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Literature Survey of Venture Capital Support Schemes in Europe

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INTRODUCTION

The economic history of USA over the last 50 years can demonstrate many notable examples of new-technology firms that were backed by 'classic' venture capital prior to achieving spectacular growth and commercial success (Bygrave and Timmons, 1992). The role played by venture capitalists in America has had a profound influence on the ways in which other Western nations have viewed the best means by which highly innovative but still young and vulnerable companies may be supported. Venture capital is seen as playing a major role in creating and sustaining economic growth through the facilitation of new technology development and new business creation (EVCA, 2000). However, the US and Europe have embarked on quite different paths in the amount of venture capital investments provided to early-stage, high-tech companies. There is further significant variation in the proportion of high-tech investment to total venture capital investment among the European countries, as Table 1 shows.

Insert Table 1 here

Reflecting the sustained bull market for technology stocks up until Q1, 2000, the amount of venture capital invested in early stage companies (i.e. seed and start-up) has grown, between 1996 and 1999, from •444 to •3,239 Million in Europe (EVCA, 2000) and from $8,139 to $35,543 Million in the US (VentureOne, 2000). Yet, these figures disguise the fact that 75% of this growth is due to increase in the average deal size and only 25% is due a real increase in the number of number of firms financed. Again, there is much variation among the European countries in the percentage of VC investments allocated to seed and start-up stages, as Tables 2 and 3 show.

Insert Tables 2 and 3 here

Combining the above statistics, it is clear that early-stage, technology-based firms do not receive more than a small proportion of the total venture capital funds raised or invested in any

one year (Bank of England, 1996; CBI, 1996). The estimated financial needs of seed and early-stage companies, £5,000 -500,000 (Bank of England, 2001), are clearly, *and increasingly,* outside the observed range of venture capital deal sizes. Thus, it is perhaps not surprising that only 1% of SME funding for the period 1997-99 is provided by venture capitalists, compared to the 61% provided by banks (Bank of England, 2001). The reality is that venture capital has traditionally been a minority financial instrument of relevance to a tiny cadre of exceptionally high potential firm starts in any one year.

Although the special nature of new technology-based firms (Delapierre et al., 1998) has been pointed out (Storey and Tether, 1998a), until recently public policy had not treated NTBFs as a special subset of small firms worthy of separate treatment (Storey and Tether, 1998b). However, since 1996 and following the EU Green Paper on Innovation (European Commission, 1995), new technology based firms (NTBFs) have increasingly caught the attention of policy makers at both European and member state level. In view of the wave of recent policy initiatives targeted at the financing and support of NTBFs, this paper aims to provide a review of these initiatives. It is structured as follows: section II outlines the past and present issues in small firm financing, with particular attention being paid to NTBFs; section III examines the role of venture capital in adding value to their portfolio firms, in promoting NTBFs, and discusses the current trends in venture capital investment patterns; section IV reviews public policies for the early-stage financial support of NTBFs; section V provides a detailed review of focused NTBF schemes; finally, section VI concludes.

OVERVIEW OF SMALL FIRM FINANCING

The two most important sources of finance for small firms are the owners themselves (Rosen, 1998) and commercial banks (Meyer, 1998). Berger and Udell's (1998) comprehensive overview of small firm financing in the United States provides empirical support for this view. These authors found that owners and financial institutions accounted for over 58% of the total value of small firm financing. Table 4 provides a breakdown of the aggregate small firms financing in the US. In terms of working capital, bank overdrafts and trade credit are more heavily used by small firms than by large firms (Storey, 1994).

Insert Table 4 here

On the Existence of an "Equity Gap"

The past century has been marked by incessant debates on the existence and nature of market failure in the financing of small firms. In fact, the term "equity gap," referring to the systematic shortage of small amounts of external equity for young firms, was first used by the MacMillan Committee in 1931 (Storey, 1994). Despite the serious nature of the financing gap debates, there have been relatively few comprehensive empirical studies on the adequacy of financing for small firms. In Europe, empirical work has been largely based on large-scale surveys measuring the verbalized attitudes of SMEs towards their financing environment (European Commission, 2000a). In addition to the severe methodological and empirical constraints underlying such studies (European Commission, 2000a), the derived conclusions are far from uniform. Cressy and Olofsson (1997) conclude that there are "both supply and demand constraints in some European countries." There are differences not only by country but also by type of small firm, with Early Stage and Highly Innovative Enterprises experiencing the highest

financing supply constraints (European Commission, 2000a). However, in the UK, the Aston Business School (1990) survey of small firm financing suggested that funding fears might be exaggerated. Aston reported 22 case of market failure in an analysis of the financing of 609 growth oriented firms (3.6%).

In the US the availability of aggregate financial data has enabled researchers to quantitatively estimate the adequacy of small firm financing. The results have been interesting. (Schweiger, 1958) systematically examined two measures for financing adequacy, i.e. health and ability to grow the business (internal funds), and distribution of available funds (both for equity and debt). This author found little support for the thesis of inadequate support for small firms. This was quite opposite to the prevailing public opinion at the time. Similarly, (Widicus Jr., 1966) argued that most of the available research did not build strong enough case for the necessity of government intervention in the financing of small businesses.

Overall, the degree of fulfilment of the financial need of SMEs has been hard to assess. Financing adequacy is not a straightforward concept. For example, surveying SME owners only provides us with a one-sided view of the issue and may often reflect owners' unfulfilled ambitions or other subjective interests. In addition, viewing SMEs as an aggregate group conceals important within-group variance, as suggested by the European Commission (2000a) report. A more fruitful avenue of research is likely to be the focus on specific sub-groups of small firms.

The Special Case of New Technology-Based Firms

The commercialisation of scientific and technological progress is universally accepted as a major driver of economic development. The means by which commercialisation activity is implemented has become a highly relevant and contemporary debate. Commercialisation has frequently been implemented by new rather than existing firms (Saxenian, 1994; Kenney and von Burg, 1999). While it is argued that the exploration of scientific advances by existing firms often runs into bureaucratisation and risk-averseness (Maclaurin, 1950), the dispute on the relative contributions to innovation made by new (small) vs. old (large) firms is far from settled (Tether, 1998). To the extent that new firms are important vehicles for innovation, the nurturing of technological progress is a matter of ensuring sound incubation of NTBFs. Broadly, NTBFs are defined as independently owned businesses established based on the exploitation of an invention or technological innovation with significant technological risk (Arthur D. Little, 1977). Given their unique role in innovation and commercialisation, NTBFs form a distinct subset of SMEs and should be given special attention (Storey and Tether, 1998a).

In addition to the special attention they deserve, NTBFs should not viewed outside of their surrounding innovation context, the technopolis (Smilor et al., 1988), comprising of research institutions, existing firms, and support institutions (Autio, 1997;Kenney and von Burg, 1999). Empirical work (Licht and Nerlinger, 1998) has shown that the number of NTBFs in a region depends on the R&D endowments of universities and other public research institutions in that region. Using Maclaurin' s (1953) framework, the cohesiveness of technological advance and thus the health of NTBF formation and growth is ensured by the following factors: (1) propensity to develop pure science, (2) propensity to invent, (3) propensity to innovate, (4) propensity to finance innovation, and (5) propensity to accept innovation.

The Financing of NTBFs

Benefiting from developments in pure science is largely dependent on the channelling of capital to new technological ideas (Maclaurin, 1953). Interestingly, England in the 1930s is cited as an exemplary environment where capital shortage was keeping advancements in pure science

from being commercialised (Maclaurin, 1953). This was exactly the time when the term "equity gap" appeared in the public policy documents. Yet, while these policy documents attributed the "equity gap" to market failure, simpler causes were found in the preoccupation of the professional investment classes with holding liquid investments (Keynes, 1936). At the same time, in the US, wealthy individuals were foregoing immediate liquidity concerns and were more willing to back inventive talent than their UK counterparts (Maclaurin, 1950). This channelling of private wealth to the the financing of new technological endeavours was later formalised through the emergence of classic venture capital firms in the period 1950-1970 (Bygrave and Timmons, 1992). The growth of the venture capital industry has, and continues to be largely driven by the rapid technological development in Silicon Valley and Route 128, and by the spectacular success of early technological entrepreneurs (Kenney and von Burg, 1999). In many cases the venture capitalists' timely involvement has been instrumental in the creation of new industries (von Burg and Kenney, 2000).

In the late 1990s the topic of the financing of NTBFs has grown in importance. To a degree, this has been as a consequence of the changing nature of the venture capital industry, which has increasingly in Europe turned away from classic venture capital and towards merchant capital (Bygrave and Timmons, 1992). Two parallel themes have dominated this stream of literature. The first stresses the disproportionately larger difficulties faced by NTBFs in obtaining external financing (Westhead and Storey, 1997; Storey and Tether, 1998a; Delapierre et al., 1998; European Commission, 2000a). The second stream stresses the investors' reluctance to invest in NTBFs, particularly venture capitalists (Murray and Lott, 1995) and institutional investors (Bank of England, 1996). The Bank of England (1996) refers to 'institutional reluctance to invest in early-stage technology firms" and to venture capitalists' tendency to ignore early-stage investments. In its 2001 report the Bank, while reluctant to pronounce a 'market failure" in the financing of small technology-based firms (STBF), makes it clear that the hopes of bridging the equity gap for the early-stage, technology investments also lie with the involvement of other financial market agents including business angels, seed capitalists, corporate venturing, and banks.

THE ROLE OF "CLASSIC" VENTURE CAPITAL

As we saw in the previous section, venture capital and technological development have been grouped together for a large part of the past century. We now turn to examining more deeply the role venture capital plays in the emergence and growth of NTBFs.

The Value of VC Involvement

The questions of whether and how venture capitalists add value to their investee companies have remained largely unanswered. While research has described the activities of venture capitalists in the governance of their investee firms (MacMillan et al., 1989; Sapienza, 1992;Lerner, 1995) it has not been possible to determine what the differential benefit of venture capitalist involvement is. The relations between venture capitalists and their investee companies have been examined from various perspectives: the contextual impact of innovation, development stage and entrepreneur's experience (Sapienza, 1992); effect of agency risks and uncertainty on relations (Sapienza and Gupta, 1994; Sapienza et al., 1996); effect of degree of involvement on performance (MacMillan et al., 1989); the active participation of the venture capitalist on the investee company's board (Fried et al., 1998; Bruton et al., 2000; Lerner, 1995); the effects of ownership institutionalisation and control concentration on venture performance (Khavul, 2000).

All this work suggests that while venture capitalists make a contribution in strategic, financial, networking, and recruiting matters (MacMillan et al., 1989; Timmons and Bygrave, 1986; Fried and Hisrich, 1995), they have no single best response of working with new ventures. A lot depends on the experience of the entrepreneur and the characteristics of the venture. This 'fit" between the venture capitalist and entrepreneur is stressed by Perry (1988), classifying entrepreneurs as inventors, builders, and innovators, and venture capitalists as investors, advisors, and partners. In addition, venture capitalists, as specific type investors, have performance goals that may not be fully aligned with those of the entrepreneurs, as is evidenced by the fate of the 'living dead" investments in a venture capitalist portfolio (Ruhnka et al., 1992). All these considerations make it hard to reconcile the fact that most of the firms in a venture capital fund portfolio 'fail' - at least by the economic targets imposed on them by their professional investors (Sahlman, 1990;Zeider, 1998).

Venture Capital and NTBFs

In the context of NTBFs the role of venture capital is positive by association – many of the most successful US technology companies (DEC, Intel, Apple, Cisco, Sun Microsystems, etc.) have been backed at start-up or early in their life cycle by venture capitalists (Bygrave and Timmons 1992). Classic venture capitalists, armed with patience and business acumen, were a good match for cash constrained companies exploring new technologies. Based on that early success, public policy has almost unequivocally seen venture capital as a an important element assisting the effectiveness of innovation. European governments have sought to replicate US innovation successes by developing their venture capital industries (European Commission, 1995). Still, the prevalence of venture capital in the financing of NTBFs has generally remained low in the European countries (Manigart and Struyf, 1997). The Anglo German Foundation study estimated that the provision of venture capital to young high tech companies was under 10% of all firms in the period 1987-96 (Burgel et al, 2001). The increase in the attractiveness of new technologies is likely to have markedly increased that proportion in the period 1997-2000.

Despite this stylised generalisation on the positive role of venture capital, there has been little systematic research on the link between venture capital and innovation (Kortum and Lerner, 1999). The only step in this direction has been these authors' finding of a positive association between venture capital activity and patenting rates. This association, however, does not unequivocally establish the primacy of venture capital in generating innovations – increased patenting may just be an indicator that firms backed by venture capital are more keen on seeking protection for their intellectual achievements. Also as the Anglo-German Foundation study noted, UK entrepreneurs are often loath to patent innovations given the increased public scrutiny such activities attract.

Some limited empirical research has been directed towards appraising the effects of government programs, particularly the Small Business Innovation Research (SBIR) program of the US government. Lerner (1999) found that the interaction between SBIR awards and venture capital activity had the strongest influence on the SBIR awardees' increases in sales and employment. Wallsten (2000) refined Lerner's claim by arguing that firms receiving SBIR awards were already larger and that SBIR awards displaced the firms' own R&D spending. In the UK, there is some evidence that investors use the ability of firms to win a SMART award as an indication of the (good) quality of the technology.

Another area of exploring the link between venture capital and high-tech investments is whether all VC firms invest in high-tech businesses with equal intensity. This is simply not the case - the top 21 high-tech VC firms in the US (4% of the total number of VC firms) account for

25% of the total high-tech investing (Bygrave and Timmons, 1992). Further, there is a tight geographical concentration, with the firms based in California, Massachusetts, and New York accounting for over 75% of the high-tech investments (Bygrave and Timmons, 1992). Finally, syndication patterns of VC deals suggest that there are distinct regions of importers and exporters of high-tech, VC funds (Florida and Kenney, 1988). The issues of regionalisation and the supply/demand for venture capital is still a highly relevant policy issue. Governments in Europe including the UK, German and French states have introduced SME financing programmes that have a clear regional element. Policy makers face the difficulty that a dearth of venture capital finance might constrain the economic development of an area but the state's provision of equity finance cannot resolve related issues of, for example, the local level of entrepreneurial experience, the quality of intellectual property and the role of local universities in the development process.

The New Face of Venture Capital: Return and Deal Flow Considerations

There was little resemblance between the venture capitalists of the early to mid 1990s and the classic venture capitalist of the 1960s and 1970s (Bygrave and Timmons,1992). It is not by chance that the adjective "classic" has been used to describe the earliest and most technologically oriented form of venture capital activity.

What are the reasons for early-stage technology investments' being unpopular with venture capitalists? Some of the answers have been sought in the existence of particular, experience-based negative attitudes held by VCs (Murray and Lott, 1995). Such work has confirmed that early-stage investments in general are perceived as much riskier and thus require much higher rates of return (49-57%) when compared to debt financing (Murray and Lott, 1995). The perceived risk stems from the lack tangible assets or performance history, and, in the case of technology-based investments, significant market uncertainty. In the context of highly innovative enterprises, financial sector reluctance is based on (1) uncertainty of returns, (2) lack of adequate protection for the ownership of ensuing benefits, and (3) indivisibility of the investment (European Commission, 2000a). Yet, moving from perceptions to actual performance, empirical studies have failed to account for the higher riskiness of NTBFs (Murray and Marriott, 1998; Storey and Tether, 1998a). None the less, the very poor returns to technology investments in early stage firms were a fact of the mid-1980s. The reality of this fact set European venture capitalists against the idea of investing in young or new businesses for a decade. A revision of the industry's attitude to 'classic' venture capital only became possible with the continued bull market for technology stocks in America and its eventual (positive) effect on the European market for technology stocks by the mid 1990s.

In addition to inflated investment return perceptions, another explanation for the scarcity of venture capitalist investments in NTBFs may be found in the economics of the VC firm itself, and more specifically in the transaction cost of the individual deal. With the number of possible investments limited by the venture capitalists' available time, focusing exclusively on start-up investments would require raising a small-size fund. Thus, there is a positive association between minimum fund investment and fund size (Murray, 1999). As start-up firms often require several financing rounds before becoming full-fledged viable enterprises, follow-up financing is of major concern for early stage VCs. For those technology specialist funds with very limited financial resources, this situation of capital or fund scarcity may lead to a "second equity gap". This results in a poor bargaining position for the start-up investor in relation to new investors (Murray, 1994b). Such imbalanced position arises because the pool of later stage investors is limited. Amit, Brander and Zott (1998) argue that the existence of information asymmetries makes venture capitalists want to sell to informed investors.

If a start-up enterprise is in need of follow-up financing, there is the danger of a 'second equity gap' existing. This occurs if the initial VC investor is not in position to continue to invest pro rata to its original stake in the investee firm, and thereby provide an eventual good return for the original investing fund. Essentially, the initial investor cannot follow-on in subsequent rounds of finance and is heavily 'diluted'. Thus, the original investor accepts the highest levels of risk/uncertainty but does not reap a correspondingly high reward given the original funds inability to provide appropriate levels of further funding. Partial confirmation of this problem exists in the reports on the lower returns earned by early-stage VC funds (Murray and Marriott, 1998). Faced with such prospects, venture capitalists who are able to, make provisions for follow-up financing, which in turn results in larger fund size. In addition, the viability of small VC funds is limited by the nature and amount of their operating expenses (Murray, 1994a; Murray, 1999). Given these deal and time restrictions, as fund size increases, larger investments become economically more feasible and attractive. The reason for this allocation lies outside the venture capitalists' deliberate choice, but rather in the limitations posed by their large or small level of funds and managerial resources.

Venture Capital in its National Context

In addition to deal flow considerations, national contexts are important sources of variance in the observation of venture capital investment patterns. The two most common factors through which a national context influences venture capital activity are the legal foundations of investor control and the country's entrepreneurial propensity/infrastructure. In regard to the first factor, the countries' prevailing legal regimes (e.g. Common *versus* Roman law) and degree of law enforcement determine the degree of investor protection. This in turn influences the size and dynamics of the countries' stock markets and the available sources of external financing (La Porta, Lopez-de-Silanes et al, 1997). Further, the prevalence of banks versus stock markets as financial conduits to the firm dictates the control mechanisms available to investors (Black and Gilson, 1998). Venture capital investments by their nature necessitate the subsequent cashing-in of control rights, a process facilitated by stock markets (Black and Gilson, 1998). The strength and prevalence of the banking system (e.g. in Germany) has been seen as a deterring factor for the development of a strong venture capital industry in the 1980s (Pfirmann et al., 1997). However, an EC study of banks also noted the positive effect that the provision of debt finance has on NTBFs being able to subsequently raise external equity (Enterprise Directorate General, 2000). Stock-market-centred economic environments put high weight on accurate financial performance data. This allows for objective comparisons between companies and industries in order to identify under-performers. Therefore, the stock market, through its significance for exiting VC investments, both acts as a catalyst for venture capital industry development and imposes common valuation methods for standardized performance comparison. However, in order for stock markets to function well they need a strong supply of new businesses and sufficient liquidity for businesses already registered. In both these regards, the large number of European stock markets, with over 30 regulated markets and eighteen regulatory bodies (AltAssets Research, 2001), works against an optimal capital market structure.

The size and dynamics of a country's stock market also influences how venture capital investments are made, i.e. the prevalent investment vehicle(s). The emergence of the fixed-term, limited partnership has greatly facilitated the process of fundraising from institutional investors (Fenn et al., 1995). Thus, in the US, the prevalence of limited partnerships has contributed to the fact that 64 percent of venture capital funds are provided by institutional investors (Sahlman, 1990). In the larger economies of Europe, with the exception of the UK, institutional investors have traditionally been less relied upon. Banks have played a more major role. Accordingly,

venture capital funds in Europe are structured more in a captive or semi-captive way in relation to the major capital provider. Limited partners in the US are restricted in their on-going influence on the investment preferences. However it is clear that the investment preferences of the main captive fund investors, especially along the risk-return relationship, take precedence in the investment selection and valuation process of the private venture capitalist. Murray (1994a), in an evaluation of the EU seed capital pilot scheme, found systematic differences between funds established for financial (i.e. return maximization) purposes and those established for social purposes (i.e. regional development), along sources of both fund capital and deal flow. Recent data (British Venture Capital Association, 1998; Burgel, 2000) and reports (Murray and Marriott, 1998) show that historically European early-stage VC funds earn lower returns than their later-stage counterparts. It is only in the last three years that the returns to early-stage investments in the UK have accelerated to outperform over a ten year period the returns of later-stage categories (PWC & Westport Private Equity, 2001).

In regard to the second factor, the low degree of start-up investments may be simply a reflection of the low intensity of new business creation in a given country. The Global Entrepreneurship Monitor (Reynolds et al., 2000) classifies the majority of the EU countries as having a 'medium' degree of entrepreneurial activity. As a generalisation, new firm formation is much lower in Europe than that in the US. While 1 in every 10 adults in the US is attempting to start a new business, the highest comparable figures for Europe are 1 in 25 (Germany) and 1 in 33 (UK, Italy, Spain, Denmark). The same report establishes a positive correlation between this prevalence of entrepreneurial activity and the prevalence of Business Angels. These empirical facts have important demand-side implications for the availability of start-up finance.

VENTURE CAPITAL AND PUBLIC POLICY

Policy has historically been important in removing obstacles for growth in both the US and the UK industries. Similarly, the venture capital industries in continental Europe could not have established a strong footing without the intervention of public policy makers (Davidson, 2001). While this may be partly attributed to the inert nature of the national stock markets (Pfirmann et al., 1997), certain characteristics of the market for equity finance may be explained by the nature of public policy in the area of encouraging venture capital investments. However, the conducive environment or level playing field which venture capital requires to flourish cannot be enacted by those other than government. The levels of taxation and the legal provisions controlling both the raising, the allocation and the realising of investments are strongly under public governance regimes. Whether we like it or not, corrective or positive change requires the active participation of government. Thus, the current section will review public policies both in the US and in Europe.

Brief Overview of US Policy

Even before innovation was widely accepted as fuelling economic growth, the US had embarked on an innovation-promoting path. After the Second World War, drawn into headlong competition with the Soviet Union, the US accelerated investment into its scientific research institutions. It is not by chance that the subsequent technology regions have been formed around the strong scientific base of MIT and Stanford (Saxenian, 1994;Kenney and von Burg, 1999;Roberts, 1991).

From the mid-1950s, with the passage of the Small Business Act in 1953, the attention of US policy was directed towards the financial needs of small businesses. The Small Business Investment Company (SBIC) program, launched in 1958, was designed "… to stimulate and supplement the flow of private equity capital and long-term funds which small-business concerns need for the sound financing of their business operations and for their growth, expansion, and modernization, and which are not available in adequate supply" (Widicus Jr., 1966). Since the original SBIC program's launch the US government has been very active in both its venture capital (Lerner, 1999) and high-tech development (Bygrave and Timmons, 1992) initiatives as well as in further programs facilitating the flow of institutional investor funds into venture capital (Fenn et al., 1995).

There is no outright agreement as to the exact influence of these initiatives on the development of the private venture capital industry in the US. This lack of clarity stems from the dearth of empirical studies on the effects of these programs and from criticisms in the few studies undertaken that the programs were inefficient in both their reach and administration (Widicus Jr., 1966; Wallsten, 2000). Yet, there is almost unanimous agreement that, in their aggregate, these initiatives have had a positive effect on the development of the US venture capital industry.

European Directives and Policy Measures:

Seed capital schemes launched prior to 1996.

Prior to 1996, policies within the EU have been largely in the context of providing seed and early-stage financing for small firms. The European Seed Capital Fund Pilot Scheme (ESCF), active in the period 1988 - 1995, helped start the movement for encouragement and financial support for early-stage investments. The ESCF scheme has been recently succeeded by the CREA[1] programme supporting seed capital funds. In 1989, the Eurotech Capital program was launched by the EC. It was generally (if not specifically) aimed at supporting venture capital organizations in closing the equity gap for hi-tech enterprises. Within the same context, Eurotech Data has been established to assist venture capitalists in gathering information on new technologies and products. This program has been recently opened to the I-TEC (mentioned below) program participants (aka LIFT program). In most cases, European programmes were constrained by the issue of 'subsidiarity'. Accordingly, most EC programs have a strong international and collaborative focus between member states.

At the country level, most of the schemes available in the mid 1990s did not focus explicitly on NTBFs, but were rather directed at SMEs in general (Storey and Tether, 1998b). In spite of the variety of financial assistance available to SMEs, no evaluation existed for the relative efficiency of the different assistance modes. As there was no convincing evidence that these broad, SME-directed schemes spefically or efficiently benefited NTBFs, Storey and Tether (1998b) concluded that NTBFs require "specialist" schemes which reflected the peculiar circumstances of NTBFs in European countries.

The European Investment Bank and European Investment Fund.

[1] Capital Risque pour les Enterprises d'Amorcage

In addition to the European Commission, two additional policy based institutions targeting the seed and early-stage financing of small firms are the European Investment Bank (EIB) and its associate organisation the European Investment Fund (EIF). The EIB's program involvement has been largely in formulating strategic directives. In 1997, the EIB launched the "Amsterdam Special Action Programme" (ASAP) targeting the increased investment in technologically innovative companies. EIB's latest initiative, "Innovation 2000" calls for strengthening venture capital and incubator support for the development of innovative SMEs. The EIF, established in 1994, is the implementation arm of the EIB. In 1996, it set up an equity participation programme with the purpose of taking equity stakes in innovation-oriented venture capital funds. Most of EIF's activities reflect specific EC and EIB directives:

- Partnership with the EC in the I-TEC[2] project. Launched in 1997 and aimed at encouraging early-stage investment in innovative enterprises, I-TEC reimburses certain VC investments, given that the VC fund has committed 25% of its investments to early-stage innovative enterprises over a 3 year period. 28 funds in 13 countries, with a total investment capacity of 1.3 billion EUR are participating in the program. As of April 2000 there were 196 investments reported, at an average of EUR 720,000 per investment[3].
- EIF manages, on behalf of EIB, the "European Technology Facility" (ETF), a venture capital programme established within the framework of the ASAP.
- EIF manages, on behalf of the EC, the "SME Guarantee Facility" established under the "Growth & Employment" initiative.
- EIF manages, on behalf of the EC, the "ETF Start-Up VC Programme," also established under the "Growth & Employment" initiative.
- EIF manages, on behalf of the EC, the "Growth & Environment" guarantee pilot scheme.

The Innovation Initiative.

European governments have sought to replicate the US innovation success by developing their venture capital industries (European Commission, 1995). Thus, the link between venture capital and government policy has been established in the context of promoting innovation. In the late 1980s and early 1990s, as innovation and technological progress had become increasingly seen as a major vehicle for overall job and economic growth, Europe became concerned with its falling behind the US in terms of implementing new technologies. "In the Commission's opinion, Europe's research and industrial base suffers from a series of weaknesses. The greatest perceived weakness, however, is Europe's comparatively limited capacity to convert scientific breakthroughs and technological achievements into industrial and commercial successes" (European Commission, 1994). Promotion of innovation has been the underlying theme of many recent EU programs. Innovation, in this context is "the successful production, assimilation and exploitation of novelty in the economic and social spheres" (European Commission, 1995, p.1). A landmark statement of the European Commission's approach to fostering innovation was its Green Paper on Innovation (European Commission, 1995). Subsequently, its First Action Plan (European Commission, 1996) included three focus areas: (1) to foster an innovation culture, (2) to establish a framework conducive to innovation, and (3) to better articulate research and innovation.

Following this EU-wide initiative there has been a surge of policy schemes in the EU member states since 1997. To facilitate the exchange of information and benchmarking amongst

[2] Innovation and Technology Equity Capital
[3] Source: EU website (www.cordis.lu/finance/src/schemes.html)

member states in regard to their implementation of innovation policies, the European Trend Chart on Innovation[4] was launched. Its purpose is to document continuously the various policy measures launched in the member states. Given the diversity and complexity of member states individual actions, the Trend Chart survey represents an important means by which new and existing schemes may be compared and appraised coherently. Within the measure of better articulation of research and innovation, start-up of technology-based companies has been an actively pursued policy avenue. This action represents a major priority in 8 members states and a growing priority in 3 member states (European Commission, 2000d).

Evaluation of EU and Member States' Policy Programs

Similar to the US, policy evaluation studies in Europe have also been relatively scarce given the difficulties of truly objective analyses. An early evaluation of the ESCF program in the early 1990s concluded that, while its activity has been evaluated as broadly successful (23 seed funds created; ECU 41 Million of institutional money raised on top of the program-provided ECU 8.76 Million; 188 enterprises with 2,085 jobs), the stand-alone viability of the created seed funds was low (Murray, 1994a; Murray, 1998). A major impediment to the successful operation of the funds was seen as their small size (less than ECU 2 million average per fund) relative to their annual operating costs of approx. ECU 150,000 (Murray, 1994a). In addition, the small fund size was seen as preventing the fund from participating in later stage financing, thus relying on outside (commercial) sources for follow-up investments. The overall assessment of the author was that the ESCF scheme, despite its merits, was a one-sided policy susceptible to long-term failure if not supported by complementary infrastructure and demand-side activities. Issues of the size and performance of early-stage technology venture funds were soon found to be subjects of persistence relevance.

Contemporary evaluative evidence within the EU countries has been less systematic. This dearth is largely due to the fact that most of the country initiatives in venture capital financing are less than 4 years old. Some evidence exists for the effectiveness of the older programs (e.g. the BTU program in Germany). However, overall, the evidence is conflicting and inconclusive. For example, while the BTU program in Germany has been credited with jump-starting the German venture capital market (Lehrer, 2000), public guarantees for venture capital firms in the Netherlands have been abandoned for lack of evidence that their presence changed the attitudes of venture capitalists towards high-risk technology ventures (European Commission, 2000c). The complexity of policy engendered instruments or incentives within the context of individual state economies requires a high level of caution in the drawing of European wide prescriptions.

NTBF FINANCING SCHEMES IN THE EU COUNTRIES

While the technology boom of the 1980s and 1990s found a well-developed VC industry in the US, the European VC industry with the exception of the UK was virtually non-existent in the early 1980s. The well-established banking sector was not prepared or organised for supporting enterprises based on just innovative ideas rather than more traditional forms of collateral. It is therefore, somewhat natural that the efforts of European governments were directed at first fostering a venture capital industry. Similarly, for a country to benefit from broader EU schemes targeted at venture capital organisations (e.g. the EIF programs), it first needs to have a developed

[4] For detailed information, see www.cordis.lu/trendchart

venture capital industry. However, the individual countries' policy responses have been diverse and the underlying motivations country- or region-specific.

Among the schemes described in the Trend Chart database, there are two categories related to the financing of NTBFs: "Innovation Finance" and "Start-up of Technology-Based Firms" (a detailed description is provided in Appendix 1). Existing classifications of these schemes (Bonnin, 2000a; Bonnin, 2000b) have been mainly nominal and do not create an appropriate framework for judging the potential efficiency of the measures. For example, while Bonnin (2000b) concludes that government activity in support of technology based company start-ups has been increasing, there is little consideration for the likely and necessary degree of cohesion between such public activity and the private sector. Such cohesion can only be estimated if a deeper classification is utilised.

Classification of Support Schemes

Somewhat similar to the classifications provided by Storey and Tether (1998b) and Murray (1999) the current review proposes a classification of the schemes in the above Trend Chart categories along the following two policy dimensions: *broad vs. focused* and *direct vs. indirect*. Table 1 shows the distribution of programs along the two dimensions.

Broad	69 (37.5%)	59 (32.1%)
Focused	33 (17.9%)	23 (12.5%)
	Direct	**Indirect**

Table 5: Program Distribution
Source: TREND Innovation Chart. Classified by current author.

The first dimension (Broad/Focused) pertains to whether or not a particular program is targeted specifically at seed and start-up companies. This can be usually established by looking at the program's description and the stated target entities. Broad programs are oriented towards promoting innovation *per se* and thus tend to target a wide range of companies – any company undertaking R&D or innovation activities. In contrast, focused programs explicitly target NTBFs.

The second dimension (Direct/Indirect) refers to the mode of assistance or delivery the program offers. Indirect programs target intermediary (or infrastructure) organizations and their purpose is to create incentives for such organizations' investment in seed and start-up companies. The intermediaries targeted and the modes used to deliver financial assistance to them include the following:

- Incubators – funding, in the form of grants or subsidies, is provided to organisations establishing incubators at or around universities and research institutions.

- VC funds – funding is provided as a capital subscription to the funds' investment capital. Participating funds are usually pre-approved and certain restrictions are placed on the funds' investment activities, e.g. commitment that a certain percentage of the funds' capital be invested in early-stage, technology projects. Public funds rarely provide for more than 50% of the investment capital. Another mode of financial assistance is the provision of guarantees for the funds' investments in early-stage, technology companies. The guaranteed percentage usually varies by project stage.

- Technology-transfer organisations - funding, in the form of grants or subsidies, is provided to organisations established to facilitate the transfer of technologies out of universities and research institutions. Creation of technology-base firms is part of the program goal.

- Banks – guarantees are provided for loans given to early-stage, technology companies. The guaranteed percentage usually varies by project stage. It is the bank as intermediary that benefits from the guarantee scheme not the debtor.

- Information networks and exchanges (creation and maintenance) – this pertains, most notably, to business angel networks. Such networks provide potential and nascent entrepreneurs with contacts to potential funding sources.

Direct programs do not rely on intermediaries and provide the funding directly to the intended recipients. The following modes of delivering the funding have been identified from the reviewed schemes:

- Incubators – direct program involvement in the establishment of incubators at or around universities and research institutions. In addition to (or instead of) financial resources, these programs provide advisory services, training, and operational assistance.

- Grants and subsidies – programs offer these on an award basis, subject to fulfilment of the stated program criteria. Such programs are the most traditional and are available in almost every European Union country. Their focus within the last few years has been on university and research-centre related projects.

- Venture capital – sometimes provided alongside a pre-specified amount invested by private sources. Unlike traditional venture capital, such programs rarely perform any post-investment value-adding activities. These programs are important because of the upside leverage they create to private investors in small venture capital funds. This is achieved by the state funds assuming some form of subordinated and lower level investment return than that available to the private investors (Murray 1999).

- Loans – these are usually provided in cases when bank lending cannot take place due to the insufficient collateral projects can provide.

- Other Schemes - these refer mostly to training, operations, and network support offered to young companies by the program agency in order to lower costs and/or increase survival rates .

Evaluation of Support Schemes

Support schemes are typically evaluated based on the number of supported projects, amount of private funds raised or the number of new firms and jobs created. Job effect evaluations may be carried out to determining the cost of creating a new job. To date, there are only few evaluations publicly available. This is in part due to the programs being relatively new. Public program evaluations in general are susceptible to politically-motivated biases. Wallsten

(2000), for example, shows that factors such as the existence of imminent political elections can represent a major influence on how programs are appraised regardless of their original objectives.

Direct programs can be generally viewed as being demand-side measures. They never provide all the necessary financing needed by the recipient firm. To the extent that they increase the enterprises' survival rate, they create demand for subsequent fundings. Indirect programs, on the other side, are supply-side measures aimed at improving private investor attitudes towards start-up investments and at improving the infrastructure for carrying out financing transaction (mainly by reducing information costs). Supply side measures can be measured more easily in formal venture capital firms as the fund raising process is usually both visible and publicly documented.

In the cases where indirect programs provide part (commonly although not invariably a minority) of an investment fund's capital, the success of such fund depends largely on its ability to raise complementary capital, usually from private sources. This is an issue not to be underrated, since it has the implication of taking us back to the original problem – increase private funding for early-stage investments. Murray's (1994a;1998) evaluation of the EU Seed Capital Fund Scheme shows that funds created with a more "social" purpose raise significantly less money from private institutional investors than do commercial funds although the effect of external support may be greater in terms of the marginal money raised as a function of the original resources of the fund. In addition, Murray showed that social funds source a smaller number of deals through private sector channels. In short, social funds tend to invest primarily in socially derived projects often initiated by parties with job creation or local development goals rather than more commercial objectives. The convergence of government and private sector goals is therefore important for the successful implementation of such programs if they are truly to have a more commercial relevance.

FOCUSED SCHEMES IN THE EU COUNTRIES

There are 56 focused schemes identified from the Trend Chart review in Summer 2001. Their distribution by country and type is shown in Table 6 below.

Insert Table 6 here

Clearly, compared to previous reviews (Storey and Tether, 1998b), there has been increased interest in the establishment of incubators and in facilitating the provision of venture capital to NTBFs. Schemes in these two areas will now be reviewed.

Incubators

From the 57 focused schemes identified - 12 are incubator related with 7 direct and 5 indirect. 10 of these schemes have been established since 1996. Incubator programs are present in 9 of the 16 countries (EU and Norway) reviewed. There are no incubator programs in Austria, Germany, Greece, Norway, Portugal, Spain, and Sweden. Initial success is evident in some of the countries where the incubator programs have been established. Some of the schemes are reviewed in detail below.

The Twinning Centres (Netherlands, NL 15). This program was launched in 1998 with the goal of providing incubator support for NTBFs in the Information and Communication

Technology (ICT) industry. Initially, the centres were established in Amsterdam and Eindhoven and eventually the cities of Delft-Rotterdam and Twente were added.

The Twinning concept is built around investing in and accelerating the growth of innovative ICT start-ups through the leverage of expertise and resources. There are three major elements to the program:

1. Networks – consist of individuals with proven track record in the ICT industry. The major goal of the network is to provide start-ups and their entrepreneurs with important contacts in terms of advice, business services, and suppliers.
2. Funds – two funds have been set up. The Twinning Seed Fund provides the initial financing of around €200,000 to promising companies. The Twinning Growth Fund focuses on companies that have grown past the start-up phase. This latter approach is rather inactive or passive, focusing on co-investing around €1 million with accredited venture capital firms.
3. Twinning Centres – purpose build accommodation and facilities for ICT start-ups. Management advice and coaching is also provided. The typical duration of stay of a client young firm is 1-2 years.

The Twinning Centres program targets companies meeting the following criteria: (1) ICT related, (2) innovative, (3) representing an exportable product, and (4) start-up or recently started company. Expenditures on the program have been €13 million in 1998, €9 million in 1999, and €9 million in 2000. The success of the program is to be measured by the growth in ICT-related start-ups. Although there has been no formal evaluation, a realised strengths of the program is its vital role in increasing the number of start-ups in ICT: more than 50 start-ups have been supported. Yet, one weakness of the program lies in the slower than anticipated finance deal flow.

Creation of Regional Incubator Structures (France, FR 12). Launched in 1999, this is a key measure in supporting the cooperation between public research and commercial enterprises. It aims to bring closer the production and diffusion of knowledge by creating an efficient interface between public research and the business world. €15 million are budgeted for the first phase and €7.5 million for the second phase of the program.

The incubator structures seek to cover the following areas: detection and evaluation of projects, managerial and financial support in the creation of firms within universities or research institutes. They finance 50% of the expenses of the entrepreneur directly related to the creation of an innovative firm. They will receive subventions for 3 years, covering 50% of the internal or external expenses linked to the support of innovative firm creation. A minimum of 15 firms per structure should be created.

After 14 months, 29 incubator structures in 22 regions have been selected with €23.4 million allocated.

Science Enterprise Challenge (United Kingdom, UK 21). Established in 1999, this program has funded the creation of 12 enterprise centres at UK universities with the following three main goals: (1) to foster the commercialisation of high quality research and new ideas, (2) to help stimulate a culture of scientific entrepreneurship within British universities, and (3) to incorporate more centrally the teaching of enterprise into the UK science and engineering curricula. In addition to the £28.9 million allocated to the 12 centres, the centres themselves are expected to raise substantial additional funds from private sources. The government hopes that the established centres should become self-sustaining enterprises within 5 years. The main

revenue sources for the SEC centres are- tuition fees, commercial sponsorship, and product licensing. Although no formal evaluation has been undertaken to date, additional £15 million have been made available for a second round of the program.

Incubators and Innovation Centres (Belgium, BE 27). This program was formally established by the Flemish government in 1998. It targets the establishment of innovation centres and incubators at public research institutions in order to facilitate the creation of spin-off companies. The program follows up on incubator establishments that date back to 1994. The beneficiary is required to build the innovation centre or incubator within a university campus or a science park. Maximum financial support per organisation is €372,000. Three incubators have been supported so far. Although there are no formal evaluations of the program to date, informal indicators point to space shortage and lack of building renovation and maintenance funds.

Technology Incubators (Denmark, DK 4). Since its start in 1997, six technology incubators have been approved and established at universities and science parks with the goal of facilitating the commercial transfer of research via the creation of new enterprises. After an initial funding allocation of €40 million for a period of 3 years, an additional €54 million has been approved for the period 2001-2004.

The incubators provide a channel for state-financed seed capital in the form of grants, loans, and equity as well as administrative support and training to selected entrepreneurs in companies of no more than 6 months old. The maximum funding per company is €100,000. The effectiveness of the program is to be evaluated by the number of started projects created, amount of seed capital committed, and amount of capital further raised from private sources. Preliminary evaluation has been positive - 172 new innovative companies have been started in high growth industries. However, only 38 percent of the funded projects have been research-oriented.

SPINNO Business Development Centre (Finland, FI 1). This is a business incubator scheme, established in 1990, which promotes knowledge-based entrepreneurship at universities and research institutes in the Helsinki area. Newly-formed businesses are provided with operational training and advice, and with financial support in the form of grants. The selection of the companies to be assisted is via semi-annual business plan competitions, whereby the best plans are selected for further development and seed funding. 200 new Finnish companies have been established with the support of the scheme. No formal evaluation of the program has taken place to date.

Business Incubation Centre program (Ireland, IE 28). Started in 1996, this program aims to expand the number of high-tech companies operating on college campuses through developing and expanding incubation facilities. It provides assistance to universities and research institutes in setting up incubators and reimburses up to €2.5 million towards the set -up costs. A total of €6 million have been allocated to the measure.

Agreement Sviluppo Italia-MURST (Italy, IT 26). Established in 2000, this is an experimental agreement targeting the creation of firms through research spin-offs at four Italian universities. Free support services are provided to supporting professors, researchers, and students in the conception and start-up phases of the projects. The project lasted for a period of 6 months and provided €260,000 in funding. No evaluation has been undertaken.

Summary and implications.

Except for the Twinning Centres program in the Netherlands, all the incubator programs are established around universities and research institutions. They aim to facilitate the commercialisation of pure science research by providing assistance to firms founded by researchers and other science associates. There are, however, important differences in the degrees to which the schemes look beyond the short term, founding event of the NTBF. A good example of a comprehensively designed program is the Twinning Centres, which provides young firms with important, and hopefully enduring, support network contacts. As there has been little evidence on the actual performance of the programs, we abstain from praise and, conversely, provide some issues to be considered:

- It is not clear from the provided description and mechanisms of the schemes where the management and supervisory resources come from (especially in the direct schemes). To the extent that these resources are not available at the universities or research institutes themselves, it is not clear how these resources will be contracted (acquired) from the private sector. Venture capitalists, as potential providers of follow-up funding, will inevitably consider the existence of such resources critical fin agreeing to make a follow-on investment. Therefore, considerations should be made for continuous exchange between management and research resources. For example, the partnership between University College London, Kings College & Queen's College and London Business School (LBS) is made tangible by the Centre for Scientific Enterprise (CSE) having offices at London Business School despite concentrating most of its time on initiatives for science graduates at UCL and the other three participating London University colleges.

- In addition, there has been little attention paid to providing the fledgling businesses with proper support networks. Only the Twinning Centres program has specifically designed network ties to existing businesses and entrepreneurs. It is unreasonable to expect that the NTBFs coming out of the incubators could stand a firm ground without a good support network, namely suppliers and service providers. The availability of such support network is a key success factor for a high-tech region. (Again the success of the LBS/CSE initiatives is that the NTBF entrepreneurs are able to access London Business School international commercial links via faculty).

- The NTBFs coming out of the incubators will soon need additional financing for their start-up stages. While there are implicit expectations that such financing will be provided by the private sector it is unreasonable to expect that the private sector will deviate from their current investment patterns, i.e. little investment in early-stage, technology businesses. Therefore, the incubator schemes should be complemented with schemes stimulating the provision of risk capital to NTBFs. (The incubator at London Business School was set up with £2million of private finance in 1997. By 2001, the management of the seed fund and incubator has raised a further £25 million via both private (£21m) and public sources (£4m) to achieve an operational viability of £27 million.)

- As subsequent investments in these companies are most likely to be made (if at all) by private investors, any existing doubts in the selection ability of the created incubators may result in a negative certification effect. This outcome could reduce outside investor interest. In the evaluation of the EU Seed Capital Scheme it appeared that there were significant differences in the survival rates of companies selected by "social" and commercial funds (Murray, 1994a;Murray, 1998) with the former funds having a significantly worse performance record.

- It is not yet clear what the operational economics of the incubators will be, i.e. how viable they can be on their own. For reasons stated previously successful trade sale may be rare occurrences. Thus it is not presently clear how incubators can have a consistent, long-term survival rate. Certainly, the experience of Europe and the US since the downturn of technology markets in Q1, 2000 suggests that only a minority of incubators have a sustainable businesses model outside highly bullish, financial and early-stage markets.

Gradually, as we start gathering results on the incubator activity, we will be able to address the above issues more clearly. These results need to be examined through the ability of incubators to attract subsequent investments, not purely on the number of firms supported by the incubators. Overall, incubator schemes could help make young firms investment ready by increasing their early survival rates. This could make them an important part of the venture capital cycle as they provide vital nurturing services that are uneconomical for venture capital firms to provide.

Early-stage Venture Capital

Of the 56 focused schemes identified, 13 facilitate the provision of venture capital to NTBFs in seed and start-up stages. 9 of the programs have been established since 1996. Only half of the reviewed countries have such schemes: Austria, France, Germany, Greece, Ireland, Netherlands, Norway, and UK. Indirect programs (7 in total) target the establishment of special seed or early-stage funds through participation in the funds' subscription capital. Direct programs (6 in total) seek to complement private venture capital investments in early-stage, technology companies. In addition, there are 5 guarantee schemes, aiming to reduce the risks of high-tech investments by providing guarantees to venture capital funds or to banks for the amounts invested in NTBFs. Such guarantee schemes are present in Austria, Denmark, France, and the UK.

Support for the Creation of Seed-Capital Funds (France, FR 13). This is an important measure in the government policy of supporting the creation of NTBFs. It was launched in 1999 with the objective of creating seed-capital funds in important centres of technology in France via partnerships with major universities and research institutions. Additionally, 75% of the funds are to be invested, through the regional incubator structures, in firms directly linked to public research.

A fund is considered a seed-capital one if at least 75% of its funds are invested in early-stage firms linked with public research. It is organized as a Public Venture Capital Fund, with private investors providing the majority share and the management. The investment mode is via direct, reimbursable, non-interest bearing loans for up to 30% of the total amount of investment. €22.9 million has been budgeted for the program.

After one year, one biotechnology seed capital fund has been selected, with a public grant of €5 million and total capitalization of €30.4 million.

Venture Capital for Technology-oriented SMEs (BTU[5]) (Germany, DE 12). The program was launched to address a perceived shortage of venture capital for start-up and small technology-based firms in Germany. Designed to lower the risks for the limited and managing partners of VC investment in technology-based firms , the program offers two types of support:

[5] Beteigungskapital fur Technologieunternehmen

(1) co-investment – TBG[6] invests in NTBFs provided that a private investor provides at least the same amount of money; (2) refinancing – KfW [7][8] Bank provides low-interest loans to refinance venture capital investments in NTBFs.

Target group of recipients: SMEs of a maximum of 499 employees and €50 million annual turnover for the refinancing program; SMEs of max 49 employess and €7 million annual turnover for the co-investment program. Because of the success of the program and the successful development of the German private VC market, the conditions of the program have been restricted. Its budget has been increased in 1999.

Mode of delivery and amount provided: max refinancing €1.5 million out of a max investment of €2 million (i.e. 3:1 ratio) ; max co-investment of €1.5 million on a max investment of €3 million (i.e. 2:1 ratio). €234 million provided in 1997, €404 million in 1998, €650 million in 1999, and €1,100 million in 2000.

Evaluation: amount of privately mobilized VC; since 1995 the volume of venture capital mobilised by BTU and other measures has increased from €90 million to €750 million in 1999 (European Commission, 2000b). Estimations show that nearly 75% of the early-stage venture capital directed to NTBFs is BTU-financed. On average, a company financed by the BTU program creates approx. 20 new jobs in the first four years. The BTU programme and its predecessor, the BJTU program, have directly contributed to Germany becoming the fastest growing early-stage technology sector in Europe.

In 2001 a new program, BTU – Early Stage, was launched, specifically targeting start-ups form science. It provides pre-seed and seed stage venture capital for technology-based firms in the form of equity of up to €150,000. The selected companies should work with a "coaching investor" and find other investors. A network of "coaching investors" is established by TBG to scout promising start-ups.

Seed Financing Programme (Austria, AT 3). Established in 1989, this program directly supports NTBFs in two phases, conception and implementation. The conception stage support consists of analysis of market potential and economic feasibility, while the implementation stage support consists of seed financing for the start-up activities. This seed financing, in the form of grants and loans, can be in amounts up to €728,000, with loan repayment conditions based on the growth prospects of the enterprise. Operations consulting services are also offered. The program budget was €6.5 million in 2000 and €5. 1 million in 2001. A total of 167 enterprises have been supported since the start of the program. An evaluation report in 1996 pointed to several areas of potential improvement including increased effectiveness, more benchmarking, and higher focus on equity financing.

Seed Capital Funds (Norway, NO5). Established in 1997, this program funds 50% of the capital stock of selected, privately-owned seed capital funds by providing loans. These funds invest in high-risk projects with high potential for wealth creation. 4 regional funds and 1 central fund have been established. By end of 2000, these funds had invested a total of €25.2 million in 80 projects. Although no formal evaluation of the program exists, there have been reports on the difficulties in attracting the participation of private investors in the regional funds. (The suspicion of private investors in leveraged public schemes is a very common phenomenon and

[6] Technologie-Beteiligungsgesellschaft
[7] Kreditbank fur Wiederaufbau
[8] These two banks have now merged in 2001

illustrates investors' concerns as to the ability of the state to be productively involved in the selection of commercial opportunities.)

Actions relating to Equity Finance for Innovation (Ireland, IE 8). This is a set of initiatives addressing the perceived shortage of seed capital for innovation. The Seed & Venture Capital Measure has resulted in the establishment of 11 special funds between 1994 and 1999. Further, the Enterprise Fund has been established to cover the gap in the supply of investments in the range €30,000 -130,000. All established funds involve at least 50% private financing. Preliminary results show that private sector involvement is likely be a positive catalyst.

PMTs Participation Companies for NTBFs (Netherlands, NL 04). Established in 1996, this program is designed to (1) boost investments in NTBFs and (2) provide incentives by reducing the risks and management resources associated with the private sector's investing in NTBFs. Three VC companies (PMTs) have been created, with participating interests by private companies, regional development company, and third parties. €1.4 million interest-free loans has been provided to each PMT, given that €3.6 million equity participation has been raised. Under given conditions the loan may be converted into a grant. The PMTs focus exclusively on investing in NTBFs, at €45,000 - €227,000 per NTBF. No evaluation of the results of the program has been undertaken to date.

Fund for the Development of New Economy (Greece, GR 36). The fund was established in 2000 and aims to financially support VC companies and to fund early-stage ventures. The initial share capital of €294,000 is subscribed by the Greek State. Venture capital companies may apply to the fund for grants and will be selected based on their solvency and their potential contribution towards the development of the new economy. The fund is not yet operational.

Regional Venture Capital Funds (UK, UK 53). This program is due to start in 2001 and is designed to address the equity gap for risk capital available to SMEs. A number of regional VC funds will be created in order to provide risk capital of up to £500,000 to growing SMEs. They will be set-up as commercial funds and will be operated by professional fund managers. Up to £80 million have been allocated to this scheme. The scheme is based on the State's financial contribution being subordinated to the interests of both the limited partners and the management company. It is planned to have at least once regional venture fund in each of the major regions in England. Scotland, Wales and Northern Ireland operate similar schemes under their respective national civil services.

Summary and implications. In their design, venture capital schemes are very similar to the EU Seed Capital Fund Scheme from the period 1988-1995. Indeed, the later schemes were designed in the light of the knowledge gained from this 'pilot scheme'. Public funds are co-invested in venture capital companies with the hope of achieving leverage in the attraction of private capital for investment in NTBFs. The leverage is designed to compensate the limited partner for the peculiar risk to which the investor is exposed. The partner role of the government, however, is limited primarily to providing investment directives and determining the nature and scale of the gearing (e.g. certain percentage of funds to be invested in NTBFs). Thus, the following issues need to be considered:

- More attention needs to be paid to the totality of the ESCF scheme, i.e. its assessment as a one-sided policy susceptible to long-term failure if not supported by complementary infrastructure and demand-side activities (Murray, 1994a; Murray, 1998). In this regard, similar to the incubator schemes, it is vital to consider the

overall holistic context of the scheme and whether the scheme provides for the effective establishment of support networks for NTBFs.

- More attention needs to be paid to the management resources of the supported VC firms. It is unreasonable to expect that, simply by receiving public funds, venture capitalists may become adept at selecting and nurturing fast growth, technology investments. Prior biases are likely to persist.

Other Support Schemes

As seen in Table 6, of the remaining focused schemes 16 provide grants and subsidies, 5 provide loans, 2 provide support to technology transfer organisations, and 7 provide other services (information exchange, networking, operations support, and training). The grant and loan schemes are the most "traditional" schemes in the sense that schemes of this kind have been available for relatively long time. However, these schemes, although simple, are quite passive. They rely on entrepreneurs seeking out the available schemes and applying for financial assistance. Such passivity could be quite inefficient in environments where the entrepreneurial alertness amongst science associates is dormant. The two schemes dealing with technology transfer organisations (in Belgium and Finland) are very similar to incubators, but do not provide as much nurturing support as incubators do. Possibly one of the most promising sub-group is the information-providing schemes. They exist in Austria (AT 04), Netherlands (NL 32), and Sweden (SE 08) and form an important interface between the private capital and NTBF communities. For example, the NUTEK Investment Forum in Sweden (SE 08) is an annual event bringing together venture capitalists and NTBFs.

Overall, these schemes face similar issues as the schemes dealing with incubators and venture capital: it is unlikely that the funding from such schemes can take the supported enterprises to higher development stages without the need for significant additional financing. In order to feed any emerging growth, a smooth transition by the firm from relying on public to private sources of finance is needed. What still remains unresolved is uncertainty and information asymmetry, the presence of which makes many private investors reluctant to associate themselves with high-tech investments.

CONCLUSION

This paper has reviewed the context of investing in NTBFs by looking at 1) the role of venture capital in nurturing technological development and at 2) recent policies in the EU countries aimed at improving the flow of risk capital into NTBFs. While venture capital is an important catalyst to the development of new technology-based industries, the emergence of a nurturing venture capital industry is not an automatic or self-directed process. Judging by the US experience, the present state of the venture capital industry bears the imprint of several intertwined factors, both at macro (cultural/social values and government policies) and micro (people, capital, markets, support organizations) levels (Bygrave and Timmons,1992). Underlying this framework is the continuing willingness of both institutional and private investors to support with their finance risky but exciting new technological endeavours.

Two important policy areas emerging in the EU countries since 1996 have been the creation of incubators and the specific provision/support for the supply of early-stage venture

capital. One theme that has emerged from our review of current policies in these areas is the need to have complementary schemes, addressing the needs of NTBFs at different stages (conception, start-up, early growth, rapid internationalisation). Although policy initiatives in these areas have on occasions been generous and are present in all reviewed countries, there is little achieved complementarity among schemes. The most advanced national programs in this regard are those from France, Ireland, Netherlands, and UK. These schemes include implementing schemes that cover both incubation and later stages in the development of NTBFs.

We would like to conclude with presenting the following questions for further thought:

Europe has traditionally been much more bank centred that bourse centred in finding additional financial resources for the small, growing firm. It remains to be seen how much banks can adapt to the growing importance of equity and the different dynamics of investing in the knowledge-based and largely intangible assets of the high-tech young firm.

Many of the existing schemes target the current centres of pure science, namely universities and research institutes. Yet, to the extent that these centres are frequently spatially detached from the existing financial centres, is it likely that private capital support institutions will emerge in these research locations? Conversely, more direct or alternative linkages will have to be made between these disparate academic and financial/commercial entities. Perhaps above all of the national programs mentioned in this brief overview, it is the UK's Science Enterprise Challenge that addresses most directly the nature of the existing divide between academe and the market. It remains a matter of urgency to determine empirically the outcome of such a scheme.

This question of determining outcomes leads to our last comment. Few of the cited schemes have undergone a rigorous, third party assessment of the impact of the scheme either on the recipients of the state's resources or in terms of the social/economic benefits to the wider economy. The authors are left with the impression of nations and their policy makers constantly having to 're-invent the wheel'. We believe that the defining of a common evaluation template linked into existing databases of existing and past program evaluations may enable current researchers a greater and more accurate perspective.

REFERENCES

Amit, R., J. Brander, and C. Zott. 1998. Why do venture capital firms exist? Theory and Canadian evidence, ***Journal of Business Venturing*** 13(6): 441-466.

Arthur D. Little, 1977. ***New Technology-Based Firms in the United Kingdom and the Federal Republic of Germany.*** London: Wilton House.

Aston Business School. 1990. ***Constraints on the Growth of Small Firms.*** London: DTI.

Autio, E. 1997. New, Technology-Based Firms in Innovation Networks Sympletic and Generative Impacts, ***Research Policy*** 26: 263-281.

Bank of England. 1996. ***The Financing of Technology-Based Small Firms.***

Bank of England. 2001. ***The Financing of Technology-Based Small Firms: A Second Report.***

Berger, A.N. and G.F. Udell. 1998. The Economics of Small Business Finance: The Roles of Private Equity and Debt Markets in the Financial Growth Cycle, ***Journal of Banking and Finance*** 22: 613-673.

Black, B.S. and R.J. Gilson. 1998. Venture Capital and the Structure of Capital Markets: Bank versus Stock Markets, ***Journal of Financial Economics*** 47: 243-277.

Bonnin, J. 2000a. ***Innovation Finance. Thematic Report.*** The European Innovation TREND Chart.

Bonnin, J. 2000b. ***Start up of Technology Based Companies. Thematic Report.*** The European Innovation TREND Chart.

British Venture Capital Association. 1998. ***Report on Investment Activity 1997.***

Bruton, G.D., V.H. Fried, and R.D. Hisrich. 2000. CEO dismissal in venture capital-backed firms: Further evidence from an agency perspective, ***Entrepreneurship Theory and Practice*** 24(4): 69-77.

Burgel, O. 2000. ***UK Venture Capital and Private Equity as an Asset Class for Institutional Investors***. London Business School.

Burgel, O., Fier, A., Licht, G, Murray, G. C. 2001. ***The rapid internationalisation of high-tech young firms in Germany and the United Kingdom***, London & Berlin: Anglo-German Foundation for the Study of Industrial Society.

Bygrave, W.D. and J.A. Timmons. 1992. ***Venture Capital at the Crossroads.*** Boston, MA: Harvard Business School Press.

CBI. 1997. ***Tech Stars: Breaking the growth barriers for technology-based SMEs.*** London: CBI.

Cressy, R. and C. Olofsson. 1997. The financial conditions for Swedish SMEs: Survey and

research agenda. ***Small Business Economics***, 1997; 9(2):179-194.

Davidson, C. 2001. ***European private equity: the positive impact of legislation***, London: Alt Assets Research

Delapierre, M., B. Madeuf, and A. Savoy. 1998. NTBFs - The French Case, ***Research Policy*** 989-1003.

Enterprise Directorate General. 2000. ***Funding of new technology-based firms by commercial banks in Europe.*** Luxembourg & Brussels: European Commission.

European Commission. 1994. ***White Paper "Growth, Competitiveness, Employment. The Challenges and Ways Forward into the 21st Century".***

European Commission. 1995. ***Green Paper on Innovation.***

European Commission. 1996. ***The First Action Plan for Innovation in Europe.***

European Commission. 2000a. ***The European Observatory for SMEs. Sixth Report.***

European Commission. 2000b. ***European Trend Chart on Innovation. Coutry Report: Germany.***

European Commission. 2000c. ***European Trend Chart on Innovation: Innovation Policy in Europe 2000.***

European Commission. 2000d. ***European Trend Chart on Innovation: Overview Report.***

EVCA. 2000. ***2000 Yearbook.***

Fenn, G., Liang, N., and Prowse, S. 1995. ***The Economics of the Private Equity Market.*** Washington, DC: Board of Governors of the Federal Reserve System.

Florida, R. and M. Kenney. 1988. Venture Capital and High Technology Entrepreneurship, ***Journal of Business Venturing*** 3(4): 301-319.

Fried, V.H., G.D. Bruton, and R.D. Hisrich. 1998. Strategy and the board of directors in venture capital-backed firms, ***Journal of Business Venturing*** 13(6): 493-503.

Fried, V.H. and R.D. Hisrich. 1995. The Venture Capitalist: A Relationship Investor, ***California Management Review*** 37(2): 101-113.

Kenney, M. and U. von Burg. 1999. Technology, Entrepreneurship and Path Dependence: Industrial Clustering in Silicon Valley and Route 128, ***Industrial and Corporate Change*** 8(1): 67-103.

Keynes, J.M. 1936. ***The General Theory of Employment, Interest and Money***.

Khavul, S. 2001. ***Money and Knowledge: Sources of Seed Capital and the Performance of High-Technology Start-ups***. Unpublished doctoral dissertation. Boston University.

Kortum, Samuel and Lerner, Josh. 1999. ***Assessing the Contribution of Venture Capital to Innovation.*** Working Paper, Harvard Business School

La Porta, R., F. Lopez-de-Silanes, A. Shleifer and R. W. Vishny. 1997. Legal Determinants of External Finance. ***Journal of Finance***. 1997; 52(3):1131-1150.

Lehrer, M. 2000. Has Germany Finally Fixed Its High-Tech Problem? The Recent Boom in German Technology-Based Entrepreneurship, ***California Management Review*** 42(4): 89-107.

Lerner, J. 1995. Venture Capitalists and the Oversight of Private Firms, ***Journal of Finance*** 50: 301-318.

Lerner, J. 1999. The Government as Venture Capitalist: The Long-Run Impact of the SBIR Program, ***Journal of Business*** 72(3): 285-318.

Licht, G. and E. Nerlinger. 1998. New Technology-Based Firms in Germany: A Survey of the Recent Evidence, ***Research Policy*** 26: 1005-1022.

Maclaurin, W.R. 1950. The Process of Technological Innovation: The Launching of a New Scientific Industry, ***The American Economic Review*** 40(1): 90-112.

Maclaurin, W. R. 1953. The Sequence from Invention to Innovation and Its Relation to Economic Growth. ***Quarterly Journal of Economics,*** 67(1):97-111.

MacMillan, I.C., D.M. Kulow, and R. Khoylian. 1989. Venture Capitalists' Involvement in Their Investments: Extent and Performance. ***Journal of Business Venturing,*** 4(1): 27-47.

Manigart, S. and C. Struyf. 1997. Financing high technology startups in Belgium: An explorative study, ***Small Business Economics*** 9(2): 125-135.

Meyer, L.H. 1998. The Present and Future Roles of Banks in Small Business Finance, ***Journal of Banking and Finance*** 22: 1109-1116.

Murray, G. 1994a. The European Union Support for New Technology Based Firms: an Assessment of the First Three Years of the European Seed Capital Fund Scheme, ***European Planning Studies*** 2(4).

Murray, G. 1994b. The *Second* Equity Gap: Exit Problems for Seed and Early Stage Venture Capitalists and Their Investee Companies, ***International Small Business Journal*** 12(4): 59-76.

Murray, G. 1998. A Policy Response to Regional Disparities in the Supply of Risk Capital to New Technolgy-Based Firms in the European Union: the European Seed Capital Fund Scheme, ***Regional Studies*** 32(5): 405-419.

Murray, G. and J. Lott. 1995. Have UK Venture Capitalists a Bias Against Investments in New Technology-Based Firms?, ***Research Policy*** 24(2): 283-299.

Murray, G. and R. Marriott. 1998. Why Has the Investment Performance of Technology-

Specialist , European Venture Capital Funds Beed So Poor?, ***Research Policy*** 27(9): 947-976.

Murray, Gordon C. 1999. ***Early-Stage Venture Capital Funds, Scale Economies and Public Support.*** Warwick Business School

Perry, L.T. 1988. The Capital Connection: How Relationships Between Founders and Venture Capitalists Affect Innovation in New Ventures, ***The Academy of Management Executive*** 2(3): 205-212.

Pfirmann, Oliver, Wupperfeld, Udo, and Lerner, Joshua. 1997. ***Venture Capital and New Technology Based Firms: An US-German Comparison.*** Heidelberg: Physica-Verlag.

PWC & Westport Private Equity. 2001. ***BVCA Private Equity and Venture Capital: Performance Measurement Survey 2000.*** London: BVCA.

Reynolds, P. D., Hay, M., Bygrave, W. D., Camp, S. M., and Autio, E. 2000. ***Global Entrepreneurship Monitor. 2000 Executive Report.*** Kauffman Center for Entrepreneurial Leadership.

Roberts, E.B. 1991. High Stakes for High-Tech Entrepreneurs: Understanding Venture Capital Decision Making, ***Sloan Management Review*** 32(2): 9-20.

Rosen, H.S. 1998. The Future of Entrepreneurial Finance, ***Journal of Banking and Finance*** 22: 1105-1107.

Ruhnka, J.C., H.D. Feldman, and T.J. Dean. 1992. The "Living Dead" Phenomenon in Venture Capital Investments, ***Journal of Business Venturing*** 7(2): 137-155.

Sahlman, W.A. 1990. The Structure and Governance of Venture Capital Organizations, ***Journal of Financial Economics*** 27: 473-521.

Sapienza, H. 1992. When Do Venture Capitalists Add Value?, ***Journal of Business Venturing*** 7(1): 9-27.

Sapienza, Harry J. Variations in Venture Capitalist-Entrepreneur Relations: Antecedents and Consequences. University of Maryland. 1989.

Sapienza, H.J. and A.K. Gupta. 1994. Impact of Agency Risks and Task Uncertainty on Venture Capitalist - CEO Interaction, ***Academy of Management Journal*** 37(6): 1618-1632.

Sapienza, H.J., S. Manigart, and W. Vermeir. 1996. Venture capitalist governance and value added in four countries, ***Journal of Business Venturing*** 11(6): 439-469.

Saxenian, A.L. 1994. ***Regional Advantage: Culture and Competition in Silicon Valley and Route 128.*** Cambridge, MA: Harvard University Press.

Schumpeter, J.A. 1942. ***Capitalism, Socialism and Democracy.*** New York: Harper & Row.

Schweiger, I. 1958. Adequacy of Financing for Small Business Since World War II, ***Journal of Finance*** 13(3): 323-347.

Smilor, R.W., D.V. Gibson, and G. Kozmetsky. 1988. Creating the Technopolis: High-Technology Development in Austin, Texas, ***Journal of Business Venturing*** 4(1): 49-67.

Storey, D.J. 1994. ***Understanding the Small Business Sector.*** London: Routlege.

Storey, D.J. and B.S. Tether. 1998a. New Technology-Based Firms in the European Union: An Introduction, ***Research Policy*** 26: 933-946.

Storey, D.J. and B.S. Tether. 1998b. Public Policy Measures to Support New Technology-Based Firms in the European Union, ***Research Policy*** 26: 1037-1057.

Tether, B.S. 1998. Small and Large Firms: Sources of Unequal Innovations?, ***Research Policy*** 27: 725-745.

Timmons, J.A. and W.D. Bygrave. 1986. Venture Capital' s Role in Financing Innovation for Economic Growth, ***Journal of Business Venturing*** 1(2): 161-176.

VentureOne. 2000. ***1999 Venture Capital Industry Report.***

von Burg, U. and M. Kenney. 2000. Venture capital and the birth of the local area networking industry, ***Research Policy*** 29(9): 1135-1155.

Wallsten, S.J. 2000. The Effects of Government-Industry R&D Programs on Private R&D: The Case of the Small Business Innovation Research Program, ***RAND Journal of Economics*** 31(1): 82-100.

Westhead, P. and D.J. Storey. 1997. Financial Constraints on the Growth of High Technology Small Firms in the United Kingdom, ***Applied Financial Ecomonics*** 7(2): 197-201.

Widicus Jr., W.W. 1966. A Quantitative Analysis of the Small Business Investment Company Program, ***Journal of Financial and Quantitative Analysis*** 1(1): 81-111.

Zeider, B. 1998. How Venture Capital Works, ***Harvard Business Review*** November-December: 131-139.

Appendix 1: Trend Chart Category Description

Innovation Financing[9]: Provision of finance for innovation activities. Includes measures designed to deliver or stimulate the delivery of financial support for innovation including:

- ¬ mobilisation of private capital, equity finance, venture and risk capital;
- ¬ promotion of investment into R&D
- ¬ creation of guarantee mechanisms
- ¬ operation of stock markets, especially for growth enterprises
- ¬ dissemination of information
- ¬ development of specialist training
- ¬ provision of advice
- ¬ schemes to disseminate best practice and experience.

Start-up of technology-based companies[10]***:*** Actions for encouraging researchers and engineers to start up technology-based companies within universities ("incubators" and "campus companies"), science parks, or as spin-offs from larger firms. This will also embody aspects of measures for facilitating the spread of such practice (covering IPR, social rights, financial arrangements, administrative and legal simplification, etc.) and promotion schemes. Actions could also deal with the dissemination of best practice through pilot projects involving, for example, university technology-transfer departments, the regional institutions concerned (e.g. local authorities, chambers of commerce), risk capital companies, and technology brokers.

[9] Source: Trend Chart (trendchart.cordis.lu)
[10] ibid

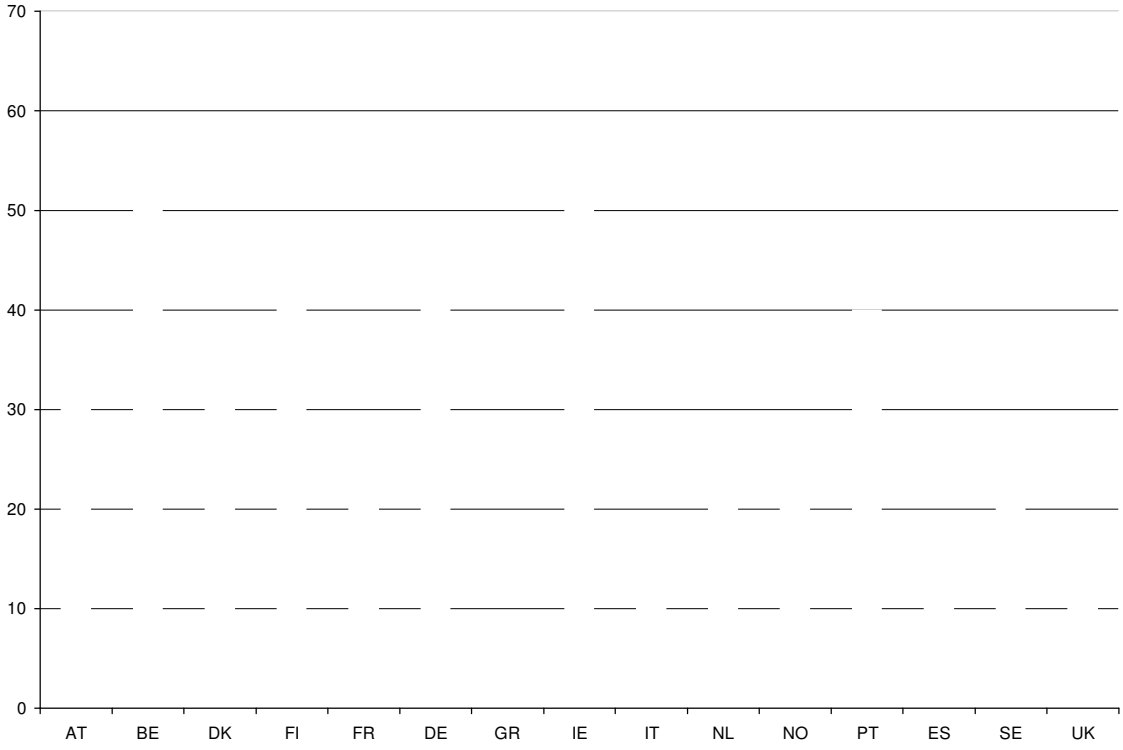

Table 1: 1999 High-tech investments as percentage of total VC investments
Source: EVCA 2000

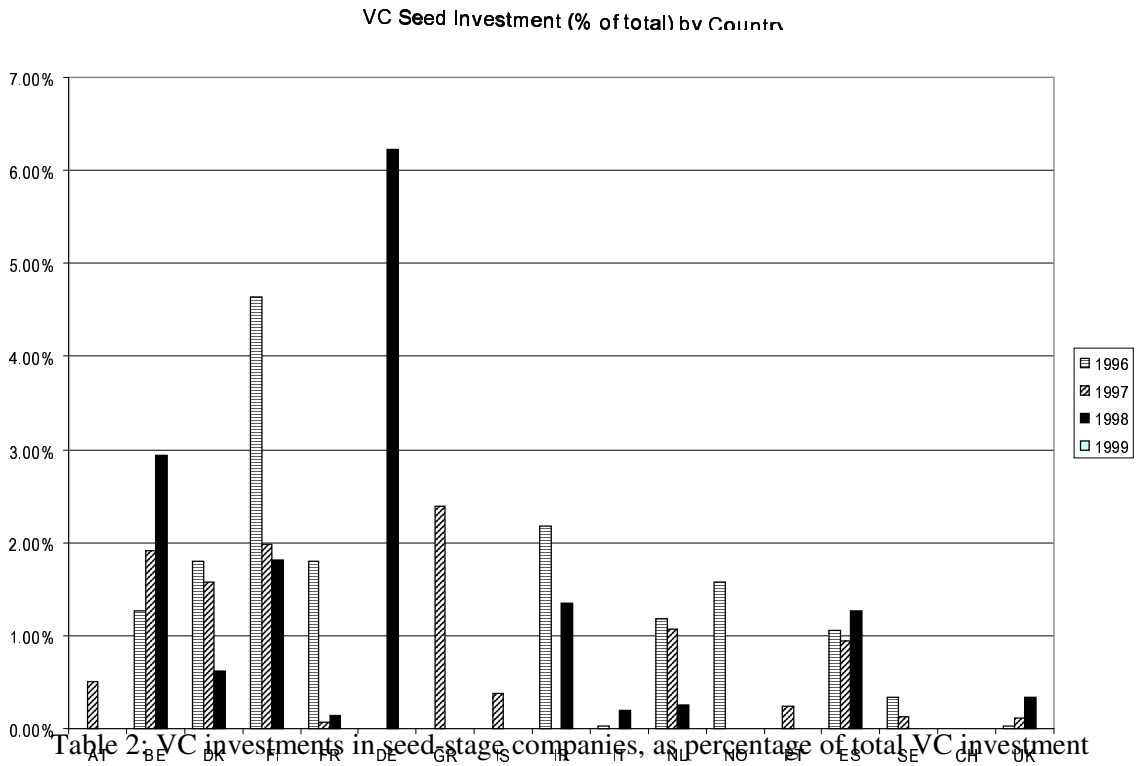

Table 2: VC investments in seed-stage companies, as percentage of total VC investment
Source: EVCA 2000

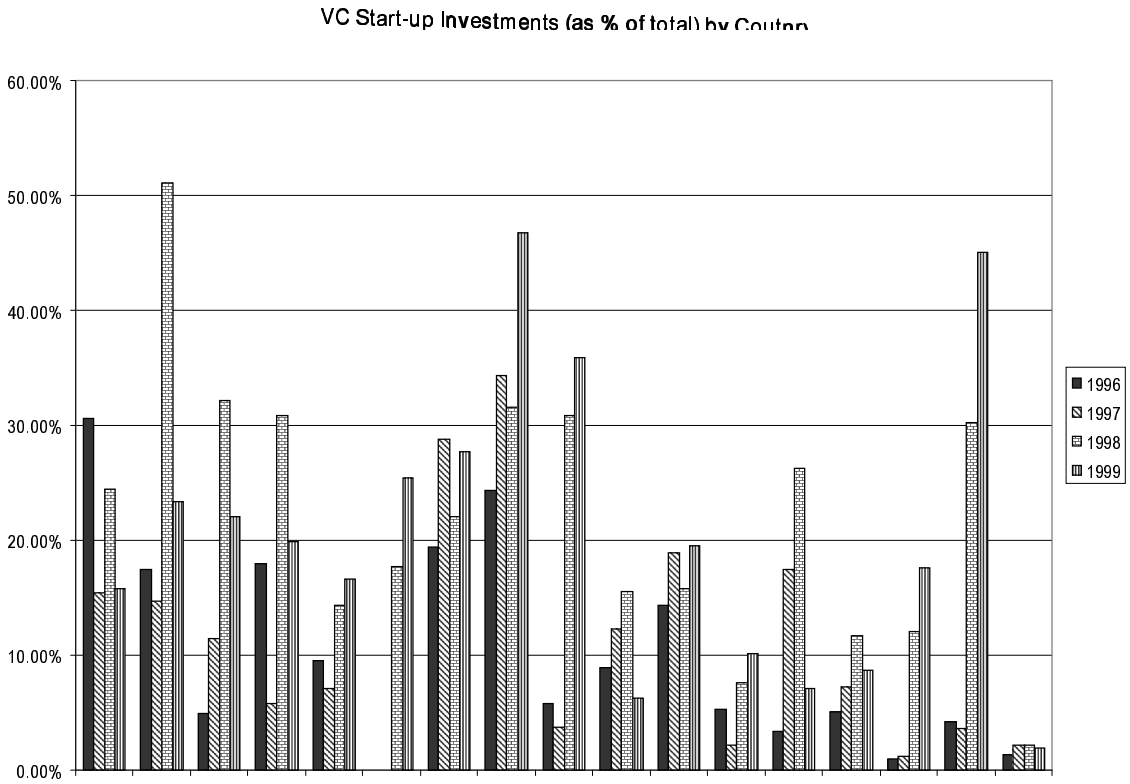

Table 3: VC investments in start-up companies, as percentage of total VC investment
Source: EVCA 2000

Table 4: Aggregate sources of small firm finance in the US
Source: Berger and Udell (1998)

EQUITY		
Principal owner	31.33%	
Business Angels	3.59%	
Venture Capital	1.85%	
Other Equity	12.86%	
TOTAL EQUITY		**49.63%**
DEBT FROM FINANCIAL INSTITUTIONS		
Commercial banks	18.75%	
Finance companies	4.91%	
Other financial institutions	3.00%	
TOTAL DEBT FROM FINANCIAL INSTITUTIONS		**26.66%**
TRADE CREDIT		**15.78%**
OTHER DEBT		
Other business	1.74%	
Government	0.49%	
Principal owner	4.10%	
Credit card	0.14%	
Other individuals	1.47%	
TOTAL OTHER DEBT		**7.93%**

Table 6: Distribution of Focused Schemes among 16 European countries
(EU and Norway).
Note: 3 schemes are classified in two categories

		DIRECT				
	Total	**Incubator**	**Seed / VC**	**Loan**	**Grant/Subsidy**	**Other**
Austria	5		3	1		1
Belgium	3	1			2	
Denmark	1	1				
Finland	2	1			1	
France	1				1	
Germany	7		2	1	3	1
Greece	0					
Ireland	1				1	
Italy	1	1				
Luxemburg	1	1				
Netherlands	2	1	1			
Norway	6			2	4	
Portugal	2				2	
Spain	1			1		
Sweden	2				2	
UK	2	1				1
Total	37	7	6	5	16	3

		INDIRECT				
	Total	**Incubator**	**Seed / VC**	**Tech Tran**	**Guarantee**	**Other**
Austria	3				2	1
Belgium	2	1		1		
Denmark	1				1	
Finland	1			1		
France	4	1	2		1	
Germany	1		1			
Greece	1		1			
Ireland	2	1	1			
Italy	0					
Luxemburg	0					
Netherlands	1					1
Norway	2		1			1
Portugal	0					
Spain	0					
Sweden	1					1
UK	4	2	1		1	
	23	5	7	2	5	4