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Access to external capital for techno start-ups: evidences from the UK

Abstract

How should new technology based firms (NTBFs) finance their business? Some high-tech entrepreneurs choose debt instead of equity in order to preserve their chance of high returns in the future, accepting the greater risks involved. However, some experts believe that the riskier the project, the more entrepreneurs should seek VC support. Our work attempts to answer this question and build a framework helping technology-based entrepreneurs match their business plans with the most appropriate financial strategy. We relate to the pecking order and financial rationing theories. Many attempts to understand them have been developed, but with dominant focus on investor's supply and their decisional criteria, and few determinants normally investigated at a time. Our approach is novel because it is firm centric and holistic, evaluating the relationship between firm's profile and the optimal investor. Through multiple in-depth case studies on UK NTBFs, and their critical discussion, we provide entrepreneurs with a robust assessment tool to navigate the complex scenario of financial alternatives available to NTBFs. The research investigates and discusses the role played in the fund raising process by entrepreneur's profile, technology, features of the business plan and market; it can also help investors understand entrepreneur's motivations and expectations. Our contribution is twofold: first, the model is made of reliable assessment criteria for complex and ambiguous dimensions such as technological risk and market focus; secondly, we develop a holistic approach with understanding of both the firm's and investor's points of view.

Keywords: NTBFs, entrepreneurship, banks, business angel, venture capital, pecking order theory.
JEL Classification: G30, G31, G32, M13, O30.

Introduction

Over the last few years, academics, policy makers and practitioners have become increasingly interested in the relationship between technology, entrepreneurship and finance. New technology based firms (NTBFs) have demonstrated dramatic success, especially at the very early stages, and contribute significantly to the economic environment, particularly the knowledge economy.

Western countries can beat the new challenges generated by low production cost countries only by fostering their comparative advantage through innovation. Audretsch (2004) identifies the 'commercialization of knowledge' – through Venture Capital (henceforth VC) and the creation of new firms – as one way to achieve this.

One of the most significant constraints new firms have to face is the lack of resources. It seems that NTBFs face a particular financial gap – the combination of high tech risk, information asymmetries and low collateral may worsen capital market imperfections (Carpenter and Petersen, 2002), creating a funding gap, with firms investing substantially less than they would if external funds (particularly debt) were a perfect substitute for internal finance.

Financial institutions are extremely challenged by intangible (or knowledge-based) asset evaluation. Typically start-ups lack history or any reputation, are generally perceived as extremely risky and show many managerial limitations. This creates a problem of opacity in the lending process, which often prevents both investors and NTBFs from developing their strategies effectively, if at all.

How should high-tech start-ups finance their business? Should they borrow from a bank or is it better to relinquish some equity to a venture capitalist to avoid saddling the new company with debt? Some high-tech entrepreneurs choose debt instead of equity in order to preserve their chance of high returns in the future, accepting the greater risks involved (Schäfer et al., 2004). However, some experts believe that the riskier the project, the more likely entrepreneurs are to seek VC support (Carpenter and Petersen, 2002).

Our work attempts to answer this question and help technology-based entrepreneurs match their business plans with the most appropriate financial strategy.

Our perspective is similar to Freel et al. (2006): academic literature and related policies recommendations have been mainly concerned with investor's availability and criteria. However, it is likely that patterns of venture capital usage (the same can be argued for debt) can be also explained by demand-side financial constraints in NTBFs, caused, for instance, by the reluctance of entrepreneurs – even those wishing to grow – to sell equity, but also by firm's strategies, resources, and competitive scenario.

As to the juxtaposition between debt and equity, there are plenty of (potential) entrepreneurs whose expected growth is not likely to require VC investment, but whose projects are worthy of financing (Cassar, 2004; and Huyghebaert and Van de

Gucht, 2007); indebtedness, may also have a positive effect on start-ups; as it may boost their performances in terms of value creation (Franck and Huyghebaert, 2007). On the other hand, many entrepreneurs may be VC worthy and but are unaware of the fact. Many of the pilot interviews we ran at the beginning of our research showed that promoting awareness among the entrepreneurial community of appropriate investors with the best match to different business opportunities, was regarded by business founders as very useful.

This work represents the second step of a broad research effort, whose first findings were presented, through a framework based on fuzzy logic in Minola and Giorgino (2008). Much improvement was needed to that first study, as concerns the theoretical approach and the model of analysis. In particular, the overlap and conflict between the entrepreneur's and investor's perspectives called for more rigorous investigation. In this paper we set the fuzzy implementation aside, as we're more concerned about the theoretical and methodological issues outlined above. Yet fuzzy logic and expert systems prove to be very useful and effective (Güllich, 1996; Bath and Weyer, 1996) as a tool used by financial institutions to score credit – or funding – worthiness of companies. Our purpose is to recover the functionality of expert system for a later stage of research, where some quantitative analysis may make the framework reliable and the prediction tool more effective in suggesting the 'best' financial strategy for an NTBF.

1. Literature review

Several literature streams analyze how investors could reduce informational problems in financing NTBFs, which are intrinsically disadvantaged in a classical risk-return paradigm. As entrepreneurs have information the investor lacks, asymmetries tend to be very high, so that ex ante evaluation and subsequent monitoring are difficult (Colombo and Grilli, 2003). Debt contracts, in particular, raise moral hazard issues: after the investment has been made, entrepreneurs' incentives can change and the bank can be damaged by the firm undertaking riskier projects (Myers, 1984). On the other hand, investors may run into adverse selection (Ackerlof, 1970). All these factors lead to a phenomenon that Stiglitz and Weiss (1981) identified as credit and equity rationing.

The most significant theory we rely on is the pecking order theory, which states that firms prioritize the source of financing from internal (cash flow or entrepreneur's own capital) to external, according to relative availability and (opportunity) cost. Support for this theory was recently provided by Cosh et al.

(2005), who find that the more that capital expenditure exceeds profits, the greater the likelihood a firm will apply for external finance.

From the empirical evidence that most NTBFs fail to obtain equity financing, Ueda (2004) builds a model that compares the likelihood of applying to banks rather than venture capitalists according to asymmetric information and intellectual property (IP) protection. Her assumption is that VCs can evaluate the risk and value of the project accurately, but can also expropriate the project from the entrepreneur. Her findings, in agreement with Audretsch and Lehmann (2003) and Gompers and Lerner (2001), suggest that little collateral, high growth, high risk, and high profitability, as well as stronger IP protection (she presents no evidence about high tech), lead to VC investment. In contrast, Berger and Udell (1998) observe that debt contracts provide 50% of external financing for the small firms sample (though not specifically NTBF) they analyze. Huyghebaert and Van de Gucht (2004) also argue that Belgian NTBFs in high-growth industries seek more borrowing. Åstebro (2002), analyzing US NTBFs, even says that of the few companies that asked for debt, the vast majority obtained it.

Cosh et al. (2005) focus simultaneously on credit and the equity market and their competition; they affirm that, while banks are likely to finance profitable business, VCs are more likely to finance innovative, risky and growth-oriented start-ups. Specifically, they note that rejection rates by banks tend to be higher for firms formed as pure start-ups. Huyghebaert and Van de Gucht (2004) determine that banks still finance NTBFs; but to avoid adverse selection, they may reduce the level of investment.

Schäfer et al. (2003) use project and financial dimensions to proxy the overall risk. They analyze the likelihood that NTBFs will obtain external financing, looking at size, assets, project and novelty. According to their findings, risk does not have a predictive power of the likelihood of a company receiving debt or equity.

Berger and Udell (1998) and Hogan and Hudson (2006 and 2007) suggest that different leverage may be optimal for firms at different stages of the so-called financial growth cycle paradigm; according to their model, differences in the relative relevance of information provided may be a justification for how NTBFs are funded.

Our analysis adopts a generalist approach, comparing debt and equity financing. The literature contains research on different forms of both. Huyghebaert and Van de Gucht (2004) suggest that leasing and trade credit may be used to replace bank contracts in case of adverse selection. Trade credit is

also found to be relevant by Berger and Udell (1998) (as suppliers may suffer less from information problems than lenders), though it's generally expensive. The same research provides a good analysis of VC and business angel financing, as do Mason and Stark (2002).

So how should high-tech start-ups finance their business? The literature shows the need for research to answer this question. Our research, like Huyghebaert and Van de Gucht (2004) and Cosh et al. (2005), examines several sources simultaneously. These authors represent a milestone in our theoretical formulation, although we take into account technological and innovation issues, as well.

A common critical issue is how a firm's and investors' priorities may differ. Even though we want to adopt the firm's point of view, our research also takes into account the vast literature stream investigating investor's evaluation criteria, which should be understood by the firm as relevant and a frequent constraint to its financial strategy (De Coster and Butler 2005; Davila et al., 2003; Muzyka et al., 1996; Shephered et al., 2000; and Sohn et al., 2007).

2. Theoretical approach

Our research focuses on the new tech venture process of seeking money: we seek to understand which factors influence it and how. What is the correlation between the main characteristics of a high tech venture and the kind of finance it attracts?

Our original contributions to the literature investigated so far, are:

 ◆ We adopt the entrepreneur's point of view, taking a holistic approach in evaluating the relationship between the firm's profile and the targeted investor (whereas normally single or specific dimensions are investigated in the literature).

 ◆ At the same time, we don't want to disregard investors' evaluation criteria, as they often act as significant constraints in the fundraising process. This simultaneous focus on different points of view, trying to identify critical and challenging issues, is novel in the literature, where the focus is normally on investors.

Another original aspect of our empirical research is that it is UK based and in particular Cambridge-based; some remarks may help understand the unique features of this context and justify the importance of studying it:

 ◆ The UK has the highest levels of both venture capital and business angel activity in Europe. It also has a relatively dense network of business incubators and other initiatives designed to promote the formation of early-stage growth businesses, especially those involved in innovative technology.

 ◆ The UK venture capital industry is mature by European standards, but differs significantly from the industry in the US. In 2004, the US National Venture Capital Association (NVCA) members raised an aggregate of £37bn ($68.4bn) of which £9.4bn ($17.3bn), i.e. 25%, was by venture capital funds, investing in businesses where the principal purpose is to fund market entry and business growth.

 ◆ The Cambridge Region is accepted as one of the world's leading high technology clusters.

 ◆ Cambridge is acknowledged as the European hot spot for technological entrepreneurship and innovation, with about 25% of UK and 8% of European VC investment. Library House, an intelligence broker, was a useful resource of information about the local as well as European VC industry.

 ◆ In Cambridge, banks are also involved in entrepreneurship fostering, being part of a broader distributed network of players which has proved to be very effective.

HSBC's experience of investing in NTBFs has been significant, both because of its effectiveness and of the theoretical background to HSBC's investment appraisal tool, i.e. the interesting model developed by De Coster and Butler (2005). Their methodology is based on a scoring system, the criteria of which are consistent with the literature analyzed earlier, and leads to an evaluation, although mainly in qualitative terms. Their assessment tool has been applied to over 400 business plans.

One of the main pieces of evidence suggested by HSBC's experience is that, despite many theoretical considerations, banks do lend to young, innovative, even technology-based companies. There are several explanations for this. One is the so-called 'funding escalator' approach, also called 'relationship lending' by Berger and Udell (1998).

Another significant justification is the 'soft start model' (Bullock, 1983), also mentioned by Connell (2006, p. 1): "A company whose funding comes mainly from R&D contracts is sometimes known as a 'soft' company. Its business may be based around the founders' scientific or engineering expertise or around a piece of proprietary technology with applications in different markets. 'Hard' companies, focused on the development of standard products, have less flexible strategies. They conform more to the Silicon Valley approach to venture capitalism."

Soft start firms require relatively low investment to get started and growth can often be achieved through internal finance. These features, combined

with modest rates of growth, make soft start firms of a low interest to VC investment. Software companies often show a good implementation of a soft start (Hogan and Hudson, 2006).

We now want to go some significant way along the field of entrepreneurial finance, to highlight the main dimensions of a firm's 'profile' that will identify such a pattern.

A huge stream of research focuses on entrepreneurs' and management's profile and skills, in terms of human capital (Audretsch and Lehmann, 2003), education and professional experience (Colombo and Grilli, 2003) or educational capability (Shephered et al., 2000). Battisti and Ganotakis (2007) argue that both educational and experience variables have a significant effect on the willingness and effectiveness of the entrepreneurial team to apply for external finance. In Muzyka et al. (1996) the human capital of the entrepreneurial team is found to be much more relevant than financial requirements. We don't limit our focus to skills, but also look at dynamic aspects, such as entrepreneurial orientation, willingness to disclose information about the business, control, and personal concerns in terms of career and reputation, as highlighted by Landier (2002). In Landier's model, entrepreneurs' exit options shape their bargaining with the investor, who – in a model of several infusions of capital – can deny further investment. We also intend to monitor the cohesion of the entrepreneurial team and the reason why the firm was established, which, according to Cosh et al. (2005), affects the likelihood that the money sought will be obtained.

The general quality of the entrepreneurial project is held as significant, even though ambiguous: expected profitability (IRR and payback time for the investor) attracts external investors (Muzyka et al., 1996) and strengthens the chance of obtaining funding, but fails to predict the likelihood that the firm will seek external finance (Cosh et al., 2005). As concerns expected growth, while Huyghebaert and Van de Gucht (2004) show the proportion of bank debt to be higher for Belgian NTBFs with larger expected growth, the work by Davila et al. (2003) sheds a new and different light. Their findings indicate that VCs seem not to consider expected growth as a consistent selection criterion but, at the same time, firms that receive equity show faster growth. We will also monitor whether or not a firm implemented a soft start model (Bullock, 1983) at the time money was sought.

Issues about timing often mitigate or strengthen the worth of start-up projects and the efficiency of financial contracting: according to Shepherd et al. (2000), timing affects the profitability of the business and De Coster and Butler (2005) hold timeliness as a relevant market criterion (i.e., if the market is ready for the product and vice versa). Finally, VCs are known to be more long-term investors than bankers.

Our approach also takes into account the technology and innovation features of the company: whereas Schäfer et al. (2003) and Audretsch (2000) indicate that a firm's innovativeness makes it more likely to obtain equity, De Coster and Butler (2005) argue that recently launched and innovative products (if combined with positive early reports from customers) are significant requirements for bank lending.

One of the major constraints for a start-up business is the absence of assets to be pledged as collateral. Investors, especially banks, often need collateral to reduce moral hazard in the relationship with the firm (Huyghebaert and Van de Gucht, 2004). In Berger and Udell (1998), the role of collateral explains the tremendous and surprising amount of external debt obtained by young firms; they also distinguish between inside (firm's) collateral, which is ambiguous in predicting the risk of the firm, and outside (from wealthy entrepreneurs) collateral, the availability of which acts as a strong indicator of the lower risk of the firm. Colombo and Grilli (2003) underline the value of personal wealth as a funding source but also as a signal for investors (especially banks) about the quality of the firm.

We will also monitor the role played by intangible assets (eventually pledged as innovative collateral) and government support initiatives to fill the funding gap, like the Small Firm Loan Guarantee (SFLG) scheme and grants. The SFLG covers 75 per cent of the lenders' exposure, with the borrower paying a two per cent premium to the government. The aim of the SFLG is to help viable, debt-appropriate businesses that lack sufficient collateral to access loan financing in the market. Nearly 6,000 loans (worth £400m) were made under SFLG in 2003/04 demonstrating the success of this partnership between government and the lending institutions.

The last dimension is the market. Many investors are disappointed by first-time entrepreneurs taking access to the market for granted; integration and understanding of the market are often crucial for success. Shepherd et al. (2000) say that the relative risk of the market (considering maturity and level of competition) strongly lowers the profitability assessment made by VCs, while according to Cosh et al. (2005), the level of competition (proxied by the proportion of larger competitors) lowers the likelihood of a firm's obtaining the amount of external capital sought. In Franck and Huyghebaert (2007),

the indebtedness is determined to have negative effect on NTBF performance when an industry is highly concentrated.

As control variables, we also investigate other aspects of start-up funding; firstly, we're concerned with how investors' qualities and skills are perceived by the firm. As Garmaise (2000) underlines, the traditional pecking order is reversed when investors' skills and value-added are relevant. We are interested in whether the acknowledged values or reputation of the investor may fill a gap in the firm's bid to be financed, or even change the financial terms of the contract (Hsu, 2004). Secondly, we take into account potential issues that may arise in the relationship between the firm and the investor and affect the ex-post perception of the worth of a given financial strategy (problems concerning timing, exit strategy, control, financial terms, etc.).

3. Research framework and methodology

In recent years, case study-based research has been very successful in the management sciences because phenomena can be studied within a real-life context, particularly useful when the borders between phenomenon and context are not very evident (Yin, 1994). Our empirical research was done through case studies in which we tried to take into account all the aspects of a funding process with lower effort, acknowledging that the larger the number of dimensions considered, the more rigorous the research.

Our approach has been descriptive and retrospective (in order to catch the instant of choice of a funding strategy, as a result of a past identifiable event).

We developed multiple case studies, based on seven companies (coherently with Eisenhardt, 1989), as represented in Table 1; the cases were chosen according to the theoretical replication principle (i.e., different results explained by governed differences), in order to strengthen the cause/effect relationship between the funding source (which was the only selection criterion) and its determinants. The unit of analysis is the firm as a whole at the precise moment of a fundraising process.

Table 1. Synthetic description of all cases

	Description of the NTBF	Source of £	Amount (k£)
1	Hardware and software platform for real-time location system	Angel(s)	2000
2	Semiconductor for high bandwidth wireless connectivity	VC	7000
3	Innovative projection systems	Angel	120
4	Mobile search engine platform	VC	5000
5	Inkjet hard coating	Bank	100
6	Software and consultancy in the field of affiliated marketing	Bank	130
7	Bio diesel from animal fat	Bank	100

A common criticism of this study might be the level of reliability in replicating investor's and/or entrepreneur's assessment criteria. By retrieving and extending some of the criteria presented by De Coster and Butler (2005), our framework has aimed to capture as much quantitative and objective information as possible. In running the case studies, we have monitored the variables for which no reliable quantitative proxy was found, trying to understand whether those dimensions were commonly and objectively rated by entrepreneur and investor, converging in an identical – although fuzzy – definition (we call these variables 'quasi-objective'). In depicting the framework in Figure 1, we anticipate the result of such an analysis, presenting the framework and classifying its variables as objective, quasi-objective and non-objective.

In Figure 1 we present the general framework developed for the study of the cases, and the cross comparison is presented. It is a holistic model meant to analyze each and every dimension of firm profile and to help understanding their impact on firm financial strategy. The dimensions have been selected and formalized with reference to the literature investigated, outlined in Sections 1 and 2 of the present research. It is the evolution of the one presented in Minola and Giorgino (2008). The structure is hierarchical, which indeed reflects the model origin, since the multi-layer aggregation is a core functionality of expert systems.

Multiple sources of information were used, in particular companies web sites and brochure, along with Library House Database; in each case we gathered information on the company, the product, the market, the investor and the entrepreneur before the interviews took place. Wherever possible we interviewed both the founder and the investor, with the aim of providing insight into different evaluation issues.

The interviews were developed through a very rigorous protocol, compiled by the interviewer, asking for mainly (but not only) quantitative information, which made the interview process easy and fluent and the discussion objective and reliable.

The protocol for the interview was built with the aim to provide reliable information and to capture those aspects of the cases which appeared more complex and fuzzy. A number of questions was prepared – some were derived from literature, others were prepared ad hoc – which helped the interviewer assessing and rating the fuzzy dimensions. As an example of this methodology we show in Table 2 the scoring set for the 'Competitive advantage' dimension, derived from De Coster and Butler (2005). The interviewee was asked 'How does it satisfy a sector of the market? How high is the competitive advantage?' and the set of answers was proposed. According to the closest statement, a score from 1 (lowest) to 10 (highest) was assigned by the interviewer.

Table 2. Competitive advantage rating tool

Answer	Score
No specific market sector has yet been identified	1
Preliminary investigations indicate that there is potential customer base but quantification is not yet possible	3
The market sector can be defined in general terms. There is limited feedback from customers, which is encouraging	5
There is a clear market demand and it is possible to demonstrate that some customers will be satisfied with the product (prototypes/test marketing)	7
There is a strong demand from a well-defined sector of the market. The product can be demonstrated to meet the requirements of customers fully	10

4. Case studies

Case 1 is a start-up that designs, develops, manufactures and sells a hardware and software platform that delivers a real-time location system, with customers from different sectors: logistics, retail, manufacturing, workplace, entertainment, military, healthcare and hazardous environments. The company has offices in the USA, Germany and Asia. In 2006 the company raised £2 million from a syndicated business angel deal.

The team's background was industry relevant and helped to attract informal investors, according to the CEO, who is a serial entrepreneur and business angel himself (one of his previous businesses was listed on Nasdaq and later acquired by a large corporation). He claimed the founder team's fear of failure was extremely low, even though the venture is still rather risky and not yet profitable. These factors, and his perception of VC strategies as too short-term for ambitious businesses, influenced his choice of informal investor. As a matter of fact, as the market could only be defined in general terms, with limited feedback from customers, investors in this company seem to have borne considerable risk.

This company represents a very good example of a soft start, having strong and constant revenues from consultancy and services, which also bring in new customers. This strategy seems to be particularly successful in stimulating demand from the market (the order backlog is currently worth several million pounds).

In conclusion, the entrepreneur was very happy with his financial sources: there were no issues to raise with investors and he felt that there was no funding gap for NTBFs. The company is looking to float shares on the stock exchange in the not-too-distant future.

Case 2 is a fabless semiconductor company developing single chip solutions for high bandwidth wireless connectivity based on ultra wideband (UWB) technologies. UWB enables data rich content to move securely over short or medium distances. The firm offers a range of complete UWB chipsets and reference designs, licensable IP, firmware and software. We focused on the company's fundraising in 2004, when the company raised £7m through a syndicated VC deal. The technology was attractive, but surprisingly over the years the company raised some £25 million, even though it was (and still is) precustomer and pre-revenue.

The CFO, who is one of the founders, said he appreciated the VCs' commercial experience and high risk tolerance, but that a lot of issues and concerns arose from the company's relationship with them; he also felt there was no funding gap and said that the company would be likely to look to exit through an IPO in late 2009 or early 2010.

The investor is a Cambridge-based VC. He said he appreciated the team's commercial skills and background (the founders came from another successful high tech start-up). Key criteria for the investment were a strong disclosure from the team, the firm's ambition and technological breakthrough, a good report from an early customer, extremely high expected growth and a favorable payback time. Sales readiness, patents as a unique form of protection, size of the deal and the founder's own co-invested capital were not found to be drivers at all. Finally, the investor seemed to have no perception of the critical issues pointed out by the entrepreneur and had a more modest and realistic view of the team's previous entrepreneurial success.

Case 3 is a university spin off (USO) developing innovative projection systems through a patented and performing technology, which obtained £120,000 from a business angel in 2005. One of the founders, a PhD student at that time, said he felt no personal risk, but this perception would have been enhanced by the company's being bank backed.
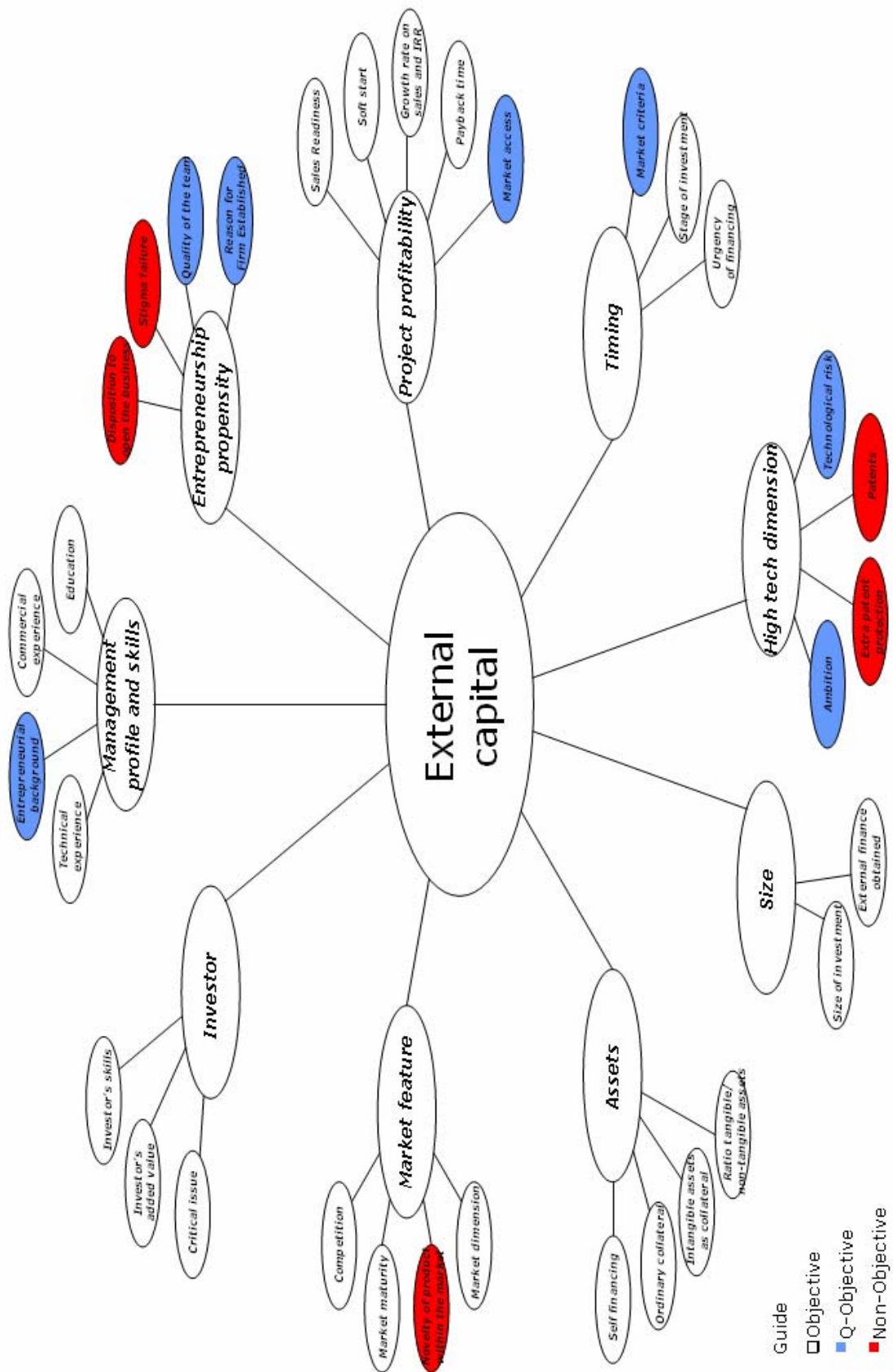
Fig. 1. The framework for the analysis

Interestingly, this company implemented a soft model, too, but its considerable expected growth and the amount of capital it required to grow quickly were not compatible with debt capital financing. The founder said that the market was not promising enough (in terms of focus and clearness) to seek VC finding, and was also too uncertain for a bank, but was the most consistent driver for seeking angel investment. The informal investor appreciated intangible assets, collaborated in the firm's development and was happy with the size of investment (a recent application for £0.5m had been refused by VC).

Surprisingly, the investor, a Cambridge-based business angel and serial entrepreneur, didn't consider anyone except the young founders in his evaluation, although an experienced manager was already on board at the time of the fundraising and contributed to the development of the company. The young team's evident gaps in managerial and commercial skills, and the fact that the technology was at an early stage – ambitious and not yet proven – were not barriers to investment. On the contrary, they made the company attractive, as it required the investor's direct and active involvement and corresponded to his investment strategy. He seemed to be mostly concerned about stigma of failure, and the entrepreneurs' personal ambition, control and wealth anxiety: he stated that a key criteria for every investment should be the extent to which people work for the company rather than for themselves. Finally, when a considerable problem arose around IP rights, it seemed the investor had a clearer perception of its relevance and risk than the founder team.

Case 4 is a mobile search company, due to launch its service by the end of the 2007, which recently (end of 2006) raised £5 million from VC. The founder is a serial entrepreneur who had had several previous deals with the same VC firm currently backing him.

The business model is far from a soft start. Both the entrepreneur and the investor agree that the targeted market is immature, but that it is going to grow dramatically, as the next evolution of the global communications scenario. However, they are still unsure about how and when this will happen. The entrepreneur sought VC investment because he considers VC investors more risk tolerant, more ambitious and more suitable for large amounts of investment. The VC firm selected was chosen on the basis of the specific commercial competences it could provide.

Both entrepreneur and investor agreed about the positive role of the entrepreneur's stigma of failure, which helped the business to be run more effectively, without impacting the need for or usefulness of investment.

Furthermore, the investor said that he trusted the entrepreneur, because of their long relationship, and had a strong preference for opportunity over need-driven entrepreneurship. He confirmed the company's ambitious market vision and added that his VC firm was not looking for good sales and revenues deals, but for a unique core service and good value proposition in a market worth £ billions.

Case 5 is a family business, driving the expansion of inkjet hard coating into targeted industry sectors, through a patented process. The company was founded in 1999 but the new business (based on licensing and development of the technology) and the fundraising are quite recent activities: the company received £100,000 as a bank loan in late 2006. The entrepreneur explained that the company had not been making enough money since 2001 (when the main patent was filed) because of the lack of sufficient funding to help it grow: he had problems with banks because of collateral. The firm was in the final of Library House – Running the Gauntlet 2006 (a competition that offers £1 million investment to East Anglia-based entrepreneurs) but was rejected because the Cambridge VC considered the business too capital intensive (the entrepreneur, who didn't agree, considered the competition a waste of time). The firm then also received £200,000 from an investor, but this was not enough, so the entrepreneur and his father had to put much of their own capital into the company in its first years. Regarding the access to debt capital, a key role was played by the Department of Trade and Industry's (DTI's) SFLG scheme, very useful to the entrepreneur, who was highly satisfied and would advise all entrepreneurs to use it. Sadly for him, the UK government changed the rules in 2006, preventing the company – because of its age – from using SFLG scheme further. He was forced to pledge some personal assets as collateral: despite this risk, he accepted this as part of the entrepreneurial challenge.

According to the entrepreneur, when asked directly, his motivation to open the business was high, but at the same time he proved to be very concerned about keeping control of the business. Market focusing and product readiness were quite good, unambiguously driving him to apply for debt. Patents were also robust, and core to the business, but he complained that banks didn't even look at them (in contrast, in Germany, a subsidiary of theirs obtained a bank loan simply on the basis of the exclusive licensing agreement). He felt the bank had no evaluation or general skills and did not provide any high-value service to the company, but his relationship with the bank manager was quite good.

Case 6 is a software and consultancy firm in the field of affiliated marketing which in 2006 applied to the technology program for a major UK bank. The fundraising process is projected to provide the company a £130,000 loan. In the meantime, the company has been forced to raise some equity (from an informal investor) due to the bank's slow response. Despite this, the company has increased sales from £170,000 to £500,000 in 2006.

The entrepreneur claimed no soft start was implemented, as the company chose to focus on the development of the new web application, although, in this case (as it often happens in the ICT), the borders between the soft and the hard start implementation were quite fuzzy.

The access to the SFLG scheme and the repayment capability strongly enabled the access to debt. The entrepreneur was motivated to maintain the control over the business.

Case 7 is a company producing bio diesel from animal fat, whose aim is to supply the oil distribution industry at a competitive price. The risk to the venture is not at technological or financial level: it is concerned with developing operational skills (i.e., reaching the proper dimensional scale and building an effective supply chain) and obtaining the necessary authorizations.

The company benefited from an EU grant to buy the equipment. This was pledged as collateral to access £100,000 in 2006. Previously, equity was offered to the firm by VC, angel and friends but was always declined, because the entrepreneur claimed he had enough expertise to run the business and was concerned about the control.

The business model was initially based on the naïve forecast that payments would be received in 7 days; however, in reality, customers take on average of 52 days. This generates a need for larger cash flow financing. To meet this challenge the bank provided both loan and overdraft, as well as invoice services. The company co-financed 25% of the project with early revenue from the stocks produced by the first pilot plant. The entrepreneur also pledged his own money and stated that self financing of the business was the most important factor enabling the company to obtain debt from the bank.

Surprisingly the entrepreneur was pleased with the level of bank's technological and industrial skills (although provided by consultants and professionals).

5. Cases discussion

Each single case study helped us to get a deep understanding of fundraising processes and correlated phenomena. Added value was also given by a cross-case comparison, we developed through the technique of 'pattern-matching'; we tried to report some simple evidence and to find explanations for some independent (profile of the firm) and dependent (financial choice and preferences) variables. We acknowledge that, given the small (but thoroughly investigated) sample, the validity of our findings has an analytic rather than a statistically generalizable meaning. Appendix presents a table to sum up the attributes of each start-up firm and discuss "cross-case comparison" of the key factors and key variables from both the firm's view and investor's view.

Common traits from the different cases were documented only when they emerged clearly and reliably, on the basis of the information collected. This was not possible for all of the variables considered.

Coherently with Battisti and Ganotakis (2007), in all equity financed companies, we found that the entrepreneurial background presents successful track records (see case 4), unlike the bank debt cases. This is explained in two ways: from the investor's point of view it seems that, whilst bankers are concerned with the financial track record of the company, VC and angels tend to look more at the entrepreneur's track record (Sohn et al., 2007). From the recipient's point of view, the cases show that previous entrepreneurial activities help the team establishing networking and relationships with investors, and this seems to enhance fundraising capability (Muzyka et al., 1996). Unique exception is case 3, where the founding team was composed by young PhD students, as discussed and explained in Section 4.

Other common features that differentiate the companies who obtained equity from those who were debt financed, are: companies that began with teams, instead of single entrepreneur, founding teams including serial entrepreneurs and higher levels of education (PhD and MBA).

In every case the entrepreneurs claimed that a willingness to disclose information about the business was high, but when we consider the willingness to relinquish (part of) the control of the business, the segmentation between companies raising debt (very low) and others (very high) is quite consistent. Surprisingly the entrepreneurs' 'stigma of failure' fails to show a consistent pattern in all the cases.

Both angel- and debt-backed companies in our sample show good implementation of the soft start (this initial observation seems to be consistent with Connell (2006), who states that VC may be relatively less interesting to soft companies). Debt financed businesses also unambiguously differ from angel funded firms as, at the time of fundraising, sales readiness was high thus generating shorter repayment time to the investors.

All the companies we studied shared a typical high-tech profile: technological risk, level of ambition, relevance of patent and high intangible-to-tangible assets ratios in all of the entrepreneurs' self-assessments and investors' judgements.

Our model takes into account a series of factors – some of which are also represented in Appendix – such as technological risk, quality and quantity of patents and market features (in terms of clear focus, time accordance with product development and estimated value), obtained through quantitative data and objective scoring. According to these dimensions, our limited sample suggests the following clustering of firms: higher technology risk was common in VC-backed firms, while angel-backed companies exhibited in less focused and more risky market positions, and debt-backed companies are identified by less ambitious technology and more established markets (with reduced expected growth).

Some unique features of the bank financed companies are: entrepreneurs' self financing and (tangible) collateral were always involved and strongly required by the banks, investors had less evaluation and operational skills (interestingly outsourced to third parties as universities and consultants) and did not provide added-value services.

The size of the investment seems, in the sample considered, to have the highest predictive power: larger amounts of money are more likely to be funded by Venture Capitalists or Business Angels; smaller amounts by a bank loan.

By analyzing companies on the basis of the holistic framework presented in Figure 1, we were also concerned about understanding, for each investigated dimension, different evaluation issues and perspective between start-up founders and investors.

By relying only on consistent patterns emerging from the cross-cases analysis, we have classified the variables in the framework across those affecting entrepreneur's choices, affecting investor's decisions, affecting both and those which, although revealing common patterns among the seven companies, were apparently considered neither by the former, nor by the latter ('latent' concerns). In Figure 2 we draw this preliminary conclusion; variables excluded from all the previous categories are found not to show a consistent pattern among the case studies, and are thus called 'ambiguous' dimensions.

It is quite clear from the literature on entrepreneurship (see Stam and Garnsey, 2007) that determinant analysis should be separately presented at both personal and firm levels. In Figure 2 we also take this into account, by illustrating to which of the two levels each variable of the framework belongs.

Conclusion

As only a small minority of proposals are suitable for classic venture capital investment, further training is required to enable bankers to understand technology and the changing needs of the businesses involved in it. The European high tech ecosystem would also benefit from further development of the business angel sector.

In this scenario, we have seen that the way NTBFs access financial resources is a crucial point; through seven case studies that examine how Cambridge based NTBF raised funds from different investors, we moved a step towards an assessment of debt versus equity orientation, and proposed a dynamic approach that allows us to characterize appropriate financial strategies.

On the basis of the data collection and analysis process, as well as interviewees' comments, the indications are that the model of analysis proposed in Minola and Giorgino (2008) may be comprehensive. Some improvements were also made to the model for the purposes of analysis; some new aspects have also been taken into account: the implementation of a soft start, the level of ambition, the market description (focus and timeliness) and the use of the number of competitors as a proxy for the market competition. Some light has been shed on the possibility of clustering the decisional criteria.

To capture fuzzy and complex dimensions we used scoring tools derived from our previous research and from literature; they proved to be quite robust and understandable by interviewees, thus representing a significant contribution to existing knowledge.

A limitation of our research is the lack of performance measurement in the fundraising process, reflecting the optimality of the financial decision. The research indicates that the fundraising process, as a whole, involves relevant aspects at the individual or firm level, or both. Behavioral science argues that non-financial rewards act as significant motivators for entrepreneurs; thus at the individual level, as in Moore and Garnsey (2003) and Garnsey (1998), derived by Penrose (1959), stakeholder's expectation alignment may be introduced as a measure of optimality. At the firm level it could be controlled by traditional performance measures, as suggested by Davila et al. (2003) or, as suggested by Pavlov et al. (2004), flexibility in choice of financing arrangements, which may represent the most important driver for optimality in SMEs financial strategy.

The value of this research effort consists in having built a framework containing relevant attributes of an NTBF raising funds. Each of them could be more deeply operationalized and tested on a larger and statistically significant sample.
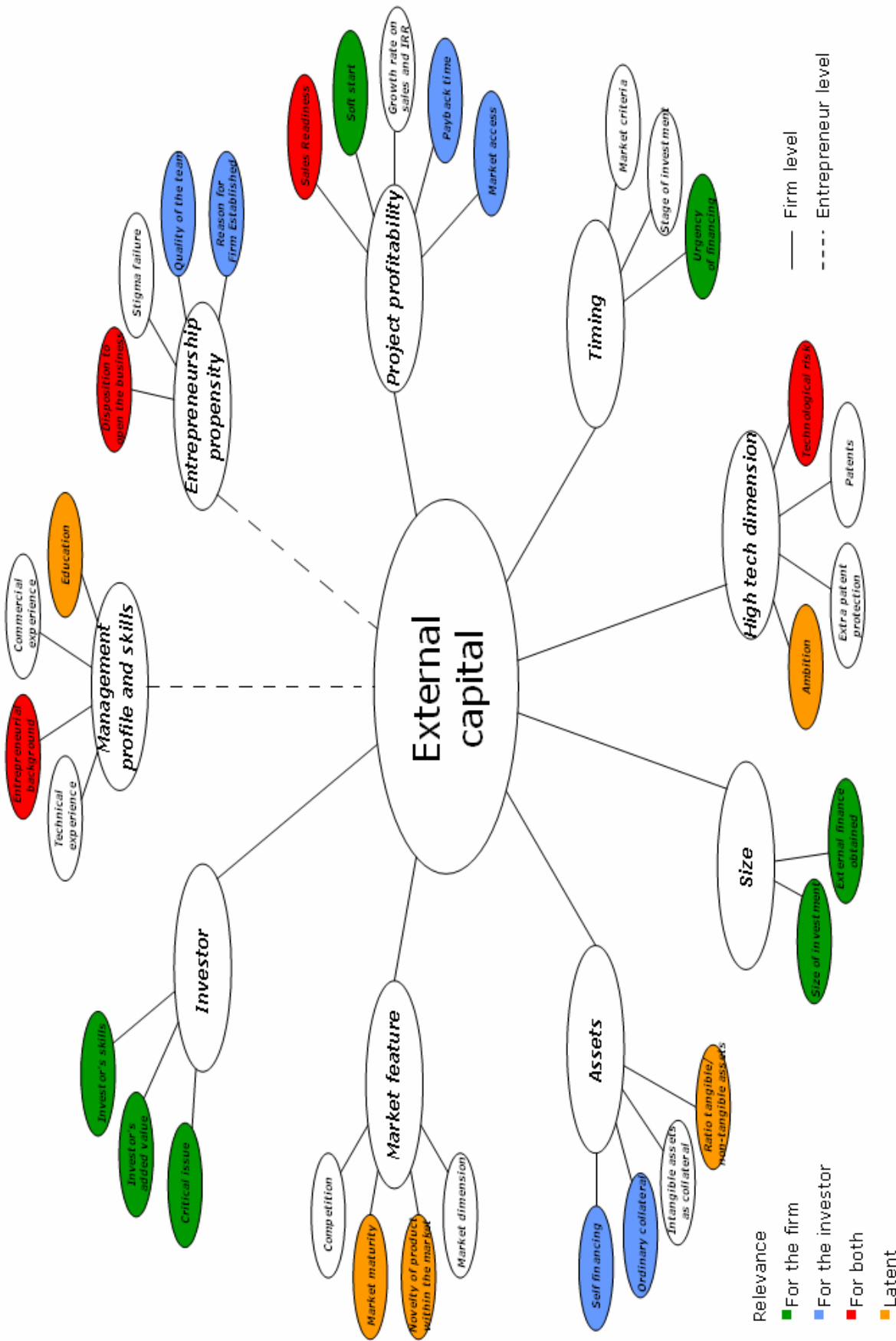
Fig. 2. Perspectives overlapping and conflicts in the fundraising process

We focus on the case of UK, which may not be the same as the case in the US or other developed countries. A limitation of the present work may be the relatively small sample considered and perhaps its UK- and Cambridge-related bias (although we do not offer conclusions that are environmentally dependent). It will be interesting to extend future analysis on a broader geographical focus, in order to evaluate whether our findings are consistent with the financing of high-tech start-ups with existing literature for the case of other countries. We expect such analysis to show on a national level, that the model proposed has a different capacity to explain the problem in different countries, given different combination of legal, institutional, traditional, economical, geographical and entrepreneurial characteristics that are peculiar to a nation or European region.

Precise mixtures of debt and equity financing appropriate for a business depend on a number of factors, many of which will be individual to that business. Implication of this research is that equity is a more appropriate financing option where a business has a long product development phase but is then anticipating high growth. In many other situations bank financing may be an underutilized path to funding NTBFs and should therefore be researched further. In particular the cases seem to recommend the SFLG usage, which could be enhanced by spread of knowledge among entrepreneurs and rules simplification.

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Appendix

Table 3. Cross cases comparison. Panel A. Dimension investigated

Dimension investigated	Measure	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Source of £		Angel(s)	VC	Angel	VC	Bank	Bank	Bank
Amount (k£)		2000	7000	120	5000	100	130	100
Technical experience	years	20+	20+	10	10+	20+	5	15
Entrepreneurial background	*	7,5	7	3,5	9	4,5	1	6
Commercial experience	years	20+	10+	5	25+	30+	5	5
Education	Title	PhD	MBA	PhD+MBA	MBA	MSc	None	MSc

Table 3 (cont.). Cross cases comparison

Dimension investigated	measure	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Cohesion of the entrepreneurial team		Good	Pretty good	Good	Good	Good		
Reason for firm established		Self-employment	Self-employmen	IP to exploit	Self-employmen	IP to exploit	IP to exploit	Boredom & Philantropy
Sales readiness/Assured cash flow		High	Low	Low	Low	High	High	Pretty high
Level of "Soft Start" implementation		High	Low	High	Low	High	Low	
Competitive advantage	*	5	4,5	4	5,5	7	7	7,5
Market criteria – timeliness	*	3,5	/	1	1	6,5	7	9
Stage of investment		Start up	Start up	Early stage	Early stage	Expansion	Expansion	Start up
Urgency of financing	months	7,5	3,5	2	12	3	3	3
Technological content	*	7	3	3,5	3	5	2,5	3
Patents	*	8	4	4,5	5	7	/	/
Ambition	*	7	8	8	8			
Size of investment	'000 £	1000	8000	300	5000	150	130	250
External finance obtained (totally)	'000 £	2000	14000	120	5000	100	130	300
Self financing		Yes	No	No	Yes	Yes	Yes	Yes
Larger competitors		0	2	4	10	20	7	5
Total competitors		0	5	5	15	20	7	5

Panel B. Entrepreneur's priorities of the sources of £ (from 1 to 7)

Entrepreneur's priorities of the sources of £ (from 1 to 7)	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Long/short-term debt				4	1	1	7
Short-term debt					5	2	1
Leasing contracts				5	3		7
Trade credit	2			6	2	1	4
Factoring	2			7	4		1
Private equity / VC	7	1	2	1	7	4	7
CVC (Corporate VC)	4	2	3	3		4	7
Business angel	1	3	1	2	6	4	7

Panel C. Entrepreneur's evaluation of investor's skills

Entrepreneur's evaluation of investor's skills	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Evaluation skills	Very good	Very good	Very good	Very good	None	Very good	Good
Hands-on contribution	Very good	Very good	Very good	Very good	None	None	None
Added value services	Good	Poor	Good	Good	None	None	None
Critical issues in the relationship with the investor	None	Many	Some	Few	None	None	Many

Notes: ☐ – relevant to the entrepreneur for the eventual decision to accept the investment; ☐ – relevant to the investor for the eventual decision to invest; ▩ – relevant to both; * – Likert Scale (from 1 to 10) as explained in Table 2.