Ilian PETKOV ILIEV

Judge Institute of Management
Trumpington Street, Cambridge CB2 1AG, UK
Phone: +44 77 863 73 965, Fax: +44 1223 339 701
E-mail: pi204@cam.ac.uk

Domagoj RAČIĆ

The Institute of Economics, Judge Institute of Management
Trg J. F. Kennedy 7, 10000 Zagreb, Croatia
Phone: +385 1 2335-700, Fax: +385 1 2335-165
E-mail: dracic@eizg.hr
and
Judge Institute of Management
Trumpington Street, Cambridge CB2 1AG, UK

VENTURE CAPITAL FIRMS AS PRODUCTION NETWORK PARTICIPANTS IN TRANSITION ECONOMIES

INTRODUCTION

Innovative SMEs play an important role in modern economies. They are characterized by higher rates of employment and output growth than other SMEs and large enterprises. Furthermore, innovative SMEs perform a vital function in corporate production networks, by introducing and assisting in the development of new technologies, diversifying the technological risk of corporations, and serving as a channel for technology transfer from higher education institutions (HEIs) to industry. This role in production networks often goes beyond an arms length relationship between the SME and the corporation, and may be characterized by persistent and intensive linkages.

Such linkages need to be promoted by appropriate network organizers – a major actor who assumes the lead organizing role. In the case of innovative SMEs, their creation and development and inclusion into production networks is often facilitated by the entry of venture capital firms (VCs) in innovative SMEs. VCs are able to do so not only by providing firms finance to facilitate their growth, but also by assisting the development of firms' growth strategy, and facilitating entry into corporate production networks and technology transfer from HEIs to industry. Thus both directly and indirectly VCs can act as important participants in networks, and possibly as network organizers.

This paper is aimed at (i) providing an overview of what is known about the role of VC in developed economy production networks; (ii) comparing this to the situation in CEEs; and (iii) identifying particular factors that may be responsible for differences in the role of VCs between CEEs and developed economies. A subsidiary aim of this contribution is to stimulate further research into the topic of VC role in production networks. Better understanding of the constraints VCs face in CEEs will facilitate the identification of specific policies aimed at increasing the flow of knowledge and technology between the differ-

ent actors in CEE production networks. This will ultimately contribute to sustainable growth in productivity and employment in CEEs. The paper has relevance for a number of theoretical debates, including but not limited to the literature of entrepreneurship, theories of venture capital, strategic management theory, and policy studies of transition economies.

PRODUCTION NETWORKS: AN OVERVIEW

The participants in production networks

The growing complexity of inter-organisational relationships puts emphasis on the importance of networks within which the firms are embedded (Gulati, 1998; Galaskiewicz and Zaheer, 1999), and links the explanation of a firm's conduct and performance to the examination of the structure and types of relationships it enters into. A firm's network of relationships brings about both opportunities and constraints (Gulati, Nohria, Zaheer, 2000). Such relationships may enable better access to information, resources, markets and technologies, reaping of the advantages from learning, scale and scope, and achievement of strategic objectives such as risk sharing and outsourcing non-strategic production activities, getting windows on new technologies, and sharing organisational competencies held by different participants in the network. However, network membership may also lock firms into unproductive relationships, sub-optimal technological trajectories, or hinder co-operation with other viable firms. Strategic networks are a subset of production networks, and overlap with other types of relations, such as static supplier-customer networks. They differ especially in terms of their emphasis on relational contracting (Richardson, 1972) and on knowledge-intensive transactions that make arms-length contracting unfeasible (Freeman, 1991). Furthermore, where knowledge-intensive transactions are concerned, the focus by the network participants is on sustaining competitiveness over time. This favours long-term relationships, as the necessary knowledge complementarities between organisations take time to develop, are not limited to once-off transactions.

At the sectoral level, the intersection between the different networks that are involved in the process of building sectoral capabilities involves various actors and networks. According to Gristock (2003), in addition to domestic and MNE firms, such networks and their interactions are influenced by regional/local and state govern-

ments, research and development or educational institutions, international agencies and other intermediary bodies. Effective networks often involve a major actor who assumes the lead organising role. Where the integration is facilitated by an organisation or group with a particular strategy (rather than a market or set of markets), such an organisation becomes a *network organiser*. Theoretically, any actor with the necessary capabilities and resources can be a network organiser. However, given the requirements in terms of financial resources and management capabilities, global production networks are primarily focused around large multinational enterprises (MNEs). National and regional networks may be focused on large local actors such as domestic corporations, Higher Education Institutions (HEIs), or MNE controlled enterprises[1] (Yoruk, 2002).

Linkages between large corporations and SMEs

Advancements in information and communication technologies (ICT) have allowed the development of management information systems, which in turn have facilitated the decentralisation of production and the formation of global production and distribution networks, with the retention by corporations of control of the production process (Ackroyd, 2002)[2]. The new technologies enable the breaking up of value chains into smaller components that can be obtained from independent contractors (Kaminski and Smarzynska, 2001) or established partners with whom relational contracting prevails (cf. Richardson, 1972). At the same time, the importance of regional clusters of firms engaged in similar activities has become apparent, partly due to the increased value of unique competencies and tacit knowledge, as codified knowledge becomes increasingly commodified through the increase in global communications (Hirst and Thompson, 1996; Lawson and Lorenz, 1999; Keeble et al., 1999; Lawson, 1999). The combined result is that enterprises are able to participate in *both* international and regional production networks, and are thus able to access resources, markets and competencies globally, while the value of localised competencies increases. This view is supported by research showing the growing value of science-based products[3], the exports of which have doubled from 1970 to 1995, while the share of scale-intensive exports in world trade has remained the same (Guerrieri, 1999).

The development of production networks due to technological advancements and the penetration into new

markets entails the simultaneous differentiation of, and functional alignment of partners. Due to increased competition, firms are encouraged to focus on their core competences and specialise in particular products or technologies where they can outperform their competitors. However, the effectiveness of such a strategy relies on the achievement of economies of scale, which in most economies implies a need for access to global markets. Especially in the case of knowledge-intensive production, the size of domestic markets may be limited, again reinforcing a need for access to global markets. Major global firms engage layers of networked independent or semi-autonomous strategic partners and subcontractors that enable them to reconcile their needs for innovation, flexibility, risk sharing and efficiency. The co-operation through strategic alliances includes risk sharing and/or pooling of resources in order to stimulate organisational learning and/or utilisation of the partner's or commonly developed resources (cf. Child and Faulkner, 1998). Firms endowed with greater resources and competencies outsource the functions of non-strategic importance, diversify risk and achieve a stronger focus on their core competences. Simultaneously, they achieve access to a larger pool of competencies in their wider network, and consequently a greater exposure and access to external innovations. When it comes to smaller network members, participation in global value chains provides them with growth opportunities, which enable them to accumulate resources and competences, to access resources held by the larger members (such as marketing, distribution, as well as R&D conducted elsewhere in the corporate network), and move along the value chain and technological trajectories.

The fragmentation of value chains correspond to specialisation, generation of specific knowledge and innovation by autonomous and diverse agents. The focus of modern corporations on their core competences, coupled by the interconnectedness within the network mean that the firms' behaviour and strategies are interdependent. Firms develop strategic relationships, co-ordinate particular actions and engage in collective learning. Functional integration leads to selection mechanisms that control the level of diversity and determine the dominant technological solutions in particular situations. Viability and effectiveness of production networks require both the facilitation of diversity through innovation, and appropriate selection processes that enable acceptance of particular technological problem-solutions as standards which spur and channel further innovations.

The inclusion of innovative SMEs in corporate production networks holds a number of benefits for large enterprises. The outsourcing of many of the non-core corporate production activities takes place through SMEs. However, the need for continued coordination and the need for diffusion of innovations and standards throughout the networks implies high competence requirements on the SME members of corporate production networks. In turn, the relational proximity to innovative SMEs allows the network integrator to benefit from innovations taking place within SMEs. Furthermore, the presence of innovative SMEs allows the outsourcing of a number of R&D functions, effectively subjecting the corporation to the positive externalities of the risk-taking by entrepreneurs. Large enterprises may either be unwilling to take on the risk of experimentation with new technologies, or may be experiencing lock-in effects in old technologies. In either case, "large firms can prey upon the risk-taking of reckless small firms. Thus small firms provide an externality of recklessness" (Nootebaum, 1999:143).

As the most flexible parts of production networks, SMEs play a vital role in their development and functioning. Many SMEs engage in retail trade, cost-competition in standardised products and services, and generally little innovative content. Such SMEs are characterised by readily replicable capabilities, and thus their role within production networks tends to be small, limited to arms-length relationships, discrete transactions, with little or no strategic relationships with other network participants. On the other hand, a significant proportion of SMEs engage in innovative activities: 44% for small and 61% for medium-sized enterprises in the European Union (Radošević, 1999). Where the SMEs are involved in knowledge-intensive production, their role in production networks is likely to be more important and non-replicable. Innovative SMEs develop highly specific and inappropriable capabilities, and contribute to a diversification of the technology risk within production networks, and a general diversity in capabilities and technological trajectories within production networks.

While SMEs may have highly developed technological capabilities, they lack the complementary resources necessary to reach global markets independently. Participation in corporate production networks may allow them access to a number of complementary corporate resources, such as marketing, distribution, and mass production facilities.

The linkages between SMEs and larger enterprises are thus crucial for facilitation of supply of and the demand for product and process innovations, and for the corresponding flexibility of production networks. In support of this, evidence from the UK for 2002 (Hughes and Cosh, 2002) shows that close to 40% of all SMEs enter collaborative partnerships, while 60% of innovative SMEs do so. The same data shows that 60% of SMEs collaborate with firms in similar line, 47.8% collaborate with customers, 48.4% collaborate with suppliers, and 16% with higher education institutions.

THE ROLE OF VENTURE CAPITAL FIRMS IN DEVELOPED ECONOMIES

Facilitation of innovative SMEs

The growth in the importance of innovative SMEs has been at least partly facilitated by the growing role of Venture Capital (VC) in production networks. "[V]enture capital, by stimulating the creation and growth of technology-based firms, helps translate the results of research and development into commercial outcomes. In doing so, it plays a catalytic role for innovation" (EIB, 2001:2). Empirically, the impact of VC in developed economies can be illustrated in terms of contributions of VC-backed companies to employment and innovation. Employment growth in VC-backed companies in the EU is 15%, which is 7 times faster than the top European companies (EVCA, 1996), with similar results for the UK (BVCA, 1999) and higher for US (NVCA, 1999). In terms of the role of VC-backed firms in systems of innovation (SIs), the relationship here is complicated by the particular patterns of VC investment in an economy. US VC activity has been more focused on early-stage and technology-intensive investments than is the case in the EU, and is hence likely to account for a higher proportion of innovation levels. A study of the contribution of VC to innovation in the US economy for the period of 1982-1992 (Kortum and Lerner, 2000) suggests that VC-backed companies are responsible for a disproportionately large contribution to innovation – while VC accounts for 3% of corporate research and development, it contributes to 8% of industrial innovations. While historically VC in Europe has been focused more on low-tech late-stage investments, recent studies of the EU suggest that there is a convergence in these measures, with EU levels of high-tech investment increasing, and overall VC activity reaching 0.24% in 2001 (EC, 2002a)[4].

The standard view of VC is of a financial intermediary that fills a credit and equity financing gap left by traditional providers of finance such as banks and stock markets[5]. From a principal-agent perspective, such investments are most efficiently financed through equity investments, which allow close monitoring by the investors of managers, thus minimizing moral hazard effects. However, the small size of SMEs prevents access to organised equity markets[6], thus leaving an equity market gap filled by VCs as providers of equity capital to high-risk ventures based on the specialisation in intensive monitoring (Gompers, 1995, 1999; Admati and Pfleiderer, 1994). Thus VC is an organisational form appropriate for SMEs characterised by high-risk strategies and low collateral levels, and may act as a "half-way house" between the start-up phase and initial public offering (IPO) on a stock market.

However, the role of VCs goes beyond that of a "pure" financial intermediary, and this role varies for different types of actors. For investees, the role played by a VC ranges from a provider of finance to the provision of strategic management and network integration services. For large corporations, VCs provide access to a population of SMEs characterised by higher than average corporate governance mechanisms, which can provide options on emerging technologies, technology risk sharing opportunities, vertical and horizontal expansion opportunities. In addition, the presence of VCs in a corporate production network facilitates the divestment of non-core assets by corporations, simultaneously enriching the production networks, and facilitating a focus on core competencies by corporations. For science-industry relations, VCs provide a technology transfer route complementary to technology licensing, by facilitating the growth of technologies through university spin-offs that would not have entered industry otherwise. Thus far from being a "pure" financial intermediary, VCs can play an important role in national, sectoral or regional systems of innovation.

The "pure" financial intermediary view of VC is even more debatable, given that in practice the role of organized equity markets for VCs is limited. Even in developed economies the majority of VC exits occur through trade sales (sales of portfolio companies to a corporation). For instance, Europe-wide trade-sales accounted for 41% of exits in 2000, whereas equity market exits (IPO *and* sale of quoted equity) for the same period accounted for 24% for Europe[7]. The dominance of corporate buyers of

VC-backed companies opens the possibility that VCs may be affected by corporate growth strategies in their selection and development of portfolio companies. If that is the case, then VCs themselves may be said to be a part of corporate production networks, as they are an intermediating mechanism between corporate strategy and SME development strategy. This aspect of venture capital is difficult to quantify and there has been limited research in this area, but there are good reasons to expect that the impact of corporations on VC selection and development strategy is non-trivial. We explore next some aspects of the VC roles in production and strategic networks.

Corporate links with venture capital

Trade Sales

VCs realise the gains on their investments through the sale of the companies they have invested in. In principle, exits can occur through several channels – an IPO[8], a trade sale[9], a sale to another financial intermediary, sale back to the firm's management/founders, or a write-off. As noted above, while IPOs are the preferred exit route for VCs (as returns tend to be highest there), even in developed economies the majority of VC exits occur through trade sales. Both institutional factors[10] and sector-specific factors[11] increase the importance of corporations as an exit route.

The reason we emphasise the dominance of trade sales as a VC exit strategy is that there is a qualitative difference between an IPO and a trade sale. In an IPO the purchasers of shares in a listed company invest in expectation of "pure" financial returns, and are not necessarily concerned with the corporate strategy of enterprises per se. By contrast, corporations tend to purchase or divest companies in line with a corporate growth strategy, in which "pure" financial aspects of the transaction are not the main criteria. Rather, strategic aspects of the transaction, such as the "fit" of a purchased company in the buyer's production network, its place in a corporate expansion strategy, or its value as an "option on technology" may be the determining factors. Thus if trade sales are the dominant exit strategy, then corporate strategies will impact directly on the VC selection of investees, and on the post-investment development strategies. To illustrate, if a VC has to select between two investment proposals that are equal in all aspects (projected financial returns, management team, and so on), except for a different likelihood of an exit, then the VC will provide finance to the company that it be-

lieves has the highest probability for exit. Furthermore, once a VC investment is made, its role is not limited to passive monitoring of the investment, but involves the formulation or modification of a firm's development strategy. As enterprise development is not a linear and deterministic process, but a creative and indeterminate one, strategic choices made during the growth process impact the firm activities in a non-reversible manner. And, as argued above, such strategic choices are based on the strategic requirements of the expected corporate buyer.

This is an important observation, as it implies that VCs are not neutral selection mechanisms in the way financial intermediaries are usually seen. VC dependence on corporate demand for investees may impact negatively on the prospects of whole classes of investees, which could be sustainable in pure financial terms. The negative aspects of this filtering mechanism may be limited if the population of corporate participants in the VC industry is sufficiently diversified. However, if there is a "skewed" pattern of corporate participation in the VC industry, this filtering effect will be strong. We will see in the section on VC in CEEs how the dominance of MNEs of the VC industry results in such a skewed pattern of investment.

Corporate Venture Capital and Corporate Spin-offs

Beyond their role as buyers of VC-backed companies at the exit stage, corporations have two other direct channels of participating in the VC process – corporate spinout development and corporate venture capital (CVC). One mechanism behind corporate spinouts is corporate refocusing away from unrelated activities to core capabilities identified by management as strategic (Haynes, Thompson, Wright, 1999). Another source of corporate spinouts is the generation of non-core capabilities as a by-product of a corporation's R&D and other activities (McNally, 1997). In both cases the corporation possesses resources that are non-core to the company's focus. Their spinout as (semi)independent enterprises enables better management focus, while also generating extra income. The spinouts may continue to enjoy access to resources of the parent company, as well as benefiting from the inherited informal network of its employees[12].

Corporate spin-offs provide a high quality deal flow[13] to VCs, since these are companies with distinct competencies, experienced staff (especially on the technical side), but experiencing a lack of financial resources and management expertise. Hence the presence of VCs in corporate

strategic networks allows corporations to benefit from the ability to dispose of non-core assets, VCs to increase their deal flow, and for the competencies and knowledge carried by spinouts to survive in the marketplace.

CVC represents a radical entry by corporations in the VC market. CVC may be direct (the establishment of a VC fund by the corporation), indirect (the corporation provides funds to a VC, and interacts indirectly with the investees), and joint (a corporation enters ventures jointly with a VC). Research suggests that corporate motives for engaging in CVC are mostly strategic, aiming at identifying new markets and new technologies that may improve the competitive position of the corporation, rather than aiming to capture direct financial returns from such investments (McNally, 1997:206; also cf. Teece, 1992 on foreign CVC in Silicon Valley). Furthermore, CVC may also expand demand for a corporation's products and services (Brody & Ehrlich, 1998). For the entrepreneur, a crucial characteristic of CVC is that "the small firm not only receives an injection of finance but also gains access to the resources of the investor, including managerial expertise, manufacturing capacity and distribution channels" (Mason & Harrison, 1999:16-17). Thus CVC may be seen as a complementary service to that provided by VCs to investees – if VC concentrates on corporate governance issues, CVC provides strong strategic elements to the investment.

CVC is assisted by VC firms acting as (i) referrals of venture opportunities to CVC programs, (ii) a channel for learning of young CVC programs, and (iii) use existing VC investments as a signal of venture quality (Sykes, 1990). VC firms are assisted by CVC by providing (i) a co-investor, with potentially more patient capital, (ii) a competent advisor during the due diligence process; and (iii) as a potential exit route for the venture (Sykes, 1990; Teece, 1992; Miles and Covin, 2002). Overall, CVC can be seen "as a means by which investing corporations gain access to the intangible, behavioural resources of the small firm, including its flexibility" (McNally, 1997:216).

Science – industry technology transfer

One common factor to many high-technology clusters (e.g. Silicon Valley, Cambridge – Massachusetts, Cambridge – UK) is the central role played by higher education institutions (HEIs) as a source of both technology transfer and entrepreneurs. The development of knowledge-intensive enterprises in these regions has been assisted by technol-

ogy transfer from HEIs to industry. Recent research on the economics of science and knowledge has illustrated the need for assistant organisations in science- industry technology transfer. This is attributed to the presence of tacit knowledge in such environments (Ancori et al., 2000; Cohendet and Meyer-Krahmer, 2001), and the difficulty of transferring tacit knowledge across organisational boundaries, as well as inadequate incentive structures to facilitate such transfers (Dasgupta and David, 1994; Saviotti, 1998). Therefore as technology transfer from science to industry is not an automatic process, it involves complex transfer arrangements, which need to accommodate the flow of both tacit and codified knowledge across organisational boundaries, and the resolution of high levels of technological uncertainty.

In the context of the above several technology transfer mechanisms from HEIs to industry can be identified – technology licensing, contract research/consulting, and academic spin-offs (cf. Management Science "Special Issue", 2002; Antonelli, 2003). The determinants of industry demand between these channels are complex and related to several factors. For instance, high levels of information asymmetry between inventor and technology purchaser may prevent technology licensing from occurring, thus opening up the option of a spin-off as a way of developing the technology to a level at which it will be easier for the market to absorb it (Gallini and Wright, 1990; Lowe, 2002). The companies formed in this process are more commonly known as the "new technology based firms" (NTBFs), defined as firms created on the basis of exploitation of research from HEIs (EC, 2002b). As NTBFs are often engaged in process and intermediate product innovation, they are naturally integrated in corporate production networks, and ultimately absorbed by corporations.

Besides supplying finance, VCs may have an important role as a supplier of managerial services in the case of NTBFs. Academics are seen as generally lacking entrepreneurial and managerial skills, while they also face conflicts between academic career and business development requirements[14]. Thus, while the academic founder of the enterprise may be highly technologically competent, there is a need for the simultaneous development of the finance, marketing and strategy functions.

VC assists the creation of NTBFs through the channels identified in the earlier sections. What is different here is that the VCs are integrated in the strategic networks clustered around HEIs rather than corporations[15]. Several channels through which VCs interact with HEIs can be identi-

fied: (i) HEIs are a source of deal-flow for the creation of NTBFs through spin-offs and academic start-ups; (ii) HEIs provide a pool of consulting expertise and professional labour for high-tech start-ups; (iii) HEIs are a source of technology transfer to *existing* VC-backed enterprises; (iv) HEIs provide formal and informal[16] incubating facilities to high-tech start-ups. Beyond this there are a number of informal ways through which the HEI environment assists VCs in nurturing businesses, most importantly through the provision of a milieu of tacit-knowledge and innovation (Lawson and Lorenz, 1999).

There is by now an established literature on the technology transfer by universities through entrepreneurial spin-offs (e.g. Allen et al., 1992; Roberts, 1991; Management Science, 2002), and the importance of informal networks between different systems of innovation actors (e.g. Keeble et al., 1999; Lawson, 1999; Lawson and Lorenz, 1999). In terms of our focus on VC and production networks, this literature illustrates that VCs act as facilitators of technology transfer to production networks, assist the formation of strategic relationships between NTBFs and other network members, and may even act as network organizers and integrators.

Venture capital firms as network organizers

In developed economies, the role of VC is not limited to the provision of finance, but also includes involvement in strategic managerial decisions of its investees, and the facilitation of the integration of VC-backed companies in corporate production networks. Furthermore, VCs may act as intermediaries in the technology-transfer process from HEIs to industry, by basing their choice of investments partly on perceptions of the likely relevance of the technological area of a particular investment proposal. Finally, VCs assist corporations in the acquisition of highly competent enterprises, the shedding of non-core assets, and in seeking exposure to new technologies and markets through equity participation in innovative start-ups. In short, VCs play a crucial role in the process of selection, growth and integration of innovative SMEs in developed economy production networks, and technology transfer between various actors in these networks. In doing so, VCs increase the flexibility of these networks, as it facilitates the absorption, recombination and shedding of capabilities and resources necessary to maintain corporate competitiveness.

As indicated above, VCs can be thought of as network organizers, since "venture capital firms sit at the centre of

extended networks linking financiers, entrepreneurs, corporate executives, head-hunter and consultants through which they are able to share information, organize deals and mobilize resources, and thereby stimulate entrepreneurial start-ups" (Mason and Harrison, 1999:22). Other networking services are the provision of access to potential customers and suppliers, the active search for a corporate partner and possibly buyer, as well as the linking of companies held in the same VC portfolio that may exhibit synergies. Furthermore, especially in highly fluid environments where issues of both technological capability and corporate governance are important, VC investment may act as a signalling mechanism of the *quality* of an enterprise, since it shows that the portfolio company has been through a due diligence process and has a corporate governance mechanism in place[17]. Access to VC backing signals the enterprise's commitment to a credible development strategy, which in turn reflects the VC's filtering mechanism. This information is relevant to potential customers, strategic partners and future investors. Thus in an environment characterised by high levels of fluidity and uncertainty, the presence of a filtering and management organisation such as a VC may act as a powerful network integrator, as it decreases uncertainty both on the corporate side and the SME side that may have prevented the formation of a network hitherto.

PRODUCTION NETWORKS IN CEE

Restructuring of production networks in CEE

In CEEs the production networks inherited from socialism have undergone a radical transformation. The transition period, characterised by macroeconomic shocks, privatization, radical institutional change, and the sudden obsoleteness of organisational competencies due to the change from a central planning to a market coordination mechanism have put large domestic firms in a defensive position (Radošević, 1998a, 1998b). Only a few firms in each country have been able to enter the global market with high value added products, despite the relatively high level of technological development of these economies during central planning (Radošević, 2002; Radošević and Yoruk, 2002; Yoruk, 2002). Moreover, such firms rarely have the resources or capabilities to serve as focal points for the development of production networks characterised by strategic linkages with domestic or foreign firms. Due to the lack of affordable sources of finance, and intensi-

fied competitive pressures from domestic and foreign firms, many firms underwent defensive restructuring, which was much more focused on cost reductions than on finding of new market opportunities, or the building of strategic networks. While the restructuring of the large firms has often resulted in the shedding of different industrial units, this has not led to the development of production networks characterised by durable and "thick" links between the different enterprises in an industry (cf. Radošević, 1998a; Stiglitz and Ellerman, 2000). Domestic corporations tend to rely on foreign suppliers in the procurement of knowledge-intensive products, rather than investing time and resources in developing local alternatives through alliances with local enterprises. Moreover, they often do not generate sufficient innovativeness and the volume of business that would justify focusing on core competences and developing more complex co-operation with subcontractors.

The arrival of MNEs into transition countries has led to some integration of local firms into global production networks (Linden, 1998; Van Tulder and Ruigrok, 1998; Kaminski and Smarzynska, 2001; Dyker and von Tunzelmann, 2002; Turlea and Merkuta, 2002)[18]. However, the benefits of MNE-centred networks accruing to domestic enterprises have been narrow. The networks being built are often restricted to the MNEs' subsidiaries with limited local subcontracting (cf. Radošević, 2002). The integration of local suppliers into the MNEs' global production networks has so far been mostly limited to low-value added activities[19] (Linden, 1998; van Tulder, 1998; Dunin-Wasowitz, Gorzynsky, Woodward, 2002), while the capability enhancements and technology transfer benefits accruing to domestic companies partnering with MNEs on innovative projects is limited (Sadowski, 2001). This is in line with international evidence suggesting that MNEs tend to concentrate innovative activity in their home countries (Patel and Pavitt, 1998), and that where investments do occur in high-tech investment, it is to exploit an *already existing* high level of innovation (Teece, 1996). The danger is that a dominance of MNE-centred production networks in CEE economies may lead to (i) the development of a dual economy, where the best SMEs are integrated in MNE networks with limited knowledge spillovers to the rest of the economy; and (ii) that local enterprises may become trapped in low-value added activities, with innovative activities limited to adaptation of global products to the local environment. Radošević (2000) suggests that CEE production networks and sys-

tems of innovation are in a state of flux, and today's network organisers will shape their future patterns. Furthermore, the ownership patterns after the privatisation of CEE industries and FDI entry modes impacts on the thickness of networks. Individual sale, especially to foreign buyers, destroyed linkages inherited from the socialist period, while greenfield FDI is integrated in *foreign*, rather than domestic production networks (Radošević, 2000). However, in the case of locally owned enterprises, the remaining local production networks have not been beneficial to new entrants – often due to defensive restructuring strategies. Consequently, the level of linkages developed by domestic corporations with SMEs is rather low, and characterised by low knowledge-intensity.

Innovative activities in CEE

Despite the decline in total innovative activity since the beginning of reforms, CEE systems of innovation (SIs) remain relatively robust. For example the proportion of innovative firms *as a whole* in the CEE is still close to or above that of some EU members (see Table 1). Furthermore, at least according to some indicators, candidate members' R&D systems are *more* productive in terms of patents to Gross Expenditure on R&D – "the ratio for patents/GERD suggests that the candidate countries produce three times as many patents per Euro of GERD as the cohesion countries" (EU, 2001:74)[20], while data on resident

Table 1
Shares of Innovative Firms in EU and CEE

Country	Share of Innovative Enterprises
Russia	6%
Romania	28.3%
Slovenia	31.9%
Italy	34%
Spain	37%
Luxembourg	37%
Poland	37.6%
France	39%
EU	**50%**
Norway	53%
Denmark	56%
Netherlands	57%
Belgium	61%
Germany	67%
Ireland	72%

Source: Radošević (1999); Period: 1996-1998

patent applications and science and engineers engaged in R&D also show levels at or above EU averages (World Bank, 2000). In terms of innovative capacity CEE SIs continue to score high. One way to reconcile this observation with the earlier discussion of the low levels of innovation in domestic industry is that there is a lack of (i) transfer of HEI based knowledge and capacities to industry; and (ii) integration of SMEs with both HEIs and large corporations.

Knowledge-intensive production involves high set-up costs, complex networks of production including not only firms but also HEIs, and the sharing of a vast array of complementary and interrelated knowledge sets generated by these participants (Antonelli, 1999). Thus the likelihood of the increase in knowledge-intensity of production networks in CEEs will be linked to the technological capabilities of the participants, as well as the presence of a network organiser (Radošević, 1998a). The absence of strong network integrators in CEEs has led to a general shift toward production characterized by lower levels of technological complexity and knowledge intensity (Radošević, 1998b). This impacts negatively on the ability of CEE corporations to compete in knowledge-intensive industries that require continuous innovation (cf. Radošević and Yoruk, 2001).

Table 2
Corporate Innovative Activity by Firm Size in CEE and EU

Romania		Poland		Slovenia		Russia		EU	
Firm Size	Share of Innovators	Firm Size	Share of Innovators	Firm Size	Share of Innovators	Firm Size	Share of Innovators	Firm Size	Share of Innovators
20-49	2.7%	6-50	16%	1-50	14.2%	<49	4.9%	<100	44%
50-199	9.6%	51-500	33%	51-250	29.9%	50-99	6.6%	100-500	61%
200-499	26.3%	501-2000	72.5%	250>	62.9%	100-199	12.4%	500>	79%
500-999	36.3%	2000>	87.5%			200-499	18.3%		
1000>	52.9%					10,000>	79.8%		

Source: Radošević (1999); based on the 1998 EU Community Innovation Survey, and various surveys in CEE

Table 3
CEE Active Enterprises Profile by Sector and Year of Creation

Year Created	Manufacturing	Construction	Distributive Trade	Transport	Hotels, Rest., etc.	Other Services	Enterprise Distribution By Size		
							0	0-50	>50
1995	12.6%	9.4%	43.9%	6.8%	4.6%	22.7%	66.9%	32.3%	0.8%
1996	14.1%	11.7%	36.8%	9.2%	5.3%	22.8%	60.1%	39.1%	0.8%
1997	12.2%	11.9%	37.4%	7.6%	4.4%	26.5%	65.9%	33.2%	0.9%
1998	10.8%	12.1%	37.6%	7.2%	4.7%	27.7%	68.7%	30.6%	0.7%

Source: Eurostat (2000)

The majority of new SMEs remain too small, too weak and too disconnected from both domestic and foreign corporations (Gabor, 1997; Bateman, 1997). While there is no dataset that allows a direct comparison between collaboration levels of SMEs in the EU and CEE[21], anecdotal accounts of CEE SMEs suggest that collaboration levels are significantly lower than the EU levels. Several studies of CEE systems of innovation conclude in particular that linkages between SMEs and HEIs are particularly weak, while linkages between SMEs and large enterprises are generally concentrated on collaboration with MNEs[22].

A comparison between data collected from innovation surveys for the EU and CEEs shows that while CEE large enterprises have similar levels of innovative activity to EU averages, the proportion of innovative SMEs in CEE is significantly less than EU levels (Radošević, 1999, illustrated in Table 2). In line with this, surveys show that the majority of new enterprises (of which SMEs compose 98%) are engaged in activities commonly associated with low levels of innovation, such as distributive trade and the hospitality industry (Eurostat, 2000, Table 3)[23]. It is likely that both current and historical factors are behind the low level of innovation in SMEs. Historically it is possible that the dominance of large industrial units of manufacturing during central planning at least explains the concentration of SMEs on low-innovation level services in the initial period of transition. At present this situation seems to be compounded by the lack of strategic network building efforts by large domestic corporations and lack of finance for SMEs, among many factors. SMEs have insufficient resources and capabilities to engage in innovation, and insufficient resources to reach external markets. On the other hand, domestic strategic and production networks remain underdeveloped, which is particularly related to the smaller role of SMEs in production networks, lower levels of innovation in these, little interaction between HEIs and industry, as well as the dominant role of MNEs as network integrators.

There is an increasing recognition by policy makers of the need for knowledge-intensive production to increase in CEEs to facilitate the integration of these economies in the European Union:

> "the cohesion of an enlarged EU will depend on the economies of the [candidates] being able to sustain high rates of growth through increased technological change... New mechanisms for supporting innovation and industrial upgrading will be needed if productivity growth is to be maintained" (EC, 2001:11).

In particular, "the major issue is whether new innovative firms are able to obtain finance for the start-up and early growth phase of their existence... [and] innovation finance, in the broadest sense, must be a priority for [CEE] governments" (EC, 2001:65)[24]. Development of a population of innovative SMEs' requires financial resources, as well as strategic management and network integration services, which they cannot easily access by themselves. Given the insufficient communication and co-operation between corporations and (especially innovative) SMEs in CEEs, there is an obvious lack of mediating institutions that would align their interests, facilitate innovation and the selection of the most appropriate solutions within production networks. Thus the issue of the present nature of VC involvement in CEE economies, and the identification of means of enhancing its role in CEE production networks becomes paramount to the discussion of the transition process in CEEs.

THE ROLE OF VENTURE CAPITAL IN CENTRAL AND EASTERN EUROPE

So far we have attempted to identify important characteristics in developed economy production networks that explain their success, and compare these to features of CEE production networks. We concentrated on the important role innovative SMEs play in developed economy production networks, and we identified this as a conspicuous gap in CEEs. In the first section we identified VC as an important actor that facilitates the creation and integration of innovative SMEs in developed economy production networks. In the remainder of the paper, we focus on the extent to which VC in CEEs plays this role.

The venture capital industry in CEE

Enterprise surveys (cf. Eurostat, 2002) show that for all CEEs "lack of funds" is perceived as the greatest problem, with "limited access to credit" in second or third place. Whereas only 14% of EU SMEs found "access to financing" a constraint, this was a primary problem for a massive 73% of CEE enterprises. Similarly, technical analysis of balance sheet data for CEE enterprises concludes that credit-rationing effects are strong in CEEs, and financial intermediary underdevelopment prevents enterprises from achieving their desired capital structures (Cornelli et al., 1996). Thus it would appear that the major benefit offered by VCs in CEE is the mitigation of the inadequate supply

of finance to SMEs in financial markets. Without trying to diminish its importance, we are reluctant to concentrate solely on the provision of finance aspect of VC. As discussed, credit and equity market gaps do not explain the role of VC in developed economies. While in the short-run VC will continue to play the role of a substitute for more traditional forms of finance, attention should also be focused on the more sustainable role they can play as participants in production networks.

However, when it comes to facilitation of growth of innovative SMEs and the role of VCs in production networks, the effects seem limited. A significant difference between VC in CEEs and developed markets is the extreme concentration on late stage investments, old enterprises, and low-tech investments (Table 4 and Figure 1). Isolated from other factors, this should be surprising, given the relatively high levels of innovation and lack of alternative sources of finance would imply high levels of unsatisfied demand for finance by SMEs. Perhaps the deal-flow structure could give some indication on the reasons for this situation. So far a significant part of the VC deal-flow has come either from privatised enterprises, or the setting up of businesses explicitly modelled on developed economy strategies. The socialist legacy of underdeveloped sub-sectors of the economy, lack of market-oriented corporate strategies, and changes of consumer demand toward "Western" patterns, have meant that investment opportunities have been precisely in traditional industries, where the wholesale transfer of Western business models and technologies have led to satisfactory returns. In the words of one VC manager, "you are in a European risk environment where you can pioneer these tried and tested techniques. Steadily every feature and every lending structure makes its way to central Europe" (EVCJ, 2001:61).

A more ambiguous contributing factor could be the dominance of foreign-controlled VCs in CEEs. Whereas in developed economies VC firms are usually locally founded and staffed (which allows the utilisation of localised knowledge and informal networks), in CEEs VCs are an imported institution usually founded and managed by outsiders (Karsai, 2001). There is a tension here, since the dominance of the industry by outsiders is itself related to the lack of local management talent that could be used by VCs. But the cost of this is the under-utilisation of local networks, and the difficulty of embedding VCs into local networks.

The low proportion of innovative SMEs also implies that the statistical likelihood of the emergence of quality

Table 4

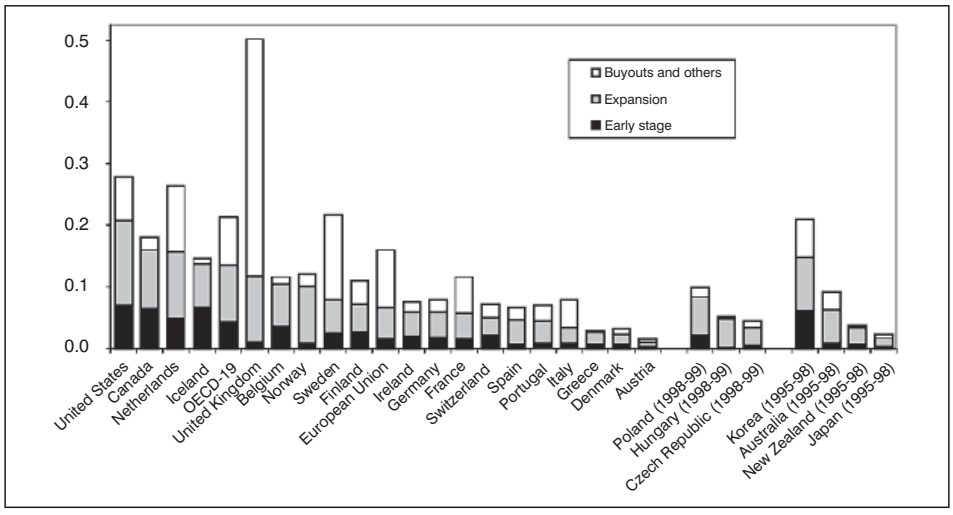
Private Equity & Venture Capital in selected EU and CEE economies

INVESTMENT COMPOSITION – 1st Half, 2000									
Country	Seed	Start-up	Expan-sion	Replace-ment Capital	Buyout	No Compa-nies (all stages)	Total Investments (×1000 €)	VC % GDP (annualised – H1×2)	% Europe Market
Europe	9.3%	35.1%	40.7%	5.7%	9.3%	4,630	€ 13,470,173		100.0%
Czech Republic	0.0%	11.1%	77.8%	0.0%	5.7%	9	€ 33,007	0.118%	0.2%
Hungary	0.0%	16.7%	66.7%	16.7%	0.0%	12	€ 8,651	0.034%	0.1%
Poland	2.8%	5.6%	80.6%	11.1%	0.0%	36	€ 116,276	0.134%	0.9%
Slovakia	0.0%	75.0%	12.5%	12.5%	0.0%	8	€ 1,404	0.013%	0.0%
Romania	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
INVESTMENT COMPOSITION – 1st Half, 2001									
Country	Seed	Start-up	Expan-sion	Replace-ment Capital	Buyout	No Compa-nies (all stages)	Total Investments (×1000 Euro)	VC % GDP (annualised – H1×2)	% Europe Market
Europe	7.3%	35.0%	46.9%	3.1%	7.8%	4,465	€ 11,125,502		
Czech Republic	0.0%	0.0%	100.0%	0.0%	0.0%	3	€ 10,240	0.037%	0.1%
Hungary	0.0%	16.7%	66.7%	0.0%	16.7%	6	€ 20,972	0.084%	0.2%
Poland	3.1%	37.5%	50.0%	6.3%	3.1%	32	€ 52,542	0.061%	0.5%
Slovakia	33.3%	33.3%	33.3%	0.0%	0.0%	3	€ 1,824	0.017%	0.0%
Romania	0.0%	0.0%	23.7%	76.3%	0.0%	38	€ 2,042	0.010%	0.0%

Source: EVCA, 2001

Figure 1

VC Investment – Stages of Investment as Percentage of GDP, 1995-99



Source: Baygan & Freudenberg, 2000

early-stage high-tech investment opportunities may be lower than in the EU. But perhaps just as importantly, the lack of *demand* for SMEs by corporate buyers on the exit side of the VC cycle may also be inhibiting early-stage and high-tech finance. As discussed earlier, VCs take into consideration the likely exit route from an investee at the time of the investment. Since at present the exit market for VCs is almost entirely composed of foreign corporations, the needs of international corporate production networks impact on VC selection of enterprises and their management. This may be contributing to the investment by VCs predominantly in companies that can fit into international corporate production and distribution networks in nodes characterised by low value-added activities.

Corporate links with venture capital

As discussed earlier, we can distinguish three general channels of interaction between corporations and VCs: trade sales, corporate venture capital and spin-offs. In CEEs the pattern of development of each of these is substantially different from that in developed economies.

Trade Sales

As discussed earlier, the dependence by VCs on trade sales as an exit route makes corporate strategies relevant in the selection of investments by a VC. In particular, if there is a lack of diversity in the potential corporate exits, this may lead to a strong bias toward a particular type of enterprises. This appears to be the case in CEEs. Table 5 below shows that trade sales in CEEs account for a larger proportion of VC exits than the EU average. Thus the influence of the corporate buyers on the VC's enterprise development strategy is likely to be much higher than in other developed economies. Furthermore, given the predominance of MNEs among the population of buyers, it is mostly the corporate strategies of MNEs that impact on VCs' exit strategies. We argue that the corporate strategies of MNEs operating in CEEs are an important *filtering mechanism* in the investment selection process of VCs, as the viability of an exit option depends now on the attractiveness of the investee for a trade sale to a foreign company.

In line with this, major VCs in CEE state that "[it is a] requirement for local companies to support both greenfield and privatized operations as foreign MNEs heavily invested in a range of sectors" (3TS Mission Statement). Similarly, "[DBG is] attracted to industries that are suitable for a consolidation strategy through acquisitions or

Table 5
Exit Strategies in CEE and EU – 2000 and 2001

Country	Divestment/Exit (by No of companies) – 1st Half, 2000						
	Trade Sale	IPO	Sale of Quoted Equity	Write-off	Other	Total No of Companies	Total Value of Divestment (×1000 €)
Europe	41.3%	8.0%	16.4%	10.6%	23.7%	1,495	€ 3,949,532
Czech Rep.	100.0%	0.0%	0.0%	0.0%	0.0%	1	€ 6,403
Hungary	57.1%	0.0%	28.6%	0.0%	14.3%	7	€ 34,481
Poland	84.6%	0.0%	0.0%	0.0%	15.4%	13	€ 27,553
Slovakia	0.0%	0.0%	0.0%	100.0%	0.0%	1	€ 81
Romania	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Country	Divestment/Exit (by No of companies) – 1st Half, 2001						
	Trade Sale	IPO	Sale of Quoted Equity	Write-off	Other	Total No of Companies	Total Value of Divestment (×1000 €)
Europe	26.5%	1.2%	11.4%	13.6%	47.4%	3,019	€ 5,329,789
Czech Rep.	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Hungary	0.0%	0.0%	0.0%	0.0%	0.0%	1	€ 2,784
Poland	40.0%	0.0%	8.0%	8.0%	44.0%	26	€ 52,326
Slovakia	n/a	n/a	n/a	n/a	n/a	1	€ 21
Romania	98.5%	1.5%	0.0%	0.0%	0.0%	67	€ 2,068

Source: EVCA, 2001

expandable through regional expansion" (DBG Mission Statement). Case studies for Hungary similarly suggest that the requirements of MNEs restrict VC investment strategies (Szerb and Varga, 2002), and the absence of media reports of trade sales to domestic corporations supports the view that the involvement of CEE domestic corporations in the VC industry is limited.

Thus the firms most likely to gain VC finance are those that can become large enough to provide a national/regional "platform solution" to foreign corporations seeking entry into the CEE. This type of focus makes a number of categories of investments unattractive for VCs. Insufficient *demand* for SMEs by corporate buyers may be hindering early-stage and high-tech finance. Investment in potentially viable innovative SMEs will not take place, because irrespective of their *financial* viability, the lack of an exit channel will prevent VCs from investing in such a firm. In turn, the lack of domestic innovative SMEs makes the development of competitive domestic production networks more difficult for reasons outlined earlier.

The above strongly suggests that the absence of domestic corporations from trade exits is detrimental to the development of national or regional systems of innovation. As MNEs in CEEs tend to invest in the context of a strategic expansion of their networks, they will be unlikely to invest in companies that duplicate innovative activities performed elsewhere in their network: if there is a corporate unit in one country that is already doing a certain task, it is unlikely that the corporation will invest at another location for the same activity. But what is duplication on a corporate level may be necessary for the development of innovative and absorptive capacity of domestic production networks. The development of competitiveness of domestic corporations in technologically intensive areas is linked to the development of linkages with other enterprises that can provide it access to a variety of capabilities and resources. An increased participation by the domestic corporations in the VC industry would create alternative exit routes for VCs and thus diversify VC demand for investment opportunities that can be fitted in domestic production networks. It would also embed VCs in local production networks, and increase the flexibility and variety of capabilities in domestic production networks.

Corporate Venture Capital

In terms of CVC, in the CEE context it is useful to differentiate between foreign and domestic sources of CVC. Instances of foreign CVC are some investments by the CVC arms of global corporations such as Intel, Microsoft, GE and Deutsche Telekom[25]. Given the known patterns of foreign CVC for the UK and US (McNally, 1997; Teece, 1992), it is most likely that foreign CVC in CEEs concentrates in late stage enterprises with high technological competencies, which fit well within corporate R&D strategies[26]. While there is anecdotal evidence of such investments in some high-tech firms, this has remained limited and linkages with the local VC sector do not appear to have developed. The lack of studies in this area prevents any judgement, but there are hardly any examples or indications that CVC by domestic corporations is significant in CEEs. This seems consistent with the apparent absence of the domestic corporate sector from the VC industry as a whole, which is itself linked to the underdeveloped nature of local production networks and domestic corporate strategies.

Corporate Spin-offs

As discussed earlier, corporate spin-offs are the result of the shedding of non-core activities at points of major corporate strategic refocusing, or the spinning-off of non-core results of continuous innovative activities at corporate R&D facilities. In the CEEs this category of participants in the VC industry is perhaps the most underdeveloped. The radical decline in innovative activity in domestic corporations as well as the lack of widespread modern corporate practices probably contributes to an absence of corporate spin-offs as a deal source for VCs. We base this statement on the lack of reporting by VCs, media and experts of corporate spin-offs as a source of a deal flow. However, it is possible that the continued development of domestic corporations in CEEs and increased awareness of novel innovation management techniques will lead to the emergences of corporate spin-offs in the future. Perhaps in this regard a more pro-active approach by VCs aimed at increasing domestic corporate awareness of the possibility of capturing value through spin-offs could accelerate the emergence of such corporate practice.

Venture capital and science-industry relations

R&D expenditures in CEEs have undergone radical reductions during the transition period (cf. EU, 2002). The prevalence of defensive restructuring of enterprises negatively affected the in-house R&D facilities of enterprises (which were often reduced, outsourced or even terminated), and more generally, diminished their innovative capacities. Along the way, the capacities of companies to transfer, absorption, application or modification of new technologies and cooperation with research institutions also suffered. On the other hand, public research institutions have been affected by the budgetary constraints. The need for additional funding has not been channelled into more sophisticated science-industry relationships, which seems paradoxical. Namely, the budgetary cuts in HEIs may have *increased* the need for academic entrepreneurship as a way of providing additional or alternative sources for income both for individual academics and organisations to which they belong. These problems have been exacerbated by the lack of appropriate incentives, cultural differences, as well as the lack of mediating institutions and networks between science and industry (cf. EC, 2001; De Koning and Deeds, 2003). Given such conditions, it is not surprising that the relevance of the science-industry relationships to the performance of the economy in CEEs is

both under-researched and insufficiently understood at the policy-maker level. Such issues have recently been touched upon in discussions on innovation policy in the context of EU accession (EC, 2001; EC 2003). However, the processes of utilization of channels available for technology transfer, overcoming of the barriers actors face, and implementation of policies to improve this aspect of systems of innovation are still largely ineffective. The interaction processes among science and industry which are aimed commercialization of research, dissemination of new technologies and building technology capacity of firms could be strongly assisted by VC, as a mediating institution that provides both the financial resources and managerial services, and is positioned within broader production networks.

Given the intense linkages between VCs and HEIs in developed economies, the lack of such linkages in transition economies is a source of concern. One reasonable hypothesis to explain this is that the mobility of academics between HEIs and the private sector is inhibited by the absence of incentives and a supporting culture. The severing of the linkages between transition countries' HEIs and the newly privatised enterprises has inhibited the commercialisation of university research, as well as removing the channels through which industry could subcontract R&D research. Some of the constraints identified in a developed economy context (e.g. Casper and Murray, 2002) seem to be even more relevant in the CEE context: (i) potentially good business ideas arising from university research are not formulated and do not leave the academic system; (ii) there is a limited supply of entrepreneurs within the universities; (iii) there is insufficient access to capital for the funding of start-ups; (iv) scientists with ideas cannot find adequately educated entrepreneurs; (v) high information asymmetries between investors and scientists mean not only lack of understanding, but lack of awareness of existence of good business ideas.

Regarding the need for an increased interaction between VCs and HEIs in CEEs, a possible objection would be that CEE knowledge institutions are unlikely to generate similar levels of world-first innovations as their counterparts that have been instrumental in the development of high-tech clusters (e.g. Stanford University, Massachusetts Institute of Technology, Cambridge University). However, the benefits of HEI spinouts do not lie only in generating "world-first" innovations, but in the inward transfer of innovative technologies available internationally, their adaptation to local market needs, the provision of consult-

ing services, and other innovative activities besides radical innovation. The issue underlying technology transfer between knowledge institutions and industry refers to the leading role that knowledge institutions can play in their *domestic* environment. In this sense HEIs will generally be the institutions whose tacit knowledge can catalyze the technology transfer of world-first technology to domestic industry. The countries that lag behind in terms of technological development should invest relatively more in embodied technologies (including their adaptation to local conditions), as well as on activities like reverse engineering and product and process imitation than on R&D (cf. Radošević, 2003). The role of NTBFs in facilitating such transfer outside the context of developed economies is gaining increasing attention. In such contexts the NTBF's role as a challenger and source of new technologies is even more pronounced (Fontes & Coombs, 2001).

In addition to upgrading the competitiveness of domestic corporations, the science-industry collaboration has as a potential by-product the creation of innovative SMEs, which is beneficial not only to the economy as a whole, but also to potential link-ups with the VC sector. The improvement of linkages between science and industry, through VCs among other type of intermediaries, can improve the flexibility of production networks (i) directly, by increasing the variety of actors in the production network, through the creation of NTBFs; and (ii) indirectly, by shortening the organisational route of the identification and absorption of world-level technological developments.

Barriers to deal flow[27]

The lifeline of any VC firm is the deal flow, the investment proposals that are made to VCs. The deal flow can indicate the economic prospects of a region (Peeters, 1999:121), while it allows VCs to optimize their portfolio composition. In the context of CEEs an increase and diversification of the deal flow will aid the maturing of the VC industry, with the emergence of differentiation among VC providers.

The constraints on deal flow that have been identified in CEEs can be divided into several groups (developed from Iliev, 2002a). Some are related to the rare emergence of SMEs with innovative products and/or significant growth potential that could be nurtured by VC involvement. This is due to:

- **exhaustion of the privatization pool** – the completion of privatization in most CEEs has terminated the

initial deal source that attracted many VCs to the region;

- **lack of linkages with HEIs** – as discussed, technology transfer policies remain in their infancy, and academic entrepreneurship appears to be particularly underdeveloped. In the absence of adequate incentive structures and organisational support, HEI spin-offs are unlikely to develop in significant numbers.
- **limited number and quality of corporate spin-offs** – as discussed, investment opportunities arising from corporate spin-offs are limited in number. Available spin-offs mostly stem from non-strategic corporate activities (rather than R&D). They are often found in traditional industries and require defensive restructuring before expansion can be attempted.

Another group of constraints occurs due to the lack of available financial and managerial resources necessary for SME creation and growth and stimulating VCs' interest and involvement. These include:

- **lack of business angels** – business angels are (serial) entrepreneurs that contribute small sums of finance and managerial skills to a start-up. Some EU estimates of business angel investments put it at higher levels than formal VC[28]. Access to business angel finance allows start-ups to grow to levels at which VCs can become involved. Their absence in CEEs[29] limits not only the funding available to start-ups, but also the managerial resources and referral opportunities available to them.
- **lack of established referral networks** – the traditional referral sources (such as accountants, investment bankers, lawyers, past customers and other VCs) are types of actors who are also new entrants to the CEE context, hence their ability to act as a referral source is limited;
- **lack of managerial track record** – the short period from privatisation / enterprise development means that enterprise managers have a limited track record, which complicates management team evaluation for the VCs (Bliss, 1999);
- **VC managers' background** – lack of domestic senior managers for VCs may be contributing to the lack of connections between VCs and domestic formal and informal networks, while standardised strategy of multi-country VC firms may be contributing to the setting of minimum investment levels beyond the size of a big part of the investment opportunities and sub-optimal development strategies;

- **low wealth levels** – low entrepreneur wealth-levels lead to lack of seed capital and collateral for larger start-ups, as well as sub-optimal personal savings portfolios;
- **lack of equity financing culture** – a major constraint identified by VC managers is the unwillingness of entrepreneurs to part with equity, and unreasonable expectations from VCs.

CONCLUSION

We have attempted to direct attention to a previously under-researched aspect of CEE economies – the role of venture capital and VC-backed companies in corporate production networks. This was done by firstly identifying relevant aspects of developed economy production networks, followed by a comparative analysis of CEE production networks. In particular, we emphasized the importance of innovation within corporate production networks, and the role played in this by innovative SMEs. Innovative SMEs need to be involved in production networks to access complementary capabilities held by other actors, such as marketing channels, mass production facilities and distribution networks. Firms with larger resources and stronger competences actively seek access to novel technologies either to protect current market positions, to gain access to new markets, or to diversify the technology risk. In this context, VCs are an important production network actor by identifying viable enterprises, and assisting the entry of these in production networks; assisting corporate strategic refocusing on core capabilities by absorbing corporate spin-offs of non-core capabilities, assisting corporate exposure to new technologies, and actively seeking SMEs that will be absorbable by production networks. Furthermore VCs have an important role in facilitating technology transfer in science-industry relations, where they support the growth of academic spin-offs, provide strategic management functions, and facilitate the integration of these into corporate production networks.

In the context of CEEs, research indicates that domestic production networks are largely underdeveloped, and MNEs are the dominant network organisers. Consequently, while the entry of MNE corporations into the CEEs has led to some integration of local suppliers into global production networks, the networks being built are often restricted to MNE companies' subsidiaries with limited local subcontracting. At the same time, domestic production networks are underdeveloped, with little participation of SMEs, and in general low levels of innovation. We argued

that this situation both results from the traditional absence of SMEs from domestic production networks, and diminishes the likelihood of the emergence of a population of innovative SMEs. The absence of linkages between innovative SMEs and domestic corporations impacts negatively on the competitiveness of domestic production networks, and their ability to respond to external shocks and new opportunities. We also argued that it is unlikely that SMEs within MNE production networks will develop substantial levels of innovation.

We also argued that the underdevelopment of science-industry technology transfer policies contributes to an absence of a population of NTBFs. This can be linked to the lack of clear policy guidelines, incentive structures and a facilitating environment for the development of academic entrepreneurs, as well as to the lack of demand for innovative SMEs by domestic industry, and low linkages in general between domestic corporations and HEIs. Low levels of science-industry technology transfer in general, and of NTBFs in particular, restrict further the levels of innovation and linkages with innovative SMEs in domestic production networks. This again contributes to low levels of competitiveness and flexibility in domestic production networks.

In the context of the VC industry, underdeveloped linkages with innovative SMEs and HEIs of domestic corporations are manifested by the dominance of MNEs as trade buyers and sources of corporate venture capital, an absence of corporate spin-offs as a source of VC deal flow, and a lack of linkages between VCs and HEIs. The net result is that VC selection of investments is biased towards SMEs that will fit in MNE production networks, at the expense of companies that may bring new technologies to the domestic industry, while the potentially important role of VCs in stimulating science-industry technology transfer is not realised. The converse is that increased VC participation in domestic production networks and linkages with HEIs can increase the level of investment in innovative SMEs, levels of technology transfer from HEIs, and consequently increase the competitiveness of domestic production networks.

The identification of these two general areas of barriers to the development of the VC industry – the absence of domestic corporations from the VC industry, and underdevelopment of HEI technology transfer policies – allows us to begin the indication of policy options aimed at increasing the number of innovative SMEs, and improving their access to VC finance.

In terms of the need to stimulate the participation of domestic corporations in the VC industry, a first step would be to increase awareness by domestic corporate managers of novel innovation methods, and the role of VCs in these. Demonstrative and awareness programs through local chambers of industry and business schools are one low-cost way achieving this. More substantively, given the existence of a number of policy programs aimed at stimulating linkages between corporations and SMEs, such programs can be used to leverage sub-programs focused on stimulating VC-domestic corporate relations.

The area of science-industry technology transfer is perhaps richer in policy alternatives, given the high public involvement in HEI policy. Overall, we have identified a need to streamline the technology transfer process, and an awareness of the full scope of technology transfer channels available to an HEI. Of crucial importance is the establishment of incentive structures that will promote the emergence of academic entrepreneurs, supportive organisations for NTBFs, as well as an increased awareness of this area among academics and industry participants. Simple measures such as organising business plan competitions, and stimulating interaction between business schools, science and engineering departments, and local VCs can prove surprisingly effective in both increasing awareness of the possibilities for HEI spin-offs and directly resulting in viable enterprises. More resource intensive measures are the establishment and increased efficiency of business incubators, science parks, and technology centres, which again could benefit from a proactive approach aimed at attracting the attention of VCs. Beyond this, VC funds backed by public funds (by national governments, or institutions such as the EBRD) could include in their mandate incentives for VCs to finance HEI spin-offs.

We emphasise, however, that the above is aimed merely to serve as suggestive of some policy directions, and are not to be seen as restrictive and exclusive of other measures. The formulation of detailed policy options depends on individual country conditions, a precondition for which is the conduct of further detailed research in the areas outlined earlier. We hope that this contribution can facilitate the formulation and conduct of such research, and consequently the development of effective policy measures, in the ultimate aim of stimulating the knowledge-based economy in CEEs.

[1] In this case the local network would overlap with a multinational's network to the extent that the network members' activity is directed to the multinational.

[2] According to Ackroyd (2002:190), "as the hubs of international networks, major companies form spheres of influence and power over numbers of affiliated and collaborating business units. Such organizations may be delayered internally, but they are not depowered either internally or externally".

[3] Science-intensive products are one example of such localized competencies, since the knowledge behind such products is not easily codifiable and requires highly specific capabilities, and is therefore not easily imitable.

[4] The recent changes in the EU venture capital industry can be attributed both to a maturing of the industry, and an increased public support for entrepreneurship and science-industry technology transfer. However, it is important to note that there are significant differences between different EU states in the structure of the VC industry, as well as between regions.

[5] Following the credit-rationing literature (e.g. Stiglitz and Weiss, 1981), lending is constrained by adverse selection (information asymmetry to the rationing of low risk lenders) and moral hazard effects (information asymmetry *after* lending leads to risky lender behavior) constrain the amount of credit available to borrowers. This effect is especially pronounced for firms characterized by knowledge-intensive production, due to low levels collateral and high levels of information asymmetry.

[6] In the case of CEEs this problem is compounded by the *absence* of mature equity markets.

[7] Paradoxically the UK, with the most developed equity market in Europe, trade sales accounted for 55% of exits in 2000, while equity market exits only accounted for 27%.

[8] Initial Public Offerings (IPOs) is the first-time sale of a company's shares on a public stock market.

[9] Trade sales occur when corporations purchase investees from a VC.

[10] For instance the traditionally bank-centered financial systems in continental Europe. See Karaomerlioglu and Jacobsson (2000) for a discussion in the context of the Swedish economy.

[11] See Casper and Kettler (2001) for a discussion of the role of VCs and pharmaceuticals in biotech startup development.

[12] Often the management of a spinout will continue to be employed or associated with the parent company. In this sense the degree of separation between the parent company and the spinout varies from case to case.

[13] The deal-flow is the stream of viable business proposals received by a VC. A high and diverse deal-flow allows a VC to construct a viable investment portfolio that maximizes the use of a VC's competencies.

[14] For instance academic advancement requires the publication of research results, while the strategic requirements of the firm may require secrecy for these results.

[15] Of course we are only creating typologies here for ease of analysis. In reality, VCs are members of multiple networks, including HEI *and* corporate strategic networks, and to the extent that this is the case, this increases the value added they can provide an investee.

[16] An example of informal incubating facilities is the laboratory of an academic that is used to assist the development of a NTBF product.

[17] Here the reputation of a particular VC becomes of crucial importance.

[18] The greater propensity of MNEs than domestic corporations to build up links with local players is somewhat counterintuitive, since outside players are likely to face greater costs in establishing such networks than domestic enterprises.

[19] Still some MNE investments are characterized by significant and growing levels of innovative activity conducted locally. Even those foreign-owned enterprises that conduct R&D and/or interact with HEIs do not have interaction with any other domestic actors, thus limiting the potential for technology transfer to the domestic economy resulting from MNE entry (Biegelbauer et al., 2001).

[20] The EU study on this issue concludes that "domestic technological activity is relatively more developed in the CC5 [Czech Republic, Estonia, Hungary, Poland, Slovenia] than in Greece, Portugal and Spain" (EU, 2001:73).

[21] The European Innovation Scorecard surveys (EC, 2002) have included an "SME innovation cooperation category", but most of the candidates have not returned data on these. Better response rates to future surveys should allow an insight into these issues.

[22] The studies concerned are (for the respective country) Czech Republic (Mueller, 2001), Estonia (EIFS, 2001), Hungary (Havas, 2001), Poland (Kozlowski, 2001), Slovenia (Bučar, 2001), and were commissioned by the European Community's Directorate General Enterprise.

[23] More recent evidence from Poland (Niedbalska, 2002) shows that proportion of innovative enterprises as a whole has fallen from 37.6% for 1994-96 to 16.9% for 1998-2000, and it appears that the number of innovative SMEs within this aggregate has also fallen. This is attributed by the author to the negative economic climate in Poland in the late 1990s.

[24] This emphasis is in line with the commitment by the EU to close the "knowledge gap" with the US (the 2001 Lisbon Declaration), while the 1998 RCAP (Risk Capital Action Plan) focuses specifically on the stimulation of the venture capital industry.

[25] Based on information provided on the company websites and news media.

[26] See for instance the mission statement on Intel Capital's website (www.intel.com/capital).

[27] We engage with this issue at the end of our discussion, to indicate some other factors inhibiting VC deal flow that go beyond the issues discussed earlier.

[28] The website of the European Business Angel Network (www.eban.org) gives a good introduction to the issues linked to informal venture capital/business angels. Even though it is an issue of high relevance for the prospects of VC in CEEs, it is not an issue that can be discussed at length here.

[29] Privatization and restructuring of CEE economies has created a new class of entrepreneurs, some of whom amassed considerable wealth. However, the experience gathered in such processes is not readily transferable to the SME development outlined here, which partly explains their reluctance to act as business angels or providers of VC.

REFERENCES

Admati, A. and Pfleiderer, P. (1994), Robust Financial Contracting and the Role of Venture Capitalists, *The Journal of Finance*, 49(2), pp. 371-402.

Ancori, B., Bureth, A., Cohendet, P. (2000), The Economics of Knowledge: The Debate About Codification and Tacit Knowledge, *Industrial and Corporate Change*, 29(2), pp. 255-287.

Antonelli, C. (2003), Knowledge Complementarity and Fungeability: Implications for Regional Strategy, *Rethinking the Regions and Regional Competitiveness Conference*, 20th June, New Hall College, Cambridge University, Cambridge, UK.

Antonelli, C. (1999), The Evolution of the Industrial Organization of the Production of Knowledge, *Cambridge Journal of Economics*, 23 (2), pp. 243-260.

Bateman, M. (1997), Industrial Restructuring and Supply Chain Development in Eastern Europe, in: Sharma, S. (ed.), *Restructuring Eastern Europe: Microeconomics of the Transition Process* (pp. 14-28), Edward Elgar, Cheltenham.

Bateman, M. (1999), Small Enterprise Policy in Transition Economies: Progress with the Wrong Model?, *Zagreb International Review of Economics and Business*, 2(1), pp. 1-36.

Baygan, G. and Freudenberg, M. (2000), The Internationalisation of Venture Capital Activity in OECD Countries: Implications for Measurement and Policy, *Technology and Industry Working Papers*, Directorate for Science, 2000/7, OECD, Paris.

Biegelbauer, P., Griebler, E., Leuthold, M. (2001), The Impact of Foreign Direct Investment on the Knowledge Base of Central and East European Countries, *Political Science Series*, 77, Institute for Advanced Studies, Vienna.

Bliss, R. T. (1999), A Venture Capital Model for Transitioning Economies: The Case of Poland, *Venture Capital*, 1(3), pp. 241-257.

Brody, P. and Ehrlich, D. (1998), Can Big Companies Become Successful Venture Capitalists?, *The McKinsey Quarterly*, 2, pp. 50-63.

Bučar, M. and Stare, M. (2001), Innovation Policy Profile: Slovenia, *Innovation Policy in Six Candidate Countries*, Directorate General Enterprise, European Commission, Brussels.

BVCA and PriceWaterhouseCoopers (1999), *The Economic Impact of Venture Capital in the UK*, BVCA-PriceWaterhouseCoopers, London.

Casper, S. and Murray, F. (2002), Marketplace for Ideas: Biotech Industry, Cambridge-MIT Institute, National Competitiveness Summit: "Britain's Technological Performance", London.

Casper, S. and Kettler, H. (2001), The Road to Sustainability in the UK and German Biotechnology Industries, Wissenschaftezentrum für Sozialforshcung, Berlin & Office of Health Economics, London.

Child, J. and Faulkner, D. (1998), Strategies of Cooperation: Managing Alliances, Networks and Joint Ventures, Oxford University Press, Oxford.

Cohendet, P. and Meyer-Krahmer, F. (2001), The Theoretical and Policy Implications of Knowledge Codification, *Research Policy*, 30, pp. 1563-1591.

Cornelli, F., Portes, R., Schaffer, M. (1996), The Capital Structure of Firms in Central and Eastern Europe, CEPR Discussion Paper No. 1392.

Dasguptha, P. and Paul A. David (1994), Toward a New Economics of Science, *Research Policy*, 23, pp. 487-521.

De Koning, A. J. and Deeds, D. L. (2003), A Theory of the Emergence of New Ventures from the "Republic of Science". Paper presented at the "Network Structure of Entrepreneurship and Innovation" conference, October 2-3. Rensselaer Polytechnic Institute, Troy. http://scte.mgmt.rpi.edu/phanresearch/tiie/deKoning%20Deeds.pdf

Dodt, S., Stein, L., Strack, S. (2001), Do-It-Yourself Silicon Valley: Using Business Plan Competitions to Spur Economic Development, *McKinsey Quarterly*, 1.

Dosi, G. (1982), Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change, *Research Policy*, 11, pp. 147-162.

Dunin-Wasowitz, S., Gorzynsky, M., Woodward, R. (2002), Integration of Poland into EU Global Production networks: The Evidence and the Main Challenges, Working Paper No. 16, School of Slavonic and East European Studies, Centre for the Study of Economic and Social Change in Europe, University College London.

Estonian Institute for Futures Studies (2001), Innovation Policy Profile: Estonia, *Innovation Policy in Six Candidate Countries: The Challenges*, Directorate General Enterprise – European Commission, Brussels.

European Business Angel Network (EBAN), www.eban.org.

European Commission (2001), *Innovation Policy in Six Candidate Countries: The Challenges - Cyprus, Czech Republic, Estonia, Hungary, Poland and Slovenia*, DG Enterprise, Innovation Directorate, Brussels.

European Commission (2002a), 2002 European Innovation Scoreboard: Technical Paper No. 1. Member States and Associates, European Trend Chart on Innovation, Enterprise Directorate-General, Brussels.

European Commission (2003), *Innovation Policy In Seven Candidate Countries: The Challenges - Bulgaria, Latvia, Lithuania, Malta, Romania, Slovakia and Turkey*, DG Enterprise, Innovation Directorate, Brussels.

European Commission (2002a), 2002 European Innovation Scorecard – Technical Paper No 2 Candidate Countries, *European Trend Chart on Innovation*, Directorate General Enterprise, Innovation Directorate, Brussels.

European Commission (2002b), The Changing Role of Public Support to Academic Spin-offs, Policy Benchmarking Workshop, *European Trend Chart on Innovation*, Directorate General Enterprise, Innovation Directorate, Brussels.

European Investment Bank (2001), Financing Innovative Firms Through Venture Capital, EIB Sector Papers, www.eib.org/publications.

European Union (2002), *R&D and innovation statistics in candidate countries and the Russian Federation*, Data 1997-99, EC, Theme 9, R&D, Eurostat, Luxembourg.

Eurostat (2000), *New Enterprises in Central European Countries in 1998*, Office for Official Publications of the European Communities, Luxembourg.

EVCA & Coopers & Lybrand (1996), *The Economic Impact of Venture Capital in Europe*, European Venture Capital Association & Coopers & Lybrand Corporate Finance.

EVCA (2001), *Mid-Year Survey of Pan-European Private Equity and Venture Capital Activity*, European Private Equity & Venture Capital Association.

EVCJ (2001), Central Europe: The New Land of Private Equity Opportunity?, *European Venture Capital Journal*, September, p. 85.

Fontes, M. and Coombs, R. (2001), Contribution of New Technology-Based Firms to the Strengthening of Technological Capabilities in Intermediate Economies, *Research Policy*, 30, pp. 79-97.

Freeman, C. (1991), Networks of Innovators: A Synthesis of Research Issues, *Research Policy*, 20, pp. 499-514.

Gabor, I. (1997), Too Many, Too Small: Small Entrepreneurship in Hungary – Ailing or Prospering, in Grabher, G., Stark, D. (eds.), *Restructuring Networks in Socialism: Legacies, Linkages, and Localities*, pp. 158-175, Oxford University Press, Oxford.

Galaskiewicz, J., Zaheer, A. (1999), Networks of Competitive Advantage, in Andrews, A., Knoke, D. (eds.), *Research in the Sociology of Organizations*, pp. 237-261. JAI Press, Greenwich.

Gallini, N. and Wright, B. (1990), Technology Transfer Under Asymmetric Information, *Rand Journal of Economics*, 20(1), pp. 147-160.

Gittelman, M. (2000), Mapping National Knowledge Networks: Scientists, Firms, and Institutions in Biotechnology in the United States and France, Working Paper, New York University, New York.

Gompers, P. (1999), Resource Allocation, Incentives and Control: The Importance of Venture Capital in Financing Entrepreneurial Firms, in: Acs et al. (eds.), *Entrepreneurship, Small and Medium-Sized Enterprises and the Macroeconomy*, Cambridge University Press.

Gompers, P. (1995), Optimal Investment, Monitoring, and the Staging of Venture Capital, *Journal of Finance*, 50, pp. 1461-1489.

Grabher, G. and Stark, D. (1997), Organizing Diversity: Evolutionary Theory, Network, and Post-socialism, in: Grabher, G., Stark, D. (eds.), *Restructuring Networks in Socialism: Legacies, Linkages, and Localities* (pp. 1-32), Oxford University Press, Oxford.

Gristock, J. (2003), Achieving Growth in Wider Europe: Understanding the Emergence of Industrial Networks. Summary of the ESRC Project "The Emerging Industrial Architecture of Wider Europe". University College London etc. London.

Guerrieri, P. (1999), Patterns of National Specialisation in the Global Competitive Environment, in: Archibugi, D., Howells, J., Michie, J. (eds.), *Innovation Policy in a Global Economy*, pp. 139-159, Cambridge University Press, Cambridge.

Gulati, R. (1998), Alliances and Networks, *Strategic Management Journal*, 19, pp. 293-317.

Gulati, R., Nohria, N., Zaheer, A. (2000), Strategic Networks, *Strategic Management Journal*, 21, pp. 203-215.

Havas, A. (2001), Innovation Policy Profile: Hungary, *Innovation Policy in Six Candidate Countries: The Challenges*, Directorate General Enterprise, European Commission, Brussels.

Haynes, M., Thompson, S., Wright, M. (1999), Sources of Venture Capital Deals: MBOs, IBOs and Corporate Refocusing, in: Wright, M., Robbie, K. (eds.), *Management Buy-outs and Venture Capital - Into the Next Millennium*, Edward Elgar Publishing, Cheltenham.

Ho, J. (2002), *Socially Embedded Venture Capital: Experience from Taiwan, PhD Dissertation*, Judge Institute of Management Studies, Cambridge University.

Hughes, A. and Cosh, A. (2002), UK Technological Performance in Perspective, presentation in Cambridge-MIT Institute Summit, "Britain's Technological Performance", London.

Iliev, I. (2002a), Venture Capital in Central and Eastern Europe – A Theoretical and Empirical Overview, unpublished PhD Report, Judge Institute of Management, Cambridge University.

Iliev, I. (2002b), Venture Capital Strategy Proposal for the ITC Sector in Bulgaria, Policy Proposal to the Republic of Bulgaria Ministry of Transport and Communications.

Kaminski, B. and Smarzynska, B. K. (2001), Integration into Global Production and Distribution Networks through FDI: The Case of Poland, *Post-Communist Economies*, 13(3), pp. 265-288.

Karaomerlioglu, D. and Jacobsson, S. (2000), The Swedish Venture Capital Industry: an Infant, Adolescent or Grown-up?, *Venture Capital*, 2(1), pp. 61-88.

Karsai, J. (2001), *The Impact of Venture Capital Investments on the Hungarian Economy*, Hungarian Venture Capital and Private Equity Association, www.hvca.hu.

Keeble, D., Lawson, C., Moore, B., Wilkinson, F. (1999), Collective Learning Processes, Networking and "Institutional Thickness" in the Cambridge Region, *Regional Studies*, 33, pp. 319-332.

Kortum, S. and Lerner, J. (2000), Assessing the Contribution of Venture Capital to Innovation, *Rand Journal of Economics*, 31(4), pp. 674-692.

Kozlowski, J. (2001), Innovation Policy Profile: Poland, *Innovation Policy in Six Candidate Countries: The Challenges*, Directorate General Enterprise, European Commission, Brussels.

Lawson, C. and Lorenz, E. (1999), Collective Learning, Tacit Knowledge and Regional Innovative Capacity, *Regional Studies*, 33, pp. 305-317.

Lawson, C. (1999), Towards a Competence Theory of the Region, *Cambridge Journal of Economics*, 23(2), pp. 151-166.

Linden, G. (1998), Building Production Networks in Central Europe: The Case of the Electronics Industry, *BRIE Working Paper 126*, UC Berkeley, Berkeley.

Lowe, R. (2002), *Entrepreneurship & Information Asymmetry: Theory & Evidence From the University of California*, Haas School of Business, UC California – Berkeley, Berkeley.

Management Science (2002), Special Issue on University Entrepreneurship and Technology Transfer, *Management Science*, 48(1).

Mason, C. and Harrison, R. (1999), Editorial – Venture Capital: Rationale, Aims and Scope, *Venture Capital*, 1(1), pp. 1-46.

McNally, K. (1997), *Corporate Venture Capital - Bridging the Equity Gap in the Small Business Sector*, Routledge, London.

Miles, M. and Covin, J. (2002), Exploring the Practice of Corporate Venturing: Some Common Forms and Their Organizational Implications, *Entrepreneurship Theory and Practice*, Spring, pp. 21-40.

Mueller, K. (2001), Innovation Policy Profile: Czech Republic, *Innovation Policy in Six Candidate Countries: The Challenges*, Directorate General Enterprise – European Commission, Brussels.

Munir, K. and Phillips, N. (2002), The Concept of Industry and the Case of Radical Technological Change, *Journal of High Technology Management Research*, 81, pp. 1-19.

NVCA (1999), NVCA Yearbook, National Venture Capital Association and Venture Economics.

Niedbalska, G. (2002), Innovation Activities in Polish Industry in 1998-2000 – Main Results From the GUS 2001 Innovation Survey, Working Paper 25, *Centre for the Study of Economic and Social Change in Europe*, School of Slavonic and East European Studies, University College London.

Nooteboom, B. (1999), Innovation, Learning and Industrial Organization, *Cambridge Journal of Economics*, 23(2), pp. 127-150.

OECD (1997), *Government Venture Capital for Technology Based Firms*, OECD, Paris.

Patel, P. and Pavitt, K. (1998), National Systems of Innovation Under Strain: The Internationalisation of Corporate R&D, Working Paper No. 22, SPRU, University of Sussex, Brighton.

Peeters, J. (1999), Deal Generation, in: Bygrave et al. (eds.), *The Venture Capital Handbook*, Financial Times Press – Prentice Hall, London.

Radošević, S. (2003), (Mis)Match Between Demand And Supply For Technology: Innovation, R&D and Growth Issues in Countries of Central and Eastern Europe. Paper presented at the conference "Knowledge-Based Society – A Challenge for New EU and Accession Countries", October 23-24. Ivo Pilar Institute for Social Sciences, Zagreb.

Radošević, S. (2002), The Electronics Industry in Central and Eastern Europe: An Emerging Production Location in the Alignment of Networks Perspective, Working Paper No. 21, Centre for the Study of Economic and Social Change in Europe, School of Slavonic and East European Studies, University College London.

Radošević, S. (2000), *Regional Innovation Systems in Central and Eastern Europe: Determinants, Organizers and Alignments*, Centre for the Study of Economic and Social Change in Europe, School of Slavonic and East European Studies, University College London.

Radošević, S. (1999), Patterns of Innovative Activities in Countries of Central and Eastern Europe: An Analysis Based on Comparison of Innovation Surveys, Working Paper No. 34, SPRU, University of Sussex, Brighton.

Radošević, S. (1998a), Transformation of S&T Systems into Systems of Innovation in Central and Eastern Europe: The Emerging Patterns of Recombination, Path-Dependency and Change, Working Paper No. 9, SPRU, University of Sussex, Brighton.

Radošević, S. (1998b), The Transformation of National Systems of Innovation in Eastern Europe: Between Restructuring and Erosion, *Industrial and Corporate Change*, 7(1), pp. 77-108.

Richardson, G. B. (1972), The Organisation of Industry, *Economic Journal*, 82, pp. 883-896.

Roberts, E. B. (1991), *Entrepreneurs in High Technology - Lessons from MIT and Beyond*, Oxford University Press, Oxford.

Sadowski, B. (2001), Towards Market Repositioning in Central and Eastern Europe: International Cooperative Ventures in Hungary, Poland and the Czech Republic, *Research Policy*, 30, pp. 711-724.

Saviotti, P. P. (1998), On the Dynamics of Appropriability, of Tacit and of Codified Knowledge, *Research Policy*, 26, pp. 843-856.

Stiglitz, J. and Weiss, A. (1981), Credit Rationing in Markets With Imperfect Information, *The American Economic Review*, 71(3), pp. 393-411.

Stiglitz, J. and Ellerman, D. (2000), New Bridges across the Chasm: Macro- and Micro-Strategies for Russia and other Transitional Economies, *Zagreb International Review of Economics and Business*, 3(1), pp. 41-72.

Sykes, H. B. (1990), Corporate Venture Capital: Strategies for Success, *Journal of Business Venturing*, 5, pp. 37-47.

Teece, D. J. (1992), Foreign Investment and Technological Development in Silicon Valley, *California Management Review*, 34(2), pp. 88-106.

Teece, D. J. (1996), Firm Organization, Industrial Structure, and Technological Innovation, *Journal of Economic Behavior and Organization*, 31, pp. 193-224.

Van Tulder, R. (1998), European Cross-National Production Networks in the Auto Industry: Eastern Europe as the Low End of the European Car Complex, BRIE Working Paper 121, UC Berkeley, Berkeley.

Westhead, P., Batstone, S., Martin, F. (2000), Technology-Based Firms Located on Science Parks: the Applicability of Bullock's "Soft-Hard" Model, *Enterprise and Innovation Management Studies*, 1(2), pp. 107-139.

World Bank (2000), World Development Report 1999, World Bank, Washington D.C.

Yoruk, D. J. (2002), Industrial Integration and Growth of Firm in Transition Economies: The Case of a French Multinational Company, Working Paper No. 20, School of Slavonic and East European Studies, Centre for the Study of Economic and Social Change in Europe, University College London.