Real-time evaluation methodology as learning instrument in high-technology SME support networks

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Abstract: This paper focuses on the philosophy and implementation of an evaluation approach used as a learning instrument in the evolution of a major enterprise support network in the UK: Connect Scotland. The Connect real-time evaluation methodology has distinguished and assessed the value flows delivered by the program as perceived by its stakeholders. It has done so not in a *post-mortem* fashion but in real-time fashion (i.e., during the program), with the aim of capturing strengths and weaknesses and contributing to its further development.

The paper discusses the importance of support networks for enterprise development then looks at some of the concepts and limitations facing the evaluation of enterprise support networks. This is followed by a detailed analysis of the real-time evaluation methodology used in Connect Scotland, including an examination of the Connect program itself. The paper then summarises the key results of the value-flows of Connect as perceived by the stakeholders, before ending with a discussion on value for money and key recommendations.

Keywords: SME support networks; real-time evaluation methodology; constituency-building; value flows; CONNECT constituency

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1 Introduction

This paper focuses on the philosophy and implementation of an evaluation approach used as a learning instrument in the evolution of a major enterprise support network in the UK: Connect Scotland. The Connect real-time evaluation methodology has distinguished and assessed the value flows delivered by the program as perceived by its stakeholders. It has done so not in a *post-mortem* fashion (i.e., after the end of the program) but in real-time fashion (i.e., during the program), with the aim of capturing strengths and weaknesses and contributing to its further development.

The structure of the paper, first, discusses briefly the importance of support networks for enterprise development, then looks at some of the concepts and limitations facing the evaluation of enterprise support networks. This is followed by a detailed analysis of the real-time evaluation methodology used in Connect Scotland, including an examination of the Connect program itself. A further section summarises the key results of the value-flows of Connect as perceived by the stakeholders. The paper ends with a discussion on value for money and key recommendations.

2 Rationale for support programs

In recent years, there has been a proliferation of support programs for stimulating the formation of new technology ventures in many countries. Amongst the best known are the Austin Texas incubator, the Connect San Diego and the industrial cluster programs of the Basque Country (Spain) and Scotland. The frequent target for these initiatives is the high technology sector, viewed by policy-makers as promissory of major long-term economic benefits. High technology companies are perceived as having greater growth potential than conventional firms that can lead to significant regional economic prosperity [1-3]. High technology firms have also been viewed as corrective for unemployment caused by the decline in traditional industries [4].

The most common argument used to justify support programs is the high rates of business start-ups that experience early failure. Factors that contribute to failure can be seen at both the firm level and in the external environment. At the firm level, commercialisation complexities in starting a high technology company, it is argued, require specific supportive mechanisms that not only improve survival but lead to growth. More start-up successes and growing firms can result in increased employment, a stronger high technology sector and spillover effects that combine to contribute to economic prosperity. Failure at the external level relates to lack of supportive elements for firms. Research on successful high technology regions, such as Silicon Valley, Cambridge, UK and Cambridge, Massachusetts points out the critical importance of a supportive infrastructure for new and growing firms. These elements include tax incentives, the provision of business parks and programs that facilitate supportive agents that understand the needs and requirements of emerging and existing firms. Government intervention, it is argued, is required that stimulates creation of supportive agents and thus a critical mass of competitive firms can be established that make an impact on the regional economy.

3 Enterprise support networks

The stimulation of 'enterprise support networks' is a common strategy designed to create and develop a supportive infrastructure for high technology companies, or an 'entrepreneurial infrastructure' [5]. It is based on entrepreneurial network theory that suggests that strength, complexity and diversity of business relationships influence newly formed firm performance, resulting in improvement of the longer term chances of firm survival and growth [6].

Similarly, the literature on 'industrial districts' puts forward the argument that there are a certain number of invisible factors that are favourable to economic development, such as the constitution of networks and the development of confidence and close relationships between firms [7]. Malechi and Todtling [8] assert that network creation is a growing policy prescription for regions where networks have failed to emerge.

A body of research literature stresses the importance of informal social contact as a starting point to knowledge acquisition for the entrepreneur. Initial contacts from social networks evolve into business-focused networks, and then into strategic networks, which allow firms to innovate and to thrive by their links to other organizations [9-12].

Monsted [13] distinguishes between three types of networks, with each serving a different function for the entrepreneur:

1 networks for service and assistance

2 networks for information and structuring, particularly for knowledge about whom to contact for a specific purpose

3 networks for entrepreneurship and product development.

Sanberg and Logan [14] found that an entrepreneur's 'network' really comprises multiple networks defined by the resources each network provides. They argue that the entrepreneur who fails to make this distinction, directing energies toward developing an undifferentiated 'network', is less likely to acquire critical resources than is one who targets their most effective sources. One question that Sanberg and Logan propose is not whether networks are required for co-ordination, but under what conditions they work best. Larson (1991) found that the entrepreneurial firm's ability to identify, cultivate and manage a network partnership is an essential condition for survival and success [15].

A body of research has shown that entrepreneurs gain access to resources and information through their networks to start-up, develop and grow enterprises [10,16-18]. In addition to a supply of resources, networks provide social support and self-confidence and strategic capacity to learn and organise for new activities [18]. Best [19] suggests that networks are preferable to markets because they involve more social contact and encourage information to be shared, they are more co-operative and less competitive and they reinforce the sense of mutual obligation on which society depends.

Pihkala *et al* [20] suggest that networking involves a variety of capabilities, including communicating skills, cooperativeness, ability to share a vision, trust, ability to act as a network broker, customer orientation, ability to use market information, knowledge of cooperative agreements and market orientation. Many of the higher order competencies required to operate a successful new venture are learned from other successful businesses. Previous entrepreneurs may share their knowledge that is essential in

operating a business, such as regulations, taxes, accounting, suppliers, customers, and marketing and distribution.

Networks may be particularly important at the start-up phase. Starr and MacMillan argue that the entrepreneur needs to mobilise 'social resources' because of liabilities that include size, lack of market legitimacy and newness. Sharman *et al* [21] state that, for entrepreneurial ventures, networks can contribute positively to gaining organisational legitimacy and to developing a desirable marketplace reputation.

4 Evaluating support networks

Much of the debate over support for high technology questions the effectiveness of support strategies. While difficult to quantify, the quality and the value added by support initiatives reflect great variation from country to country, and even from location to location in a given country [1]. Further, Lalkaka and Abetti [1] suggest that there is a need to compile and publicise the 'best practices' in each country and internationally, to provide a benchmark, and also to avoid duplication of effort and control confusing signals from the myriad of entities operating in this field.

There is little evaluation research specifically on constituency-building or network programs [22] similar to Connect Scotland, despite the fact that many have been operating for over a decade in high technology 'regions' of North America and Western Europe. Johannisson [23] points out a number of methodological problems associated with analysing networks. He suggests that networks are often taken for granted and not fully appreciated, in part because of the social or informal character of many networks. A related issue is the difficulties in establishing a causal relationship between networking and enterprise performance.

A key factor in evaluating program effectiveness is the purpose and motivation for evaluation. An evaluation methodology for any intervention program requires a defined purpose as well as scaleable and appropriate assessment objectives. Different organisations may have different motives for undertaking and commissioning evaluations. Public accountability may emphasise a cost-benefit analysis and level of performance measurement for program delivery.

Much evaluation research has arisen from a rather narrowly based concern to ensure that public program represent 'good' value for money. Many evaluations are concerned fundamentally with assessing the success or failure of programs [24]. Few evaluations are able to provide definitive evidence regarding 'success', mainly because of the complexity of methodological issues that confront researchers, according to Gregory and Martin [3]. Success may be determined in absolute or differential terms. The measurement of impacts present particular problems because of the way in which evaluators adopt various definitions of what constitutes success, i.e., job creation, firm growth or firm survival rates.

Deakins *et al*. [2] note that research on business development support programs is too often carried out retrospectively; giving little or no opportunity to compare the differences that such support has made to the objectives and managerial ability of clients involved in the program of support. In the same vein, studies of support programs have pointed to a consistent lack of internal monitoring and information-gathering mechanisms that make it very difficult to evaluate results and impacts.

Alford [25] stresses that evaluators require high quality primary data, and the program administrators rarely assemble it adequately. Few program evaluations have included both qualitative and quantitative measures of 'process-oriented' outcomes and as a result some evaluators have found themselves unable to advise on improving program design to enhance effectiveness [3]. Individuals and groups may require evaluation systems that continually audit the delivery of services and their outcomes, and provide evidence of effectiveness to aid in their decision-making [24].

Patton [26] points out that process evaluations are aimed at understanding the internal dynamics of program operations, and typically require a detailed description of program operations. Process analysis asks how the program works with emphasis on identifying ways of improving program design and delivery, and is typically qualitative in approach [27]. A process evaluation requires sensitivity to both qualitative and quantitative change in programs throughout their development, and means becoming intimately acquainted with the details of the program [26].

Patton suggests that process evaluations permit decision makers and information users to understand the dynamics of program operations, shedding light on the extent to which the program is operating the way it is supposed to be operating. They are also useful for revealing areas in which programs can be improved as well as highlighting those strengths that should be preserved. Patton cites two other uses of process evaluations. They permit people not intimately involved in the program-external funders, public officials and external agencies-to understand how the program operates. As well, they are particularly useful for dissemination and replication of programs under conditions where a program has served as a demonstration project or is considered to be a model worthy of replication at another site. The real-time evaluation of Connect Scotland offers a particular way of realising the spirit of process evaluation.

4.1 Some basic criteria for program evaluation

An analysis of the evaluation literature concerned with support programs shows that there are at least four major criteria to be fulfilled in a process evaluation. These are:

1 An evaluation methodology for any support program requires a defined purpose as well as scaleable and appropriate assessment objectives in terms of both process and outcomes.

2 A process evaluation requires sensitivity to both qualitative and quantitative change in programs throughout their development, and means becoming intimately acquainted with the details of the program.

3 If the results of an evaluation are to gain widespread acceptance and credibility in the public domain, it is essential that a full range of stakeholder perspectives be incorporated into the research design. This suggests incorporating a measure of the 'value' that stakeholders perceive from exposure to the program, and preferably how that perceived value changes over the time of the program.

4 If a phenomenon under investigation is complex, information-rich cases are useful in learning a great deal about issues of central importance to the purpose of the evaluation. This is difficult to achieve and requires a level of analysis that focuses on each company (micro-firm level).

Drawing together evaluation results, establishing effectiveness and credibility and improving the program's delivery and process are seen as important challenges for most evaluations. As we shall see, the real-time evaluation of Connect Scotland tries to incorporate all these criteria in its design and implementation. Before entering into the discussion on the methodology, however, the paper will review the rise and development of the Connect Scotland constituency.

5 Rise, development, aims and mechanisms of the Connect Scotland Programme

5.1 Origin of Connect Scotland concept

Connect is a story of transfer of entrepreneurship; its origins have evolved from Connect San Diego. In February of 1995 Ian MacDonald had an initial idea of researching US business links and support programs as part of his PhD. This research took him to Washington DC, where MacDonald first heard of a project operating in San Diego called Connect. He got in touch with the Connect San Diego Program Director, Dr. Abigail Barrow, who had spent some time working and researching in Edinburgh. From this meeting, it was proposed that in a further visit to the US, MacDonald would visit Connect in San Diego. Upon his return to the US, he spent a month interviewing various individuals involved with the Connect network. This research gave rise to the strong opinion by MacDonald that a similar style of organisation could play a significant role within the Scottish business arena.

Initial efforts began in January 1996, focusing on creating both awareness and support for a Scottish version of the original San Diego Connect project. One of the first people Ian sought for consul and discussion on the concept was Martin Ritchie, a successful Scottish entrepreneur whose support, MacDonald thought, would provide initial credibility in developing a supportive infrastructure in this critical early stage. From this point, founding sponsors were identified and secured, largely drawn from the private sector. Connect found a home at the Management School following strong support from the University of Edinburgh. In their interviews, both MacDonald and Martin Ritchie allude to the critical support from Sir Stewart Sutherland, the Principal of the University of Edinburgh, who facilitated Connect locating the program at the Management School.

5.2 Initial Connect's formalisation steps

The initial steps of formalising the creation of the Connect program were taken in 1995 at the University of Edinburgh. In 1996, a proposal was submitted to the Scottish Higher Education Funding Council (SHEFC) [28] for the start of a pilot program of activity and events initially focused on the Lothian and Fife region. In this 1996 proposal, it was made clear that the intention was for the activities of Connect to be eventually extended to other regions within Scotland. This intention was realised through a further proposal in 1997, with the result that the program expanded nationally to become Connect Scotland [29].

The Connect concept conformed to one of the key themes in SHEFC's 1995 Corporate Plan**,** namely, "to develop the responsiveness and vitality of the research base

in Scottish higher education, and to work with higher education institutions and other agencies in contributing to economic competitiveness and the quality of life." More specifically it conformed to a critical objective within this theme, "to develop further links between Scottish higher education institutions and industry and commerce" [29]. Most importantly, the development of a Connect program in Scotland was a central recommendation given in the Technology Ventures strategy document published on 28 August 1996.

This document built on the earlier Commercialisation Enquiry conducted by Scottish Enterprise (SE) and the Royal Society of Edinburgh (RSE) and identified a wide range of factors requiring attention to help nurture a technology ventures culture and economy in Scotland. It also proposed avenues to tackle the problem, amongst them, the establishment of "a networking and business support infrastructure to generate effective academic-industry links facilitating the multi-directional flow of information between academia, companies and service providers. Connect at the University of California, San Diego, may be an appropriate model" [30,31]. The development of Connect in Scotland constitutes a clear answer to this recommendation and the "vision is to create and develop a program that will have an impact in Scotland similar to that of the Connect program is San Diego" [29, p.4].

Thus, Connect was developed against a background of the Technology Ventures Strategy. Technology Ventures' broad aim is to establish new businesses and jobs within Scotland and is based at Scottish Enterprise. Technology Ventures itself was created as a result of a Commercialisation Enquiry conducted jointly by the Scottish Office and the Royal Society of Edinburgh.

Today, Connect Scotland is supported by Technology Ventures, the Royal Society of Edinburgh, the Scottish Office Education and Industry Department and the Scottish Higher Education Funding Council.

5.3 Connect's objectives

Since its inception, Connect set for itself an ambitious mission:

> "To support the creation, development and growth of technology-based enterprise throughout Scotland".

The above mission was to be achieved through a program of activities and events facilitating and encouraging interactions between the university sector, large corporations, emerging companies, service providers, regional government, economic development agencies and support groups. The program was to bring together 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.

Connect's mission followed the rationale that interaction between these communities is critical for the development of high growth and high technology enterprises [29]. It also followed the findings and recommendations of enquiries and policies of key Scottish industrial and academic institutions, including Scottish Enterprise, SHEFC and the Royal Society.

To a large extent Connect Scotland set for itself a fundamental challenge for the Scottish knowledge economy namely to "stimulate a resource and expertise environment for interaction, learning and opportunities for different communities interested in the

development of technology-based ventures and, ultimately, economic growth". Bridging of the knowledge gap existing between these different communities is central to this purpose and relates to the Connect's six key objectives, as listed below:

1 Develop and educate an expert infrastructure that understands and supports the needs of technology-based ventures, giving companies access to a network of expertise and resources essential to their success in a global market-place.

2 Facilitate and support the transfer of technology from the Scottish science base to new and existing firms, either by spin-out or through collaborative projects.

3 Complement specific initiatives in individual agencies and organisations, providing a resource that can be used by all participants to promote and develop related activities and projects [32].

4 Enhance the ability of new and existing firms to secure finance.

5 Educate entrepreneurs about business development and issues germane to their industries.

6 Help entrepreneurs to define new businesses and whether they should start them.

5.4 Connect organisation and delivery and communication channels

Connect as a networking organisation is involved in managing and propagating communication through its events, which is the primary responsibility of Connect staff. Logistical and administrative activities for event delivery are major work tasks, followed up by event facilitation that ultimately provides the interface between Connect and its stakeholder constituency.

Notification of events is send out – through Jargon - a newsletter that keeps members and sponsors abreast of developments and news regarding events, workshops etc.

An important aspect of recruiting new company members is scanning a variety of sources for companies that Connect staff views as relevant for membership. The Connect database of contact firms is thus constantly expanding.

Figure 1 provides an approximation of the Connect network. Starting from the bottom right are all the members of the Connect constituency: firms, sponsors, individuals, etc. who are scattered across North, East and West of the country. Sponsors maybe private service providers, technology companies, enterprise agencies and they pay a £3000 fee. Virtually all Scottish universities are also sponsors. Individuals are attendants to events who have no organisational affiliation and firms maybe non-sponsor technology companies who are either paying members (at £150 each) or non-paying members. These stakeholders have regional working groups as shown to the left of Figure 1 and they can form part of the Connect Executive or National Board, where they interact more closely with the Connect Administration. The entire process is guided by the Connect's Advisory Board, made up by sponsors and regional working groups who are instrumental in developing the array of topics for the events.

Figure 1 Connect organizational network [33]

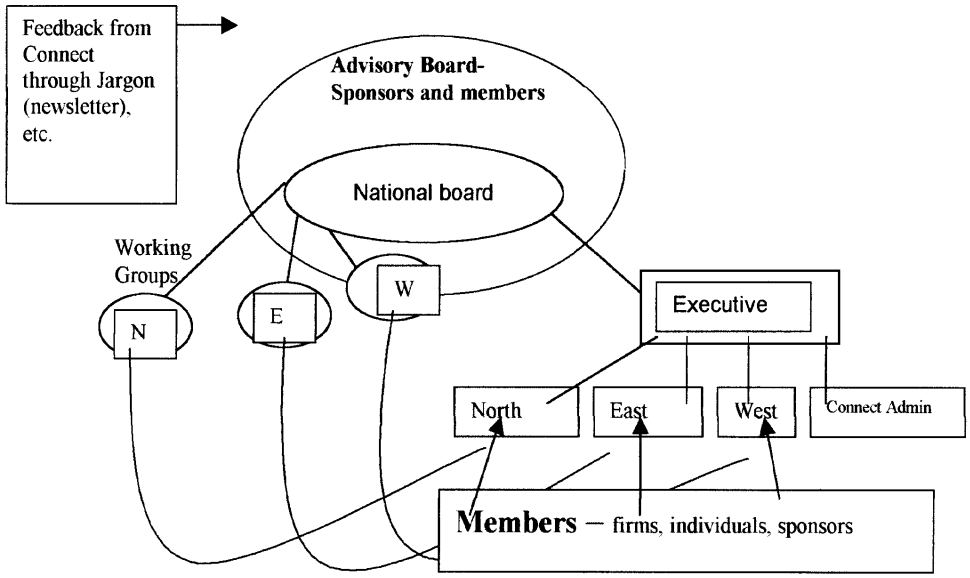
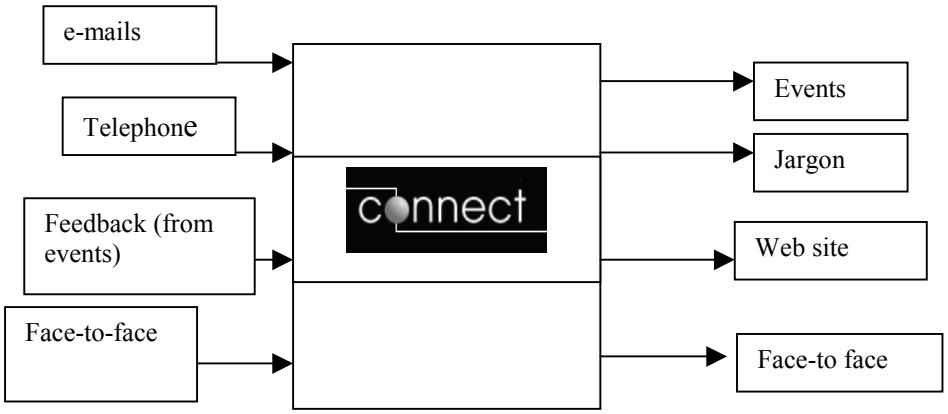


Figure 2 illustrates the range the delivery and communication interface and feedback processes used by Connect. Most of the items are self-explanatory with exception of Jargon that is the newsletter of Connect.

Figure 2 Delivery and communication interface for Connect



5.5 Connect's support mechanisms (activities and events)

Table 1 shows the activities and events that includes briefings, lectures, courses, workshops, conferences, technical and social support. The six Connect events shown in Table 1 are expected to play a specific purpose for specific target audiences and they all combine to fulfil the targets of the overall program.

There are three recurring types of events that are considered core activities for Connect, in that they are intended to involve the greatest number of participants and maintain a continuous flow of learning among stakeholders: These events are *enterprise workshops, an audience with*…, and *technology briefings* – the first two focused on enhancing general managerial skills and stimulating learning from the experience of others, whereas *technology briefings* provide a forum for actual business processes of collaboration to be initiated.

Table 1 shows three additional types of events: two annual conferences (Investment and Partnership) and the Springboard Workshop delivered on a flexible but less than frequent basis. The first three core events are the main subject of the first-phase of the evaluation of Connect, described in this paper, in line with the scalability of the proposed methodology (see below section 6).

Table 1 Connect's events

Type of Event	*Description*	*Objective*
Technology briefings	Forum for institutional researchers to present their work and research activities to Connect sponsors and technology companies.	To enhance understanding and facilitate technology transfer
Enterprise Workshops	Workshops bringing together technology companies and researchers with advisors and business professionals	To develop management skills of both technological entrepreneurs and entrepreneurial technologists
"An Audience with…"	Technology entrepreneurs discuss the development of their businesses, their successes and failures and their views of what it takes to succeed.	Learning from the experience of others and discussing development of their own businesses
Springboard Workshops	Forum for individual/businesses to present, in confidence, their technological concepts, proposed business strategy or business plans to an appropriate expert panel	To provide the entrepreneur or academic with practical, realistic and expert advice and recommendations
Investment Conference	Annual venture capital investment conference	To provide the opportunity for technology companies seeking finance to present to an international audience of investors.
Partnership Conference	Annual Corporate Partnership Conference will present institutional research to an audience of industrialists and businesses (1st in March 1998)	To assist in the exploitation of the research through partnerships, joint ventures, new company creation

5.6 Connect's committed targets

At the start of its events and activities, Connect set for itself a number of quantitative and qualitative targets. These are shown in Table 2 and are the original targets established for Connect's first four years of operation, 1997-2000.

Table 2 Quantifiable targets for Connect's outputs and impacts (up to end of year 2000)

Key Indicators	*Quantifiable Targets*
No. of events held	-At least 162 events; minimum of 25 participants per event; target mix is 50% technology ventures; 30% academics and 20% business professionals
No. of technology ventures participating in events	-At least 180 new and emerging technology companies will attend the mix of workshops and briefings; *-Learning achieved will significantly enhance the ability of participating companies to increase their rate of sustainable growth* -Quality target is 75% of participants to rate the event as 'good' or better on a scale measuring the perceived value of the event to the business/individual
No. of collaborative projects	-At least 216 academics/research staff will attend the mix of events -At least 45 collaborative projects between technology ventures and university/research centres to be established in the project period
No. of technology ventures securing funding	-At least 40 technology companies will secure developmental/growth funding *-Pilot has already established that technology ventures participating in Connect significantly improve their ability to secure development finance through their increased understanding of the needs of providers of finance*
No. of spin-out companies formed	-Connect will facilitate and enable the creation of 15 spin-out companies from the Scottish science base and established technology companies *-Participation in Connect is likely to improve the survival and growth rate of any spin-out company*
No. of new jobs	-Minimum of 180 new high income jobs enabled by Connect

Connect's committed targets contain six key indicators with quantifiable targets and are focused on three themes:

- number of events and audience mix (stakeholder attendance expected to events)
- number of technology companies securing development/growth funding
- number of spin-out companies, collaborations and associated jobs created

From Table 2, it can be seen that the nature of the committed targets increases in difficulty as one moves down the table. Delivering a specific number of events, for example, is much easier than demonstrating that a minimum of 180 new high-income jobs were enabled by Connect. Yet the evaluation of Connect must strive to account for both.

6 Real-time evaluation methodology for Connect Scotland

> "… From the outset it was emphasised to sponsors that they would be unlikely to see any significant return on their investment for at least three to five years."
>
> (Ian MacDonald, Director of Connect, 1997)

Connect has a broad mandate to develop a supportive infrastructure for high technology companies, or an 'entrepreneurial infrastructure'. Connect is a unique support program with its own particularities and characteristics. No off-the-shelf recipe exists to evaluate a program such as Connect. This section describes the main tenets of the real-time evaluation methodology applied to the Connect Scotland program.

6.1 Purpose and ingredients of real-time evaluation

It should be first stressed that the defined purpose of the evaluation of Connect is not an arms-length *post-mortem* evaluation. It is indeed intended and designed to contribute to the development of the program by making explicit achievements, difficulties, challenges and weaknesses, with the results fed back into the evolving constituency. In short, the Connect evaluation is, in itself, an explicit learning factor of the program.

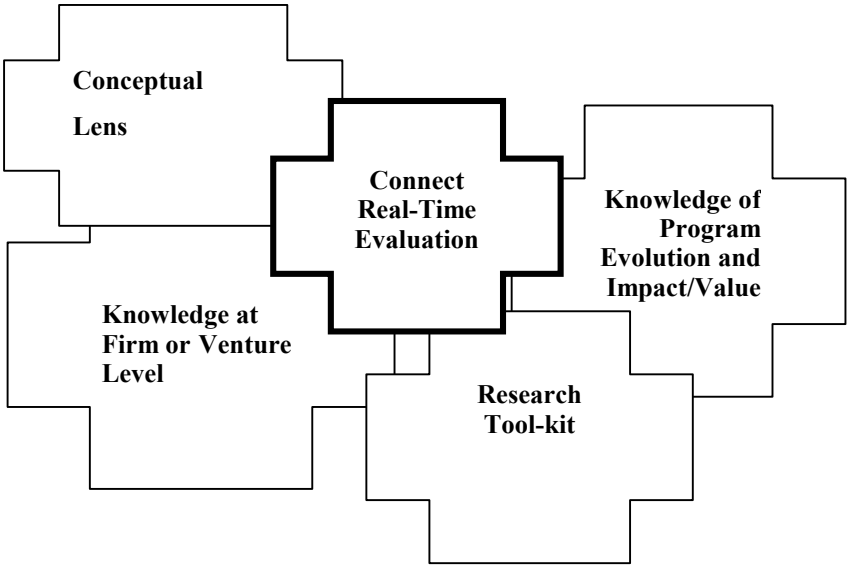
In addition, in line with the findings of the literature, the real-time evaluation of Connect is longitudinal, process-oriented and flexible. It includes assessment of achievements against committed targets, but it does not focus exclusively on them, since such a focus is not revealing of the development of a supportive infrastructure and the actual value added by the program. Indeed, it must be taken into account that Connect is fundamentally about 'connecting' and stimulating social, financial and knowledge flows. But Connect itself does not pursue the formal and systematic mentoring or nurturing of a newly emerging venture, collaboration or potential spin off. In this respect, Connect has no *direct* control of processes leading to new or increased numbers of collaborative projects, technology ventures securing funding, spin out companies, or new jobs. This means that exclusive focus on committed target suffers from a gap in the understanding of the processes between event participation and significant new venture creation. It seems to be assumed that such intermediate processes have simply happened if committed targets such as the creation of spinouts occur with clear reference to an initial stakeholder 'connection' stimulated by Connect. A longitudinal, process-oriented methodology should take care of such a 'process gap', particularly by capturing the experience of emerging ventures through case study at firm level.

The real time evaluation of Connect integrates four major complementary ingredients illustrated in the 'methodological jigsaw' of Figure 3.

- A conceptual lens to make sense of the complexities and multiple elements involved in the Connect constituency building process. This framework enables an appropriate organisation of the problem together with continual information gathering for evolutionary analysis of Connect's objectives related to effect on stakeholders
- Knowledge on the evolution of the Connect constituency at program level. This looks at two aspects: (a) the origins and development of the Connect program revealing what has happened with the implementation of its core activities and (b) the value-added delivered by the Connect program with reference to its original objectives and as judged by its stakeholders. Three types of value flows are distinguished: social, knowledge and financial flows, each offering a gradation of possible outcomes from 'easier' to 'more demanding' to achieve. The two aspects complement each other to generate a picture of the development of Connect's and its impact with reference to the program's committed qualitative and quantitative targets.

- Knowledge of ways in which Connect's activities is having an influence at individual firm or venture levels. These 'best-practice' cases complement the findings of the program level by seeking to reveal where and how Connect's value is realised through the experiences of specific stakeholders. The combined insights of the program and case-study levels help produce a richer picture of the evolution of Connect, its achievements, limitations, and lessons of practical value for both Connect and other similar programs.
- A battery of research tools combining review of secondary literature and archival data, survey questionnaire, semi-structured interview guides, and elements of participant observation through event attendance.

Figure 3 Ingredients of real-time evaluation of Connect at program and 'best-practice' venture level

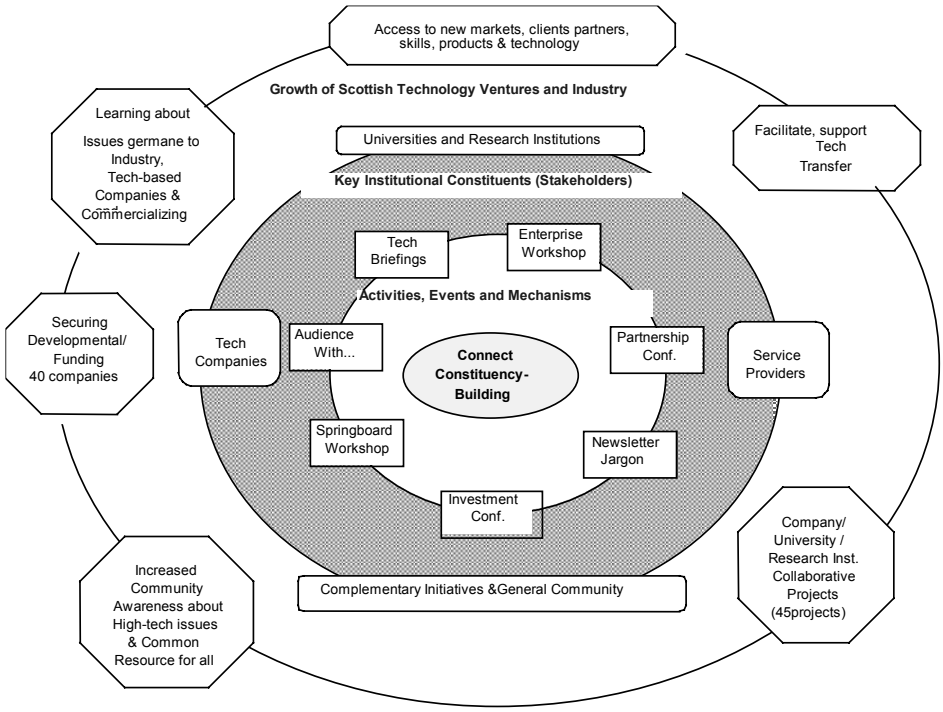


6.1.1 The conceptual lens of constituency-building [34]

To provide a unifying conceptual lens to the understanding of the Connect program, the real-time evaluation methodology treats the development of Connect as a process of constituency-building targeted on specific audiences and intent on achieving defined targets through the implementation of an integrated set of mechanisms and activities. In particular, the lens of constituency building helps to partition and organise the treatment of the multiple elements involved in the development of the Connect constituency. The content of this constituency-building process is illustrated in Figure 4, in the form of a multi-layered diagram containing Connect's events and mechanisms, Connect's existing and target stakeholders, and Connect's existing and target outcomes. These layers should

not be seen as separate from each other. In practice, each of the outer layers subsumes and requires of the inner layers to happen.

Figure 4 Overview of Connect's constituency-building process



A more detailed explanation of Figure 4 shows that the circle at its centre represents the focus of the real-time evaluation, namely, the entire process of Connect constituency-building for the sake of supporting the creation, development and growth of technology-based enterprise throughout Scotland.

The first layer around the core shows the main activities, events and mechanisms through which the Connect constituency-process is realised.

The second layer around the core shows the key constituents or stakeholders, either present or targeted by the activities, events and mechanisms of the Connect programs.

The third and final layer around the core shows the target results expected to lead to the ultimate mission of growth of Scottish technology ventures and industry.

The critical feature of the Connect constituency-building process is its facilitation and encouragement of interactions between the stakeholders through their activities, events and mechanisms. The unifying lens of constituency-building should enable the capturing of this process.

6.1.2 Knowledge of Connect Program evolution and impact with reference to committed qualitative and quantitative targets

This aspect of the evaluation is a continuous, flexible and scaleable process that looks at the evolving Connect experience, identifying strengths, weaknesses, and lessons. Three reports under the title of *Connect's Targets, Evolution and Achievements* are envisaged during the two-year life of the evaluation.

An initial assessment of Connect's key indicators and quantifiable targets (see Section 5.6) was originally conducted by August 1999, on the basis of information made available by the Connect office. The results can be seen in the far right column of Table 3. Of the six key indicators, only two could be approximately quantified with the data available and some of the categories were not precisely defined. The number of collaborative projects, technology ventures securing funding, spinout companies formed, and jobs, was unknown.

This prompted the need to develop the methodology further in order to generate a picture with a much finer resolution of Connect's impact and value. Three value flows were identified from Connect's own objectives -social, knowledge and financial value flows. Indeed, as Table 4 shows, 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 since informal and formal social contacts are the starting point for business-focused networks and developments.

Table 3 Quantifiable committed and realised targets for Connect

Key Indicators	*Quantifiable Targets*	*Realised (Aug-1999)*
No. of events held	-At least 162 events; minimum of 25 participants per event; target mix is 50% technology ventures; 30% academics and 20% business professionals	-109 events, 51 events under 25 participants 32% technology ventures 24% bus. professional 16% academic 24% 'other' 4% individuals
No. of technology ventures participating in events	-At least 180 new and emerging technology companies will attend the mix of workshops and briefings; *-Learning achieved will significantly enhance the ability of participating companies to increase their rate of sustainable growth* -Quality target is 75% of participants to rate the event as 'good' or better on a scale measuring the perceived value of the event to the business/individual	-this specific type of company was difficult to ascertain from avail. data. -Quality unknown
No. of collaborative projects	-At least 216 academics/research staff will attend the mix of events -At least 45 collaborative projects between technology ventures and university/research centres to be established in the project period	-over 400 staff -Unknown

Table 3 Quantifiable committed and realized targets for Connect (continued)

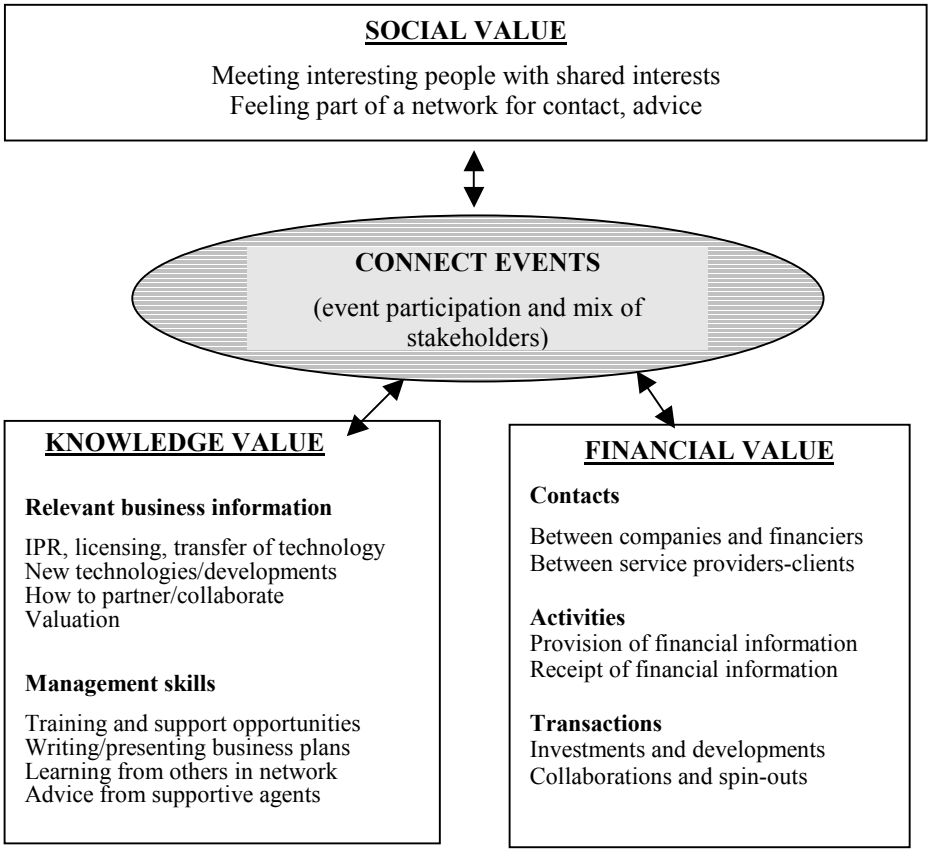
Key Indicators	*Quantifiable Targets*	*Realised (Aug-1999)*
No. of technology ventures securing funding	-At least 40 technology companies will secure developmental/growth funding *-Pilot has already established that technology ventures participating in Connect significantly improve their ability to secure development finance through their increased understanding of the needs of providers of finance*	Unknown
No. of spin-out companies formed	-Connect will facilitate and enable the creation of 15 spin-out companies from the Scottish science base and established technology companies *-Participation in Connect is likely to improve the survival and growth rate of any spin-out company*	Unknown
No. of jobs	-Minimum of 180 new high income jobs enabled by Connect	Unknown

Table 4 Value focus of Connect's core events

Type of event	***Objective***	***Value focus***
Technology briefings	To enhance understanding and facilitate technology transfer	Knowledge
Enterprise Workshops	To develop the general management skills of both technological entrepreneurs and entrepreneurial technologists	Knowledge
"An Audience with…."	Learning from the experience of others and discussing development of their own businesses	Knowledge
Springboard Workshops	To provide the entrepreneur or academic with practical, realistic and expert advice and recommendations	Knowledge
Investment Conference	To provide the opportunity for technology companies seeking finance to present to an international audience of investors.	Finance
Partnership Conference	To assist in the exploitation of the research through partnerships, joint ventures, new company creation	Knowledge/Finance

Each of the three value flows was then decomposed into topics aimed at capturing a gradation of impact or value added by Connect as perceived by the program's stakeholders. The resulting topics are listed in Figure 5 and provide the basis for questions to stakeholders on where Connect has been beneficial regarding social and business contacts, gaining or giving relevant knowledge, and attracting or providing financing for new companies or ventures.

Figure 5 Topics for determining social, knowledge and financial value from Connect events



Given the complexity and multiplicity of elements in the Connect constituency-building process illustrated in Figure 4, the evaluative analysis prioritises certain aspects of this process over others in different reports of the entire set making up the evaluation of Connect. This is facilitated by the longitudinal and process-oriented character of the methodology that permits a flexible and scaleable application along the life of the project.

Thus, in dealing with the first layer of Connect's *activities, events and mechanisms*, the paper chooses to focus primarily on what has happened regarding Connect's three core recurring events (see Section 5.5 above): *enterprise workshops, an audience with*…, and *technology briefings*), leaving aside the treatment of other Connect events and mechanisms. At least two elements of assessment are included:

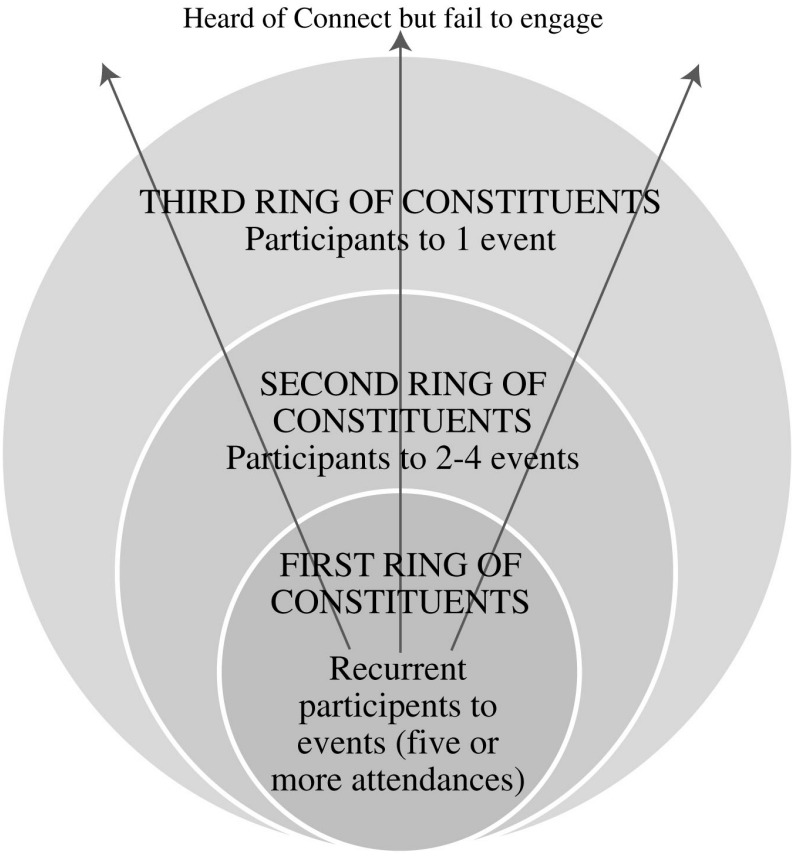
1 *Actual effort versus committed targets*. This is a straightforward general quantifiable evaluation of the targets and milestones committed by the program (see Table 2).

2 *Response rates*. This is focused basically on event attendance. It is mostly quantitative and does not inquire into the quality of the responses.

However, in dealing with the second and third layers of Figure 4 -Connect's *institutional constituents/stakeholders and Growth of Scottish Technology Ventures and Industry*- the

report concentrates on the assessment of the social, knowledge and financial value delivered by the Connect program as judged by the stakeholders. Here the methodology adopts the 'expanded rings' approach illustrated in Figure 6, as a practical way to select a meaningful sample of specific stakeholders to be approached for the research.

Figure 6 'Expanded Rings' approach to assessment of Connect's value flows



The first ring includes those individual and institutional constituents/stakeholders who have participated most in the activities and events of Connect. These include stakeholders who are recurrent participants to Connect events (for instance, five or more events). Outward from the first ring there will be a gradation of participation passing through those stakeholders who, for instance, have attended two to four events, right through to those who have attended one event only, and to those who may have heard of Connect but not engaged with the program yet.

The premise is that those constituents in the first ring, by being more active, are likely to be the most informative about the value flows generated by the Connect program. The further away from the first ring, the less informative the stakeholders will be, although they may be highly revealing of reasons why the program has failed to engage them recurrently, or at all. The first-phase evaluation applied this 'expanded ring' approach to

select a significant interview or survey sample containing stakeholders from the three rings illustrated in Figure 6.

6.1.3 Knowledge of 'best-practice' cases at firm or venture level

As already noted, the real-time evaluation of Connect complements the findings at program level with 'best-practice' case studies seeking to reveal where and how Connect's value is realised through the experiences of specific stakeholders.

In practice, Connect participants are likely to vary in their appreciation and experience of the value delivered by the Connect program. Case study evaluation helps precisely to capture these individual differences or unique variations from one program experience to another. Case studies also help to reveal more deeply the actual impact (at a given point in time) of the Connect program relative to its ultimate economic growth objectives (third layer of Figure 4). These objectives may include, for instance, companies' growth factors influenced by Connect and estimated impact on growth (e.g., capitalisation, market share).

The cases selected for study may include spin-outs, project collaborations, business funding and development, technology transfer, etc. and will examine eventual success or failure to reach the ultimate objectives of Connect. The focus will be on selecting information-rich cases with the aim of capturing and describing the main issues, factors and type of value added by Connect to the development of the venture.

The combined insights of program and case study levels will help produce a richer picture of the evolution of the Connect constituency, its achievements, limitations, and lessons. This should prove of practical value not only for Connect but, also, for other network programs with similar characteristics to Connect.

6.1.4 Research tool-kit

The real-time evaluation methodology makes use of appropriate combinations of various research tools in order to gather the data and information necessary to generate the knowledge mapped out in previous sections at both program and case-study levels. This research tools combine review of secondary literature and archival data, survey questionnaire, semi-structured interview guides, and elements of participant observation through event attendance.

In particular, a combination of archival data, survey questionnaire and semi-structured interview guides is used to map the evolution of the Connect constituency and quantify its achievement against the committed targets.

Qualitative information on the programmatic development of Connect as well as detailed data and information for the in-depth case studies is gathered primarily by means of in-depth interviews guided by semi-structured guides.

In all instances, the research makes use of appropriate search and analysis of available archival material and secondary literature to support the analysis of the information coming from the interviews.

7 Summary of first-phase results of implementing the real-time evaluation of Connect Scotland

This section looks at the findings of the evaluation with particular focus on two aspects:

1 the fulfilment of Connect's committed target, and

2 the perceived value delivered by the program to its stakeholders

7.1 Program targets. Commitments vs. realisation

Table 5 provides the quantifiable targets for Connect's outputs and impacts for the entire duration of the national program until the end of year 1999.

Table 5 Quantifiable targets for Connect's outputs and impacts (up to end of year 1999)

Key Indicators	*Quantifiable Targets*	*Realised (at 01/2000)*
No. of events held	-At least 162 events; minimum of 25 participants per event; target mix is 50% technology ventures; 30% academics and 20% business professionals	-over 162 events 62% tech ventures 14% academic (universities) 24% bus. Professionals (sponsors) 22 participants/recurrent event (average)
No. of technology ventures participating in events	-At least 180 new and emerging technology companies will attend the mix of workshops and briefings; *-Learning achieved will significantly enhance the ability of participating companies to increase their rate of sustainable growth* -Quality target is 75% of participants to rate the event as 'good' or better on a scale measuring the perceived value of the event to the business/individual	-over 180 companies of all types (104 companies have become members by mid-2000) -Good to Very Good (84% of survey respondents)
No. of collaborative projects	-At least 216 academics/research staff will attend the mix of events -At least 45 collaborative projects between technology ventures and university/research centres to be established in the project period	-well over 216 (over 400 by August-1999) -Not identified
No. of technology ventures securing funding	-At least 40 tech. companies will secure development/growth funding *-Pilot has established that tech. ventures participating in Connect significantly improve their ability to secure development finance through their increased understanding of the needs of providers of finance*	-Not identified.
No. of spin-out companies formed	-Connect will facilitate and enable the creation of 15 spin-out companies from the Scottish science base and established technology companies *-Participation in Connect is likely to improve the survival and growth rate of any spin-out company*	-Not identified
No. of jobs created	-Minimum of 180 new high income jobs enabled by Connect	-Not identified

7.1.1 Number of events held and quality

The real-time evaluation has shown that Connect is meeting its quantifiable targets for events. The committed cumulative number of events to be held by year-end 2000 (162) will be significantly exceeded. This total includes all types of events that Connect delivers and not just the recurrent events that have provided the focus for this report. However, the target mix of participants (based on 1999 data of recurrent events only) is rather unbalanced, with higher-than-targeted percentages of service providers and technology ventures attendance and lower-than-targeted academic attendance. This suggests a potential difficulty regarding the objective of stimulating university spin-outs or university-industry collaboration.

The target of minimum 25 participants by event had a variable success: sometimes above, sometimes below the target. Thus, the number of participants per recurrent event in 1999 was 22, compared to the committed target of 25. This average attendance to all three recurrent events, however, increased in the second half of 1999 - most significantly in enterprise workshops (from 12 to 28).

Based on the value survey, Connect is achieving is event rating target. Eighty four percent of respondents rated Connect events from 'good' to 'very good' on average, compared to the quantifiable target: *Seventy five percent of participants to rate the event as good or better on perceived value.*

The existing rating of Connect events as 'good' or 'better' is too generic to be really useful. The value flows and comments on the events provide a more accurate assessment of event quality.

7.1.2 Number of technology ventures participating in events

Although the quantifiable committed target is 'At least 180 new and emerging technology companies will attend the mix of workshops and briefings', the criteria of 'new and emerging technology companies' was not precisely defined or distinguished in the attendance records, so that it was not possible to make a separation. If we take all companies however the target number of 180 is easily exceeded since, for instance, 163 companies attended one Connect event in 1999 alone and there are currently 104 technology companies as members, indicating that this target is being achieved.

7.1.3 Number of collaborative efforts and spinouts

Connect has a target of 45 collaborative efforts and 40 spinouts. This report has not uncovered direct evidence of spin-outs or collaborative efforts having being facilitated or enabled by Connect. This is perhaps one of the most difficult targets Connect set for itself, as witnessed by the findings in the review of literature [44] and, particularly, by the low level of university-business interactions revealed by this report. However, as the company case study reports 4 (Spektra Systems) and 5 (Yaba Ltd.) show [45,46], companies are benefiting from Connect, mostly in intangible ways that may have a connection to collaborative efforts, spin-outs and jobs. Spektra Systems, for instance, credited Connect as a mechanism they effectively used to get themselves well known in Scotland. In turn, Yaba Ltd. considers Connect the most important support program for their commercialisation efforts and they attend it regularly [47]. This could be seen as

more in line with the softer comment accompanying the committed quantifiable target in Table 3, namely, the *Participation in Connect is likely to improve the survival and growth rate of any spinout company.*

7.1.4 Number of technology ventures securing funding

Connect has a target of 40 companies securing funding. The value survey did not uncover direct supporting reference to Connect having secured funding for technology ventures until end-1999. Some respondents saw some connection as a result of attending the events but did not ascertain direct causal relationship. This could be seen to be more in line with the softer comment accompanying the committed quantifiable target in Table 3, namely, "*technology ventures participating in Connect significantly improve their ability to secure development finance through their increased understanding of the needs of providers of finance."*

7.1.5 Number of jobs created

Connect has a target of a minimum of 180 new high-income jobs enabled by the program. Again, the value survey did not uncover direct supporting reference to Connect having enabled high-income jobs. This is consistent with the lack of evidence for direct Connect-facilitated spinouts or collaborative efforts already discussed.

7.1.6 Problem with the assessment of committed targets

There is a real problem with identifying, assessing and measuring Connect's direct impact on targets such as new venture development, company growth and job enablement. The problem is that the causal relations for this type of outcomes are not simple and, definitely, they are influenced by factors beyond the direct impact of the activities and mechanisms of the Connect constituency-building process. As an interviewee put it:

"Can Connect identify where the value conversations commence; where the 'sign-posts' are? Connect introduces people; what they do from there is beyond Connect, as Connect won't be involved, and the entrepreneur may not require anything else from Connect beyond the introduction".

(Scottish University Commercialisation Officer, interview, February 2000)

7.2 Stakeholders' perception of Connect's social, knowledge and financial value flows

As noted, the value survey decomposed each of the social, knowledge and financial value flows into 'value statements' aimed at capturing a gradation of impact or value added by Connect as perceived by the stakeholders. The following are the results, taking into account that the period goes until end of 1999.

Stakeholders rated social value as the most important perceived benefit from attendance to Connect events (Figure 7). This suggests that at the time of the evaluation the greatest impact of Connect has been on social networking. This is consistent with the

logical evolution of networks where social interactions and acquaintances tend to precede the exchanges and collaborations involving knowledge and financial value. Indeed, Gregson [22] has stressed the importance of informal social contact that evolve into business-focused networks, and then into strategic networks. A test for the evolution of the Connect program will be to increase the knowledge and financial value delivered by the program as perceived by the stakeholders.

Figure 7 Perceived value (%) from attendance to Connect events (n=69)

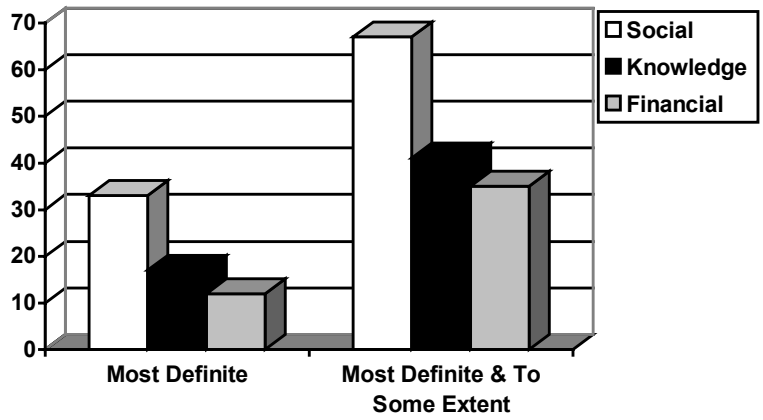
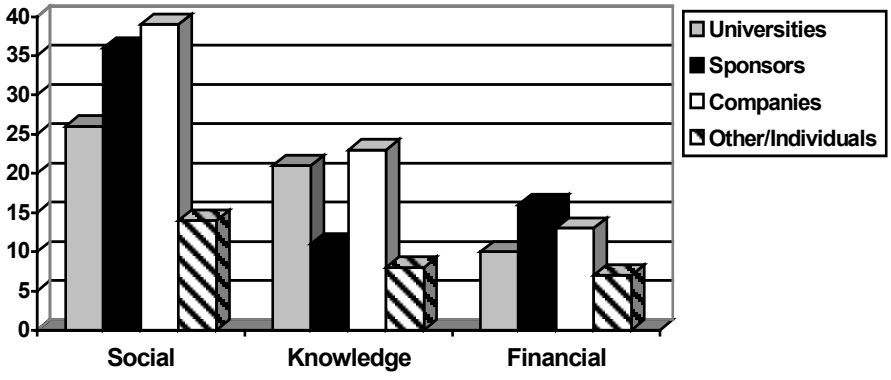


Figure 8 shows the variation in perceived social, knowledge and financial value of Connect by stakeholder category. Companies and sponsors vary the most in diversity of perceived value from Connect events.

Figure 8 Perceived value (%) by stakeholder group (n=69)

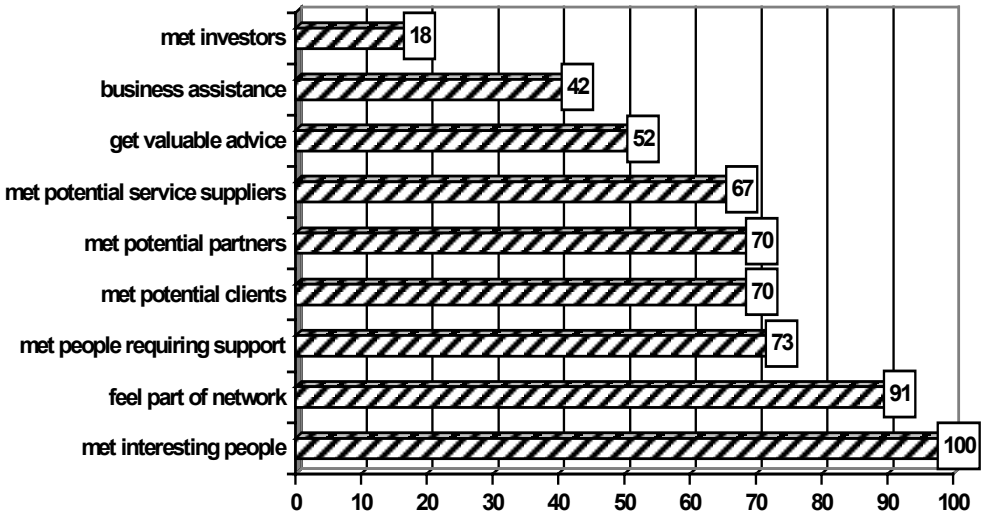


Let us now look in greater detail at each of the Connect's social, knowledge and financial values as perceived by each of the key categories of institutional stakeholders: sponsors, companies, universities.

7.2.1 Social value for stakeholders

Figure 9 shows the ranking of 'social value statements' according to percentage of positive responses accumulated from all respondents. As expected the number of respondents perceiving value decreases as the statements imply a more demanding value towards the top of the graph.

Figure 9 Percentage (%) of positive responses to questions relating to social value of Connect (n=69)



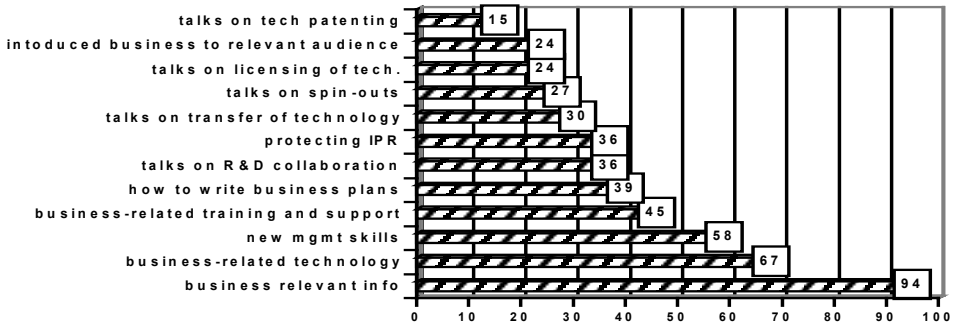
Thus 'value statements' directly related to network formation is seen by all respondents as the most valuable social value of Connect participation. Likewise, meeting interesting people that share similar interests and concerns, and a network of advice and contact are clearly important for all stakeholders. In particular, participants noted that Connect allows them to keep in touch with what is happening in Scotland, as well as providing a unique networking venue that allows individuals to begin the process of building up trust. In contrast, getting valuable advice or business assistance score much lower although still with a significant number of 42% and 52% respondents respectively. The ability to meet people willing to invest was scored the lowest.

7.2.2 Knowledge value for stakeholders

Figure 10 shows that learning relevant information and relevant technologies for business was most important for all stakeholders. Again as expected, the number of respondents perceiving value decreases as the statements imply a more demanding value towards the top of the graph. Thus, knowledge interactions for commercialisation purposes (patenting, licensing, etc) were ranked low in perceived value. More specifically, during

interviews, stakeholders identified lack of business-specific knowledge as a problem in Scotland, with Connect perceived as a facilitator of the '*lateral transfer of information'*. Companies in particular saw significant value in hearing about other people's experiences in setting up businesses and the problems that they have encountered.

Figure 10 Percentage (%) of positive responses to questions relating to knowledge value of Connect (n=69)



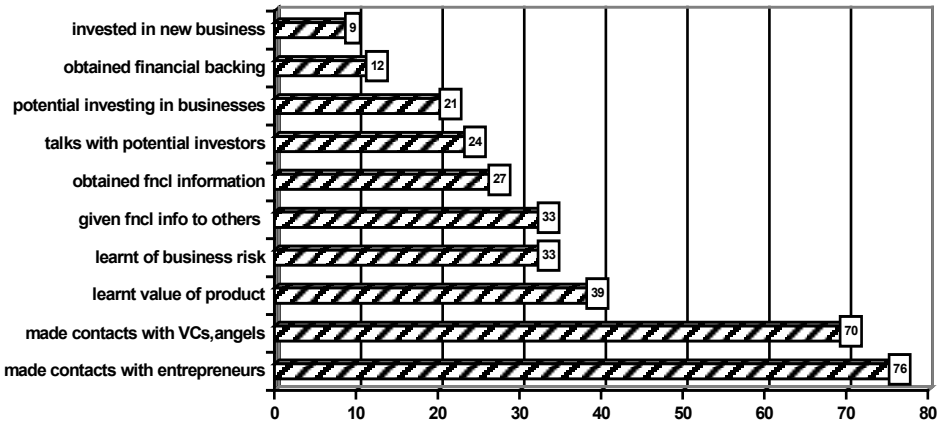
Also, Connect helped to increase "*market awareness, who are the players, angels, etc. and what is innovative in Scotland"*. Significantly, companies did not cite university-generated knowledge as highly important. This reinforces the point that university-business interactions still require substantial development work.

7.2.3 Financial value for stakeholders

Figure 11 shows that making contact with both entrepreneurs and business angels/venture capitalists is ranked highest, yet obtaining financial backing and investing in new business is ranked lowest. Again, as expected the number of respondents perceiving value decreases as the statements imply a more demanding value towards the top of the graph. This suggests that contacts for financial purposes are being made but effective investments have been below original expectations.

Universities and companies were the primary respondents to financial value questions on the survey, although service provider sponsors did indicate a desire for financial gain through service to new companies in the future. Interviews with commercialisation officers representing three universities found that seeking and securing financial support for university research was a prime motivation for participation in Connect. Showcasing and discussing commercially viable research is facilitated through Connect, yet other possible financial values in the survey were ranked much less in importance.

Figure 11 Percentage (%) of positive responses to questions relating to financial value of Connect (n=69)



Companies, on the other hand, reflect a variety of needs of which financing is one. There are a number of possible explanations for variations in perceived value by stakeholder category, amongst them

- Stage of commercialisation of company attending event(s). Adequate financial support and management skills are seen as critical elements in start-ups. Other elements may be more important later on or depending on the industry sector. For instance, those with a strong social and business network are most likely to be seeking more specific tangibles such as financing.
- Period of time the entrepreneur has attended Connect events. Those who have attended Connect events recurrently for a long period may find that value diminishes, particularly if the program does not refresh its content and activities and the predominant value-added becomes confined to social value.

8 The overall program evolution to date

There has been considerable growth in the size of the Connect constituency over four years (1996-2000), measured by the number of sponsors and members. Connect has clearly developed a comprehensive network of service providers and it is perceived as a unique event-focused forum in Scotland. However, feedback on the future of Connect mentioned both the need to develop stronger linkages with existing stakeholders, particularly universities and the need for more and wider linkages with other support agencies nationally and internationally.

Connect is perceived by a number of its stakeholders as a unique event-focused forum in Scotland. A number of stakeholders stated that Connect facilitates the building of

'connections' that no other agency at present can provide. However, some stakeholders believe that it could be more. Thus, much of the feedback on the future of Connect both mentioned the need to develop stronger linkages with existing stakeholders, particularly universities, and the need for more and wider linkages with other support agencies nationally and internationally. In this respect, it is apparent that the development of a supportive infrastructure for Scottish technology companies involves other support constituencies. Assessing Connect's role in isolation from these other supportive agents does not really provide an accurate picture of this infrastructure's development in Scotland. Research is badly needed addressing the nature and value of, and inter-relations between, at least the key support programs in Scotland. This would help to advance the public policy aim of program integration and simplification for more effective delivery of support to users.

All this raises the question of future strategic direction for Connect, especially as it comes to the end of its current period. The role of Connect is a recurring issue, and it is clear that there are differences in stakeholder expectations. This will demand strong listening and leadership abilities to balance expectations and ideas in the best possible way for the future.

8.1 The issue of value for money

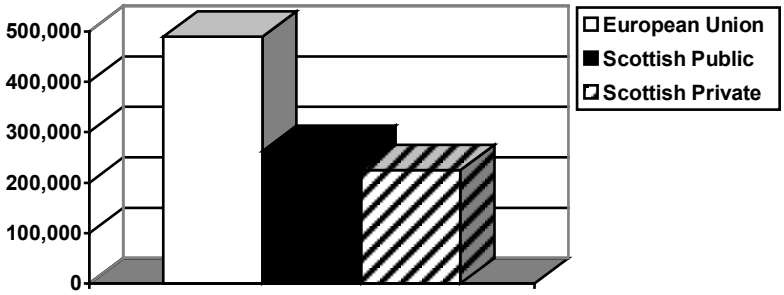
Connect has raised close to £1 million for a three-year period of activities until the end of May 2001. This amounts to an approximate average cost of £330K per year to finance all the activities, mechanisms and events. Connect has undoubtedly created a core constituency and it has been growing and delivering social, knowledge and financial value, and laying the foundations from which to climb towards the top end of the value flows. This should be seen in the perspective that the present evaluation covers mostly the first two years until the end of 1999. And as Director Ian MacDonald made clear:

> "… From the outset it was emphasised to sponsors that they would be unlikely to see any significant return on their investment for at least three to five years."
>
> (Ian MacDonald, Director of Connect, 1997)

Nevertheless, the challenge remains for Connect to raise the delivery of value to the more demanding targets it sets for itself. These targets are not easy to achieve as testified by all evidence provided by the literature on support programs. They are also not easy to measure, particularly in the case of Connect, whose predominant role so far has been to 'connect'.

A different angle of the 'value for money' issue can be seen from Figure 12. This shows that Scottish public sources, including universities, have contributed approximately £270K to the three-year Connect program (about £90K per year). Without counting the funds from university sponsorship (£118K), this amounts to close to £150K total or £50K per year.

Figure 12 Public and private sources of Connect funding (1997-2000)



This money has in turn leveraged over £220K from the private sector and close to £500K from European funding for Scotland. From this point of view of value for Scottish public money, Connect represents a rather inexpensive program for its achievements so far. The issue is whether these achievements can demonstrably be taken to the superior level of its own most demanding targets. In the spirit of the real-time evaluation, the following four recommendations were made to the Connect Scotland leadership in July 2000.

Connect should consider:

1 Improving its systems of tracking and monitoring stakeholders' participation in all its activities and assessing the quality and value of outcomes. More precise and detailed categorisations are required, for instance, the category of 'new and emerging technology companies' should be addressed in the light of recommendations that Connect should focus primarily on new and small companies. The evaluators have developed and used a system of 'value-flow analysis' that should become a periodic feature of Connect's monitoring for learning purposes.

2 Implementing further specific actions to enhance knowledge and value flows bridging universities and the business world relations. The evidence of the real-time evaluation is that the 'connecting' mechanisms implemented so far have still to realise their potential for fruitful interactions and new mechanisms may be considered. For instance, seeking to

   - increase the number of participant researchers by focusing on post-doctoral researchers who may be more liable to commercialise their technologies
   - communicate directly with researchers in order to avoid potential bottleneck generated by information 'gatekeepers.'
   - broker or offer mentoring service on the techniques and relevance of researchers' presentation for effective communication to business audiences

3 Developing stronger linkages with other support agencies nationally and internationally on the basis of a distinctive strategy.

- Nationally, the development of an integrated supportive infrastructure for Scottish technology companies involves other support constituencies and a closer dialogue and interaction will be beneficial. This may be catalysed by a research program addressing the nature and value of, and inter-relations between, at least the key support programs in Scotland. This would also help to advance the public policy aim of program integration and simplification for more effective delivery of support to users.
- Internationally, there are a range of vibrant and emerging commercialisation networks in which Connect is already a player, i.e., European programs and the Connect Global Alliance. Enhancing and strengthening these relation for purposes of knowledge sharing and cross-fertilisation of learning experiences would be beneficial. This should help with the implementation of a systematic scanning for innovative and good-practice ideas for continuous refreshment of program's content and mechanisms.

4 Improving clarity and understanding of the governance of Connect by stakeholders and particularly sponsors. A more systematic communication and consultation effort will enhance the constituency-building process by helping to make Connect the 'property' of all members of the constituency. This greater inclusivity effort should include closer dialogue with strategic participants on ways of improving Connect processes and the sharing of real-time management accounts.

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29 McDonald, I. and Ritchie, M. (1997) 'Connect National Development Proposal', *Proposal to SHEFC*.

30 The document described UCSD Connect as follows: 'Run from the University of California San Diego and funded by the private sector, it promotes the development of the region's high tech industries and the commercialization of the University's research. It creates networking

opportunities, stimulating the flow of ideas and knowledge between the academic, business and financial communicates, and offers business development services assisting, for example, companies to obtain finance and academics to commercialise their research. Within the high tech community it acts as a hub, linking local and global networks.' [31, p.22]. The perception exists that similar conditions to San Diego would apply in Scotland, thus making possible the potentially successful implementation of a Connect program in Scotland.

31 Royal Society of Edinburgh/Scottish Enterprise (1996) 'Technology ventures: commercialising Scotland's science and technology', Glasgow: Scottish Enterprise.

32 From the beginning Connect has made it clear that 'the aim is not to compete with established activity but to provide a channel for all participants, in particular research institutions and technology companies, to access skills, expertise, resources which already exist throughout Scotland.'

33 This model is based on Martin Richie's representation of the CONNECT constituency. The lines represent knowledge flows between organizational structures.

34 For further information on the 'constituency-building' approach, see Molina [35-39], and Collinson and Molina [40], Kinder *et al* [41], Kinder and Molina [42] and Klaes [43] below.

35 Molina, A. (1990) 'Transputers and transputer-based parallel computers: sociotechnical constituencies and the build up of British-European capabilities in information technology', *Research Policy,* 19, pp.309-33.

36 Molina, A. (1995) *Technology and the Making of Europe: The Human Story and Lessons of a Large-Scale Collaboration*, The Office of Official Publications, Luxembourg: Commission of the European Communities (CEC).

37 Molina, A. (1997) 'Insights into the nature of technology diffusion and implementation: the perspective of sociotechnical alignment', *Technovation,* Vol. 17, Nos. 11-12, pp.601-26.

38 Molina, A. (1998) 'The role of the technical in innovation and technology development: the perspective of sociotechnical constituencies', *Technovation,* 19, pp.1-29.

39 Molina, A. (1999) 'Transforming visionary products into realities: constituency-building and *observacting* in the case of NewsPad', *Futures,* Vol. 30, No. 9, April.

40 Collinson, S. and Molina, A. (1995) 'Reorganizing for knowledge integration and constituency building: product development at Sony and Philips', in R. Coombs, K. Green, A. Richards and V. Walsh (Eds.), *Technological Change and Organization,* Cheltenham, UK: Edward Elgar, pp.76-107.

41 Kinder, T., Klaes, M. and Molina, A. (1999) 'Sociotechnical alignment in the rise and evolution of a telemedicine constituency in Scotland', *Science and Public Policy*, Vol. 26, No. 6, pp.415-435.

42 Kinder, T. and Molina, A. (1999) 'From purposiveness to sustainability in the formation of multimedia clusters', in H.J. Braczyk, G. Fuchs and H.G. Wolf (Eds.), *Multimedia and Regional Economic Restructuring,* London: Routledge, pp.269-297.

43 Klaes, M. (1997) 'Sociotechnical constituencies, game theory, and the diffusion of compact discs: an inter-disciplinary investigation into the market for recorded music', *Research Policy,* Vol. 25, pp.1221-34.

44 Gregson, G. (2000) *Foundations of Real-time Evaluation Methodology for Connect: Review and Analysis of Relevant Literature*, TechMaPP, The University of Edinburgh, Edinburgh, UK.

45 Gregson, G. and Nicolls, D. (2000) *Best-Practice Cases No.1: Spektra Systems Ltd*, TechMaPP, The University of Edinburgh, Edinburgh, UK.

46 Gregson, G. and Nicolls, D. (2000) *Best-Practice Cases No.2: Yaba Ltd*, TechMaPP, The University of Edinburgh, Edinburgh, UK.

47 Yaba is looking for second round funding and recent information (mid-2000) suggests that they have now secured a substantial six-figures deal.