference). Approximately 80% of respondents attributed various non-investment benefits, including fine-tuning the business pitch for subsequent funding, meeting potential investors and profile raising, among others.

Network Value to Technology Ventures

Figure 6 shows significant variation in levels of social, knowledge and financial value perceptions among case companies from survey 2, suggesting that network value depends on evolving needs of companies and their founders at particular points in time.

Figure 5: Social, Knowledge and Financial Value of Case Companies (n=6)

Five of six case companies rated social value as most important in both surveys, with knowledge and financial value ratings increasing in survey 2. Findings suggest that developing social capital for a technology entrepreneur is particularly important in the Scottish context. Technology entrepreneurship is highly concentrated geographically in the ‘Silicon Glen’ corridor, a 45-minute drive between Glasgow and Edinburgh, and this close proximity breeds familiarity among innovators, entrepreneurs and young companies. The small number and proximity of service providers and investors means that many of these people know each other through professional contacts. Dense social contacts among those ‘holding resources’ highlights the importance of ‘who you know’ in Scotland. Newly emerging entrepreneurs in the Scottish commercial scene, evidence suggests, possess little power and legitimacy to engage in exchange activities until they can leverage an adequate and credible level of social capital (e.g. Sharman et al 1991; Cooper and Folta 2000).

Findings confirm the importance of a particular range of ‘intangible benefits’ for case companies. Even though different technological capabilities are centrally important, social capital as a common intangible benefit allows companies to identify and secure necessary complementary resources. University spin-out case study respondents (4 of 6 cases) identify the importance of external advice, contacts and knowledge obtained from people other than institutional technology transfer personnel, also in attendance at events. Findings identify the importance of personal linkages rather than...
institutional linkages in representing their own potential commercial interests at recurrent events and the ability to socialise with people external to the university. The ‘meet the entrepreneur’ event, for example, was credited for its provision of valuable insights into ‘trial-and-error’ issues that company founders were experiencing at the time. Findings suggest the ability of academic entrepreneurs to bypass university technology transfer offices as a first port-of-call is perceived by some universities to undermine their control of commercialisation efforts, and is among the factors seen to contribute to a weak linkage identified in the surveys between some universities and Connect.

Although knowledge value for all six cases was rated higher than survey averages, two of six companies rated financial value significantly higher than knowledge value. These respondents identify the role of Connect in helping to allay some of the difficulties faced in the search for investment. By immersing themselves within the network, those interviewed suggested that this environment provided them with a solid business-like basis for understanding, in realistic terms, what they could achieve, whom they should approach and what they could expect in terms of possible investment options. In case D, for example, its co-founders identify Connect as the company’s most important support program. Affirmative responses to all social and knowledge indicators and three of six financial indicators suggest a ‘significant’ value curve as these two entrepreneurs form their company.

All case respondents confirmed that benefits through the network have been most pronounced in the formative years. Case findings offer evidence of Connect ‘accelerating learning’ amongst early-stage technology companies by facilitating their ability to adapt their core technology to evolving markets or investor requirements, to explore and build partnerships with other technology developers, to make informed assessments of available sources of investment, to find specific sources of advice on the managerial development of their companies and in general to fill critical gaps in their own knowledge (e.g. Oakey et al. 1990; North and Smallbone 1996; Malecki 1997).

The study identifies Connect’s role in supporting technology entrepreneurs at two levels; at the ‘personal level’ where entrepreneurs seek social contacts and new knowledge from particular events. Here, Connect acts as a ‘guide’ in plugging them into the network and offering introductions and advice on how to use the network. At the second level, a ‘development level’, companies over time self-manage themselves as ‘discriminating value seekers’, building legitimacy and trust with others, identifying and engaging with investors, partners and service providers, developing their abilities to search for new management personnel, directors and other suitable human resources available directly or indirectly through network contacts, etc. At this second level, the challenge for Connect is to ensure that ongoing value provision and reciprocal value exchange is available through the right mix of network stakeholders and quality events. At the same time, membership renewal data suggests that retention of young technology companies in the network is more affected by sectoral and market conditions than either sponsors or universities, reflecting a generally high attrition rate of young technology companies.

**Role of Connect in Innovation System**

The study identifies Connect Scotland as the primary support programme for young technology-based ventures in Scotland by 2001, after 5 years of operation. At this time, Connect distinguished itself from other support initiatives “by co-ordinating a broad mix of the right kinds of people sharing a common interest in supporting new Scottish-based technology companies”, according to Connect Director Gillian Mayman. The provision of an ongoing flow of business-oriented knowledge, opportunities to meet successful entrepreneurs and technology-based briefings relevant to multiple technology sectors further contributed to making Connect distinct, she adds. Connect Director Andrew McNair suggests that the technology community in Scotland during this time became more sophisticated as entrepreneurs increased their commercial and business knowledge from attendance to Connect events, shifting the power base away from advisors and investors more towards new technology companies.

Findings identify three particular developments in the Scottish innovation system that subsequently influenced Connect’s role in supporting Scottish technology entrepreneurship. In parallel with Connect’s transition to a private not-for-profit model after 2001 (discussed in next section) was development of an extensive angel investment community in Scotland that by 2008 included 18 separate angel investment syndicates. These informal investor groups are identified in the study as offering entrepreneurs and start-ups a greater level of investment advice than ever before. The significant growth in angel activity occurred in response to a contraction of the venture capital community in Scotland following the dot com bust in 2002.
A second development was acknowledgement of weak linkages between new technology companies, universities, small-to-medium-sized enterprises (SMEs) and large corporations in Scotland, despite Connect’s efforts. These linkages are identified in the literature as essential characteristics of successful high technology regions. Although Connect Director Andrew McNair acknowledges that one objective of Connect is to involve more SMEs and Scottish-based corporations in Connect, economic data shows that Scotland’s uptake of university innovations by SMEs and industry remains among the lowest of UK regions (Charles, 2007).

A third development was the varying level of support given to Connect by Scottish Enterprise (SE), Scotland’s economic development agency. Findings reveal that SE support during Connect’s ‘constituency-building years’ (1996-2001) was in the form of active acknowledgement of Connect as Scotland’s ‘first port-of-call’ for young technology companies, despite the fact that a key mandate of SE is to support new enterprises through its network of regional local enterprise companies (LECs). Findings identify a level of diminishing support for Connect from SE as Connect gained positive recognition in the Scottish business and technology communities. The study suggests that this can be attributed to performance measures used by SE to quantify its engagement and support activities with new enterprises. Acknowledged value being realised by entrepreneurs and technology companies from Connect network events were perceived by some in SE as competing with rather than complementing SE support services, with this being more pronounced following Connect’s transition to a private not-for-profit company.

Network Lifecycle: Decline of Network Value
In July, 2008, Connect Scotland formally ceased trading after 12 years of operations and following 6 years of fluctuating membership. From a peak membership of 169 organisations (63 sponsors and 106 member companies) and 35 individual members in 2002, Connect in 2008 had less than 90 organisations and less than 35 member companies. According to UK Companies House data, Connect had been instrumental in securing £220m in private equity during its 12 years and helping 165 companies to present their business propositions to potential financial backers that include well-known Scottish technology companies such as Wolfson Microelectronics, Stem Cell Sciences and Microemissive Displays.

While Connect’s debt load was identified in the press as the reason for its demise (Scotsman 13/08/08), this study suggests a number of factors contributing to Connect’s decline as an effective entrepreneurial support network, beginning with its 2001 transition (year 5 of its operations) from a public non-profit programme to a private not-for-profit programme. This transition was primarily driven by the ambition of Connect’s original CEO to leverage benefits from an already well-established network. Connect had in place a large sponsorship base of service providers and all thirteen Scottish universities as Connect members.

A ‘new’ network management model was created to generate more ‘tangible’ benefits to private sponsors and to ‘high-potential’ technology enterprises in exchange for higher membership fees. The ‘new’ model also required Connect to improve its operational efficiencies, resulting in an increase in staffing (from 6 to 10) and more involvement by its Board of Directors. Previously, Connect had, as Director Gillian Mayman stated, “latitude without preconceived expectations”; Connect could develop various programs and also not be overly preoccupied with value for money.

A higher membership fee in turn elevated expectations from both sponsors and company members that more tangible benefits would arise from their membership in Connect. Connect therefore became more selective in the sponsors and technology companies it brought into its network. Technology companies, for example, were expected to possess characteristics that would make them more attractive clients for sponsor services (e.g. legal, accounting, marketing) and demonstrate high-growth potential to attract investors to the Connect Investment Conference, Connect’s annual flagship event. Findings suggest that a greater focus on tangible benefits to sponsors compromised the previous balance between altruistic outcomes expected on behalf of the Scottish technology sector and business-generating outcomes to private sponsors. The study identified in survey 2 concerns by some entrepreneurs that service providers were dominant at some events, in the absence of other entrepreneurs or investors.

Connect thus became a more formal ‘mediator of value exchange’ by controlling entry into the network through membership while providing a more direct mentoring service for new technology
companies. The objective of its mentoring service was two-fold: 1) to identify relevant technology companies that have high potential and are appropriate potential clients for Connect’s sponsors, and; 2) to introduce and assist new company members, based on their requirements, in finding appropriate supportive agents, resources, information and knowledge with a more customised approach to ‘plugging them into the established Connect network’. Findings suggest that Connect’s more formal approach to network management may have also affected the ability of entrepreneurs to develop their own network engagement capabilities and to access new and unique value flows. Case findings identify entrepreneurs under the ‘old model’ using the network as ‘discriminating consumers’ and self-managing their engagement activities by developing their own ‘support constituencies’ that reflect their particular social, knowledge and investment requirements.

One weakness in a more formal selection process is the difficulty in accurately predicting future success and growth, as studies have shown that multiple factors affect a company’s ability to survive and grow, with no one factor appearing to offer a predictive technique (Storey 1993). Indeed, research has yet to produce any widely accepted insights into why some companies grow more than others do when confronted with a roughly equivalent set of circumstances. Without a reasonably accurate basis for selectivity, it could also be argued that it is difficult to differentiate between needs for support and assistance on behalf of the new company (Horne et al. 1992: 65).

Findings from survey 2 already identify concerns over the mix of stakeholders at events, such as a high ratio of sponsors to technology companies. Findings from survey 2 also identify low levels of university-industry interactions, identified as an important characteristic in successful commercialisation of innovative technologies (Malecki, 1997). The fact that universities were not identified in Connect’s new model as a key stakeholder group contributed to universities not renewing their Connect memberships. By 2008, only 6 of the original 13 universities remained as Connect members. Findings from stakeholder interviews post-2002 also identify increasing dissatisfaction over the uniqueness and novelty of event speakers and topics and an increasing level of predictability related to Connect events.

The implications of literature on strong and weak ties are relevant when examining Connect’s transition to a private sector model and the potential effects on value flows (Granovetter, 1982; Burt, 1987, 1992). Previously, Connect allowed for an “other” category of network participants to attend events without a corresponding membership commitment. Inflow and outflow of participants to events was relatively unrestricted, with inflow influenced by expected benefits and outflow by the degree to which these benefits were realised. What transpired was a regular influx of ‘other’ members, primarily those visiting Scotland from London and from abroad who were drawn to Connect’s events and who possessed new social contacts, knowledge and investment opportunities for the network.

Over time, Connect’s new model appears to have restricted the flow-though of interesting and diverse network participants as the network matured and its events became more predictable and stable. Findings show that network benefits for technology companies are most pronounced in their formative year, challenging Connect to offer new value through the network in order to retain technology companies (and sponsors) as members. As noted earlier, limited success in attracting Scottish SMEs and large private corporations to join the Connect network and the gradual loss of university members further limited access to new sources of commercial, market and technical knowledge and capabilities.

**CONCLUSIONS**

The paper finds that successful creation and formation of the Connect network cannot be attributed to any one factor, but rather reflects a ‘progression of key formation milestones’. These include strong evidence of need for intervention, establishing early private-sector program credibility by involving high profile business leaders and early public sector program credibility with support from Scottish Enterprise, the national economic agency and Scotland’s leading research universities. Clearly, an explicit and commonly shared consensus among key regional stakeholders that intervention for technology entrepreneurship is needed provided the ‘demand pull’ for such a program.

Findings identify a direct regional economic development role played by the Connect network in attracting investment to Scotland and assisting promising new technology companies in becoming investor-ready, particularly while a public sector based network. The paper proposes a relevant definition for a regional entrepreneurial support network with the structural and operational characteristics of Connect Scotland as: “an integrated and co-ordinated set of formal network
activities that stimulates fee-paying institutional, new venture and individual actors to socially engage and develop ongoing economic and non-economic relations that contribute to their own development, that of new ventures and a sense of mutual obligation to regional development”.

Findings show that stimulating and sustaining a national support network requires benefit provision to all stakeholders of the network, rather than simply new technology companies, in order to attract, retain and facilitate value exchange between supportive agents that display low levels of interaction without intervention. The study establishes the notion of ‘managed reciprocal value exchange’ that identifies Connect’s role in stimulating and managing social, knowledge and financial value flows between and amongst network participants through a recurring, integrated set of events and activities.

The study supports network evolution literature suggesting that social interaction precedes exchanges and collaborations involving resources (Larson and Starr 1993). Findings show that gaining investment is strongly correlated with development of positive social relations. Perceived knowledge and financial value derived by stakeholders were found to substantially change over a two-year period of study (years 2 and 4), supporting literature that knowledge and financial value becomes more important as social interactions develop. Intangible social and knowledge benefits were more immediately realised by Connect stakeholders, whilst tangible investment benefits were traced to those enterprises with clearly superior technologies and those who presented at the Connect Investment Conference.

The study finds that while Connect was successful in developing Scotland’s premier support network for technology entrepreneurship in its first five years, its transition to a private company introduced new network management mechanisms that compromised the critical ‘right’ mix of stakeholders upon which network value was dependent. A greater focus on tangible benefits to sponsors (i.e. deal flow) and bias towards ‘high-potential’ technology companies failed to adequately recognise what differentiated the Connect network in the Scottish innovation system: an integrated multi-constituency stakeholder base, an inclusive membership model, high quality, novel events and a neutral ‘honest broker’ role played by Connect in supporting Scotland’s technology entrepreneurs. As Connect took on more characteristics of a service consultancy, support from Scottish Enterprise, universities and private sponsors began to diminish. Literature identifies the important balance between collaborative and competitive interaction that fundamentally affects the evolution and dynamism of a developing sociotechnical constituency (Molina 1990).

The study has developed a constituency-building model that may be beneficial in describing and examining other regional entrepreneurial support networks with characteristics similar to Connect Scotland. One limitation of the study is that outcomes of repeated network interactions and the development of relationships and collaborations have not been tracked. Indeed, the dynamic nature of relationships is assumed. The author concedes that network participants are interacting amongst other support initiatives in the region and outside as well so a further question is the way these network participants co-evolve with and among other networks.

Further research will examine whether Connect’s evolution as an entrepreneurial support network is similar to evolutionary phases identified in theories of the firm (e.g Mount et al 1993; Bhide 2000). Early findings suggest some similar characteristics. One question is the effect of Connect Scotland’s transition to a more formal, network management model on its evolution and lifecycle. Therefore, future research will include an assessment of Connect San Diego for comparison purposes, Connect Scotland’s original model, which continues to operate since its formation in 1988.

NOTES

1 To avoid sample bias, sample selection involved two different samples of similar stakeholder groups using the same survey and 20 indicators. Guidelines were followed from Child (1990), who argues that samples should be taken from a homogeneous population, as factors may be specific to each population. He cautions that crossing populations requires an interpretation that defines attributes appropriately.

1 SPSS correlation analysis provides evidence of relationships between variables in the value survey. Pearson’s Product Moment Correlation Coefficient (r) is used to measure interval variables (Bryman and Cramer 1994) showing significant correlation in the exchange of social, knowledge and financial value using both surveys as a single sample. However, causal relationships cannot be inferred from correlation alone (Childs 1990) as some test scores are the end products of processes – such as thinking.
or perceiving. Thus, these scores are considered in the context of other evidence deriving from stakeholder feedback.

REFERENCES


