

# THE STRATEGIC ROLE OF INVESTORS IN FINANCING INNOVATION: THE APPROACHES OF VENTURE CAPITAL IN UK BIO-PHARMA SMEs

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## ABSTRACT

This paper elaborates on the existence of two different strategic approaches by VC investors: learning and shaping *versus* selection. These can be explained in terms of the preferences for scope or depth in knowledge search about investment opportunities. The choice has implications in terms of how the strategic approach to investment decisions is built. Learning intensity, diversity, and acquisitive effects are used to explain how dedicated (learning and shaping-based) and generalist (selection-based) investors differ, how knowledge accumulation is driven by networking efforts, and how the strategic approaches can be impacted by the sources and size of funds, investment horizon and timing, investment structure, preferred stage of investment, and preferred mode of exit. Finally, future research lines are suggested.

**Keywords:** Venture capital, investment strategic decisions, knowledge base, learning, selection, bio-pharma, science-based sectors

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## *1. Introduction*

External investors do not approach innovative companies or projects the same way they do with less uncertain, less risky, and shorter-termed ones. For these to be considered real investment opportunities, lots of committed effort, information analysis and tough decisions shall be made not only before, but also during and after the release of the first funds to support a venture (Bygrave, 1987; Sahlman, 1990; Zacharakis and Shepherd, 2007; Yang et al., 2009). This is why not many potential external investors are always ready to support innovation.

Actually, the financing of innovation significantly differs from the financing of other firm activities in a number of ways (Hall, 2010). In the case of bio-tech start-ups and SMEs, the differences regarding the funding of other firms (e.g., Westhead and Storey, 1997; Guiso, 1998; Giudici and Paleari, 2000; Grilli, 2005; Colombo and Grilli, 2007; Freel, 2007) imply that innovative companies seek venture capitalists (VCs) and business angels (BAs) at an early stage, when financial constraints are deeper; these companies also look for public sources that are considered important investors in the sector, whilst founders, family, friends, and fools (usually considered informal financiers) as well as banks are regarded as less important sources of funding than they are for other sectors (e.g., software) (Ullah et al., 2009; Haslam et al., 2011). That is consistent with evidence from Europe that private equity and VC investment volume in life sciences and bio-pharma remains relatively strong despite a small loss in volume, although it keeps focused on mature companies (Bertoni and Tykvova, 2012; Mina and Lahr, 2011).

Further confirmation that external new equity under the form of venture capital, sourced through public and private investors (VC funds and BAs), is possibly the most important source of funding for innovation preferred by the bio-pharmaceutical industry in the UK comes through the fact that the presence of these companies in the stock market is rather weak. Actually, only 41 companies have been listed at AIM since 2010 (LSE/AIM data) in comparison to 130 top investors in R&D reported by BIS (2010); this means that IPOs are not either a strong funding mechanism currently (Ernst and Young, 2013), so the spotlights move towards venture capital once again. The UK is actually a top five performer in Europe in terms of private equity and VC deals value relative to GDP (Mina and Lahr, 2011).

A further component of the explanation for VC to fund innovation in bio-pharma lies in the fact that economic theory has recognised the adequacy of VC mechanisms (e.g., screening,

coaching, monitoring, certificating) to deal with the asymmetry and agency problems associated to radical innovation (Gompers and Lerner, 2001). However, recent problems with exit channels (e.g., IPO costs) have created a bottleneck in the VC investing cycle, thus adding to the claim that “*the profitability of the venture capital model and its long-term sustainability have recently been called into question and seriously tested by the current financial crisis*” (Mina and Lahr, 2011).

This set of phenomena calls for an appropriate explanation on the strategic issues behind the phenomena of financing innovation in an important science-based sector such as the bio-pharmaceutical space. In short, the questions addressed in this paper are: *How do potential VC financiers of bio-pharma innovative companies in the UK build up their strategic approach to funding? Why do some investors prefer a diversified portfolio across sectors and others favour a specialised one?*

The questions raised are addressed via a sector case study-based qualitative approach where the relevant answers obtained through semi-structured interviews with twelve experts are incorporated into a narrative that motivates and illustrates the theoretical explanations built.

Essentially, the findings obtained point to the existence of two different approaches to the investment relation: one based on the use of specific objective criteria to select the best projects and another founded on incorporating knowledge about the projects by learning about their scientific background. Learning is deeply connected to networking and involves more often selecting and shaping than just screening projects.

On such a basis, a proposal is forwarded to explain the existence of two different types of investors in innovation that go beyond the traits of their strategies (selecting/coaching) and functions (screening/coaching/monitoring/certificating). Ultimately, generalist and dedicated investors do not only differ gradually in their strategic approach, but constitute two separate species of investors.

The paper is structured as follows: section two reviews the literature on the roles of venture capital in financing innovative ventures; section three explains the particulars of the methods used for the research and describes the empirical setting. Section four, then, presents the findings made on the basis of the views of the experts interviewed and section five discusses the main issues derived from the evidence and used to make a theoretical proposal on different strategic approaches to funding innovation and the consequent implications. Finally, section six highlights some possible interesting issues that need further study.

## 2. *The roles of venture capital: selection and coaching*

A noteworthy issue concerning investors, in general, and VC investors, in particular, regards the importance of the specificities of sectors such as bio-pharma in the design and implementation of the funders' strategic approach to financing a particular project/company<sup>2</sup>.

The existing literature essentially considers that, beyond supplying funds for projects, VC funders in general carry out two supplementary value-added functions: scouting and coaching. Scouting refers to "identifying future potential projects" through powerful screening capabilities (Chan, 1983; Amit et al., 1998; Gompers and Lerner, 2001; Knockaert, Clarisse, and Wright, 2010; Bertoni et al., 2011), whilst coaching may be identified with "helping realize that potential" (Gorman and Sahlman, 1989; MacMillan et al., 1989; Bygrave and Timmons, 1992; Sapienza, 1992; Barney and Busenitz, 1996; Sapienza et al., 1996; Kaplan and Strömberg, 2004; Bertoni et al., 2011).

Moreover, some authors consider that monitoring is another function commonly carried out by VCs. Monitoring regards "controlling to avoid moral hazard" or the wrong use of the funds provided (opportunistic behaviour) (Sahlman, 1990; Gompers, 1995; Lerner, 1995; Hellmann, 1998; Kaplan and Strömberg, 2003, 2004).

Also, the scouting and coaching roles seemingly imply another related outcome: certificating (signalling theory), which refers to "advertising" the good quality of a project/firm chosen by VCs so that any interested third party will be attracted by the opportunity to invest (Megginson and Weiss, 1991; Stuart et al., 1999) and to network (e.g., potential customers, suppliers, and alliance partners) (Colombo et al., 2006; Hsu, 2006; Lindsey, 2008).

More specifically, the scouting function refers to potential VC investors screening the projects and companies for certain characteristics to determine which ones offer the best investment opportunities. The methods to do such a selection are complex (Chan, 1983; Freeman and Soete, 1997; Amit et al., 1998; Zacharakis and Shephard, 2007), may imply diverse criteria, and do not exclude the use of intuition ("gut feeling") as a decision-making factor (Zacharakis and Shepherd, 2007; Yang et al., 2009). In some cases, CVC investment for instance, there is evidence that intensive investment experience (many operations), stage-diverse experience (investing in both early and late stage projects), and syndication

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<sup>2</sup> This dual reference will be used along the paper since in many cases, start-ups in science-based sectors in particular, companies are born and grow around a single research project (one-project portfolio) and only later become multi-project companies. In fact, often the original project entails the development over time of so-called technology platforms that broaden up the company's R&D portfolio and product catalogue.

(particularly with independent VCs) can effectively develop a stronger selection capability as long as uncertainty remains rather low (Yang et al., 2009).

Of course, the final decision takes into account a wider arrangement of relevant factors, but it may be strongly based on one type or set of relevant criteria. Thus, according to their dominant selection criteria, early stage investors in high tech sectors, for example, may be classified into: technology investors (decisions based on technology protection, investor-entrepreneur contact, uniqueness of product), people investors (decisions based on the entrepreneur's leadership and the quality of the team), and financial investors (decisions based on the potential return of projects) (Knockaert, Clarisse, and Wright, 2010). Late stage investors, instead, fit better the financial investors category led by factors such as lower risk (entailing lower return) and a shorter investment horizon (less distance to market).

The coaching function, on its side, generally involves providing selected companies assistance for better strategic decision-making and allowing them access to a wider network of business contacts (Gorman and Sahlman, 1989; MacMillan et al., 1989; Bygrave and Timmons, 1992; Sapienza, 1992; Barney and Busenitz, 1996; Sapienza et al., 1996; Hellmann and Puri, 2002; Kaplan and Strömberg, 2004). Some authors are even more specific at allocating the provision of strategic resources such as technological synergies and brand image to corporate venture capital, whilst helping to raise additional funding, recruiting key figures, and professionalising the company is attributed to independent (non corporate) venture capital (Maula and Murray, 2002; Ernst et al., 2005; Maula et al., 2005; Dushnitsky, 2006; Katila et al., 2008; Narayanan et al., 2009). Apparently, high tech sector companies are better at taking advantage of the opportunities offered by corporate VC coaching (Dushnitsky and Lenox, 2006).

Yet, all VC operators, regardless of their nature (private or public, corporate or independent, individuals or organisations), are supposed to fulfil these functions although probably to a different extent according to the case (Baum and Silverman, 2004; Engel and Keilbach, 2007; Colombo and Grilli, 2010). In fact, some authors remark that according to the circumstances, "*VCs are viewed as knowledge reservoirs, coaches or certification providers*" (see Rosiello and Parris, 2009). Also, some researchers do recognise that technology VC investors essentially differ from traditional investors in their greater investment management and consulting experience (although there is no difference in the likelihood of their receiving public funding) (Knockaert, Clarisse, and Lockett, 2010), and that those dissimilar

characteristics may be associated with different fund selection behaviour when it comes to deciding which technology-based firms to invest in (Knockaert, Clarisse, and Wright, 2010).

Although it seems clear that scouting and coaching are simultaneously present in every VC investor, some authors consider that it is relevant to understand which function prevails since it means achieving a better understanding of the mechanisms at work:

*“If the VC investment-startup performance relationship is driven by VCs' ability to identify particularly promising startups, then startup characteristics should affect VCs' decisions to invest in the same way that they affect startups' performance. If, however, the VC investment-startup performance relationship is driven by VC's ability to provide management expertise and network contacts to the startup, then startup characteristics that affect VCs' investment decisions need not affect startups' performance in the same way; they may be either unrelated to or diverge in their effects.”* (Baum and Silverman, 2004)

From a complementary perspective, untangling the functions of VC funders may also have important consequences as coaching may be desirable for individual firms but it may be *“socially inefficient, as private equity may not accrue to the companies capable of making the best use of it”*, while scouting may be better *“if the growth performance of a firm and its probability to receive venture capital are correlated with the same set of variables”* (Revest and Sapio, 2010).

Moreover, recent work in that sense suggests that the selection function prevails at least when it refers to VCs reacting positively *“to patents as signals of companies with potentially valuable products”*, while there seems to be no effect whatsoever of coaching on patenting performance; accordingly, the coaching function would help investees *“rationalize technology searches and to focus on the opportunities with the highest commercial potential”* (Mina and Lahr, 2013). This is a relevant issue because it goes beyond a matter of theoretical interest regarding (reverse) causality (i.e., does VC funding enhance the innovative performance of firms –measured in some cases as the number of patents granted to a company– or is it innovative performance that becomes a determinant of VC financing?) and it has serious implications for innovative firm management, for VC investment decision-making and implementation, and for policy makers that design interventions to support innovation.

Now, a somewhat different perspective on VCs' approaches to investment opportunities proposes that micro and macro risk can not only be controlled through traditional portfolio diversification techniques (usually based on the selection function) meant to spread unsystematic risk. In fact, correlation tests done on a sample of VC investors support the hypothesis that VCs can also control risk by specialising, rather than diversifying, their portfolio in order to take advantage of networks and information sharing, although the way it works is not clearly understood (Bygrave, 1987, 1988; Norton and Tenenbaum, 1993).

### 3. *Methods*

The nature of the complex initial interaction between the two sides (investors and investees) of the innovation financing relationship requires some deep insight that can only be guaranteed by immersing into the phenomenon and gaining knowledge from those that are familiar with the subtleties of the issues involved through their experience. Hence, a qualitative approach based on the case study of the sector of interest is the choice for this study.

It is deemed the most appropriate for three reasons: *i*) this subject cannot be undertaken on the basis of exclusively quantitative information as other studies suggest (e.g., Haslam et al., 2011); *ii*) a case study is suitable to the complexity of the topic that involves different actors, issues, factors, and subtleties regarding their interactions in a characteristic environment; studying the processes that underlie the strategic decisions that regard financing innovation is easier if done in a context where theoretical concepts, constructs and categories are neatly defined in relation to reality; *iii*) case studies also allow the flexibility required to continuously incorporate feedback into the theoretical analysis of the phenomenon studied and facilitate the iterative process of building up/enhancing explanations (Hakim, 1987; Eisendhardt and Graebner, 2007; Yin, 2009).

As such, this methodological approach is in line with the need expressed in the literature to accumulate case studies in order to understand: *i*) the way in which the financial strategy is linked to other strategic decisions made by those who control resource allocation within and outside a company; *ii*) the integration into organisations of the available capability mix embodied by people and the way in which learning processes are organised; *iii*) the supply-and-demand relations and interactions that shape strategic funding decisions regarding innovation (O'Sullivan, 1998; O'Brien, 2003; Casson et al., 2007; Atherton, 2009). Finally,

the sector-based case study is used to build theory, not to test it, in accordance with the principle that “*cases are selected because they are particularly suitable for illuminating and extending relationships and logic among constructs.*” (Eisenhardt and Graebner, 2007).

Thus, the case research is primarily supported by a series of semi-structured interviews conducted with eighteen experts that have played different roles as senior managers from different organisations of the UK bio-pharmaceutical sector (firms, universities, science parks) and highly experienced VC practitioners that have worked for a wide variety of VC organisations that fund bio-pharmaceutical innovation in the UK (Gap VC funds, Generalist VC funds, Dedicated VC Funds, market-making/advisory). Interviewees were selected on the basis of two criteria: i) experience in and knowledge related to UK bio-pharma, ii) holders of a senior position where they make decisions about funding projects and have a wider view regarding the whole sector and its sub-sectors.

The selection was done by initially cold contacting about one hundred experts known to be strongly linked to UK bio-pharma. Most of the contacts were made through e-mail messages and ensuing telephone calls (not always replied). Since cold contact with these persons is difficult due to the nature and restrictions of their positions, the acceptance rate is usually very low. However, at some point, when a first contact proved successful, the snowball technique was found very useful to contact other potential interviewees because of the tight networking existing among them.

They all have, then, relevant experience in the making of deals aimed at funding innovative projects in the bio-pharmaceutical sector and some of them have also been or are currently related to non-corporate organisations linked to the sector such as one of the largest associations in the biotech industry, a science park, and a university science hub an incubator (see Table 1).

Primary information is complemented with secondary data coming from the existing literature, particularly studies and reports on UK bio-pharma and about innovation financing. This permits the triangulation of information, the contrasting of perspectives and the integration of a rich perspective on the shades that characterise the experience of different actors in the sector.

The bio-pharmaceutical sector was chosen because it exhibits an amazing complexity related to the heterogeneity embodied by a multifaceted network of players (from universities and research centres, to a range of variously-sized companies, to a multiplicity of potential



financiers, regulation bodies and national/regional government agencies included), to the nature and development path of innovative projects, and to the assorted competitive and collaborative interactions framed in a particular setting with well-defined specificities (O'Brien, 2003; McKelvey et al., 2004 ; Rosiello and Parris, 2009; UnicornBiologics, 2010; Haslam et al., 2011).

Table 1 – Basic details of interviewees for the UK bio-pharma case

<i>INTERVIEWEE</i>	<i>RELEVANT EXPERIENCE</i>	<i>CURRENT ORGANISATION</i>	<i>PRESENT ROLE</i>
Expert 1	Over 30 years international experience in the pharmaceutical & chemical industries, including recent roles as a Chairman and CEO.	BP company	CEO
Expert 2	Experienced CEO with a number of BP big companies and SMEs in the UK, holds a non-executive post at an investment fund.	BP company	CEO
Expert 3	Senior scientific manager, entrepreneur and CEO (founder of university spinout based on his own research and IP) with over 10 years experience.	BP company	CSO
Expert 4	Experienced CEO and entrepreneur with over 20 years experience. Founder of three different companies.	BP company	CEO
Expert 5	Over 8 years experience in the biotech sector as company fund raiser and innovation manager for integrated solutions in stratified medicine by teams from Medical Technologies, Health Services, and Pharmaceutical and Biopharmaceutical Hubs.	University Stratified Medicine Hub	Innovation Manager
Expert 6	Over 3 years in Biotech Industry Association	Biotech Industry Association	Head of Public Affairs and Policy
Expert 7	8 years experience in roles facilitating biomedical companies access to market, money, skills and technology.	Science and Innovation Campus	Business Development Manager
Expert 8	Over 10 years in VC industry, different types of funds	Private generalist VC fund - National scope	Investment Director
Expert 9	Over 10 years in VC industry, different types of funds	Private generalist VC fund - Regional scope	Investment Director - Equity
Expert 10	Over 10 years in VC industry, different types of funds	Public specialised gap VC fund - Regional scope	Senior Investment Director
Expert 11	Over 6 years in VC industry, different types of funds – Advisor to would-be investees	Institutional Fund Raiser - National scope	Fund Founder, Fund Raiser and Advisor
Expert 12	Over 16 years in VC industry, different types of funds	Publicly quoted specialised VC fund - International scope	Healthcare Ventures Managing Director
Expert 13	Over 12 years in VC industry, different types of funds, companies and positions	Specialised VC fund – International scope	Investment Director
Expert 14	Over 25 years in VC industry and different types of bio-pharma companies and university	Specialised VC fund – International scope	Biotech Venture Partner

	positions		
Expert 15	Over 20 years in VC industry and different types of bio-pharma companies and university positions	Specialised VC fund – International scope	Senior Partner
Expert 16	Over 10 years in bio-pharma companies as entrepreneur and manager, and incubator consultant	BP company and Incubator	Manager, Incubator Consultant
Expert 17	Over 10 years in bio-pharma companies as entrepreneur and manager, and university positions	BP company	Managing Director
Expert 18	Over 10 years in VC funds and healthcare companies as technology investment and commercialisation director	Specialised VC fund – International scope	Life Sciences Business Development Director

Source: Author's own elaboration

The one-hour on average interviews were centred on the way in which contact among project owners and prospective external financiers are established and investment terms are negotiated. In some cases, follow-up communication over the e-mail was used to clarify or go deeper into issues of particular relevance that raised further questions from the researcher.

As a result of the semi-structured interviews, a corpus of testimonial data was obtained that ranges from detailed information about one specific investment case, to general appreciations on the historical evolution of the funding activity in the bio-pharmaceutical industry, to personal views about the prospective development of future investment in the sector of interest. For the specific goal of this paper, the data are incorporated into a narrative structured around the main topics that concern the exploratory attempt to enhance and enrich the explanation of the strategic role that investors play in the formation of ties and the provision of funding to support innovation with particular reference to UK bio-pharma.

*a. Empirical setting: A brief characterisation of UK bio-pharma*

The bio-pharmaceutical sector exhibits some very specific characteristics among the so-called high tech sectors: High level innovation (fundamentally uncertain and risky) is a common costly and long-term activity, heterogeneity in and interaction among firms, funders and other players create high complexity in funding decision-making, firm strategy regarding radical innovation appears highly complex and emergent (milestones are fundamental), funding mechanisms borrowed from other sectors (e.g., VC) are under growing criticism, reactions to a changing environment promise further transformations at a global level. Moreover, recent figures point towards some dynamic trends still under development: Worldwide, relatively

small biotech companies own more than seventy-five percent of the medicines in the development portfolio, while the large pharma share is just about thirteen percent, which means that the former companies hold around sixty percent of the estimated asset value, whilst the latter own no more than thirty percent. The global configuration of the sector indicates a clearly dominant position of the US, where more than half of the companies developing new medicines are located and nearly half of the assets under development are held, though the different areas (antibodies, recombinant proteins and peptides, therapeutic vaccines, prophylactic vaccines, gene/cell therapies) are more homogeneously distributed among the US, Europe and Asia (UnicornBiologics, 2010).

UK bio-pharma, in particular, is a highly competitive sector (see Rosiello and Parris, 2009) with a number of well-known, large, international players and other relatively smaller enterprises that invest heavily in R&D (approximately one hundred and thirty companies according to the 2010 Report by the Department for Business, Innovation and Skills). Though R&D activity is very significant in the UK bio-pharmaceutical sector, it is heterogeneously distributed since about ten percent of the world total number of biological medicines are developed by UK companies for a portfolio value equivalent to just over ten percent of the global value. That essentially means that, from a worldwide perspective, the UK biological medicines portfolio *“is second only to the US with respect to the percentage of total assets in development and the relative value of those assets at each stage ... [and] with regard to the number of assets in development”*, though the areas of development in the UK differ from those in continental Europe and the rest of the world (UnicornBiologics, 2010).

However, when location is taken into account, not more than six percent of the total number of assets in development are owned by UK biotech firms, which amounts to just four percent in asset value. Internally, and markedly different from the US and the EU cases, less than a quarter (23%) of the portfolio value is owned by biotechs and more than half of it (57%) belongs to large pharma companies (US: 26%; EU: 19%) (UnicornBiologics, 2010: pp. 2-3).

According to Haslam et al. (2011), the complex bio-pharma business model where so many multifaceted stakeholders are included (e.g., universities, medical research centres, charities, national and regional government, regulatory bodies and agencies, big pharmas and SMEs, business angels, venture capital and other investors) is *“a delicate balancing act between, on the one hand, progressing product along its development pipeline, and on the other, securing sufficient cash resources to finance this product development.”*

Of great concern, then, are two risky issues spotted by the analysts in relation to the current sectoral structure and activity in the UK (Rosiello and Parris, 2009; UnicornBiologics, 2010; Haslam et al., 2011): First, insufficient investment in biotechs (that usually possess early stage assets) and, second, a bias towards assets in late stage development (which also occurs in the US according to Hellmann and Puri, 2000)<sup>3</sup>. This might cause the UK portfolio to decrease significantly in the near future as long as the lower flow of assets in the development pipe will reduce its overall value over time. The final consequence may be only one, the down falling importance of UK bio-pharma as a global player.

The only way to avoid this potentially disastrous situation is to generate new R&D projects which means raising fresh funds to early stage research in biopharma SMEs in order to sustain the network within which companies, SMEs and start-ups in particular, operate since it *“is fragile and when financially distressed, the intangible asset base either corrodes or is lost.”* (Haslam et al., 2011: p. 5). This is a particularly pressing issue given the long-term orientation and the high costs of bio-pharmaceutical R&D<sup>4</sup> (DiMasi and Grabowski, 2007).

#### 4. Findings based on experts' views

Our main findings regard the following chief issues: *a)* Not all investors have similar strategic approaches to funding innovation in UK bio-pharma; *b)* Different approaches involve variations in networking, contact making, knowledge accumulation, and structuring of operation; *c)* Investors-related characteristics entail peculiarities in the strategic approach to funding innovation.

##### *a. Different strategic approaches*

One company manager specifically remarks that *“Some [investors] are specialist, some are non-specialists, and if they're specialists then clearly they have sectoral expertise.”* Such expertise about what is behind innovative projects in the sector is related to the knowledge about the science behind the sector and that is bound to happen mostly if an investor specialises in the sector, says one VC senior manager: *“If you are a brand name life sciences fund, you are going to have more than enough deal flow for the amount of deals you want to do. And that's sort of unsolicited.”* But, in the case of generalist funds, they *“are almost*

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<sup>3</sup> Such a fact is entirely consistent with the historical situation described by Oakey (2003) regarding the meagre funding available for SMEs, start-ups included, classified as new technologies-based firms (NTBFs) in the UK.

<sup>4</sup> Estimates from recent studies indicate that the total capitalised cost per approved new molecule produced in bio-pharma is close to USD 1,240 millions, not very far from the cost for pharmas (just over USD 1,300 millions) (DiMasi and Grabowski, 2007).

*averse to wanting to see bio-therapeutics type opportunities because the capital requirements and the time to exit are so long that it is not really a sensible place for those sorts of funds to invest. Consequently, they do not actively hunt for deals in this industry, although they can be approached by some companies.*” This statement clearly embodies the existence of a divergent strategy among investors in UK bio-pharma.

Apparently, an interest for specialisation leads to building up some knowledge about the sector, whilst a generalist approach prevents investors from getting into the deep details of sector-specific investment opportunities. Sometimes, in fact, the interest that leads investors to specialise may originate in the funding source itself and the very goal of setting up the VC fund, like in the case of the Gap VC fund. This is a fund whose investment capital was raised within a joint funding initiative between the European Commission and the European Investment Bank and is addressed at the biomedical area. *“A hundred percent of it [the funds] is to be invested in the North-West of England and half of it in the Merseyside area in companies established here or wanting to move into this geographic area”*, according to its manager.

*b. Variations in networking and knowledge accumulation*

Knowledge about the sector and its innovative projects is the reason why, according to another VC manager, *“if you are not a dedicated fund, exposure to life sciences would not tend to be in the full in therapeutics.”* A senior VC manager considers that the sector will always draw the investors’ attention (*“those that are geared up to invest”*) because *‘healthcare issues don’t go away’* but, because of its characteristics (particularly the long time scales), funds will have different approaches particularly concerning early or late stage issues and how much value they (investors) can add.

Finally, a senior VC manager brings into play the role of diversely sourced VC funds and remarks the importance of corporate and State sourced VC. In the first case, the manager describes some important modifications over time: *“The corporates have played a bigger role in investing in early stage, they’ve definitely moved downstream from simply wanting to pick up late stage clinical programmes; they’ve been involved in lot of the earlier syndicates and continue to support early stage companies. That’s positive.”* In the second place, he asserts, without government support it would be quite hard to try to take early stage life sciences UK businesses off the ground: *“The TSB has been an absolute life blood for an awful lot of life*

*science companies, and they've just crystallised the biomedical catalyst fund; so TSB money dedicated to this space, it's essential."*

The differences in investment strategy seem to be strongly rooted in the knowledge that can be amassed about the innovative activities of a sector. The funders are actually very careful with their money and they do a lot of due diligence before investing. A company manager explains how such specialised knowledge can be accessed: "[At] XXX Group, the funders that I know best, ... a lot of the investment managers are recent ex-scientists and they have an interesting model where they often... the investment manager in a particular project becomes part of the spinout company as the spinout company grows, so that they'll become CFO or COO or something like that; and that's the way that XXX Group turns its staff over and makes sure their knowledge is up to date. It's a good model for everybody."

Another firm manager pinpoints other complementary mechanisms meant to facilitate access to the specialised knowledge that stands behind investment decisions in UK bio-pharma: "The funding companies will also have their contacts in the academic setting either from people they are actually funding or people they have funded and they use those people as informal consultants; so I've been approached more than once to provide an opinion on a technology opportunity that a funding company has been given. So, we are talking sometimes about very large sums of money and the funders, however much the money they have got, they are not going to just take a risk."

The point is clear, even if the investors do not possess the knowledge necessary to understand the basics behind the project/company, they find ways to access and internalise such knowledge so their investment decisions are as solid as possible. The understanding concerning investment opportunities in the sector is that "10% of investments will lead to success and of those 10% that are successes 10%, so 1% of the initial group, will probably yield a high return twenty-fold on the investment and it's that twenty-fold of 1% that lets the VC companies make roughly a four-fold over what the investment cost across the whole portfolios, including the failed investments." So, although they accept that there is going to be some unavoidable technology failure, investors do need to make sure that they are identifying at least one successful company for every ten that they invest in. They do accept wastage, but they do have to also do due diligence.

And a very important aspect of the due diligence, at least in the case of specialised investors, regards setting up the appropriate mechanisms to gain the necessary knowledge. "The usual

*networking and business finding mechanism for dedicated funds includes attending and partnering conferences in the sector or visiting universities to scout for projects so to 'bias what sort of deal flow you get.'* A reason for generalist funds avoiding this strategy has to do with time and money costs” says a senior VC manager. The networking task is, then, a decisive component of the strategy of specialised investors in the sector.

Another VC manager recognises that specialised VCs take an active stand to identify and approach investment opportunities: *“Private equity practitioners will always be looking to go out direct. Probably not direct to the companies, but to their advisors and institutions around companies, places like incubators and such”* says he. VC practitioners take advantage of their prior experience and contacts; in fact, a final source of deal flow is the more established firm management they have worked for: *“That allows them to make a lot of networking with the non-executive directors’ community, former investees and the like.”*

But networking is in itself a complex operation given the heterogeneity of the actors that take part in the bio-pharma business sector. Beyond board members, says a senior VC manager:

*“Most opportunities are introduced by advisors, corporate financiers attached to accountancy firms. They mostly belong to small accountancy firms (below the tier of PWC, KPMG, Deloitte, E&Y) such as BDO or Baker Tilly that are big enough to justify their own one or two individuals-based corporate finance team. Corporate finance boutiques (also one or two individuals), that source their opportunities from pure accountancy companies which do not possess a corporate finance function but do have accountancy clients, also have a role in identifying potential businesses... There are also universities that have some sort of commercial arm that showcase bio-tech companies. Universities also have seed-funding capacity and they contact regional funding investors for rounds B and C, later, to look for co-investors. Also, because of the profile built by regional funds in the old days of public sector regional development agencies, some opportunities came in directly that way...”*

The importance of networking is proportional to the quality and importance of the knowledge it can bring into the investing organisations. In the case of dedicated funds, *“if you look at bio-science investment firms, a lot of the people have backgrounds in the life sciences; a lot of the partners at the dedicated firms have been chief execs of successful bio-tech companies or have had twenty years in AZ or whatever... running global R&D... so they intimately*

*understand it and they do know their peers and they have got a great network and that would be part of what differentiates it. This is the value they can add.*” And yet, it may be not enough. A big reason behind the networking strategy has to do with the fact that bio-pharma is such a broad field that *“even if you have a background in a given area in say, clinical developments or discovery research, you can’t be a master of everything that you need to know. You can go so far generically but these things are so specific that you still tend to need an expert... So it’s all credentials, it’s all networking...”* specifies a VC manager.

Funds that have decided not to concentrate their investment in bio-therapeutics, that is generalist funds, spend less time maintaining that sort of a network, which means less specialised knowledge about the sector is accessed and internalised. *“If all you are doing is life sciences, it is much easier to have a very productive network”*, concludes another VC practitioner.

He also remarks that networking to identify investment opportunities and internalise knowledge is based on confidence. This is ratified by all the company managers interviewed. Knowledge and trust involved in networks are a basic factor to manage risk. One of the VC managers puts it in simple terms: *“Working with credible people, people who have a demonstrable checked record, is the best way to mitigate risk. You can mitigate risk by recognizing it, identifying it, understanding how you are going to manage it... [and] credibility, the plan, you can use experts to review that. But we tend to start with two things, what’s the market opportunity and how good the people are, and manage down the risk.”*

*c. Investors’ characteristics impact strategic approach to funding innovation*

Five characteristics of VC operators seem to affect their investment strategic approach to the bio-pharmaceutical sector in the UK. Those factors are: source and size of investment funds, investment horizon and timing, investment structure, preferred stage for investment, preferred exit mode.

- *Investment sources* (private or public, companies, individuals or organisations) may direct and sometimes restrain investments (gap VC vs independent or corporate VC, for instance). In other cases, even in the absence of sources’ conditioning, the *size* of the funding available (the “pocket depth”) is a huge factor, particularly if the VC investor has to split its resources across a portfolio of different sector projects/firms (generalist investor risk diversification).



- The *time horizon and timing* for investment is a factor to take into account, as well. The investment horizons are usually determined by the sources of the funds or by the VC organisation management; these “time windows” are artificial in length as long as they are not necessarily based on the time framework of a specific project, firm or industry. Often, VCs want to recover their investment and the corresponding profit within a time span that is usually shorter than the time horizon necessary to fully develop bio-pharma projects. Thus, time horizon mismatches may also heavily condition investment decision making by VCs. This is related to the appropriate timing of investment entrance and exit; when is it the best time to enter and exit an investment opportunity does not depend only on the characteristics of the project/company or the wants of the investor, but a number of macro and micro contextual factors are also at play and may change the whole picture in a short time span.
- A third factor is *investment structure*. Co-investing, an increasingly important modality that involves a number of funders of a different nature (e.g., public and private, corporate and independent, VCs and BAs), may be a big factor when there is a wide range of investors’ objectives, time horizons, expectations, and “pocket depth”. In particular, BAs and VCs and publicly and privately sourced investments seem to present the higher variations concerning the bio-pharmaceutical sector and this may be a huge factor when follow on funding is necessary.
- Fourthly, the *preferred stage for investment* becomes a highly relevant factor. Not only because of the reported differences between early-stage and late-stage investment, but because “early-stage” may have different meanings, particularly in a sector such as bio-pharma. In fact, the literature usually considers “early-stage” any of the pre-market stages between pre-clinical and clinical trial 3 or even pre-registration (for formal approval); yet, some investors consider early stage the very inception stage when a discovery or innovative idea has just “come across the innovator’s mind”. Moreover, some VC investors seem to be growingly specialised in throwing money and advisory in at such an early stage in order to “crystallise” investment options more easily. Stage preferences are also connected to the timing of the investment.
- Finally, and often concurrently with the investment horizon, the *preferred exit mode* plays an important role in setting up the investor’s strategy. Although theoretically

there are several options, VC investors' exit in UK bio-pharma in particular are limited to corporate buy-outs and M&As, selling out to another independent investor, and less frequently to IPOs and management buy-ins. The exit mode is also usually conditioned by the investor's time horizon and the investment structure when a variety of other investors are present.

A particularly illustrative example is embodied by the gap VC fund fed with European funds and whose manager characterises as restrained in terms of the investment targets (particular sub-spaces within a given sector and geographic region in the UK, no one-project companies, and a particular background funding condition: projects/companies rejected by other investors), the investment horizon and, partially, the investment structure (restrictions placed around funding from State agencies) and preferred exit mode (only sales and acquisitions, no management buy-outs or IPOs). In this case, the complex conditionality imposed on the operation of the VC required a particularly tough networking effort to locate the potential fundees thus enhancing the character of the VC fund and its strategy. In fact, this type of fund is clearly the opposite of a generalist VC fund based on a sharp selection function and a risk-spreading portfolio strategy.

##### *5. Discussion and implications*

According to the evidence provided by bio-pharma experts interviewed, the VC funders of UK bio-pharma SMEs and start-ups belong into one of two categories: generalist and specialised. Generalist investors are broadly characterised as reactive funders and portfolio-based risk diversifiers; this is consistent with the prevalence of what some authors call the scouting/selection function (i.e., hand picking the best projects among those forwarded by different companies to build up a portfolio of innovative and non innovative companies from different sectors).

Specialised investors, on the contrary, are largely perceived as rather proactive and focused funders with a better knowledge of the bio-pharma space or some of its sub-spaces, which means that the coaching function may have the upper hand in this case (i.e., helping develop the potential of firms/projects by using their extended knowledge about the sector)<sup>5</sup>.

Accordingly, generalist VC investors seem to better fit the literature that sees funders in general, and VCs in particular, as actors that essentially assess projects "objectively", throw

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<sup>5</sup> There is no agreed set of parameters to classify investors into specialised and generalists. Norton and Tenenbaum (1993) used the under/over 50% of capital invested in seed financing (with lower diversification) as a pragmatic classification criteria for the purposes of their paper. Rosiello and Parris (2009), instead, consider that specialist investors concentrate 60% or more of their total portfolio investment in one sector firms (e.g., bio-pharma, IT, communications, media). This remains another topic for further discussion.

money into those deemed to be “the best”, may complementarily coach the investees, and crop returns, finally. Specialised investors, on their side, exhibit characteristics that do not seem to completely fit in the theoretical model described.

Thus, our findings regarding financing innovation in UK bio-pharma seem to initially confirm the sense and substance of the proposals that see a double strategic approach to VCs investing in science-based sectors: generalists and specialised investors (Bygrave, 1987, 1988; Norton and Tenenbaum, 1993).

But, is it just a matter of fitting descriptions and labels or does a deeper issue run beneath the discussion about the two functions or categories of VC funding? While there seems to be positive evidence about the fact that innovative performance proxied by application for patents by a firm (although not the number of patents granted) is a factor for VCs to select a firm for investment (Mina and Lahr, 2013), the coaching function is still present as it is consistently performed by VCs out there. Is it then an abnormality or a caprice of the innovation funding sphere? Is it wholly justifiable in terms of enhancing the strategic and operational conduct of firms even if no positive effect on innovation performance (patents obtained) is identified?

If all VCs perform both functions, but make their investment decisions based on their selection capabilities, then the coaching function might be seen as merely complementary and could even be discussed in terms of its need, cost and effectiveness. For instance, if all VC investors select the “best” projects, no error selection should take place and, consequently, most or all the projects chosen should be successful. But then, why are VCs ready to accept a high rate of failure? Why should a Gap VC, such as the one set up in the UK to fund innovative start-ups for a specific region and sector, be necessary? Also, why some projects that are initially rejected (meaning that they are not among the best), then become successful either by being funded and supported by a Gap VC or by a different funder that picks up the signal of the “certification” issued by the Gap VC or any other venture funder?

The prevalence of the VC selection function can help explain the preference for late-stage project funding among generalist investors. But then, what about early stage projects and firms or start-up organisations that have not applied for and much less obtained any patent yet? Should they be excluded by the selective investors or is there something else that may catch the eye so they are funded? Or is it maybe that, as Mina and Lahr (2013) propose, firms may disclose patenting activities only to what they consider serious prospective VC

investors? To try an answer to these and other questions related, we posit that instead of talking about the two functions already described, one should really talk about two different types of investors defined according to the distinctive strategies they design and implement.

We may depart from the general statement that while generalist investors predominantly select the companies/projects they are ready to fund from a wide range of late-stage varied-industry proposals submitted to their consideration, specialised (dedicated) investors essentially coach (seek and help shape) very early and early-stage one-industry proposals. What is behind this assertion?

When thinking of the information asymmetries (knowledge about the innovative projects) that characterise the relation between project owners and potential funders, two types of actions seem plausible to fill up the gap: either the project owners come forward and fully explain their projects (in the case they effectively need funding to develop it) or the potential funders try and find as much information as possible about those projects that may constitute fine investment opportunities, even if their owners do not submit them to be assessed and screened.

In the first case, there is a good chance that the existing literature on project internal selection within the firm and subsequent submitting for the consideration of external funders (Eckhardt et al., 2006; Hallen and Eisenhardt, 2012) –when necessary or preferred, according to the circumstances (Myers and Majluf, 1984; Saltari and Travaglini, 2001; Hogan and Hutson, 2005; Cassia and Minola, 2011; Nam, 2012)–, and the successive selection by external funders (VCs) according to specific criteria (Knockaert, Clarisse, and Wright, 2010; Bertoni et al., 2011) has built a rather complete and detailed picture. The second case, instead, seems to have been only partially explained by the literature that supports the coaching function.

In order to explain how the two distinctive strategies imply the co-existence of two types of investors, we start by re-defining two conceptual dimensions of search behaviour (Katila and Ahuja, 2002) in the framework of innovation financing. *Scope* can be defined as the degree of new knowledge about a number of sectors that are considered for potential investment opportunities; *depth* can be defined as the degree to which the search effort revisits existing knowledge and determines the need for further knowledge about a particular sector where likely investment opportunities are spotted.

In order to make investment decisions, investors may decide that they will engage into a search characterised by either a wider scope or a deeper reach. A *wider scope* may mean a

search about several sectors and firm/project stages, which may turn very useful if the investor wants to set up a diversified portfolio of projects/companies. A *deeper reach* may, instead, mean an intensive search about one particular sector and, possibly, one particular stage, which may be useful for an investor that wants to specialise.

*Networking effort enhances knowledge*

Now, how is knowledge accessed and gained? Mostly, it is the result of networking with varied and experienced figures in the space of interest. *Knowledge* about a space (e.g., biopharma) or sub-space (e.g., immunology) is then a function of the *networking effort* (strength and continuity of network enhancing) undertaken by an investor. Because search is costly, a sustained networking effort leading to enhancing the knowledge of a sub-space/sector (*learning*) is only compatible with specialisation. In other words, only investors that want to place most of their funds in a given sector will undertake seriously the costly effort of linking to a multitude of individual and organisational players that will bring expert insight about the science/technology and the trends in the sector of interest.

*Learning* can be here defined as acquiring knowledge from and about interactions within the networks and incorporating the knowledge present in the networks entered into. Such knowledge attainment is influenced by three dimensions present in the networking experience: Intensity, Diversity, and Acquisition. In fact, we can adapt and redefine Yang et al.'s (2009) constructs by incorporating into their three dimensions of experience accumulation the specificities of innovation financing strategies.

The *intensity* of networking (“*the number of instances of repetition in the learning-by-doing process*”) allows the VC to accumulate knowledge by evaluating the actions and outcomes, and by drawing generalisations concerning the causal relations between such actions and outcomes. Concerning innovation financing, intensity may refer both to the linking and interactions within certain networks, and to the volume of deal flow generated through networking.

*Diversity* (“*the extent to which experience is accumulated through the solution of a diverse range of problems associated with subjects of interest*”) also applies to both, the networking effort and the problems that concern each investment opportunity (project/company) given the huge variation involved by innovation.

Finally, the *acquisition effect* (“*the experience [and knowledge] borrowed from others*”) is verified through the successful networking effort (linking with all types of experts active in

the sector sub-spaces that are incorporated through the network). In the case of CVC, for instance, there is in fact a proper experience acquisition through the parent company's participation in the ownership of the innovative company (Yang et al., 2009). By contrast, such experience and knowledge will be "external" to investors that do not participate in networks.

Learning, of course, modifies the *investors' knowledge base*. That essentially comprises their financial technical knowledge, on the one hand, and their understanding of technological, market and product issues in the sector and the networks of experts and other investors with comparable interests, on the other hand. The knowledge base of the funders changes over time, just like that of innovative firms in any given sector (Malerba, 2002), because new information has to be incorporated as financial innovations arise, the science and technology behind the projects/products and markets evolve, and the structure and relations of the networks are modified.

In short, one could affirm that the higher the networking effort a VC realises, the more and better knowledge such player will build up because of the effects of greater intensity, diversity and acquisition effect. This mechanism helps explain the differences between generalist and dedicated (*not specialised*) investors and their distinctive "*selection*" vs "*learning and shaping*" approach.

#### *Generalist and dedicated investors*

*Generalist* investors favour a *scope approach* based on the consideration of investment opportunities from a wider variety of sectors and give preference to late-stage opportunities that involve less fundamental uncertainty even if the investment ticket is higher (to compensate for the greater information available and the lesser risk), and because exit from these sort of opportunities may mean higher profits as well since IPRs are already formally established. Generalist investors are not interested in high networking because they do not need/cannot afford a very deep knowledge of the science/technology behind the most innovative projects in a wide range of sectors; their strategy is based on the application of "objective" criteria to select rather "mature" (late stage) investment opportunities that will make part of a highly diversified portfolio across different sectors to spread risk. This also helps explain their reactive nature as investors since it will be highly difficult and costly to gather knowledge about a big number of sectors for projects; they simply prefer project

owners to submit them for consideration and screening, although an occasionally proactive search for a project is not rejected if previous links exist.

Of course, there is some degree of learning-by-doing present in this strategy that helps consolidate the selection function (similar to what Yang et al., 2009 find for CVCs), but the intensity and diversity of learning by investing in a highly diversified portfolio of late-stage opportunities offered by a wide variety of companies and sectors (*scope approach*) is not comparable to the characteristics of the learning process embodied by the alternative depth approach.

An issue of particular interest here regards the preferred stage for investment. In fact, evidence from our interviews diverges from Yang et al. (2009) who affirm that CVC programs are bound to invest in different stage companies so “... a CVC program may obtain the diversity of experience that can help it to formulate a complete picture of the portfolio company’s life cycle, leading to better judgments on investment decisions” (p. 265). This, however, might be the case only for CVCs and not for independent VCs as will be discussed later.

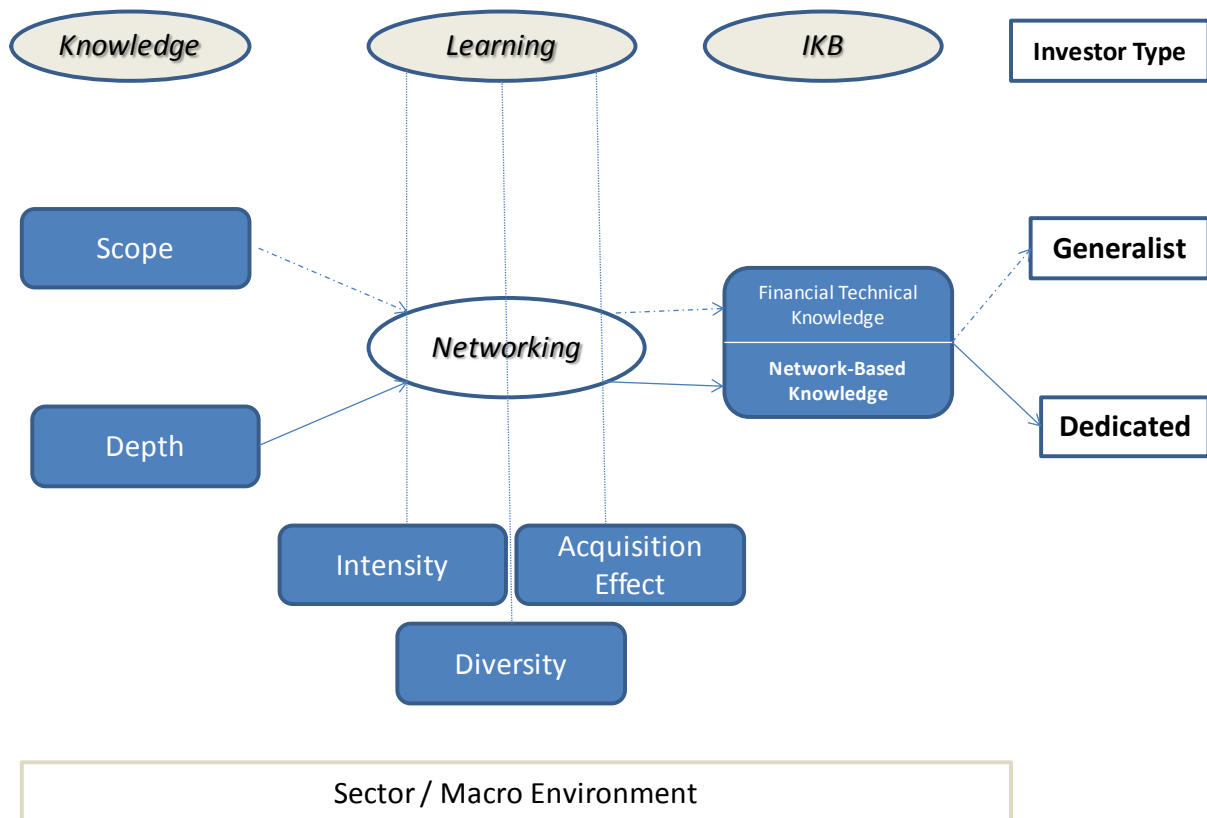
On the contrary, *dedicated* investors prefer a *depth approach* where consideration of investment opportunities is restricted to less sectors and concentrates in very early and early stage opportunities that entail more fundamental uncertainty and higher risk. This is because the investors’ deeper understanding of the knowledge base behind the technology of the projects/companies and the requirements to manage such projects more appropriately, based on their knowledge and experience and the additional network-based knowledge, allow them to build a better de-risking “methodology”. Such an approach has to do with helping the project owners shape the idea/project right since the beginning. This is entirely consistent with and explanatory of the evidence gathered by Norton and Tenenbaum’s (1993) regarding the fact that “[T]he high seed group [investing 50% of capital or more in this stage] is diversified across fewer industries and has investments in a smaller number of companies than the low seed group.” (pp 438-439)

This is because the intensity, diversity, and knowledge acquisition effect that characterise the networking effort undertaken by dedicated investors strengthen the knowledge base of such financiers regarding investment projects in specific spaces and sub-spaces (e.g., bio-pharma and immunology), thus enhancing the depth reach of the search for investment opportunities. So, selection and learning are not just two different strategies of investors. They beget two

entirely different types of investors that can operate in the same sectors, but target different types of projects and companies (Figure 1).

This can help explain why some UK bio-pharma independent VC financiers pick up their fundees among those firm investment proposals submitted to their attention by using specific “objective” criteria such as the application for patents (selection function) and prefer those that are closer to the market (late stage); they will still be able to offer some coaching regarding a better focus in the entrepreneurial process that will, for instance, avoid “*the dispersion of inventive efforts... and [to] focus on the opportunities with the highest commercial potential*” (Mina and Lahr, 2013).

Figure 1 – A model of knowledge base building for different investors



The continuous and discontinuous arrows mark two alternative paths for investors according to the way in which they build up and update their knowledge base (weakly or strongly linked to networking).

Source: Author’s own elaboration

Other investors, instead, put learning (building up knowledge) at the core of their strategy as a way to cope better with the salient features of BP innovation (fundamental uncertainty,



extremely high risk, information asymmetry, high intangibility and specificity of assets, longer time horizons, strong role of innovators). The learning function (different from the coaching function) is costly, so investors that have accumulated certain experience and information regarding companies and business areas, and are able to attain more through networking, will focus their efforts in those where they already have cost advantages over others.

Moreover, since innovative projects/programmes tend to be more affected by fundamental uncertainty regarding its potential outcomes at the very beginning of the research activity and such uncertainty diminishes as the project progresses and new information and knowledge are consolidated, an alternative way to de-risk the investment is to get involved earlier so that greater knowledge that facilitates better management is obtained and used. Consequently, it is not surprising that the traditional portfolio building techniques (used by generalist investors) need being re-considered, since “... *standard risk-adjustment methods will not work well... the variance of a portfolio constructed from such assets is unbounded so the usual diversification analysis does not apply*” to certain types of innovation, at least (Hall, 2010: p. 4).

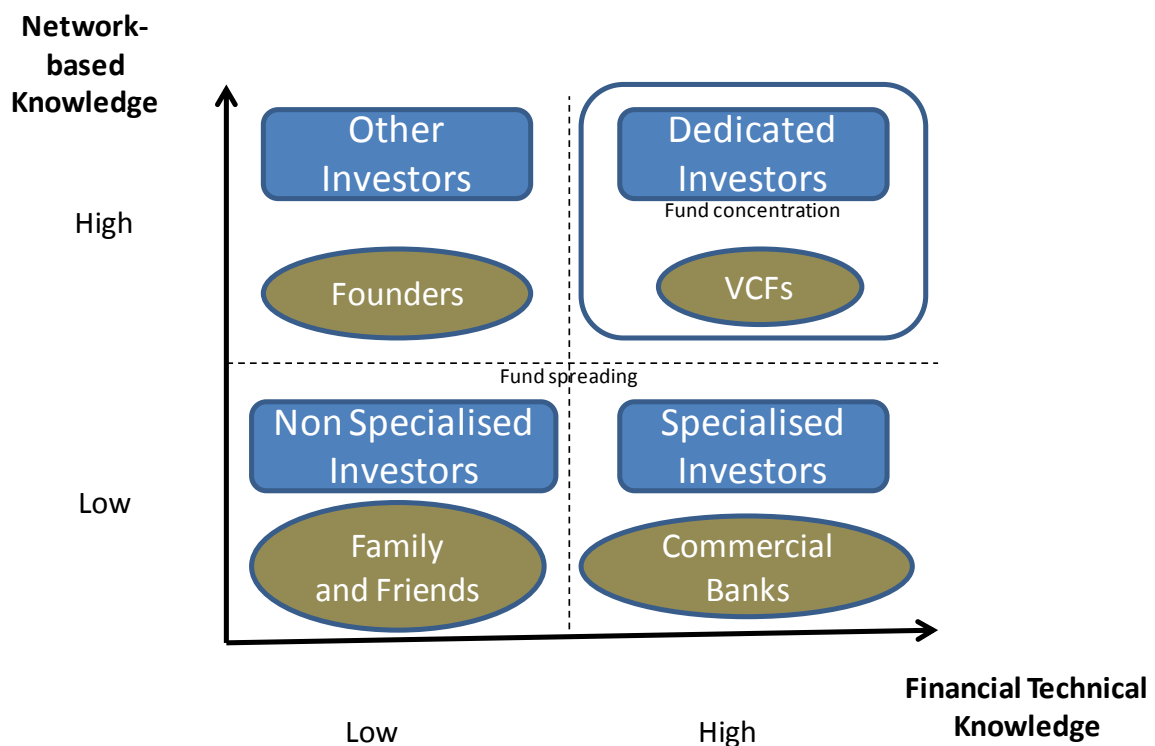
This is entirely consistent with Norton and Tenenbaum’s (1993) idea that “... *venture capitalists that invest in firms involving the greatest amounts of technical and product risk (presumably early stage financing deals) should be more specialized, should have a more narrow industry focus, and may be less diversified than those who finance later stage deals.*” (p. 435). Thus, fundamental uncertainty is still a driving force behind the decisions made by investors that tackle early stage ventures, as Yang et al. (2009) point out, and intuition has still a complementary role under such conditions; both, project owners and investors have to be permanently on alert to “*read the situation*” as best as they can, so their decisions are eventually as good as they can be. In this sense, the coaching function carried out by dedicated investors is broader than that developed by generalist investors.

We think the investors’ knowledge base concept can be used to help characterise the basic differences among investors and the possibilities of transformation over time. In fact, technical knowledge about the financial world tells specialised (high technical knowledge) from non-specialised investors (low technical knowledge). However, network-based knowledge (learning about the science/technology underlying sector-related projects) is needed to tell dedicated (high level of network-based knowledge) from generalist investors (low level of network-based knowledge) (See Figure 2).

The knowledge base structure of dedicated investors (top right quadrant) is complementarily characterised by a high concentration of funds in one particular sector (following the criteria proposed by Norton and Tenenbaum, 1993, and Rosiello and Parris, 2009), while generalist investors, that may be specialised or non-specialised (that is to say, the remaining three quadrants), spread their investments across different sectors.

An interesting issue here is that investors can move across the categories. Specialised investors can become dedicated investors and vice versa. Such a transition is based on the gradual increase/decrease of the learning processes and accumulated knowledge about a sector based on relevant networking and the concentration/de-concentration of investments. It may prove a bit more difficult, however, to go from ordinary to specialised investor (moving from the left side to the right side of the diagram) and much more difficult to turn an ordinary investor into a dedicated one because it implies two heavy undertakings: completely transforming the knowledge base (technical knowledge about finance and network-based knowledge about a sector) and focusing investments on a given sector.

Figure 2 – Investors’ knowledge base and funding categories



The structure of the knowledge base *plus* the concentration of investment funds in a given sector distinguish dedicated from generalist investors.

Source: Author’s own elaboration

Nonetheless, an interesting possibility concerns the top left quadrant. Investors who possess a high degree of sector knowledge based on experience and networking (such as scientific founders), can become dedicated investors with relative ease if they acquire the necessary financial technical knowledge and provided that they have “enough” funds to invest. Indeed, it is not unusual for a start-up to grow into an established company and then to set up a corporate venture capital fund to sponsor investment opportunities in its own or close sub-spaces. This all serves to remark the possibilities of evolution that are included in this explicative model of investment in innovation.

Finally, we draw attention to the fact that the learning-based depth approach of dedicated investors is also coherent with O’Sullivan’s claims that “... *there are no objective guidelines for making strategic decisions about the extent, direction and structure of the learning process nor for resolving disputes about the strategy for learning*” (1998: p. 185) when it comes to high level innovation. In fact, we consider that dedicated investors’ strategic decision-making can be labelled as “*learning-on-the-spot*” and is consistent with their involvement in very early stages of the projects/companies. Furthermore, such extremely early involvement of dedicated VC investors in order to learn, help shape and manage highly innovative projects/companies may also be considered an appropriate response to O’Sullivan’s allegation that decision-makers who shape the innovation process “... *require control of resources if they are to commit them to a developmental process in accordance with their evaluation of the problems and possibilities of alternative learning strategies.*” In fact, this “*build-the-path-as-you-go-forward*” method is imposed to innovation players by the constantly changing circumstances of the innovation environment.

In short, making decisions about investment in innovative companies, particularly in science-based sectors such as bio-pharma, involves some serious challenges. In the particular case of VCs, their knowledge base includes technical knowledge about finance and expertise regarding technologies, markets, and products, as well as networks that comprise experts and other investors with analogous interests. Yet, VC investors also usually face information overload in their attempt to fill up the information gap, high uncertainty regarding the successful outcome of the projects, unusual situations (e.g., about the project, the team, the macro environment), and time pressure related to the best timing for entering and exiting investment opportunities (Norton and Tenenbaum, 1993; Baron, 1998). This all is bound to affect their strategic approach to investing.

Essentially, what we posit here is that two VC investors may configure and use their knowledge base differently so not only their strategies will diverge but, in the end, they will belong to different categories of investors. Some authors contend that VC investors are bound to develop two different strategies: specialisation and diversification (Norton and Tenenbaum, 1993); such strategies, we propose, are related to other different characteristics and behaviours and give way to two types of investors: dedicated and generalist.

#### *Some further issues*

The ideas presented here about the diverging strategies and types of VC investors related to bio-pharma SMEs and start-ups in the UK entail two conceptual discussions of relevance.

In the first case, the diversification strategy adopted by generalist investors implies that diversity of stage-related investments should be a feature of the *scope approach* based on the selection of the best ventures across a wide number of industries. Moreover, this is consistent with the standard financial literature on risk diversification. Yet evidence indicates that generalist investors prefer late stage investment opportunities due to lesser uncertainty and risk, shorter time to exit, and closer distance to market. On the other side, although dedicated investors should specialise in one specific financing stage, we learn that they actually deal with more than one as they can be involved in ventures from the very early stage (project inception) to the latest stage (taking a new product to the market).

This can be explained by the conjunction of various elements described above. An adjusting time horizon and timing concept about a particular venture and a particular investment structure where “crystallisation” and follow on investment schemes are present along several funding rounds (Norton and Tenenbaum’s (1993) fourth hypothesis explicitly includes follow on investment) can help to elucidate this apparent conceptual contradiction.

In fact, an investor that helps shape the very business idea and accompanies the venture owners along the different stages (pre-clinical and clinical tests, pre-registration, registration and market development), due to timing and investment horizon considerations that give rise to follow on investment, may end up accumulating experience about more than one stage, thus adding diversity to the first-hand knowledge accrued.

A more difficult issue regards the tension created by the fact that *depth-based* investors (learning strategy) are active in a space (the very early/early stage) where the number of potential ventures is much bigger and entail the greatest uncertainty and risk because the attrition created by self-selection and external selection has not taken place yet. In fact, the

accumulation of experience and knowledge in such a case seems obviously more difficult and costly, which would strain the capabilities of dedicated investors to the limit. Maybe, the answer lies in understanding better the reach and power of networking and the type of knowledge it allows investors to incorporate.

Lastly, a number of implications are evident. Not any type of funder for any type of project seems to be the “rule of thumb” in the world of innovation, particularly in science-based sectors. Generalist and dedicated investor categories may mean a need for different approaches from innovators/innovative organisations instead of just “looking for anyone’s money.”

Also, co-investors may benefit from considering what type of partners is more convenient so co-investment structuring and follow on perspectives may be strengthened. Such beneficial analysis could spread into the combination of public and private funding initiatives for innovation, especially in some sub-spaces where speedy changes are taking place.

Policy makers interested in incentivising the development and availability of high risk finance to support sectoral innovation may also use this view to examine the best potential drivers and courses of action to increase investors’ interest and experience in such an activity.

## *6. Future research*

Several issues could follow from the discussion and proposal set up here. Co-investment among generalist and dedicated investors with a public or a private background is a topic that deserves great attention given the current trends. Clearly, it is not just a matter of discussing if there is any crowding-out or a certification effect, but an issue of how to articulate resources better to support an activity that is key for economic development.

Connectedly, a discussion on the role and importance of corporate and independent VC, and variants, as well as the growing role of charity funding in the bio-pharmaceutical sector (not to mention the exploration of new alternatives such as crowd funding) since these factors may alter even more profoundly the SSI configuration in the near future.

Also, the role of policy to strengthen the necessary type of investment according to the harsh circumstances that surround UK bio-pharma currently may be a topic to develop starting from this proposal.