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TOWARDS THE FRAMING OF VENTURE CAPITAL POLICIES: A SYSTEMS-EVOLUTIONARY PERSPECTIVE WITH PARTICULAR REFERENCE TO THE UK/SCOTLAND AND ISRAELI EXPERIENCES

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"Towards the Framing of Venture Capital Policies: A Systems-Evolutionary Perspective with Particular Reference to the UK/Scotland and Israeli Experiences"[1]

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Abstract

We compare some of the policies that have been attempted in Europe (UK/Scotland) and Israel over the past fifteen years to elaborate a new Systems Evolutionary (SE) framework for rethinking VC policy and related ITP. We argue that this perspective is useful for both real world ('positive') analysis and policy ('normative') analysis.

Our SE framework is shaped by (i) a multidimensional view of VC; (ii) strong between VC, VC policy and the development of EHTCs; and (iii) a strategic approach to policy. In contrast, many VC policies in Europe up to and including the 1990s took a 'static' financial view of VC that focused on 'bridging existng early phase finance gaps of innovative companies' rather than creating of a new mechanism to assure the timely growth of EHTCs.

We aim to present the new framework rather than to provide specific recommendations. The main conclusion is that the success of VC policies depend on factors such as the phase of evolution of (i) VC or related innovation finance organizations; (ii) the underlying segment of start up companies and of high tech industries; (iii) the specific country/region institutional setting. While in some contexts it may be worth considering the targeting of a new VC industry/market (and associated EHTC) in others the focus of policy should center in improving *pre-emergence conditions*. More specifically it may be, given that VC searches for 'investment ready opportunities', that ITP should, in many contexts, precede VC policies.

Another key conclusion is that implementing this perspective necessitates the creation of *a strategic level of policy*, with a view of specifying a set of strategic priorities for Science, Technology, and Innovation, priorities that should precede rather than follow policy design and implementation. A major challenge is to extend the present framework that was initially based on VCs oriented towards ICT to LS.

ACRONYMS

VC - Venture Capital according to Gompers and Lerner (1999; 2001) definition; **VC*** - VC oriented exclusively to early stage finance of high tech Start Up; **VCs** - VC firms; **PEs** - Private Equity firms; **CVC** - corporate VC; **BAs** -Business Angels; **MBOs** - Management Buy Outs; **IVA**-Israel Venture Capital Association; **EVCA**-European Venture Capital Association; **BVCA**-British Venture Capital Association; **STE** - Science, Technology and Education; **SCEn**-Scotland Enterprise; **EHTCs** - Entrepreneurial High Tech Clusters; **ILC** - Industry Life Cycle; **ITP**-Innovation & Technology Policy; **ICT** - Information and Communication Technologies; **LS** - Life Sciences; **SUs** - High Tech Start-ups.

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1. Background

1.1 General

The objective of this paper is to contribute to a European "VC Policy Framework". Despite many attempts to develop high impact VC policies in Europe, a consensus seems to exist that the policies that were implemented up to and including the 1990s where only partially successful and their impact was below expectations. No country in Europe has undergone a full VC* emergence process. Our presumption is that such failure is related to the perceived nature of VC mainly as 'pools of money" rather than industry/market whose emergence could potentially be targeted by policy. This might explain the apparent overemphasis on monetary incentives (with little regard for generating VC capabilities) and the strong supply push bias.

On the contrary, both the US and Israel have succeeded in creating VC industries/markets as outcomes of cumulative emergence processes. In Israel, this was the result of an explicit VC-directed policy, the Yozma program. In both countries, VC supported high tech SUs and was originally oriented to co-evolve with high tech industries. Israel's policy-led VC emergence benefited from the US experience with VC and from prior US-Israel links. However, these were only preconditions for a successful policy. At least four other factors explain the Israeli policy success: (i) the objective of Yozma was creation of a domestic VC industry and market; (ii) its novel (at the time) design, the funds-of-funds approach, up-side incentive for professional private investors, attraction of capable foreign agents, and collective learning; iii) the timing of implementation; and iv) the background conditions created since 1969 that led to a strong demand for VC by capable SUs.

This paper question the conclusions reached by past research on VC policies that did not consider emergence of a VC/VC* industry/market as an important policy objective (Avnimelech and Teubal 2008a). In particular, Gilson (2003) argues that replicating the emergence of a US VC sector in other countries entails three simultaneous factors: a high number of SUs looking for VC funding, investors seeking high-risk and technology-based opportunities and, the existence of specialized VCs that operate as a nexus of contracts. Given two of these conditions, Gilson (2003) predicts that the third will automatically be satisfied.

This 'one size fits all' perspective has been criticized. First, the dynamics of emergence of VC industries/markets differ from case to case. Second, institutional change has been an important factor in the emergence of a VC sector in the US, UK and Israel. For example, in Israel, the liberalization of the financial markets, easier access to foreign public markets, the immigration of skilled workers, the definition of the limited partnership (LP) structure and favorable tax regimes attracted many investors to the VC industry.

Third, some authors stress the role of demand-side factors. The interwoven growth of high-tech SUs and VC/VC* funds may be prevented by the likely concentration of VC investment on opportunities characterized by lower transaction costs and/or shorter periods of realization (Martin et al 2005). This propensity would drive VCs away from early-stage ventures and induce them to invest in geographically close opportunities.

Recent studies suggest that that VC policy should focus on the demand side, which means, enhancing technological capabilities and the emergence of "investor-ready" opportunities (Mason and Harrison [MH] 2003). Becoming "investor ready" hinges on

the availability of capabilities necessary to structure and grow successful businesses and on the articulation of these capabilities in terms of stocks of high tech SUs and associated deal flows. While VCs and other investors can be the source expertise that translates into benefit to portfolio companies, these will only begin operating once sufficient 'investor-ready' opportunities are in place. This implies that understanding the dynamic relationship between VC and high-tech entrepreneurship often requires focusing on context-specific factors, mainly those that trigger cumulative co-evolutionary processes.

It follows that from a policy angle, a major issue is timing the triggering of the co-evolutionary process. On the one hand, it would be difficult to create a VC industry in advance of capabilities necessary to structure and grow successful businesses since LP VCs (with a limited time horizon for exiting) will be attracted by actual rather than potential opportunities. On the other hand, it is also difficult to create the capabilities necessary to structure and grow successful businesses in the absence of VC. Overcoming this problem of creating supply (demand) in the absence of demand (supply) represents a major policy challenge.

1.2 Approaches to the analysis of VC and VC policy

There are two approaches to the analysis of VC and VC policy: a hybrid 'finance perspective' focusing on VC as pools of money and on the operation of existing VC organizations and VC industries/markets; and a SE perspective focusing also on the emergence of new VC industries/markets. The first perspective focuses on incentives to fundraising and investment while the new SE perspective focuses on a broader set of instruments and policies including those associated with the development of capabilities and the creation or emergence of multi-agent structures (a new industry, market, cluster, and product class). The finance perspective originated in the 'finance literature' (Gompers & Lerner 1999).[i] Its policy implications are relatively static and general; and they have not been very successful. The SE perspective to VC/VC* policy has its origins in early VC and VC-related research focusing on Silicon Valley and the history of the US VC industry (Florida & Kenney 1988; Saxenian 1994, Zook 2002-4). It also draws from the geographical cluster development literature in general (Bresnahan et al., 2001; Feldman & Francis 2001; Fornhal & Menzel, 2006). Recently it received support from research on the emergence of the VC industry/market in Israel (Avnimelech and Teubal 2004; 2006, 2008a, b) and the UK (Rosiello and Parris 2008).

The SE approach is expressed in terms of (i) phases in the emergence of the new industry/market (an ILC perspective) and (ii) policy phases that sustained and triggered such a process. At present Israel's successful VC targeted program (Yozma) is being studied, emulated and adopted (with adaptations) by a wide variety of countries, both in Europe and elsewhere - Russia in 2004 (OECD 2006), New Zealand's NZVIF in 2002 (Lerner et al., 2005), Latvia in 2005 (Paxis Manual 2006), and Slovakia in 2007.

The SE perspective to innovation and VC policy also suggests that, provided appropriate background and pre-emergence conditions prevail or are created by policy, VC could be a central vector in the creation of (or transformation of) existing clusters towards more startup-intensive EHTCs (Avnimelech and Teubal 2006, 2008a,b). This would require the assistance of sophisticated policymaking, so that VC could become a

major mechanism by which a country/region could benefit from ICT, LS and other emerging EHTCs.

A VC-led emergence *profile* of an EHTC, while seemingly having been so in the case of Silicon Valley and Israel (mostly in relation to ICT), is not the only possible profile of emergence. The organization of finance may differ from region to region and so the dominant forms of VC organization may differ from the LP form. As a result, the dynamics and profiles of emergence may also vary from case to case. Variety relates primarily to the types of financial institution involved, that is, VCs, BAs, PEs, CVC, internal corporate venturing, technological incubators, government R&D grants, banks offering credits to new firms, and public sources of VC such as co-investment schemes or funds-of-funds. Moreover, variety concerns investee companies and the agents who provide funds to VCs, which often results in different portfolio characteristics across countries with respect to stage, geographical scope, and sectors (Mayer et al. 2003). Finally, variety is influenced by higher education system culture, by business culture and by the industrial structure of the region/country.

1.3 Specific Research Objectives

The ultimate objective of this work is to contribute to a "VC Policy Framework". The analysis will consist of two main parts: a) a short summary of the SE perspective to ITP (Section 2); and b) elements of the proposed framework for VC policies for Europe (Sections 4-5). The former represents an underpinning of the latter; and they will be used to criticize past VC policies in Europe, particularly those implemented during the 1990s (Section 3). The SE perspective is an extension of existing evolutionary, institutional and systems of innovation approaches with a particular focus on integrated policies in innovation-related areas. It assumes that a dynamic and turbulent global context with radical uncertainty; the overarching objective of policy is to trigger and sustain cumulative process of knowledge and innovation-driven economic growth.

2. A SE Perspective to ITP & VC Policy: General Principles

The need for a new perspective follows from the weak impacts of past policies and the enhanced needs of VC in order to latch into the ICT and LS revolutions, and other new emerging technological markets. Policy-makers are required to deal with uncertainties concerning both the fitness for context of their proposed interventions and their economic impact. Assuming radical uncertainty, the overarching goal of innovation and VC policy is to trigger and sustain high impact cumulative and self-reinforcing processes of innovation-led growth. A first requirement for the effective application of the proposed policy perspective is that policymakers consider what cognitive structures to access and what constraints and opportunities to consider when designing and implementing policies.

With respect to VC policies, we should consider the nature of VC and the elements of the system that affect VC policies and their impact. The answers to this question will provide pointers to the set of VC-related policies required and it will directly affect the design, timing and implementation of the VC policies themselves.

The notion of evolutionary targeting is also central. The general framework does not focus specifically on VC nor on any one country or industrializing economy; even less does it argue that the possibility and desirability of targeting a particular industry such as VC is open to all economies at all times. Rather it proposes that under certain circumstances, it is possible and it could be desirable to target multi-agent structures such as new sub-branches, product classes, technology sectors, markets or clusters.[ii]

2.1 VC Intermediation Issues

The identification and selection of new forms of intermediation lies at the heart of the creation of new markets/industries. This also holds in relation to VC. Gompers & Lerner argued that VC (a new 'supply agent') mediates between 'investors' and innovative companies in ways that the traditional banking system (old 'supply agent') did not, thereby overcoming 'market failure' originating in asymmetric information and other factors. They also observe that the financial services provided by VC organizations to SUs are 'equity investments' rather than loans. These have been bundled with other added value services to SUs in the areas of R&D strategy, international expansion, facilitating IPOs, and marketing (Antonelli and Teubal 2008). VCs have undergone significant transformations with LPs eventually becoming the dominant form of VC organizations in Israel, the UK and the US. In addition, the SUs themselves (demand agents) have also undergone significant transformation to be more suitable for VC finance by becoming more open to equity finance and temporal control transfer and by adopting rapid growth models.

A new intermediation form is a pre-emergence condition for the creation of new market/industry, one that further specifies and complements the well-known emergence of dominant design condition of ILC theory (Abernathy & Utterback [AU] 1978). Beyond product/service bundling issues due to economies of scale in market building and in transactions costs, it involves the mutual adaptation of the supply agent, the demand agent and the institutional structure (Antonelli and Teubal 2008) as mentioned in the context of VC. Concerning the importance of institutional changes for the emergence of a VC industry and market in the US, Gompers and Lerner (1999, 2001) emphasize the importance of a flexible regulatory environment concerning investments by pension funds.

While an appropriate intermediation form leading to industry and/or market emergence should be viewed as resulting from a dynamic process, there is no assurance that this will occur. Moreover, there can be a variety of VC pre-emergence configurations with the potential to lead to successful emergence and, unlike the Israeli case, precursor organizations that dominate pre-emergence need not be of the same type as those that eventually come to dominate the new industry/market. Thus, the emergence of less formal organizational precursors, such as BAs consortia, may constitute a pre-emergence condition leading to more formal and larger actors.[iii] This was probably the case in the US, where LPs became the dominant organizational form only after VC emergence (Avnimelech, Kenney and Teubal 2006). What is important, however, is that the particular configuration/bundling of products/services and of organizational forms provide significant value to users/clients.

Under these conditions, an accelerated process of emergence may take place while an organizational and product/design configuration is evolving. For example, Don and

Harrison (2006) show that in the Scottish case hybrid investors including family, friends, and BAs are important sources of VC*, in a situation where the UK trend suggests that LPs are increasingly orienting their portfolio towards later stages. In Israel between 2001 and 2008 (maturity phase) VC became less early stage oriented; while the BA community grew rapidly and took VC's place as the dominant type of agent involved in early stage finance (Avnimelech & Schwartz, 2008). In the US a similar phenomena occurred during the mid-late 1990s (Sohl 2003). These trends suggest it may be difficult to predict whether certain 'pre-emergence' dynamics will or will not lead to specific VC organizational configurations during emergence and maturity.

Whether or not a selected pre-emergence VC organizational form will come to dominate the 'emergent' VC industry, an effective pre-emergence dynamic must involve processes of experimentation and learning, explicit pre-emergence policies and a favorable external environment. Achieving a new, high value, intermediation form links with the evolutionary targeting framework (Avnimelech & Teubal 2008a) of analysis, in that it is a central pre-emergence condition for the full emergence of new industries/markets.

2.2 Towards a Typology of Policies and the ITP Portfolio

ITP and VC policy include incentive programs, institutional/regulatory changes, systematic policy evaluations and the identification of strategic priorities. Incentive programs can be classified in terms of their objectives (promoting business sector R&D; the creation of innovative capabilities in firms; the type of entities receiving the incentives (firms, university-company consortia, general infrastructures); and the instrument used (subsidies, tax incentives, loans). We consider two types of direct support to companies, horizontal and targeted programs. Horizontal programs support functions like R&D rather than specific sectors or technologies, are open to all firms, and leave to firms the freedom to choose projects (Teubal 1997). Targeted programs support firms belonging to a particular sector or undertaking projects in particular technological areas. Recent work has emphasized the point that in many circumstances early direct support to companies should emphasize horizontal programs while, as time and experience accumulate, a partial shift towards targeted programs may be desirable (Teubal 1997; 2008a,b). Implementing incentives programs may require attention not only to monetary incentives but also to capabilities, organization, and strategy.

Comparing the experiences of VC policy implementation in Israel and UK/Scotland inspires the following considerations. First, incentives' programs alone might not be effective enough without complementary regulatory/institutional changes. Second, the successful evolutionary targeting of higher levels of organization in the present global environment involves a radically different process from targeted policies aimed at 'picking winners' (Avnimelech & Teubal 2008a). Third, targeted policies should be implemented during 'windows of opportunity' in coincidence with a supportive external environment (such as technological revolutions or rapid economic growth), while the implementation of horizontal programs is less time sensitive.

Even when the objective is the emergence of a new VC industry/market, it is important to consider other VC-related policies. Such as support of innovation at the firm level, the support of specific science/technology fields at universities or research institutes,

direct support of SUs, and adapting anti-trust legislation. These may be implemented before or during the actual targeting of VC. More generally, an SE perspective could stimulate policy makers to analyze the effects of sets of interrelated policies, some implemented at a point in time, others distributed through time.

It is also important to consider negative side effects related to high tech sectors with a dominant VC-industry, such as extremely narrow technological and geographical focus and limited variety of company structures and business models (Avnimelech at al., 2007).[iv]

2.3 Strategic Level Policy

A strategic policy level requires a distinct set of capabilities and institutions. The strategic level's central function is to set strategic priorities, to identify system failures blocking their attainment by the existing system and associated policies, and, together with the operational level, to identify and design new policies whenever these are called for by the new priorities. Such an articulation of the new policy priorities will be reflected in new or restructured programs and institutional changes and discontinuation of some or all existing programs.

Beyond the identification and articulation of new strategic priorities, a strategic level of policy should be involved in policy coordination and in characterizing the central dimensions of the country's actual and future policy portfolio for purposes of comparison, analysis and implementation through time.

2.4 Heterogeneity of VC policies

Heterogeneity of VC policies arises from variation in sector/technology and country/country types, the structure and capabilities of the business sector; the presence of islands of scientific excellence in the country (and what these areas are); and institutional structures and policy capabilities. Objectives could also vary depending on expected changes in the external and internal environments facing the country/region, and on strategic policy priorities.

Considering inter-sectoral differences, a comparison between ICT and LS is interesting. From very early stages, VC-backed ITC ventures can grow faster. If they are successful, they can rapidly generate the surplus of capital that can be re-invested in the locality as well as facilitate the training of serial entrepreneurs who are essential to grow high-tech clusters. LS are different in that the development process takes a lot longer, requires much higher capital commitments and entails more technological and regulatory uncertainty (Rosiello and Parris 2008; Tait 2007).

Numerous variants of ICT/LS clusters could represent a country's strategic priority. In Israel, in relation to LS, clusters include i) continuation of a generics-based LS sector/cluster based on the spectacular success of the leading generics company (Teva); ii) a cluster where R&D on ethical drugs becomes dominant; and iii) a LS cluster focusing on generics, orphan drugs, diagnostics and applications of biotechnology to agriculture and other areas. Our policy perspective suggests that when it comes to set strategic ICT or LS cluster priorities, the relevant variants should be identified and assessed from the point of view of overarching national objectives.

3. Venture Capital Policies

3.1 VC Policies in Europe (OECD reports)

OECD (2000; 2003) reports reveal that governments invest risk finance in small, innovative firms in order to bridge 'funding gaps'. Three directions of VC policy up to and including the 1990s are frequently mentioned: government direct supply of capital to firms; providing financial incentives to VC investments; and broadening investment rules. The 2000 OECD report lists 'supply side measures' in support of VC, which include promotion of private VC investment; removal of barriers to entrepreneurship; development of second tier capital markets; direct equity investments in SUs; and equity guarantee programs. While warning about the risks of crowding-out private VC, this report concludes that governments can play a useful role if such schemes are properly conceived.

The UK Government leads in the implementation of OECD recommendations, some of which aim at stimulating investment in innovative technology (table 1). However, UK private equity investment remains biased towards late stage opportunities. Over half of total UK investment (59% in 2006) funded MBOs, a trend that affects LS and ICT.

Post 2000 OECD recommendations focus on a number of central points:

- Quantitative restrictions on institutional investors should be eased to broaden the sources of VC in many OECD countries
- Lower capital gains tax rates will stimulate entrepreneurs and investors, while avoiding the need for special VC tax incentives
- Government equity programmes can stimulate private venture financing but should be phased out when private markets mature
- Governments should link angel networks to public programmes, such as technology incubators[v]

According to OECD (2003) in many countries, regulation prevents institutional investors, such as pension funds and insurance companies, from investing in private equity. In the UK, investment constraints on insurance companies were released in 1994 and a minimum funding requirement introduced by the 1995 UK Pensions Act.

Concerning incentives to VC, the risk profile of seed and SU firms is not generally compatible with the investment criteria of large financial institutions and, increasingly, merchant VCs. Thus, existing PEs may not help in developing early phase-oriented VC and they can be direct or indirect obstacles to such a development. It follows that governments may have to play a relatively active role in order to assure development of such a segment. A good example is the Yozma program in Israel that not only channeled substantial amounts of risk capital to young firms, but also helped, indirectly, to train managers who later launched their own funds stimulating the emergence of a VC sector[vi]. Channeling VC into SUs has also been one of the targets of the UK Government, an objective pursued by means of a variety of initiatives.

Table 1. Sample of VC policies introduced by the UK Government

The Enterprise Investment Scheme (EIS)	Introduced in 1994, EIS provides income tax relief for new equity investment by external investors and BAs in qualifying unquoted companies and capital gains tax exemption on disposal of shares. It does not apply to investors who own more than 30% of the shares. Investors can obtain income tax relief at 20% on investments up to £200,000 in any tax year. Reliefs are available only for investment in new ordinary shares. Investors must hold their shares for at least 3 years.
NESTA Ventures	Direct Investment in early-stage companies. Portfolio covers a range of sectors: Engineering, Environmental Technology, Healthcare, and Information and Communications Technology. It invests a maximum of £500,000 in each company in partnerships and through third parties.
Enterprise Capital Funds (ECFs)	ECFs invest a combination of private and public money in SUs seeking up to £2 million of equity finance. The funds help to address the scarcity of equity capital in the £500,000 to £2 million funding rounds. Total investment: £100M.The approval of these ECFs is subject to contract and funds will have up to six months to raise the full amount of private capital. Each ECF makes equity investments of up to £2 million into eligible SMEs. Investments are on commercial terms.
Regional Venture Capital Funds (RVCFs)	RVCFs are an England-wide programme to provide risk capital finance to small and medium size enterprises (SMEs) who demonstrate growth potential. The funds, managed by VC professionals, are commercially focused. Short-term objectives: to increase the amount of equity gap venture capital available to the SME market and which does not displace any existing fund activity in this segment of the market. Long-term objectives: (i) to ensure that each region in England has access to VC; (ii) to demonstrate to potential investors that commercial returns can be made; and (iii) to increase the supply of managers in the equity gap.

OECD (2003) recognizes that "not all public initiatives are well-targeted, and some have outlived their original purpose and usefulness". Over time, public programmes tend to converge towards the same market segments as the existing private sector, strengthening of PEs rather than creation of early phase oriented VC. A related point is that even if public initiatives lead to publicly owned/managed VCs, these could crowd out private investors and even delay the development of early-stage financing.

Again the Israeli case of Yozma is one where rather than crowding out private investments and privately owned/managed VC funds, the government VC component, by generating conditions for complementary public/private investment, set the stage for subsequent private VC investments (Avnimelech and Teubal 2006, 2008a,b). More generally, either by promoting a cumulative process of growth and emergence with dynamic economies of scale or through strict definitions of areas of investments and matching funds, Government funds may ameliorate the problem of crowding out private investors.

3.2 A Critique of VC Policies in Europe (with a focus on UK/Scotland)

Our short review of VC policies recommendations for OECD countries reflects the tendency to base VC policies on VC as a 'pool of money' rather than an 'industry' view; on static rather than SE analysis; and on a non-precise definition of what VC is and is not. This approach explains the prevalence of monetary incentives in the policies and its objectives can be phrased in terms of closing an early phase funding gap for high tech SUs rather than in creating new support structures for a growing number of SUs as part of the promotion of entrepreneurial clusters. Further, most

policies were designed as one shot policy rather than a dynamic phased policy. This contrast with the Israeli case, which could be interpreted as implicitly based on VC as new industry/market priority associated with the transition to an EHTC as part of on an ongoing phased policy toward the goal of innovation based economic growth.

A second point is the OECD emphasis on private crowding-out effects, which would result from a Government VC component. There is little if any reference to the possible complementarity between the Government and the private components of VC (Avnimelech and Teubal 2006, 2008a). Strong complementarities may depend both on context (whether or not a favorable pre-emergence condition exists) and on the specific channels through which the Government contribution is funneled to the economy.

Ever since the 90s, developing a strong VC based on the US model has represented a strategic priority. For instance, the UK accounts for some 40% of the European market, over €10 billion in 2004. Out of this, however, only 15% goes into VC financing for seed-growth-expansion phases while much of the rest is invested in replacement capital and buyouts (EVCA, 2005). VC investment in the UK is also extremely concentrated in some regions, with about 75% of BVCA members located in Greater London and making 92% of their investment in the Southeast region (Martin et al 2005).

The UK Government has devised a series of policies to support the development of the VC sector and to channel investment in less-favored regions. Some of these initiatives, such as the RVCFs, have been criticized because of their limited impact in stimulating the emergence of regional VC markets (OECD 2003), their excessive emphasis on covering supply-gaps (MH 2002; Harding 2002) and the inadequate consideration given to the "dynamic learning process in which demand and supply processes combine with their embededness in social networks and individual perceptions in a mutual reinforcing way" (Martin et al 2005, p.1)[vii].

The mandate to invest only in commercially viable ventures combined with limitations on investment size and geographical scope cause problems for those funds located in areas that lack opportunities. On the one hand, lack of funds tends not to be the sole cause of *investor-unreadiness*. On the other hand, strong commercial trends may not allow for enough experimentation, which can inhibit the emergence of entrepreneurial capabilities.

In contrast to the several countries/regions of Europe, Israel's Yozma program involved a Government VC component, most of it 'delivered' to hybrid, privately owned LPs (a fund-of-funds function), rather than through a Government owned VC company. This may contribute to explain why it managed to leverage substantial additional funding. The VC organizations created in the wake of Yozma (or participating in the program) and which invested a total of 250 M$ in the Yozma program (100 M$ Government money and 150 M$ additional private money) raised an additional 4.200 M$ until the year 2000. This is an extreme case of non-crowding out.

Both the emphasis on a fund-of-funds approach and the existence of favorable pre-emergence conditions explain why in Israel a strong complementarity was found between the Government's VC contribution and private contributions. Hence, it could be misleading to emphasize too much the 'crowding out phenomenon'; in the real world, there are contexts and mechanisms, which can transform what seems to be a 'structural' crowding-out into strong complementarity. Public/private VC funding

complementarities may exist but they depend on context and whether their existence may trigger a self-sustained, private VC-intensive process of VC*/EHTC emergence.

3.3 Comments on Research on VC policies

Gilson's Proposal

According to Gilson (2003), the central lesson from the successful US experience in generating a VC market is "the extremely effective contracting structure that covers the entire venture capital cycle, from initial investment in the VC fund, to the VC fund's investment in a portfolio company, to the exit from the portfolio investment to allow the VC fund's cash and non-cash investment to be recycled" (p. 1092). Gilson asks whether this model could be replicated elsewhere and whether the Government could engineer the process. Gilson assumes that the foundational structure of capital markets already exists.

The creation of a VC market is a difficult coordination problem, in that the supply of entrepreneurs is responsive to venture funding and to the appropriate financial institutions. He assumes that the first successes with VC would endogenously attract or ´reveal´ new entrepreneurs. Based on our examination of VC policies, we argue that such a statement may be misleading. There are cases where a few early entrepreneurs become engines of growth by re-investing their wealth and using their skills and expertise to support other companies. If this process is strong, enough it could generate a cumulative process of growth of entrepreneurship. However, in other contexts it need not be the case and the required entrepreneurship may not emerge, certainly not necessarily within the time framework required to create a VC industry.

Critique of Bottazzi et al (2004)

In recent years, research interest has risen on policies to promote VC. The basic conclusion is that an active VC market will strongly respond to 'incentives' but will not respond to attempts by Governments to directly affect the flow of funds directed to venture investments. This conclusion squares with past failures of Government owned VC funds to promote active capital markets, and to the accepted view reported in OECD documents that such funding would 'crowed-out' the flow of privately owned funds to VC markets.

However, the results of Bottazzi et al. (2004) are not consistent with evidence that even in countries with a well-developed VC sector (such as the UK) SUs suffer from a lack of funding (EVCA 2005), VC investment is often concentrated in some regions (Martin et al 2005; Sunley et al 2005), and synergies may exist between public policy and the rate of private VC investment - as in the cases of Israel (Avnimelech and Teubal 2006) and Scotland (Don and Harrison 2006). On the contrary, the SE theory stresses that policy action must fit within the existing industrial and institutional context, select the right timing, and coincide with the materialization of capabilities and infrastructure for innovation that are critical for the emergence of high-tech clusters.

4. Constructing a VC Policy Framework

From a SE perspective the actual VC policies applied in Europe suffered from a number of weaknesses or insufficiencies, which future policies should avoid. These are classified into five main issues.

4.1 Avoiding an Excessive Emphasis on Closing Early Phase Finance Gaps

An emphasis on supply factors or supply push approaches has a long tradition in policymaking both ITP in general and VC policy in particular. Over the past few years policy analyses and evaluations have increasingly emphasized the importance of taking into account demand factors when considering policies (OECD 2003) although few have recognized the link between 'learning to innovate' (including 'collective' and 'interactive' aspects) and the creation of demand for innovation. In the VC policy area an expression of this emphasis on supply are VC policies designed to close the 'early phase finance gap' facing high tech SUs. This view takes the 'demand' for such finance (a result of the pool of SUs) as given. This is a restrictive view of national priorities in this entrepreneurial phase of rapid change in ICT/LS. Thus, if one of the objectives is to induce knowledge-based growth by latching into the ICT/LS through cumulative processes, then, rather than filling the needs of existing SUs, an important component of the required strategy should be the promotion of both technological entrepreneurship and SUs development.

4.2 Focus on Dynamics

While not strictly necessary, it could be useful to express the dynamics of evolution of VC and of high tech clusters in terms of an extended and modified ILC perspective. In AU (1978) there are three phases-a fluid phase, a growth phase and a rigid/mature phase; and the theory is relevant only for those industries that traverse the full set of phases. Two of the extensions and modifications introduced by Avnimelech and Teubal (2006) in their analysis of Israel's VC industry are relevant: the focus on conditions for creation of a new industry and/or market; and market/industry creation as 'an emergence process' that is a process characterized by dynamic increasing returns to scale. Emergence is a particular process of 'qualitative' change whereby a set of precursor agents originally acting independently (the AU's early, fluid phase) become, through a process of interaction, a multi-agent higher level organizational structure, such as a new industry or market or cluster (the AU's growth phase). The term emergence refers both to the new organization and to its properties, neither of which characterizes the individual agents. Thus, a dominant design, a new intermediation form, the new formal and informal institutions, and the relative stability of the higher-level structure are emergent properties.

Turning now to the 'normative' side, a static view of policy is often accompanied by an *incomplete view of the pre-conditions for policy success.* The weak impact of policies derived from either a lack of required preconditions for a successful VC/VC* and EHTC (the policy objective and/or its underpinning in terms of strategic priorities was not a 'reasonable' or 'feasible' one) or the fact the policy *implemented* was not appropriate from the point of view of its objective. In the latter case, failure may be the result of inadequate design and timing of policies rather than inappropriate policy objectives.

The preconditions for a successful VC policy depend on country, domestic context (economic structure and institutional structure), the existing state of VC or relevant informal substitutes, and other factors pertaining to the global environment. Despite the limited policy experience, it seems that the prior existence of a growing mass of "investor-ready" SU is a necessary condition. In many cases the state of preconditions is such that rather than directly promoting VC the objective of VC policy should focus on improving preconditions, thus paving the way for a successful VC policy in the future.

In a more dynamic framework and assuming that the ultimate objective of VC policy is the emergence of a domestic VC market and/or industry, the set of possible combinations of elements comprising pre-conditions for policy success is wide, in that there may be considerable variation in the 'weaknesses' of existing system which block socially desirable VC/VC* growth. Weaknesses may stem from macro-economic problems or regulatory hurdles or lack of entrepreneurship. Each (or each combination) of these can be associated with a different market/system failure profile. Frequently, an early recognition of such pre-conditions would shift the focus of VC policy from VC-directed policies (with a dominant focus on monetary incentives) to VC-related policies, such as support of innovation, entrepreneurship, and institutional changes with the aim of improving pre-emergence conditions.

It follows that heterogeneity of the 'pre-emergence conditions' which VC policies may be required to act upon is yet another source of VC policy heterogeneity. For instance, while Edinburgh is home to global banks and several investment funds, only a few institutional VCs are located in Scotland and a high proportion of technology investments come from BAs (over 600M pounds of investment in private equity in 2000-4), a significant proportion of which is co-funded by SCEn. This very distinctive set of pre-emergence conditions could become a very favorable precursor to develop a vibrant VC industry domestically, one that co-evolves with the emergence of a vibrant local economy or cluster.

The above example also suggests that an initial phase of Government support to LS or ICT firms could focus on increasing investments with a view to create a critical mass to trigger self-sustaining cumulative processes of growth by 'pulling' VCs and VC/VC* investments. This support would not only contribute to reinforce pre-emergence conditions but may also generate additional information about the desirability of promoting emergence of a VC industry/market in the future. Furthermore, initiatives like co-investment programmes and grants can also contribute to develop entrepreneurial and managerial skills.

4.3 A Multi-dimensional View of VC & Classification of VC policies

Our analysis suggests three 'pure' views of what VC consists of from the perspective of a policymaker (rather than the two 'hybrid' views of Section 1.2). The first (early) view comes from the Finance literature, VC being a 'pool of money. The second view starts with a distinction between the funds on the one hand and the organizations managing the funds on the other, with policy having to address both. This is the view enshrined in the Gompers and Lerner (1999) and in Gilson (2003). According to the third view not only is VC a pool of money and organizations that manage it (and their

contracts and routines); it could also become an industry/market (Avnimelech & Teubal 2006).[viii]

This latter multidimensional view of VC underlies a novel generation of VC policies. Under certain circumstances, the object of policy should be VC organizations to be promoted; however, in other circumstances, when a dominant intermediation form has been achieved, the object of policy could be to trigger and sustain a VC emergence process where VC is considered a new industry/market (not a mere intermediary). A further objective of VC policy can be to increase the variety of agent in an existing VC industry, which is the current post- emergence stage of the Israeli VC policy. These policy options do not exclude the possibility that a SE perspective to VC* policy may entail focusing on the 'pool of money' dimension, for instance when strengthening the access to foreign sources of funds in the aftermath of a global economic crisis.

It should be noted that the successful early promotion of VC organizations might not lead to a subsequent policy for promoting a VC industry. In certain cases, the existing set and variety of VC agents, even if not constituting an industry, may be sufficient to satisfy national priorities particularly in the short run and especially for a small country/region in Europe. This could be even more so when that region/country can connect to the global VC industry and when domestic demand may become, without additional policies, part of the global market.

A basic distinction between VC-directed policies and VC-related policies, with the former directed to VC and the latter to other functions or components of the innovation system, is important. A successful VC policy will frequently require both types of policies; and there may be particular mixes between the two categories through time.

4.4 Need to Link VC Policy with High Tech Policy

A central flaw of many VC policies implemented up to and including the 1990s is the failure to link these to high tech policies more generally and, more specifically, to cluster emergence policies. The central reason seems to have been the static view of VC policies and the emphasis in promoting VC as a pool of money almost exclusively with the objective of closing early finance gaps. More recently, some policies have pursued VC-related objectives, such as promoting of University-Industry links and angel networks, making bankruptcy laws more favorable to SUs, facilitating the creation new technological infrastructures. Despite this improvement, there is limited awareness within both the policymaking and the academic communities of the need to link VC policies with high tech cluster creation policies, particularly clusters of the entrepreneurial type.

A no less important reason why the link between VC policies and high tech cluster creation policies was not recognized was the prevailing view on the impossibility of targeting EHTCs. Bresnahan et al (2001) perspective on this matter does not sufficiently recognize the centrality of a cluster's pre-emergence phase and its particular configuration in explaining subsequent cluster dynamics (emergence or non-emergence).

4.5 A New Policy Process: Redefining STE and Innovation Priorities prior to Identifying and Designing new Policies

Most VC policies in the past have not been derived from a prior, explicit process of identifying new priorities in VC-relevant areas, that is, related to STE and innovation. As emphasized in previous sections these priorities are nowadays critical for determining VC (directed and relevant) policy objectives. This implies a more realistic but at the same time more complex policy process which the countries of Europe and Israel should seriously consider prior to or in parallel with the design and implementation of a new set of innovation, VC and science and technology policies. Once new priorities are set, it is much easier to identify key policy objectives.

5. A TYOPOLOGY OF VC POLICY OBJECTIVES

Our point of departure for defining VC policy objectives is the heterogeneity of VC policies which was extensively discussed in previous sections, and which in part flows from cross country/region/context differences in strategic priorities even those relevant to a particular area, say LS. Our purpose here is not to identify policies for a particular country; rather in the following sub-sections, we analyze the set of possible policy objectives which individual countries or regions may want to consider during their VC policy formulation processes.

5.1 Promoting VC* industry/market Emergence

What is aimed at is creation of a new industry/market/cluster, which we define as a higher level of organization or multi-agent structure. Moreover, in Israel the new VC industry/market was embedded in a new EHTC a fact that led us above to suggest that in some cases, VC* emergence policies should be part of broader EHTC policies. In those countries that succeeded with policies of this type, the VC industry seems to have emerged from a set of pre-emergence conditions that provided the right setting for attempting to trigger and sustain emergence. The dynamics of VC* seem to have been closely linked with those of ICT-oriented EHTCs.

There are several alternative patterns of relationship between VC emergence and industrial clustering. These depend on local or domestic idiosyncrasies; and on sectoral differences. As a result, at times VC-related policies whose objective is emergence would respond to different specific targets and should be planned and implemented in different ways. In what follows we offer a brief taxonomy of such variants based on the experiences of Israel and Scotland/UK.

The variants of policy when the objective is VC/VC* emergence pertains to at least five different dimensions: 1) ICT/LS/Other orientation of the future VC industry/market; 2) Dominant Organizational Forms of VC organizations; 3) Role of BAs; and 4) an industry, a market or both an industry and a market.

5.1.1 Area/Technology Orientation of the VC industry/market

Whether or not to promote emergence of a LS-specialized VC* segment is a major issue in Israel which already has a well-developed ICT oriented VC* segment (and EHTC) with some investments in biotech and important investments in the medical devices area. Since no detailed and well specified strategic priority concerning what

type of biotech cluster suits that country it is too early to establish whether or not emergence of a drug development oriented VC* industry/market (and associated cluster) should be aimed at. Moreover, the specifics of the intermediation form of such LS cluster configuration would seem to be quite different from that which evolved for ICT. In addition, alternative emergence profiles are conceivable even within ICT (e.g. in Israel it seemed to have been VC*-led, see Avnimelech and Teubal 2006) and certainly when we compare ICT with LS.

It should be emphasized that in contrast to the Israeli and Silicon Valley experience with ICT clusters, the emergence profile for a LS cluster need not be VC-led. Moreover, the new VC-related intermediation form associated with ICT-oriented EHTCs need not be the only form of new intermediation required for emergence of entrepreneurial LS-related clusters. For the ethical drug variant of the latter and to a much larger degree than the former, 'management' and 'capabilities' intermediation (together with intermediation which exploits economies of scale, scope and learning) and not only 'financial intermediation' may be critical for successful emergence. This means that a slew of new, specialized intermediaries would be required, or alternatively, that the single (or small number of types of) intermediary organization(s) should bundle much more than for entrepreneurial ICT clusters, financial services with other added value services.

5.1.2 Dominant VC*/VC Organizational Form

In the US, the dominant VC organizational form eventually came to be the LP form, which also was the VC organization type targeted by Israel's Yozma Program in 1993. In other contexts, it is possible that more than one type of VC organization should be promoted. Which ones may reflect both local idiosyncratic factors or/and institutional set ups and other factors such as whether the target is ICT or LS. In the UK, we acknowledge a proliferation of VC types, some of which are the result of trajectories of development embedded in regional sub-systems, whereas others originate from the implementation of government regulation. These experiences and facts at least suggests the possibility that VC* policies directed to industry/market emergence may target either a dominant type of VC organization (which one may depend on the specifics of sector/technology, and existing financial institutions) or a set of such organizations.

As mentioned in previous sections the target depends on existing circumstances including existing forms of financial of VC/PE organization (which may either help or hinder more appropriate forms of organization) and stage of cluster development, without being circumscribed to LPs. For instance, Don and Harrison (2006) highlight that an important characteristic of the Scottish equity capital market is the role played by a small number of very large investments and a large number of BAs. About one third of investment by value between 2000 and 2003 was generated by the three largest transactions in each year, and this proportion fluctuated between 41% and 22%. Further, BAs represent a crucial source of funding for early-stage companies, providing in the same period around £115m to local businesses (27% of all risk capital investment, excluding the three largest transactions).

It follows that, depending on local circumstances, policies oriented to VC/VC* emergence need not focus exclusively on the promotion of LPs. Other forms may be

relevant, and in some cases, it may be conceivable that policies should aim at a distribution of organizational forms rather than at one, dominant organizational form.

5.1.3 Role of BAs

The above conclusion holds as regards the promotion of BAs or a mix between these and formal VC/VC* organizations which could become, in places like Scotland, a central objective of the VC/VC* structure directed to emergence. This is because across industrial sectors, early-stage companies present a varying set of challenges to investors some of which tend to complicate their risk profile in ways that formal VC organizations, despite being capable of overcoming a number of 'mild' sources of market failure, find it difficult to confront. To begin with, SUs generally lack tangible assets required as collateral to obtain finance. Secondly, investees may use the funds raised to support transaction-specific activities, which increases the risk of non-redeployability in the case of failure. Thirdly, new ventures may be formed by investor-unready directors who struggle to demonstrate a credible revenue model. This involves a variety of problems: the inability to exhibit a unique selling proposition, a credible route to market, and the possibility of a successful exit (MH 2003). Finally, there can be information asymmetries. Gompers and Lerner (2001) examine the case of biotech companies and refer to situations where the management team either invests in activities that are not strictly related to core business objectives or raises unsustainable amounts of debt.

BAs can contribute to solve some of the above sources of 'market/system failures', and this presumption reflects the fact that they are one of the most important sources of early stage funding for technology-based and high growth potential companies. In the case of Scotland, there are several angel groups. The leading syndicates have high visibility. Don and Harrison (2006) estimate that in 2004 539 investments involved BAs who were therefore responsible for over £600M of private investment - while in the 2000/2003 period, SCEn co-investment funds were involved in 44% of the total number of VC transactions.

Although the contribution of BAs to the regional economy is frequently underestimated (MH 2000), BAs can add non-monetary value by providing management expertise, strengthening the team by taking on a non-executive role, and offering access to vital networks. The analytical implication is that an active fringe of BAs can be a pre-emergence condition as it promotes variation of approaches, increases the number of SUs and act as an early mechanism of selection.

5.1.4 Emergence of a VC industry, market, or both

A major issue is whether a country would wish to develop a local VC/VC*industry and market or only a local market plus whatever is required to link with the global industry. In Israel during the 1990s there was not an option not to develop a local industry since foreign VCs, with no local agents to collaborate with in syndications, would not open offices in the country (the export of VC services from the US to Israel without a local presence in the country was impossible at the time). However, this constraint might become less and less relevant *pari passu* with the growth of the global VC industry.

It is an open question whether every region in countries like the UK or regions like Scotland need a local, *formal* VC sector. As described in the previous section and suggested by MH (2003) and Rosiello and Parris (2008), a VC industry structured around local LPs does not exist in Scotland. BAs and their networks are a component of what could be termed the pre-emergence stage, a fact that suggests a different model of evolution. From a SE angle, the strategy adopted by SCEn (in contrast with the Israeli case where both a market and an industry were developed) can be interpreted as an attempt to increase VC flow into new and growing businesses, which may become "investor ready" propositions for non Scottish-based institutional VCs who are mainly located in the Southeast. This may provide effective growth avenues to local SUs and enhance non-local VCs interest in Scottish ventures - which is to a degree happening (MH 2003) especially in the domain of LS (Rosiello and Parris 2008). The Scottish example suggests that pre-emergence conditions and policies are oriented to stimulate VC to the extent that this would enable effective linking with the broader UK-base of VC industry. The strategy would then seem to be to create a regional 'Scottish' VC market and rely largely on the UK industry.

5.2 Promoting pre-emergence conditions

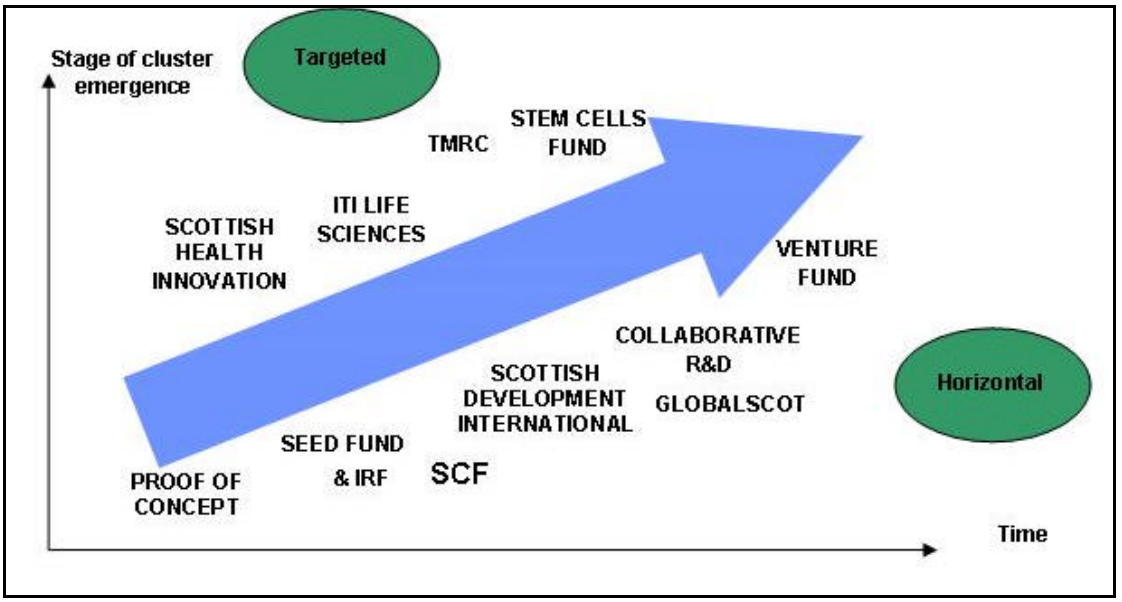
Whenever VC or VC/EHTC emergence is an objective of policy it must be that "appropriate" pre-emergence conditions prevail. Otherwise (and assuming that emergence is still a long-term objective) emergence policies should be delayed with the policy focus shifting to improving pre-emergence conditions. These mainly relate to (a) the definition of new intermediation forms adapted to domestic conditions, (b) to the promotion of investor-ready entrepreneurship, including technological capabilities and entrepreneurial culture, (c) effective coordination and partnership among various components of the innovation system, and (d) creation of links with external players.

Our SE framework is based on a VC industry ILC perspective and on a multidimensional view of VC. As VCs tend to invest in geographically proximate SUs (Powell et al. 2002; Zook, 2002, 2004; and Schwartz and El-Bar 2007) and act as "technological gate-keepers" that steer companies towards those regions with the ideal mix of factors to promote innovation (Florida and Kenney 1988), the emergence of VC markets/sectors is linked with that of EHTCs. The pre-emergence conditions to be promoted refer no less to the relevant high tech cluster than to VC* itself. EHTCs develop through cumulative processes and often originate in or are triggered by unforeseeable events such as scientific breakthroughs or historical events (Feldman and Francis 2003). These and others, frequently with the support of policy, may lead to a critical mass of central factors (pool of SU and VC) which may lead to a particular profile of emergence. While conceptualizing this process is difficult, it is critical in order to design and implement successful emergence policies. Alternatively, successful emergence policies require understanding of the possible profiles of emergence, including sets of conditions that precede emergence, a concept that has already been elaborated by Avnimelech and Teubal (2006).

The Israeli experience also suggests that different policies are needed at different development phases (Avnimelech and Teubal 2008b), a conclusion that can also be applied to the case of Scotland (Rosiello and Orsenigo 2008). For a number of years the performances of the Scottish economy was influenced by multinationals operating in the financial services, gas, oil, transport and utility sectors. By the early 00s,

however, the difficulties faced by some of these multinationals led to the severe decline of the Scottish ICT sector. At that point, the focus of policy interest shifted towards stimulating the creation of local ventures with high growth potential. Five industrial sectors were initially identified as those where Scotland had a competitive advantage, including LS and microelectronics (from a SE angle, these were 'strategic priorities' areas), later extended to eighteen.

Figure 1. Scottish Life Science Strategy: sample of measures



Some support programs operate horizontally across sectors. From the outset, the strategy included VC-directed policies such as the "Scottish Co-investment Fund" (SCF) - a £45m public/private equity fund that helps small companies to obtain money from banks and private investors by investing up to £500k - and the "Seed Fund" that invests up to £100K. More recently, additional support is available via the "Scottish Venture Fund" that participates in investments up to £10M. LS draw a large proportion of these resources: 27% of the deals completed up to 2007 via the SCS involved biotech companies, with an average leverage ratio of private investment of 2.73 (2.48 in all sectors).

Aside from VC-directed policies, we find a range of related policies that target the demand-side of VC. These initially included: "Proof of Concept" that finances the commercialization of projects across Scottish Universities and research institutes; the "Smart and Spur Awards" that support new ventures to carry out innovative projects and commercialize new products and services; and the "Investor Ready Fund" that pays 50% of legal and accountancy fees to companies seeking a private investment.

Later additions include schemes such as the "Score" and "Seekit" that support R&D projects jointly undertaken between public research bodies and private companies with specific technical needs; "Scottish Development International" helps Scottish companies gain access to people, technologies and business partners worldwide; and "Globalscot" is an international network and gateway to fellow members (mostly managers of biotech companies) worldwide

Among the more recent initiatives, we find targeted schemes that aim at creating the infrastructure, skills and technology base, and networks that are necessary for EHTC emergence. Three "Intermediary Technology Institutes" (ITIs) have been set up to provide technological platforms for economic success. Launched in September 2003, ITIs have £450 million to invest over a ten-year period in pre-competitive research project involving both industry and public research centers. The ITIs focus on LS, energy and multimedia. The "Stem Cells Fund" was created in 2006 to support projects based in Scotland and aimed at getting stem cell therapies into humans. Scottish Health Innovation Ltd commercializes innovation arising within the NHS.

The "Translational Medicine Research Collaboration" (TMRC) was launched in 2005 and it involves four Scottish Universities and the NHS. Activities include: (i) setting up a centre for the development of biomarkers; (ii) developing and coordinating clinical trials on defined disease populations; (iii) linking with the *Scottish Clinical Research Network* to deal with ethical approvals, data collation and statistical analysis of results; and (iv) coordinating research on collected samples (www.wyeth.co.uk–translational research).

5.3 Promoting VC* without Emergence in mind

As noted earlier, a fully emerged US- type VC model sector in Scotland, especially in relation to the LS-segment, is probably not achievable nor does it seem to be a sine-qua-non condition for bio-cluster emergence. Various works, including Martin et al (2005), MH (2003), and Rosiello and Parris (2008), show that VCs tend to be concentrated in the London Area and their investment in the Southeastern area of the UK. However, as suggested by MH (2003) and Don and Harrison (2006), Scottish grants and co-investment schemes are compatible with and stimulate investment in local business by a large and increasingly organized fringe of informal investors and BAs' syndicated which constitute a peculiarity of the Scottish financial community.

In certain contexts the objective of VC* policies (even in the longer run, after promotion of pre-emergence conditions) should not be triggering and sustaining emergence of a VC* industry or market. For example it is conceivable in situations where the institutional setting and prior policies are doing the job, that a country or region may want to add a measure of formal VC sources of finance and support to innovation in SU over an beyond what already exists, without wanting to develop a full fledged VC* industry/market. The objective of this kind of policy could be motivated by a 'satisfying situation', by a high perceived risk of adopting a policy oriented to VC* emergence, by the existence of idiosyncratic financial (semi public) institutions which do part of the job, or by a 'wait and see' attitude leading to the creation of new options for future policy.

Another case for promoting VC* without *industry* emergence in mind could be the case of regions where, after creating the pre-emergence conditions, a temporal increase in the pool of VC available may generate the appropriate reputation and attract the nearby VC industry to invest. For example, Beer-Sheva at the south of Israel do not need to create a separate VC industry, if it will create a competitive advantage in cleantech it will easily attract VC investment from "Tel-Aviv's VC industry".

5.4 Promoting Industry Consolidation and Diversification/Re-invention

A successful VC industry emergence process may be subject to a rough test during the next technological bubble and subsequent bust; and it is not obvious that even very successful albeit new VC industries would be able to recover. For example it may be that the returns to post bust funds were low, and that this fact would compromise the survival of the industry as a whole e.g. its capacity to raise funds, especially from leading agents. In this situation, Governments may have to make explicit and creative efforts to overcome this danger e.g. by relaxing restrictions on pension funds' investments, while letting the market undergo a rough 'selection' process. Government action may vary, depending on context. One aspect of VC consolidation may be the diffusion of ICT-oriented VC industries to serve the needs of new emerging technologies; others may involve diffusion towards non-high tech industries and services. A third possibility is to emphasize the enhanced role, after or during industry maturity, of BAs and other agents (such as CVCs and accelerators) could play. This last aspect of consolidation is crucial in order to enable cluster renewal and adjustment in coincidence with radical changes in the external environment.

5.5 Complementary, VC-related Policies and policy actions

Some of the VC-related policies that promote pre-emergence conditions should continue or even be reinforced during emergence in order to assure momentum of the process and its sustainability. These may include reinforcement of SU-oriented innovation policies including those focused to trigger and sustain VC-SU co-evolution. This could be related to the importance of creating a critical mass within a short period as well as a good reputation from the beginning of the process in order to trigger or sustain, maybe through entry of other agents including strategic investors, a self-reinforcing process of emergence. An example was the new technological incubator program, which was added to Israel's existing grants to business sector R&D program, starting in 1991; a second example was significant reinforcement of the Grants to Business Sector R&D (from 136M$ in 1990 to 440M$ in 2000). Both contributed to the momentum of the VC*/EHTC emergence process, which took place between 1993-8. In addition, related institutional changes may have to be implemented in parallel to the VC/EHTC directed policies promoting emergence. A major issue when considering VC-related policies is whether there is a strong link between VC emergence and EHTC emergence as it supposedly existed in Israel and in Silicon Valley. Hence, the set of VC-related policies could include EHTC emergence policies, such as targeting of specific areas of technology or STE policies.

6. CONCLUSIONS

We present a new perspective to VC policy based on three novel components. These are a multidimensional view of VC, a SE perspective to VC policy and, as part of the latter, a 'strategic level' of policy whose main role is to identify (i) strategic priorities in VC/VC* and related EHTCs, and (ii) translating these into policy objectives and policy designs. VC is a *multidimensional concept*: it includes a pure 'pool of money' view, a view of VC organizations to manage this pool and a view of VC as an industry and/or a market. Each one of these is important for policy, especially for those countries that do not yet possess well functioning VC industries and/or markets, the

objective of policy could be to trigger and sustain a process of emergence of such entities (mostly viewed as a cumulative, autocatalytic process involving dynamic economies of scale).

The SE perspective to VC policy (broadly defined) emphasizes links at a moment of time and through time between VC and VC policy on the one hand, and EHTCs and EHTC policy on the other; and between these and other factors such as ITP. Thus, the Israeli and Silicon Valley example strongly suggests that VC and EHTC co-evolve during the emergence of both. Correspondingly, VC policies should be considered as part of both ITP and, contrary to some of the literature on clusters (Bresnahan et al 2001), policies promoting cluster dynamics and EHTC emergence.

A strategic level of policy is increasingly being recognized as a central component of policy making both in advanced and in industrializing economies. Its existence and functions follow from the SE perspective where radical uncertainty is assumed to prevail in many areas, with implications concerning the need to continuously adapt existing policies to the changing global (and frequently, domestic) environment. The main function of a strategic level of policy is 'knowledge creation', particularly with respect to the identification and specification of strategic priorities. Given the radical changes in the post 2000 environment, Europe's new VC and EHTC policies should largely be based on a new set of strategic priorities.

This framework of analysis fits both the Scottish & Israeli experience. It is consistent with the long period of 'preparation' in Israel prior to VC/EHTC emergence during 1993-2000. During this period, a wide range of pre-emergence conditions evolved some being the outcome of policies such as the horizontal and neutral support of business sector R&D; others the result of political changes and changes in global markets and technology. Moreover, successful emergence was the result of a targeted VC-directed program (Yozma, implemented during 1992\3-7) itself the outcome of a problem solving strategic process leading to a new vision of high tech and to a new strategic priority (promoting the creation and development of high tech SU components with VC as a private, domestic supporting structure). Some of the policies implemented in Scotland, on the other hand, could be associated with the generation of appropriate pre-emergence conditions where distinctive organizations like BAs play important roles and where a LP 'model' of VC organization does not seem to have been 'selected' by SCEn. The set of policies followed is consistent with a vision of emergence of a market for VC and a LS-oriented cluster, with the VC industry serving this market being divided into a local component and a UK one.

Our SE framework is also applicable to interpret the VC/VC* experience of several large European countries up to and including the 1990s, where Europe had only limited success. The 'positive' and 'normative' perspective which seemed to guide European policy makers at the time was based on (i) VC viewed essentially as a 'pool of money'; and (ii) a static framework of analysis focused on bridging or closing 'early phase finance gaps for innovative companies'. On the contrary, this paper's framework of analysis is explicitly dynamic; we propose that a novel policy objective could be triggering and sustaining emergence of a VC industry and/or market and of an associated EHTC.

Hence, the perspective enshrined in this paper is the result of a multidimensional view of VC - a pool of money, organizations managing this pool, and industry and/or market which could emerge - and of a dynamic, ILC Perspective to the evolution of this entity

that was originally developed to interpret Israel's experience of the 1990s (Avnimelech and Teubal 2006). It is also the result of integrating two other areas of analysis. First, the dynamics of EHTCs particularly those of the Silicon Valley type (Bresnahan et al 2001), where our contribution (also following Avnimelech and Teubal 2006, 2008a) is to focus on the co-evolution of such clusters and VC. Second, a dynamic view of innovation and VC policy whereby policy implemented at a certain point in time can create conditions for the subsequent development of other policies (Avnimelech and Teubal 2008b, Rosiello and Orsenigo 2008).

The outcome is that VC policies broadly defined depend on the phase of evolution of: (i) VC or VC-related innovation finance organizations; and (ii) of the demand' for such services by the SU segment, an industry or a cluster. They also depend on the institutional setting and on other country/region specific factors. Thus, while in some contexts/phases it would be worthwhile aiming at a VC market and/or industry, in others it may be critical to focus on pre-emergence conditions. These include stimulating innovation in firms, experimenting with new forms of innovation finance and intermediation, or strengthening the underlying STE infrastructure.

A central tenet and underpinning of this approach is that due to enhanced turbulence and radical uncertainty, increasingly the gradual setting of <u>new strategic priorities</u> in a knowledge and research intensive fashion and within a specialized institution or set of institutions will become critical and to some extent should precede the actual formulation and implementation of <u>new VC policies</u>. It is also clear to us that setting such priorities goes far beyond undertaking a technological forecasting exercise (although this could well be one component). Moreover, in order to effect this transition it could be, at least in some countries of Europe including Israel, to give a hard look at the adequacy or inadequacy of existing policy institutions and governance profiles in those areas relevant to venture capital and high tech clusters

While we do not aim to identify and formulate specific policies for any particular country or region, this paper has raised a number of specific issues. To begin with, due to the role of critical mass in enhancing a self-reinforcing emergence process, early emergence policy should usually support VC agents belonging to a relatively narrow category or type. However, variety within already established markets has a significant role in reducing risk, in increasing economic potential and in enhancing future development and renewal. Therefore, we suggest that after emergence has been achieved policy should enhance variety creation in the VC market (enhancing BAs, Corporate VC, and other types of VC agents). This recommendation certainly holds both for Scotland/UK and for Israel.

Secondly, one of the major reasons for VC policy failure in same European countries was the existence of a well-developed PE industry (oriented to late stages and non-technology companies). This not only created a very high alternative cost for professionals in this field and for investment in general. It also, for other reasons, may have indirectly or directly hindered creation of an early phase oriented VC industry (what we have termed VC*) especially if its routines and strategy become dominant in the early phase of development of VC if government funding was channeled to such institutions. A solution may be to create a fund-of-funds and/or to give incentives only to new VC companies not owned or related to existing PE companies (In Israel, a recognized 'Yozma fund' had to have an independent VC management

organization, although it still could have existing domestic financial institutions as limited partners).

Thirdly, our approach to ITP, VC, and startup-intensive cluster development is evolutionary and is based on horizontal support of commercial innovation at firms at the beginning and targeted policies eventually (Avnimelech and Teubal 2008a,b). In this respect, we should emphasis that targeted policies should be implemented during 'windows of opportunity' in the sense of existence of supportive external environment (such as technological revolutions and rapid economic growth) which could leverage domestic capabilities in a timely fashion. This is an additional complexity of targeted programs not found in the implementation of horizontal programs. It points out to the importance of enhanced policy capabilities including targeting and strategic capabilities.

Finally, policy makers should distinguish between policies aimed at creating a new VC industry and policies aimed at creating new VC markets. This may be critical when trying to develop a VC market in a region that is nearby another region with a strong VC industry (Beer-Sheva/Tel Aviv or Scotland/London). In cases of VC market creation, after creating suitable pre-conditions and creating strong reputation, the region can enjoy the services of the nearby VC industry (Beer-Sheva at the south of Israel does not need to create a separate VC industry, if it will create a competitive advantage in *cleantech* it may be attract VC investment from Tel-Aviv). In such cases after creation of pre-emergence conditions, a temporal increase in the pool of VC available in a specific region may attract investments, for example via enhanced reputation, from the neighboring VC industry.

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[i] Gompers and Lerner's (in their 1999 & 2004 volumes) approach is more than a simple 'VC as a pool of money' perspective (since it does explicitly consider the organizations dealing with VC) and less than 'VC as an industry and market that emerges' perspective.

[ii] Israel's Yozma program is a successful instance of 'Evolutionary Targeting' (Avnimelech and Teubal 2008b)

[iii] In practice, it may be possible that "emergence" will bring about a stronger division of labor among actors that specialize in a certain number of sectors/investment-types. Indeed, while LPs have probably become the most common organization archetype in the UK context, EDGE FUNDS, ANGELS, VC TRUSTS also play a very important role. The normative implication is that a different set of measures ought to be planned and implemented depending of the characteristics of the local financial community and business sector.

[iv] VC-directed policies should be distinguished from VC-related policies, with the former directed to VC and the latter to other functions or components of the innovation system. A successful VC policy will frequently require both types of policies; and there may be particular mixes between the two categories through time.

[v] Note that a VC policy objective of 'emergence of a VC industry and/or market' through triggering and sustaining a 'cumulative growth process with positive feedback' does seem to part of the post 2000 OECD VC policy vision (nor for that matter that of other countries of Europe). We come back to 'objectives of VC policies' (see Section 5)

[vi] A similar role was played by the Small Business Investment Companies in the 1960s and1970s in the US (see Gompers 1994)

[vii] The RVCFs main operational criteria are: (i) each fund operates within a regional boundary, (ii) fund managers manage funds on a purely commercial basis, (iii) fund managers make all investment decisions, including how the investment should be structured. RVCFs can invest up to £250,000 in equity or debt into early stage businesses or needing development capital either for an acquisition or for organic growth.

[viii] A market is defined by a product (including aspects of product bundling. dominant design and intermediation form); it requires a critical mass of demand and supply agents and of transactions; and it must be regulated by institutions e.g. concerning quality control, assuring information flow, and the provision of collective goods like standards (Antonelli and Teubal 2008b).