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Start-up finance

The role of Micro Funds in the financing of new technology-based firms

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Executive Summary

Micro Funds are increasingly prominent players in the early stage equity investment environment, a prominence reflecting increasing government sponsorship. This research seeks to characterise the Micro Fund investment experience for both fund and portfolio firms by addressing the following research questions:

1. What is the Micro Fund investment model?
2. What has been the experience of the new technology-based firms?
3. What role does Micro Fund investing play in their financial pathways and why?
4. Is government sponsorship of these funds a suitable method of new technology-based firm support?

Below we summarise the results of our research and our policy recommendations. Whilst the development of precise policy instruments was beyond the scope of this study, we identify below what those instruments should be designed to achieve.

Definition of Micro Funds

Micro Funds are small venture capital funds worth £30 million in total or less, investing less than £2 million in total (including follow-up investments) into each of their portfolio companies.

Micro Funds are defined principally by their size, but they also typically have two other characteristics. First, a proportion of the fund comes from a government source. Second, they specialise in early stage investing, as a function of both their size and government sponsorship.

The early stage equity environment

The UK early stage equity environment has changed significantly in the past decade. The early stage equity environment was a challenging place even before the current economic crisis.

The public sector has become responsible for a greater proportion of Micro Fund sponsorship, and private sector investors are now responsible for proportionately less early stage financing. Private 'specialist' early stage funds make up the bulk of remaining private

fund activity. They are larger than Micro Funds (and can manage funds totalling up to £100 million) and make larger individual investments in their portfolio firms (£7-£10 million per round).

The early stage market is therefore segmented into two groups: the very early stage and lower capital intensive; and the more developed and higher capital intensive deals. However it is not always easy to categorise individual firms in the same manner.

Development of New Technology-Based Firms

New Technology-Based Firms (NTBFs) play an important role in the continuing prosperity of the UK economy. These firms seek to turn technological innovations into commercial products or processes. A high level of uncertainty is attached to these firms; the technology is usually unproven and their market and customers unidentified. External risk capital investment is therefore a critical source of funding.

The high levels of uncertainty make the early stage new technology firms extremely risky investments. A small number of firms develop in a linear manner: they progress straightforwardly from early technological development, prototyping, market development and eventually customers and sales. Most have a more complex and interactive development path, where technical difficulties and issues with market entry force constant re-workings of their business plans and models.

But the haphazard nature of their technology development neither means they are not good investment opportunities nor that their entrepreneurs lack appropriate experience. Each type of firm presents a distinct set of challenges.

Returns to Micro Funds

This research shows that Micro Funds invest in financing these complex technology firms. Our research suggests that the financial returns for supporting these firms do not appear to be on track to meet the commercial expectations of investors in the light of the higher risk of this form of investment. However, in the absence of a complete picture for the first generation of funds (including the three case study funds in this research) it is not yet possible fully to assess total returns to the funds.

In sponsoring early stage funds government is seeking to encourage other activities beyond financial returns. It is also interested in non-financial results or 'spillovers' including the regional stimulation of pre-commercial investment activity in new technology, the development of serial entrepreneurs, the formation of business angel networks, the support for a new generation of fund managers and the provision of start-up business experience to entrepreneurs and managers. Over time and through networks, these types of activity support the development of innovative communities.

These other objectives have been partially captured in the funds' mandates through investment objectives and restrictions in terms of geography, technology, size of investment and co-investment requirements.

The production of these additional benefits is an important potential contribution of Micro Funds, and these spillovers may occur independently of the financial success or failure of individual firms. Indeed, while the majority of financial returns to funds will come from

a small number of their very successful portfolio firms, these non-financial returns are distributed more widely.

Yet there is no clear definition or explicit expectation of these non-financial returns. Nor is there any mechanism to assess how different funds perform with respect to these activities. Public fund remuneration policy is also not aligned with the achievement of these non-financial returns. As a result, the 'spillover' experience of these Micro Fund-managed firms and the wider communities that surrounded them varies widely.

1. Evergreen funds operate over much longer time limits. Returns to evergreen funds are re-invested providing a continuous source of capital available for investment in new firms or current portfolio firms. Investment trusts operate as listed companies and invest in shares of unquoted firms. As a listed company, the investment trust model allows individual investors to enter and exit the trust at varying points of time via the sale of their shares.

Recommendation 1: Where government seeks non-financial returns in addition to financial returns it should explicitly acknowledge them by:

- Evaluating both financial and non-financial returns generated by these policies that support the early stage development of technology businesses.
- Recognising the consequences for the Micro Funds' financial returns of the restrictions imposed on funds by their mandates.
- Augmenting the mechanisms for risk reduction (e.g. government first loss) and enhanced prospective private returns (e.g. government returns capped) in order to incentivise private investors into these funds.

The experience of Micro Funds

This research highlights a widespread sentiment of conflicting objectives between success for Micro Funds and the support and development of sustainable technology-based businesses. The success of the former does not guarantee the achievement of the latter. In fact, these two objectives are often incompatible. Micro Fund portfolio firms with the greatest potential for commercial success often require significant levels of follow-on investment that dilutes the return to the Micro Funds. On the other hand, those portfolio firms with lower, or slower, success remain in the portfolio.

Through the fund analysis presented in this report and discussions with Micro Fund managers, three factors have emerged as significantly constraining:

- Fund time limits and their effects on investment activity.
- Fund selection and remuneration.
- Fund size.

Our analysis therefore suggests a need to refine the Micro Fund model. This research explores the three factors above and provides some recommendations. There is also a genuine feeling that government support could be bolder, and that the Micro Fund model provides an opportunity to break from the confines of the established venture capital model.

Broader changes to the Micro Fund model to maximize both commercial and non-commercial returns should be investigated.

2. Fund of Funds model sees the fund invest in other investment funds. The Fund of Funds builds a portfolio of other investment funds (in early stage firms in this case) rather than portfolio firms.

Recommendation 2: Evolution of the Micro Fund model

- The defined 10-year Limited Partnership model may be too short to allow the adequate development of new technology-based firms, so alternatives including evergreen funds,¹ and early stage investment trusts should be investigated.
- Where government seeks non-financial and financial returns from their sponsorship of Micro Funds it should consider fund managers' ability to achieve both of these in the fund selection process and fund remuneration structure.
- To allow for follow-on investing in successful Micro Fund portfolio firms government should be prepared to fund larger, possibly national, funds (possibly within a fund of funds model).² The aim should be to provide access to finance for these technology firms in their early stages of growth, beyond the capacity (e.g. time and size restrictions) of Micro Funds – thus providing an alternative to those trade sales that might prejudice the portfolio firm's development and growth.

The role of business angels

Business angels play a significant role in financing new technology-based firms. In this research, business angels were usually the largest private sector investors. Business angels demonstrated that they can and do follow on their investments.

The current credit crisis is having a dramatic effect on the participation of business angels in funding these firms. Angels already receive significant encouragement to participate in the early stage environment from government, largely through tax concessions. However, further government support directed at encouraging and supporting angel 'community' activity may be necessary to ensure that these valuable investors continue to invest at an early stage. Knowledge sharing between angels has the potential to unlock further angel activity.

Recommendation 3: Continued support for the co-investment model should:

- Recognise the important role business angels play in providing a commercial filter to co-investment partners and business support to early stage firms.
- Consider mechanisms supporting angel groups that allow them to share knowledge among themselves, specifically mechanisms that encourage increased deal screening and syndication.

Joined-up policy environment

Government's sponsorship of Micro Funds is just one example of policy support for innovative businesses and the development of the UK's knowledge base.

The 'Innovation Nation' White Paper highlights access to finance as a critical area of its support for business innovation. The paper notes government's intention to 'build an escalator of financial support for innovative businesses at different stages of their growth' (DIUS, 2008, p.37).

An 'escalator of financial support' is an apt metaphor. New technology-based firms need different kinds of support depending on their stage of development and a continuity of that support through the stages. Different policy tools need to be available at each stage but they need to be part of an overarching strategy, which must be communicated effectively. Care should also be taken in developing the long term nature of this overarching strategy, to ensure that whilst individual policies may evolve in line with evaluation, the overall objectives remain stable.

Recommendation 4: A holistic approach to government policy for the development of new technology-based firms should integrate policy for:

- Public procurement based innovation contracts.
- Government-backed lending.
- Grants for business.
- Public and private early stage investment.
- Policies promoting business angel groups.

It may be too much to expect a holistic policy for the creation and growth support of new technology-based firms, but at least measures should be taken to ensure that the above policies work in harmony and are applied at the appropriate stages of firm development. For example, a decision to expand public procurement support for innovation along the lines of the SBIR programme in the US would have implications for each of the other areas.

Continuing research into Micro Funds

This research has shown that Micro Funds are important financiers and incubators of new technology-based firms.

The importance of Micro Funds to these firms, and to the vitality of the UK's knowledge economy, will ensure that this remains an area of continuing research interest. The current financial crisis only brings funding new technology firms into sharper relief.

If we are going to turn to innovation and new technology-based firms as one of the sources of growth to pull the UK economy through recession (Leadbeater and Meadway 2008) we must recognise that funding the incubation period of these firms will be much more challenging and require a more imaginative and supportive approach from government.

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1. Introduction

Micro Funds, although not new in the equity investment environment, are becoming a prominent investor in new technology-based firms (NTBFs). This prominence is due to increasing levels of government sponsorship of these funds. This research analyses and characterise Micro Fund investing.

Specifically, the research addressed the following questions:

1. What is the Micro Fund investment model?
2. What has been the experience of the firms?
3. What role does Micro Fund investing play in their financial pathways and why?
4. Is government sponsorship of these funds a suitable method of NTBF support?

1.1 The role of Micro Funds in financing new technology-based firms

A recent study by NESTA (Pierrakis and Mason 2008) reveals how three important developments have changed the nature of the UK's early stage venture capital market since 2000.

- Private sector investors are now responsible for proportionately less investment, although they are still prominently involved, while the public sector has become proportionately more significant.
- The composition of early stage private investors has changed. There has been a shift from funds to private individuals, including business angels. This includes 'mega angels' investing alone, angel syndicates and other forms of organised angel investing.
- The public sector increasingly invests with a private partner. Such co-investments are becoming more common than free-standing investments.

This study examines the role of small early stage venture capital funds known as Micro Funds. Micro Funds are playing an increasing role along with business angels in early stage investment as a result of increased government support.

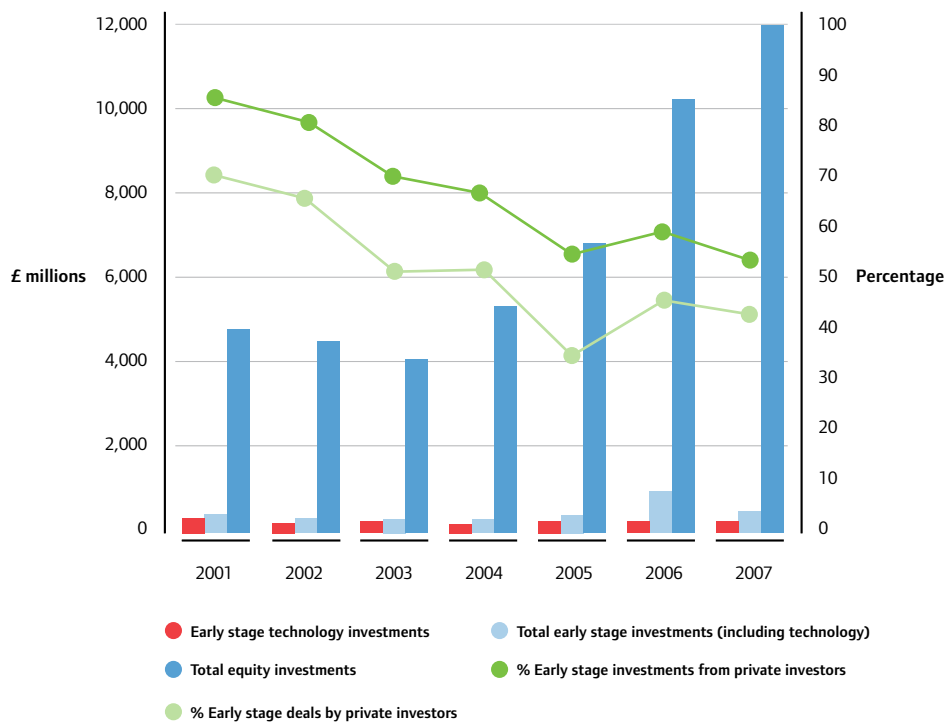
1.1.1 Definition of Micro Funds

Micro Funds are defined as small venture capital funds that are managing funds totalling £30 million or less. The funds are typically making total investments (including follow-on investments) of less than £2 million in individual portfolio companies.

Micro Funds are principally defined by their size. However they also have two other common characteristics.

- Usually a proportion of the fund comes from a government source (UK or EU).
- They specialise in early stage investing – by function of their size and/or their government sponsorship.

Figure 1: Early stage investment activity



3. Break down of private investment activity from Pierrakis and Mason (2008) using Library House database. The definition of early stage is firms in product development, fundraised 1, 2 or 3 rounds, round sizes under £2m.

4. This tendency is further magnified by these larger funds' ability to further increase in size through the provision of debt finance.

Source: Pierrakis and Mason (2008)³ and BVCA (2008)

1.2 Structural changes in the early stage venture capital market

The entrance of the public sector into the venture capital market corresponds with the relative decline of private institutional funds. In 2007 public sector funds accounted for 43 per cent of the early stage market compared with 18 per cent in 2000 (Pierrakis and Mason 2008). Business angels have doubled their share of the proportion of private investment from 15 per cent in 2000 to 30 per cent in 2007. The share of private investment of total early stage funding is shown in Figure 1.

Private institutional investors are responding to market factors in their lack of activity at the early stage, lower in 2007 than a decade earlier. Two factors can be readily identified.

- Successful fund managers are able to raise progressively larger funds from investors.⁴ The relatively fixed costs associated with due diligence and deal negotiation and the relatively modest capital demands at the early stage compared with later stages, inevitably leading to a concentration on larger and later stage deals.
- More importantly, the poor investment returns of early stage investments over the past twenty years, relative to risk, are compounded by the ability of fund managers to select 'successful' funds for investment, and further complicated by the long timescales involved and the high (and indeterminate) levels of risk.

This lack of interest in early stage investment is rational from a commercial perspective. This is evident in the relatively low and stable amounts of investments that have been invested at the early stage (shown in Figure 1). These early stage amounts are dwarfed by the larger activity in the private equity and later stage venture capital market.

5. Plastic Logic, a Cambridge-based start-up, has received in excess of £100 million in venture capital investment since its foundation in 2000. Just over £10 million was received in the company's first two years. The company is still completing product development.

6. This is the definition used by the US Department of Commerce Advisory Committee on Measuring Innovation in the 21st Century Economy.

7. The term 'incubation' is used in this report to mean maintaining a technology in an environment that is favourable to its continuing development. This should be seen as separate to 'business incubators', which are mainly physical buildings that provide business support.

Nevertheless, private institutional funds will still invest in the early stage. Early stage specialist private funds range in size from £30 million to £100 million. These funds typically invest larger amounts per round (£7-£10 million) and look at firms where they can expect a return within the fund's lifetime.⁵ This can also be seen in Figure 1 through the faster declining percentage of deals from private investors compared with overall private investment.

There is therefore a clear distinction between early stage Micro Funds and other specialist early stage funds. Both are investing in pre-revenue firms in the first round but the size of the fund and the presence of other investment mandates – particularly where government sponsorship is involved – shapes the investment behaviour of each.

1.3 NTBFs play an important role in the UK's continuing economic prosperity

Small and new firms are important drivers of innovation (Acs and Audretsch 1990) and employment (Lerner 1994). New technology-based firms play a further role in creating wealth by maturing technological innovation into commercial reality, increasingly within emerging markets. They are a source of economic growth and the products and services that emanate from these firms create the markets and industries of the future (Sainsbury 2007). Their value to economic and employment development explains why government is so keen to support their encouragement and growth.

The success of these firms depends on combining technological innovations and appropriate skills to commercialise new products and services that create value. We define a NTBF as a firm "...where its products and processes are the commercial result of investment in the research and development of new scientific and technology applications" (Haywood 2008 p.3).

So, our view of their role in the innovation process can be summarised as: "the design, invention, development and/or implementation of new or altered products, services, processes, systems, organisational structures or business models for the purpose of creating new value for customers and financial returns for the firm".⁶

1.3.1 Understanding and supporting NTBFs

The innovation process for each firm will require a particular combination of resources. It also requires a period of 'incubation'⁷ during which the technology and market are developed. In some cases the market for an innovative product will need to be identified and developed; in other cases entirely new markets will be created. Start-up strategies, particularly the funding of product and market development, are crucial. These strategies can be seen on a continuum from 'soft' to 'hard' (Connell 2006).

Soft start-ups fund product development through the completion of external research and development contracts for clients. These firms are often embedded within research consultancies or other research organisations during their formative stage and are relatively free of financial risk. R&D activity is responding to a known business need (demanded by a client) and much of the costs associated with the product development are covered by the revenue generated from these external research contracts.

Hard start-ups begin as separate, independent entities, and rely on external equity from various sources including founders, business angels, Micro Funds and venture capital. They evolve through the 'Silicon Valley model' or the 'garage start-up'. This is where the entrepreneur has the idea, starts to develop the product and then seeks external financial support to develop it further (Connell 2006). These 'hard' incubation strategies can entail higher levels of risk because external financing is sought at a much earlier stage in the firms' development and before the market has been developed.

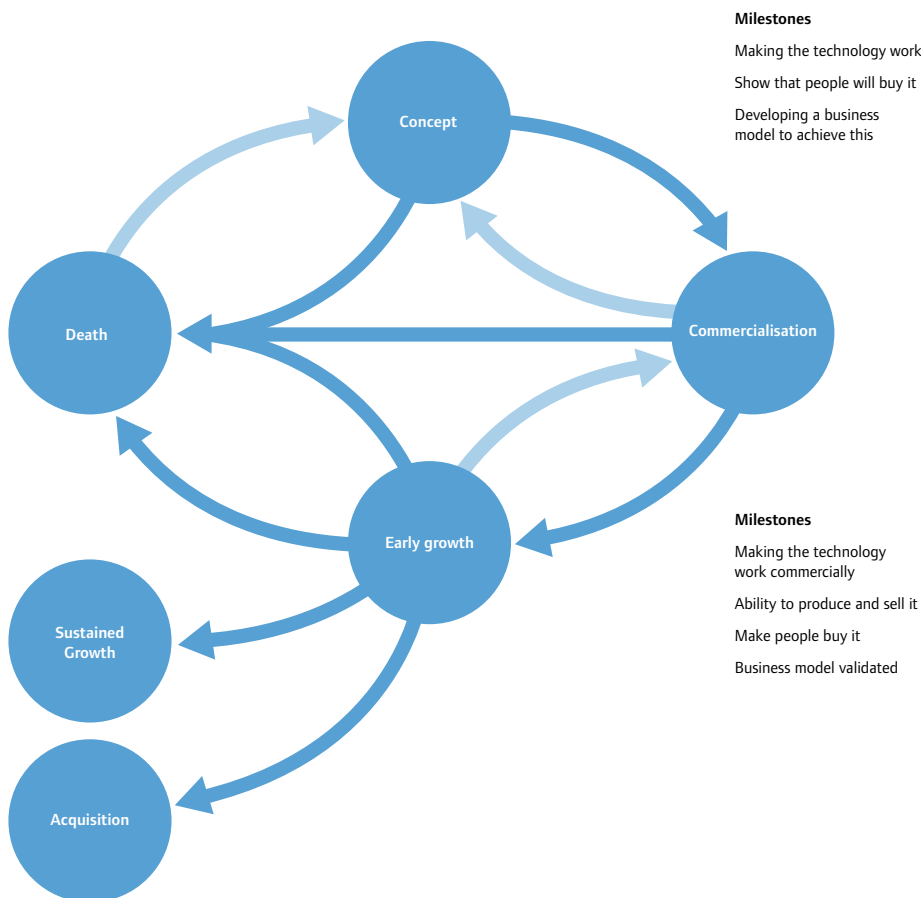
1.3.2 Stages of development in NTBFs

Business researchers have frequently drawn upon biological life-stage models to explain the process of new firm development. This widely used approach explains how an organisation moves from initial emergence to established viability (Poole and Van de Ven 2004).

Typically four stages of firm development are identified: conception, commercialisation, growth and stability (Kazanjian and Drazin 1990; Roberts 1991; Poole and Van de Ven 2004). A diagram of the four stages is presented in Figure 2. The model predicts that firms will begin at concept and will progress through each stage as milestones (both technical and market) are completed. The most critical stages of development are the initial stages of conception and commercialisation. The success of a firm’s activities at each stage determines whether the firm progresses.

The stage growth model is useful in identifying and interpreting events and the emergence of organisational structure in the overall trajectory of a firm’s development. However, the model is linear and simplified in its view of how particular firms develop.

Figure 2: Stages of firm development



8. Micro firms were defined as firms with fewer than ten employees.

A more complex explanation of NTBF development can be found in a systemic approach (Bernasconi and Moreau 2005) that examines the unique, evolutionary development of each business. Therefore, rather than examining each stage of the process as separate activities, the systemic approach, which we used in this research, examines the relationships between these activities and how they change over time. Rather than directly comparing firms across various stages, this study concentrates on the evolution of firms through stages within their specific context and with a focus on their financing.

1.4 Venture capital is important, but only for a few firms

Successive surveys of small and medium-sized businesses in the UK in the period from 1991-2004 Cosh and Hughes (2007) established that approximately 4 per cent of SMEs sought external equity financing. However, the firms that did rely on equity finance considered it as an important source of finance; this was particularly true of micro firms⁸ where the importance of equity finance increased in the survey period.

The firms for which equity finance is important are typically rich in intangible assets such as technology and specialist knowledge but lack the sort of assets that help them to access external finance. The long lead times and high costs associated with research and development work mean that these firms require access to capital long before revenues are possible. Their undercapitalisation due to their inability to access external finance can limit their ability to achieve their full potential.

Early investment can be particularly risky. Information asymmetries are extreme. There are risks associated with technology and market development. There is also a great deal of uncertainty, with a number of unforeseeable risks.

1.4.1 Why the focus on financing?

The retreat of private funds from early stage investment has led to what is often called 'the early stage equity gap'. This is where early stage firms seeking relatively small amounts of equity investment for start-up and early commercialisation development cannot access equity funds because investors prefer larger and later stage deals. Nominally this 'equity gap' exists for firms seeking funding in the range of £500,000 to £2 million (Hurley, Herriot et al. 2005; Dimov and Murray 2007). Government-sponsored Micro Funds are specifically targeted at such investments and recent research suggests that these funds have played an important role in filling this gap (Pierrakis and Mason 2008).

Not everyone accepts that there is an equity gap. Dissenters point out that supply of equity capital is less the issue than the limited number of viable propositions. However, a recent OECD report on SME financing (2006, p.10) concluded that "most OECD countries perceive that a lack of appropriate financing has been a hindrance to the expansion of innovative SMEs (i.e. firms, often in technology sectors, with new business models and high growth prospects)".

1.4.2 Increasing the supply of equity capital has been a key policy focus

Policies aimed at supporting and developing innovative activities are evident at every level of government, including regions, nations and Europe. They cover everything from education to specialist areas such as science and technology, and the governance of financial institutions.

The emergence and survival of new technology firms is influenced by the policy environment in all of these areas. But there is a specific policy dialogue around 'access to finance' where commercial equity has traditionally been seen as providing an effective way of financing new technology-based firms. Access to finance policy at both the regional and national

level is aimed at smoothing the path to equity investment, both for the firms which need investment and for the individuals and organisations that provide the equity capital.

Government activities in this respect fall into two categories; increasing equity capital funding flows and increasing the supply and quality of firms seeking funding.

1.4.3 Government-sponsored venture capital funds

A focus of policy in increasing the flow of funds into equity capital has been the creation of government-sponsored micro venture capital funds. These funds are encouraged to invest in new technology-based firms.

The funds operate with the government (through a managing department or Regional Development Agency (RDA)) investing as a limited partner, either contributing all or a segment of the total funding. Remaining funds where the government is only contributing a proportion are then raised from other private investors.

To encourage private investors into the fund the government subordinates its investment position by capping their investment returns or agreeing to 'first loss'⁹ position (BERR 2008). In addition to the government subordinating their investment position in the limited partnership, investors also receive tax concessions.

1.4.4 Increased activity of government-sponsored funds

Government-sponsored Micro Funds have received £250 million in public money in the past decade and leveraged a further £400 million from private investors (BERR 2008a). Increasing early stage equity supply is the primary policy objective though different funds may have other policy imperatives too.

Other objectives include the 'demonstration' effect of fund success in the early stage investment market to encourage commercial participation at the early stage and increase the supply of early stage fund managers. Government also seeks to promote the pre-commercial investment activity in new technology, the development of serial entrepreneurs, the provision of start-up business experience to entrepreneurs and managers and to increase employment in technology-based industries and entrepreneurship in the UK economy.

There are four main types of government-sponsored venture capital funds: University Challenge Funds; Early Growth Funds; Regional Venture Capital Funds;¹⁰ and Enterprise Capital Funds. Most fit the definition of Micro Funds, which are generally government-sponsored.

1.5 The role of Micro Funds in financing NTBFs

The equity gap debate polarises viewpoints. If one accepts that the supply of capital is a problem, then the government sponsorship of funds makes sense, as it increases the available capital supply. However, this doesn't address the disincentives facing private investors who have retreated from early stage investment in NTBFs.

But, if the problem is the supply of viable propositions – or that these firms lack 'investor readiness' – then the government sponsorship of funds will not necessarily directly increase the willingness of investors to invest. There may be indirect benefits as a result of the injection of commercial discipline into the funds, but this is not guaranteed and such discipline may be achieved more effectively by other means.

In reality, there is evidence for both propositions. This highlights both the complexity and uncertainty associated with early stage NTBF development and financing. It also means

9. 'First loss' position means that in the event of a reduction (loss) in the fund's capital base, the government investor agrees to take their loss first.

10. For further details of fund types please see 'Appendix C – Overview of Government policy and support' available on the NESTA website at www.nesta.org.uk

11. The Cambridge Cluster is prominent in the biotechnology, software, instruments and engineering, electronics and ICT sectors. A profile of the Cambridge Cluster is available in appendices to this report. See 'Appendix A – The Cambridge Cluster' available for download from the NESTA website at www.nesta.org.uk

that there is no single solution to the issue of access to finance. Given the importance of these firms to economic development, and the importance of accessing adequate finance to their survival, it is essential that we recognise Micro Funds as a distinct asset and learn from their activities.

1.5.1 This research investigates Micro Funds and their role through an in-depth analysis of one fund manager and three specific Micro Funds

A constant tension in any research methodology is the trade off between depth and coverage. Depth allows complexity to be explored whereas coverage allows for defined patterns to be observed.

We are more interested in depth for this research given the complexity of the role of Micro Funds in early stage financing. We have analysed the Micro Funds managed by one Cambridge-based Micro Fund manager, IQ Capital, to provide such deeper understanding.

IQ Capital currently has three Micro Funds under its management. Research results drawn from this research will be specific to this fund manager and to the Cambridge area. However the research also provides wider lessons for NTBFs.

1.5.2 Researching through a Cambridge-based exemplar

The Cambridge cluster is noted as a leading high technology region and is often called the UK's equivalent of the US's Silicon Valley (Library House 2004). The development of the cluster, as with Silicon Valley, was 'bottom-up' and stimulated by the establishment of a number of key institutions in the late 1970s and 1980s (Herriot and Minshall 2006).

The cluster now includes 1,500 high technology firms and employs some 45,000 people. The region has been continuously recognised for its high quality environment and support for new technology-based firms (Herriot and Minshall 2006). Particularly in the sectors of specialisation prominent in Cambridge,¹¹ the region provides an ideal environment for new firms. The advantages of the Cambridge cluster help overcome some of the other challenges and limitations faced by NTBFs which allows our research to focus more on the effects of financing. To quote one of the research participants: "...if you cannot get it to work in Cambridge, you will not [get it to do so] anywhere else" (Micro Fund Manager).

The Cambridge area receives 25 per cent of the UK's early stage venture capital investment activity (Haywood 2008). Library House (2007) stated that there are currently 108 actively venture-backed companies in Cambridge. Portfolio firms within the research sample represent almost one-fifth of this population. Also, whilst this is an analysis of one fund manager and three funds, co-investment partners in the sample portfolio firms include angels, fifteen other Micro Funds, corporate venture capitalists and later stage venture capitalists. Therefore, while the sample may not be entirely applicable to the wider UK early stage venture capital experience, it still provides a good benchmark.

1.5.3 Research sample and methodology

The research sample consists of firms that have applied for finance from one of the three IQ Capital Funds. We looked at this population in varying degrees of detail through four stages.

At the first stage, we looked at the characteristics of firms that apply for equity funding from Micro Funds and those that are ultimately successful. This provides evidence for the first research question; establishing the Micro Fund investment model.

In the second stage, we examined a subset of this population, the portfolio firms. The third stage involved case studies of ten firms. The case studies employ a systemic approach to understanding each firm's development and the role played by external equity financing.

The fourth stage involved interviews with Micro Fund managers. Their purpose was to gain further insight into the investment selection and monitoring processes of Micro Funds and to test conclusions about the characteristics of firms that were considered suitable for early stage equity investment.

1.5.4 Micro Funds are only one aspect of NTBF development

This report investigates only one aspect of NTBF financing – investment through Micro Funds. The maturing of technological innovation into a commercial reality draws upon many other factors. This is a complex area of analysis in which causality is difficult to attribute. It is impossible to separate the role of Micro Fund investment activity from this wider environment.

1.6 Structure of the report

The empirical results from this research are reported over the following five sections. The first section addresses the first research question – what is the Micro Fund investment model?

The following two sections characterise the experience of Micro Fund investment for new technology-based firms, following the systemic approach that analyses development within context. The fifth section reflects on the success of Micro Funds and firms receiving Micro Fund investment, establishing some learning points of a first generation of Micro Funds. Section Six provides conclusions and policy recommendations.

This report also has five appendices. Appendix A provides a detailed profile of the Cambridge Cluster. Appendix B covers the research methodology. Appendix C provides an overview of government support and policy in the 'access to finance' area. Appendices D and E provide further analysis from the case studies and the statistical analysis. These appendices are available for download from the NESTA website www.nesta.org.uk

2. The Micro Fund investment model

This section investigates the Micro Fund investment model. Micro Funds are defined as small venture capital funds managing £30 million or less worth of funds. The funds typically invest less than £2 million – including follow-on investment – into individual portfolio companies.

Structural changes in early stage equities mean that these Micro Funds play an increasingly important role in the provision of institutional capital to new technology-based firms at their earliest stages.

Micro Funds have received £250 million in public money in the past decade and leveraged a further £400 million from private investors (BERR 2008a). Yet, questions remain about their activities and how they can effectively overcome the disincentives that have seen the retreat of private funds from early stage investment.

12. For further discussion on the methodology please refer to 'Appendix B – A study of Micro Funds through a Cambridge exemplar', available on the NESTA website at www.nesta.org.uk
13. Investment readiness is a subjective evaluation; each evaluation is based on available information and competition from other applications at a given point in time.
14. Please refer to 'Appendix B – A study of Micro Funds through a Cambridge exemplar' (available from www.nesta.org.uk) which provides details on the structure of the sample. These percentages do not represent success rates of presentations to GEIF. Success rates of applications to GEIF are approx 13 per cent.

2.1 Establishing the Micro Fund investment model

In establishing our Micro Fund investment model, we analysed three characteristics of new technology-based firms. First, we looked at the characteristics of 'investment-ready' firms. Second, we considered which characteristics distinguish those investment-ready firms that go on to receive investment from those who do not. Finally, we identified any differences in the types of firm in which Micro Funds and business angels invest.

2.1.1 Identifying 'investment-ready' firms

The first step was the creation of a data set of 193 new technology-based firms.¹² These firms sought investment from one of the three Micro Funds between 2002 and 2007. To apply, firms submitted an application form and detailed business plan. All the Micro Funds required private co-investment, usually in the form of business angels – so, a business angel forum, The Great Eastern Investment Forum (GEIF), provided initial screening.

The firms selected for presentation to the business angels offer a proxy for investment readiness as these were selected by the fund managers.¹³ Of the 193 applications examined, 114 (or 59 per cent) were declined and 76 (or 39 per cent) were presented.¹⁴

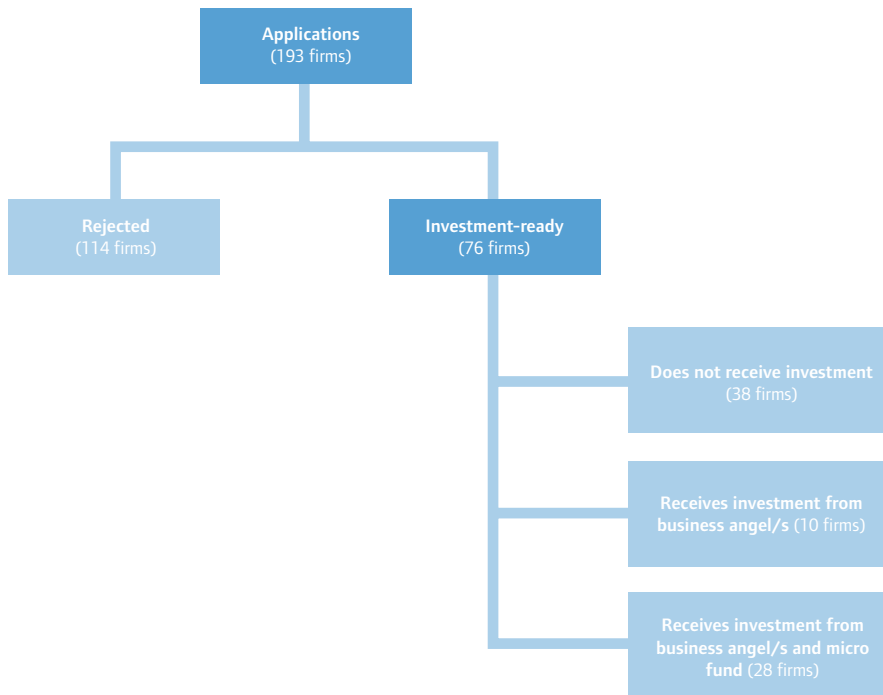
From the applications deemed investment-ready and presented to the GEIF, three alternative outcomes were possible:

- The firm did not receive any investment.
- The firm received investment from business angels.
- The firm received investment from business angels and one of the Micro Funds.

These categories were used to examine the characteristics of firms within each category and differences between categories in the three areas outlined earlier:

1. Applied and investment-ready.
2. Investment-ready and invested.

Figure 3: Breakdown of sample by application category and year of application



15. Please see 'Appendix E – Further research results' (available from www.nesta.org.uk) for further details on fund activity.

16. Average refers to the mean unless otherwise stated.

3. Invested and by whom, business angels only or co-investment between business angels and Micro Funds.

The characteristics of 'rejected' firms are also included for comparison. Figure 3 provides a flow chart diagram of these categories for summary, with the red boxes identifying the analysis categories. The number of firms in each category from this sample is also listed.

Figure 4 shows the sample for 2002-2007 by the four analysis categories in Figure 3. The success rate in each year of funding is also given, as a percentage of total applications in each year.

The peak periods for application and investment activity were in 2003, 2005 and 2006. Solo business angel activity was strongest in 2003 and 2004. These peak periods of activity are associated with the launch of new funds in these or immediately preceding years.¹⁵ Table 1 provides summary results of significant results from the statistical analysis of company characteristics in the different categories. We then discuss individual characteristics.

2.2 Funding amounts applied for

The average¹⁶ amount requested by all firms in their applications was £605,000 with a median of £500,000. The average funding request from those firms judged to be investment-ready

17. Firm characteristics that have a significant positive relationship with each category unless otherwise stated.

Figure 4: Breakdown of sample by category and year of application

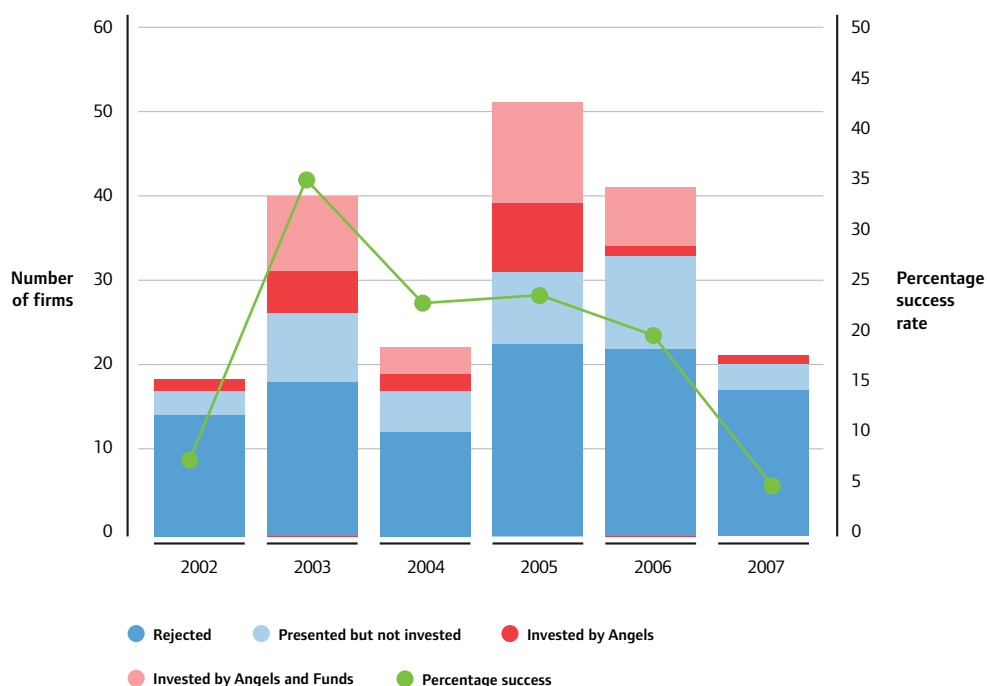


Table 1: Main firm characteristics by category¹⁷

Investment-ready	Invested	Co-invested (business angels and funds)
Cambridge-based	Cambridge, East of England or London-based	Cambridge and East of England-based
Prototype complete	Lifesciences and Healthcare, IT and Software sectors	Lifesciences and Healthcare sector
Medium funding request	Prototype complete	Prototype complete
	No exit date given in business plan (negative)	No exit date given in the business plan (negative)
	Previous start-up experience	

was no different. Firms that were successful in receiving investment from both the funds and angels were also those that requested most, with an average request of £629,000. The mean and median funding requested in each of the four categories is shown in Figure 5.

The difference between the median and the mean suggests that there were a small number of larger funding requests in the sample in both main categories. This suggests two possibilities.

Early stage firms either have relatively similar capital requirements or, more likely, they moderate their requests to a range most likely to be amenable to investors, and tailor their financial planning accordingly. Anecdotal evidence from interviews presented in the following section suggests that this may be the case.

18. Cambridge Cluster characteristics are discussed in further detail in Appendix B. The cluster is prominent in Biotechnology, Software, Instruments and Engineering, Electronics and ICT.

Statistical analysis used to test the significance of different characteristics confirmed this hypothesis, showing a positive relationship with a mid range funding request and investment readiness. The firms that are successful in being put forth for presentation are those firms that request the 'right amount'.

However success in receiving investment from business angels or business angels and funds co-investing, when other variables were considered (including location and sector) showed no relationship between the amount requested and the decision to invest.

2.3 The role of sector

Firms were aggregated into six broad industry categories. The sector characteristics of the applications (illustrated in Figure 6) reflect the sector characteristics of the Cambridge Cluster.¹⁸

The majority of the deal flow came from firms in the Health and Life Sciences, IT and Software industries. Multivariate analysis shows that there is no significant sector preference in the selection of 'investment-ready' firms, with a cross-section of sectors represented. This may be the result of the GEIF deliberately seeking a sectoral variety of investment propositions to present to the business angels.

Figure 5: Mean and median investment requests by category

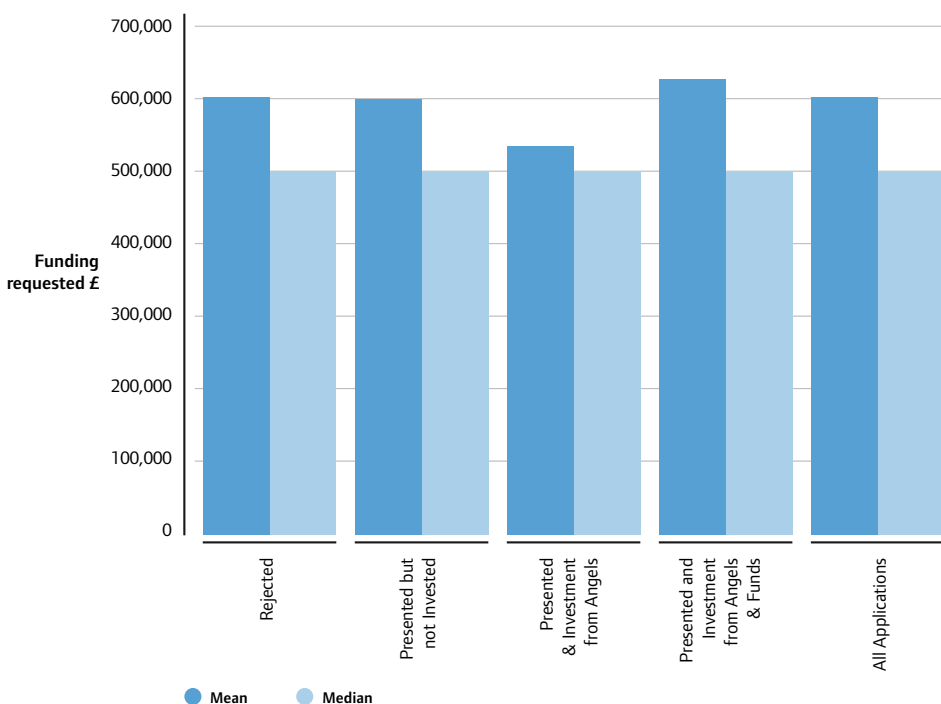
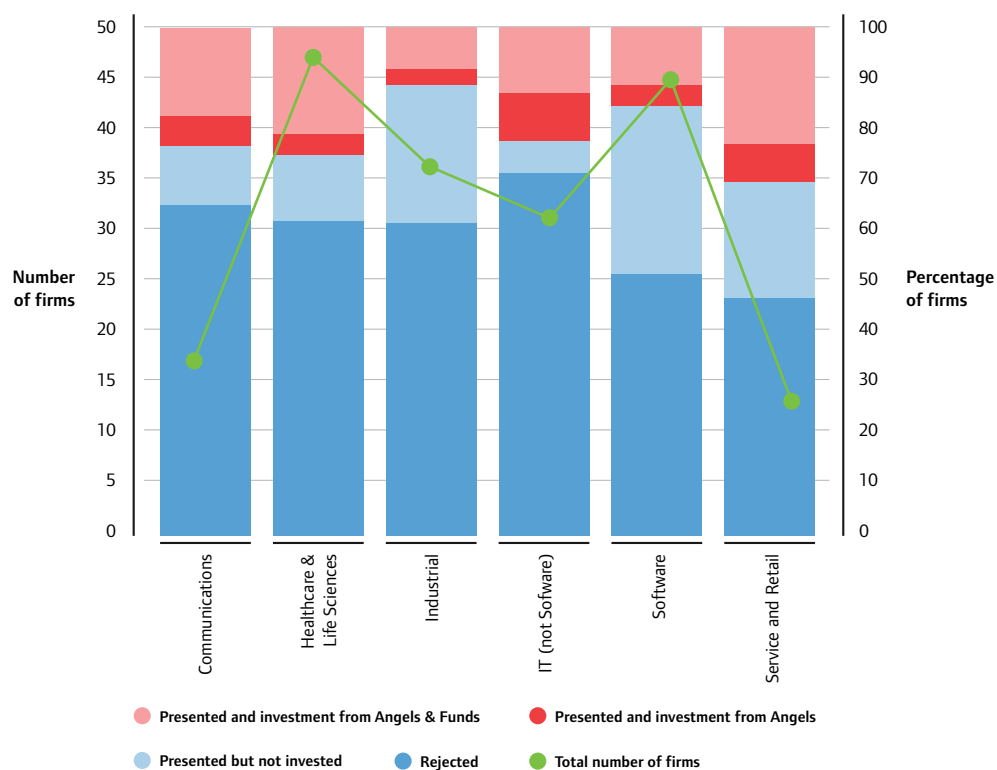


Figure 6: Sector characteristics of applicant firms



On the other hand, sector appears to play a significant role in the decision to invest. The sectors particularly favoured were Life Sciences and Healthcare, IT and software firms. These are not surprising results, within the context of the Cambridge Cluster.

The analysis also showed that co-investing angels and Micro Funds favoured Life Sciences and Healthcare firms. This suggests that the co-investment model can select more capital intensive and long-lived investments. The healthcare and life sciences sectors are known for long lead times. It is also worth noting that the firms in question are medical diagnostics and medical equipment firms rather than drug discovery or biotechnology firms.

The three favoured sectors – Healthcare and Lifesciences, IT and Software – are those that benefit most from being located in the Cambridge Cluster. With the funds also located in Cambridge, and the likelihood that firms would favour local investors, it makes sense that these sectors are more strongly represented. For the fund managers and business angels these are the sectors where they feel they have the ability to select and monitor investments most effectively, drawing on their past investment or entrepreneurial experience.

2.4 What other characteristics are important for receiving investment?

Information on other characteristics relevant to assessing firms’ applications was also collected. We looked at whether the firm was based in Cambridge or had Cambridge

alumni¹⁹ on their start-up team to test whether geographical clustering and networks were significant factors in improving investment prospects for firms.

Characteristics such as start-up experience and the stage of technological development (prototype developed, testing with customers and sales) are key factors used by equity investors to indicate the firm’s path to market and its viability as an investment. Figure 7 summarises these characteristics across the four application outcome categories.

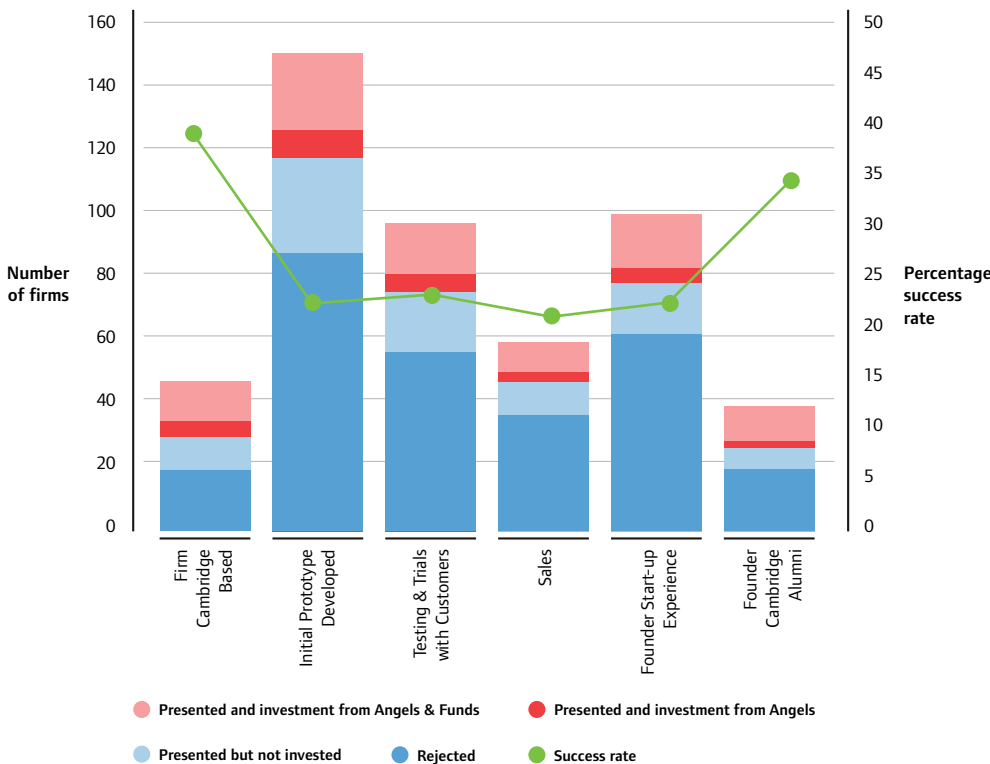
Multivariate analysis was again used to identify significant patterns. Firms located in Cambridge were very likely to be selected for presentation. There was also a slight preference for East Anglian-based firms (in the Cambridge region). Geography was a very significant factor: investment prospects were significantly improved if they were based in Cambridge, London or the East of England.

These results support other evidence regarding early stage investors’ preference for geographical proximity to their portfolio firms. Proximity reduces monitoring costs as they do not need to travel far for meetings with their portfolio firms. It also allows investors to make use of their social networks, which are also usually geographically based.

These network resources can be used to assess the suitability of entrepreneurs and founding teams. Trust and power relationships act as both a form of due diligence and as another form

19. Care needs to be taken in interpreting the significance of the characteristics of Cambridge alumni. It was not possible to get details of alumni relationships for all applications. There could possibly be a bias to Cambridge alumni in that if applicants were alumni of Cambridge they would be more likely to mention it than relationships with other universities.

Figure 7: Other characteristics of applicant firms



of control over their investment. It also allows investors to make full use of their network resources by providing the portfolio firm with contacts and customers.

Evidence of a prototype was significant for investors when selecting portfolio companies. Tangible business development results are paramount when selecting the firms they invest in. This in turn begs the question of how prototype development is funded.

Investors also prefer firms where the founding team has some previous entrepreneurial experience. Firms who do not provide an exit timeframe for investors in their business plan are less likely to gain their investment income. This became a proxy for knowledge of the equity investment environment. More often than not this timeframe was a preliminary estimate, but it showed firms' knowledge of the investment lifecycle. Both of these results suggest that investors are also looking for firms that understand the equity investment environment through previous experience.

A final characteristic reflected whether any of the founding team was a Cambridge alumnus. Firms with a Cambridge graduate had a success rate of 34 per cent. Care must be taken in interpreting these results in the absence of details on all founder alumni relationships and because of geographical bias. However, this final characteristic highlights the closely networked relationships within the Cambridge early stage community.

2.5 Towards a Micro Fund investment model

These results tell us more about the Micro Fund investment model. The funding amounts requested fall into the early stage investment bracket and are consistent with other research on early stage investments (Pierrakis and Mason 2008). Investments are assessed in a similar way to other forms of venture and risk capital. Information on the technological development – such as stage and milestones completed by firms (i.e. prototype, market contact and sales) and the quality of the management team (start-up experience) – are used to ascertain the risk associated with investing in new technology-based firms. That Micro Funds prefer investments that have already achieved certain milestones raises the question as to how these activities were funded previously.

2.5.1 Early stage investors do not have the same resources as later stage investors to devote to these due diligence activities

Later investors know more about a firm's history on which to base their investment decisions. This could also explain why geography and sector are so important for investors in early stage investment selection. Proximity reduces monitoring costs and allows investors to use their local networks both for due diligence and to support firms.

Early stage fund managers also appear to use more 'informal' due diligence mechanisms such as network contacts to generate good deals and assess propositions. Early stage fund managers face significantly higher costs establishing and securing their network position, which may deter other competitor fund managers. This in turn suggests that successful fund managers are those within strong networks; though this hypothesis would need to be tested in future work.

2.5.2 Firms face difficulties in assessing the future capital requirements of their investments

Evidence from the funding applications and interviews suggests that firms base their funding requests on what they believe investors will fund. There are various reasons for this; clearly they want to be successful in fundraising, even if it is at a sub-optimal level. Firms also appear to have little means of accurately estimating their fund requirement at the first and subsequent funding rounds.

2.5.3 Investors are also in a similarly difficult position

The difference between angel-only investment and angel/fund co-investments showed that the latter preferred Life sciences and Healthcare firms, a sector recognised for long development times and the relatively capital intensive²⁰ nature of firms.

Investors here appear to know that co-investment may be the only way to ensure the portfolio firms have adequate capital. They also recognise that early stage investment means that other risks are more acute, with fewer milestones completed and a less experienced management team.

The Micro Fund investment model for selecting investments outwardly operates in the way we would expect for risk capital. The Funds however face significant challenges in their ability to assess risk in the firms in which they invest. These risks are a function of the size of the fund (small) and the stage of investment activity – early (high uncertainties).

Without the government subsidy and encouragement to invest in the early stage it is difficult to see how the Micro Fund investment model can overcome the commercial disincentives to invest in the early stage that has been noted by other private funds.

20. Relative to the early stage – some types of firms, e.g. drug discovery, are not considered appropriate investment propositions for Micro Funds and are not even considered for investment because of the costs and time involved in development.

3. The role of Micro Funds in firms' financial pathways

This report has highlighted the importance of new technology-based firms to the vitality of the UK economy. Government sponsorship of Micro Funds is a key policy instrument in supporting NTBFs. The previous section questioned whether Micro Funds had the ability to overcome the disincentives of investing in the early stage that has seen the retreat of commercial institutional investors.

From an operational perspective the Micro Fund investment model has many similarities with later stage 'traditional' venture capital. However, there are three differences: limited resources for assessing firms; high levels of uncertainty associated with early stage NTBFs; and the fact that co-investment partnerships with multiple funds and business angels are the norm.

This section examines the experience of firms which receive investment from Micro Funds. Specifically, we look at how Micro Funding fits into their overall financial pathway, what other sources of funding are used and the stages of development that Micro Funds finance.

21. This discussion is limited to firms that were successful in receiving Micro Fund investment; a 'winners' bias is therefore attached to these comments. Comparisons of firms that were both successful and unsuccessful in achieving investment would need to be made before firm conclusions could be made.

3.1 Why do firms apply for finance from Micro Funds?

Before analysing how firms use Micro Funding it is worth reflecting on why firms seek investment from Micro Funds in the first place. Interviewees suggested a variety of reasons.²¹

The 'access to finance' literature highlights costs to firms associated with accessing equity investments for their business; such as giving up a share of their firm and hence potential profits, exposing the firms to volatile market valuations and losing control over the strategic direction of the firm.

3.1.1 No alternative to Micro Fund financing

The majority of firms noted these costs but agreed with Berger and Udell's (1998) assertions that despite these costs, there is really no other source of funding that is available to the firm at the time and stage they needed it.

3.1.2 Micro Funding perceived to be quicker to access

Timing was also acknowledged as a factor in firms' deciding how much finance to seek. The interviews showed the fundraising from Micro Funds was perceived to be quicker because of the smaller amounts involved, as one firm put it: "...you have to ask yourself how much do you really need and when do you need it by, because it will take you at least six months to raise anything under £1 million, and twelve months to raise over £1 million..." (Firm interview).

This is evident in the initial fundraising rounds, though other firms highlight long negotiation periods for subsequent rounds as initial and new investors agree terms.

3.1.3 Previous fundraising experience

Previous fundraising experience was also identified as another factor in firms' decision to approach Micro Funds. Micro Funds were seen as more accessible than later stage venture capital: "...we could have gone to a major VC first, I did not have the experience of raising a large amount of money..." (Firm interview – based on firm's previous fundraising experience).

Previous fundraising experience (or lack of it) was the reason most often cited for seeking Micro Fund investment. Firms stated they would have preferred to access larger capital investments over fewer rounds to allow faster company development and less management distraction from the fundraising process.

This preference was tempered with most firms' acknowledgement that no matter how much capital they received the firm was still subject to the uncertainties that characterise early stage development. As one firm said: "...in retrospect, if we had more money, we would have just gone quicker down the wrong path, and we may not have had the opportunity to change direction that we did..." (Firm interview).

3.1.4 Preserving founders' shareholding

The desire of company founders to preserve as much value and shareholding as possible was another reason given for seeking Micro Fund investment. Equity financing exchanges part of the ownership of the company in return for capital. Micro Funds were seen as a way to access a smaller amount of capital in return for a smaller share of the company. One firm put it thus: "...I approach things from the end, you make your money from an exit...so I need to work out how I am going to get at that trade sale and then I look back and think how much capital can I take now and still keep it sellable at the end..." (Firm interview).

This position assumes however that the firm can still access the required funding, that it is in a position to choose. This is not often the case: "...you are never really going to be in the situation where people are just handing you money...the amount of money on offer always changes through the negotiations, that is a fact of life and you have to handle it" (Firm interview).

3.1.5 Need versus need to succeed

Overall, the interviews suggested that firms were generally inexperienced in fundraising. Previous experience and anecdotal evidence from other firms' fundraising success or failure heavily influenced from whom firms sought funds as well as where, when and how much funding they requested. The key questions they think about are how much they need, as well as how much can realistically be accessed?

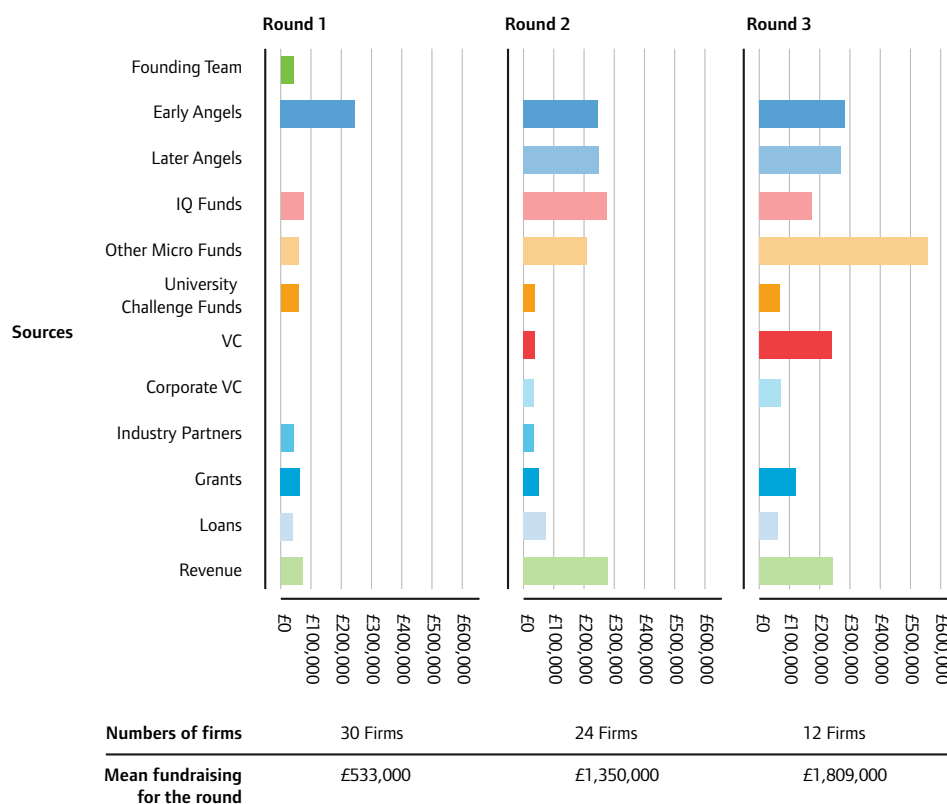
3.2 The average case

Across the 30 portfolio firms, each firm had between two to three investment rounds on average. Figure 2 shows the average contribution of the different sources of finance available to a start-up firm. This research examined grant funding, revenue and loans as well as equity investments to provide a more complete picture of early stage NTBF funding.

Figure 8 represents the average weighted contribution of each of these sources to the financing of firms. The average amount raised at each round is weighted by the average proportion of funding received from each source. Weighting the amounts in this way reduces the effect of large fundraising levels from one source by one or two firms, which would otherwise skew the average.

22. Pierrakis and Mason (2008) found the mean investment size for a sample of 122 early stage investments in 2007 was £2.9 million, whereas the median was £1 million. The nine largest deals had an average size of £17 million, the next 18 had an average size of £5.7 million, with the remaining 95 companies having an average of £978,000.

Figure 8: Average financial pathway of a portfolio firm



The differences between the weighted and unweighted averages (illustrated in Figures 8 and 9) are most evident in rounds two and three. This suggests that these large rounds operate in different ways from the smaller rounds. There is a significant difference between small scale early stage investing (sub £2 million investments) and large scale early stage investing (above £2 million investing).²² As our research is focused on early stage small scale investing, the weighted average provides more relevant results.

3.2.1 Business angels play a prominent role in financing early stage firms

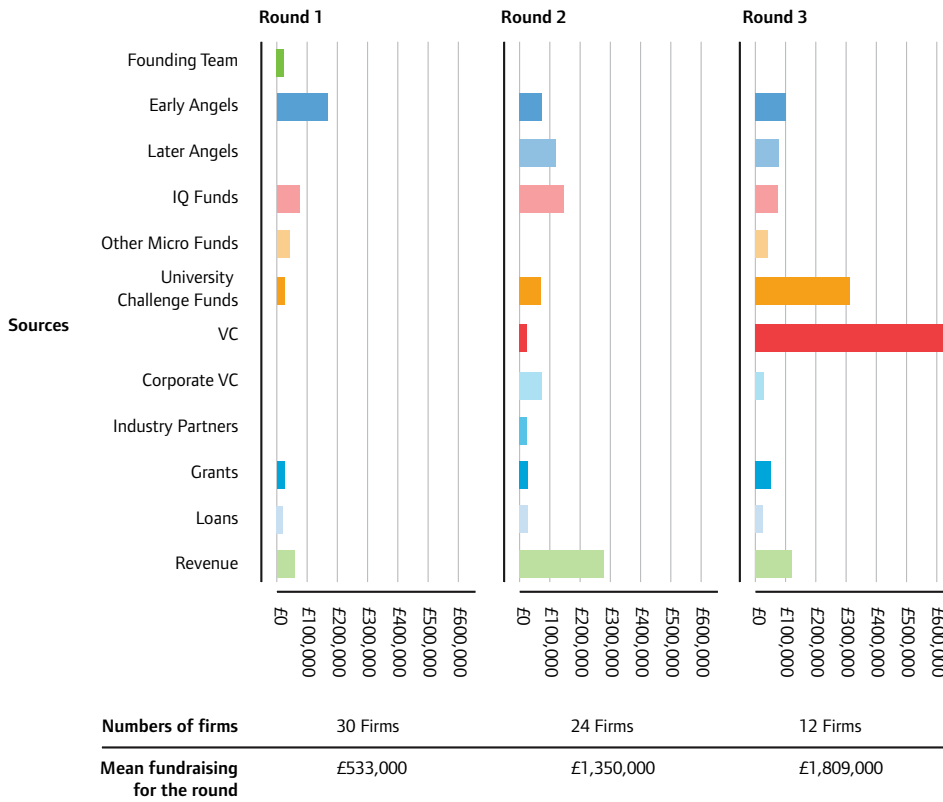
Business angels finance companies at very early stages but as Figures 8 and 9 show they have the capacity to follow into later rounds. Later angels, those that invest in the firm after the initial seed stages, are also able to follow their investments. This analysis shows that business angels are the primary source of private capital for this sample of firms in the early stages.

3.2.2 Micro Funds dominate with the provision of institutional capital

The firms used in this analysis all received investment from a group of funds managed by one Micro Fund manager. However over successive rounds of financing, co-investment with other Micro Funds is important.

This co-investment model is well established in the equity environment and well adopted in the financing of new technology-based firms. There is evidence from the case studies that the structure and management of these co-investment relationships impacts on firm

Figure 9: Average financial pathway of a portfolio firm (Unweighted)



performance and success. Co-investment relationships are discussed in further detail in section five.

Traditional (private) venture capital only features as a prominent source of funding in round three. Only five of the 30 firms investigated raised money from later stage venture capital funds in the 2002-2007 period. This result reinforces evidence that later stage venture capital is not part of the financial path for most new technology-based firms.

3.2.3 Are grants operating as we expect?

It is also interesting that grant revenue increases in later stages of development. After all, grant funding is usually associated with concept stage firm development and R&D related to proof of concept.

And we have seen that these investors prefer some technical milestones and an initial prototype prior to investment, which could be funded by grants. Yet grants seem to come at a later stage.

The need for match funding to access grant income may explain this result. Only with greater equity can firms supply the required matched funding. Which raises the question as to whether grants are operating in the way we expect them to in supporting NTBF development.

3.2.4 Early presence of revenue

It is also worth noting that revenue is a significant source of funding from round two onwards. Firms use revenue gained from R&D contracts to fund product development. Other firms are receiving investment in their final stages of product development and produce revenue from early sales. Both these sources of revenue can reduce the risk to the investor.

3.2.5 Ideal versus real financial pathways

By the third round, we are seeing a divergence of financial pathways. These different pathways are defined by the firms' technology and business models, but also by their success in being able to execute their business plans.

As noted earlier, firms would prefer to access adequate amounts of capital in as few rounds as possible to execute their business plans. Fewer rounds means less distraction from business development and less equity traded in the company.

Investors would prefer to see their investments increase in value over investment rounds and avoid flat or down rounds that devalue their previous investments. These two perspectives represent ideal financial pathways for the firms. But the uncertainty associated with these investments means that the ideal is not often met.

3.3 Average shareholding across funding rounds

Another way to look at the role of different investors is to examine the shareholdings of firms over successive funding rounds. This shows the early investors, what shareholding they took up and how they are treated over successive investment rounds by later stage investors. Figures 10-12 show the average shareholding by different types of investor.

Figure 10 Average equity shareholding of a portfolio firm with only one fundraising round

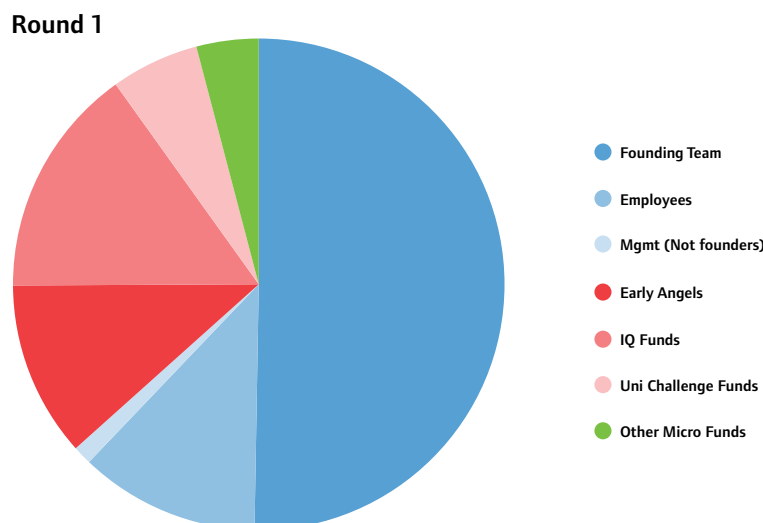
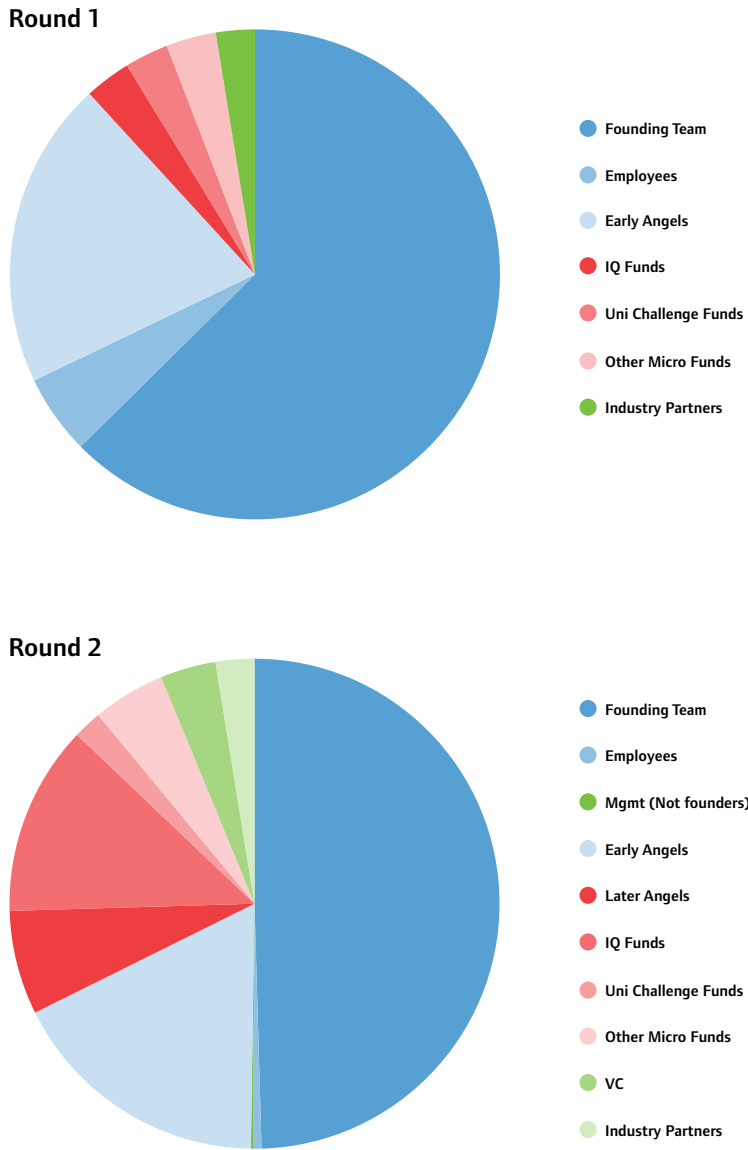


Figure 11: Average equity shareholding of a portfolio firm with two fundraising rounds



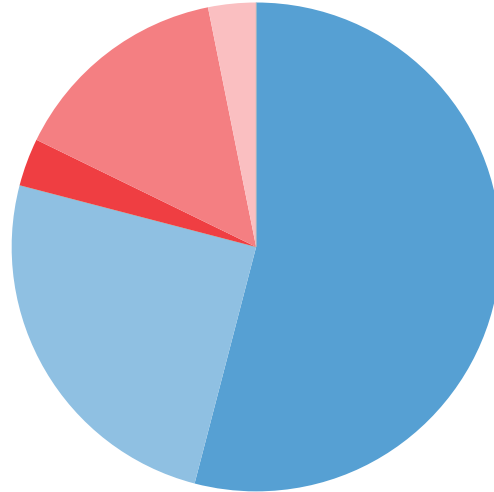
23. In this analysis of equity shareholding, options were not taken into account. Options are the main vehicle for employees and management to have shareholdings. This average shareholding analysis does not include options granted to founders, management or employees until they become 'above the line' options and are related to the value of the firm.

3.3.1 After first round founding team still majority shareholders

Figure 10 shows the average shareholding for firms receiving one round of financing. After round one, half of the shares reside with the founding team; small shareholdings of employees and management also exist for those who have bought an equity share.²³ The shareholdings of the main sources of external equity finance discussed in the average financial pathway (Figure 8) are all represented – business angels, Micro Funds and University Challenge funds. Micro Funds make up 25 per cent of the shareholding.

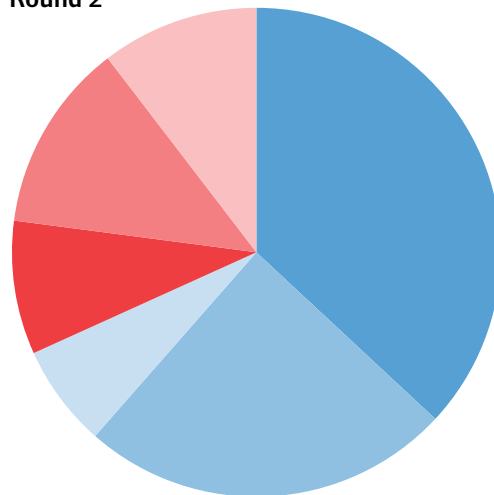
Figure 12: Average equity shareholding of portfolio firms with three fundraising rounds

Round 1



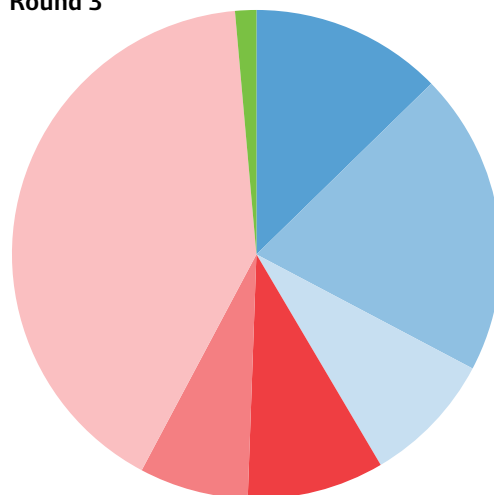
12 firms with 3 or more rounds
 Mean fundraised amount for Round 1 £502,000

Round 2



12 firms with 3 or more rounds
 Mean fundraised amount for Round 2 £639,000

Round 3



12 firms with 3 or more rounds
 Mean fundraised amount for Round 3 £1,211,800

- Founding Team
- Early Angels
- Later Angels
- IQ Funds
- Uni Challenge Funds
- Other Micro Funds
- VC

3.3.2 Founding team with two fundraising rounds maintains shareholding

Figure 11 shows the shareholding of firms with two rounds of financing. The founding team in these firms had a much larger shareholding in round one than those firms with only one financing round. By round two, the founding team still retains almost half of the shares.

The angel shareholding increases over the two rounds with the introduction of another group of angels. The IQ capital and other Micro Funds increase their shareholding while the university funds decrease their holding. Round two also sees later stage venture capital enter into the shareholdings.

3.3.3 Micro Funds largest shareholders by round three

Figure 12 shows the average shareholding across firms that have had three fundraising rounds. The shareholding of the founding team is diminished; by round three it represents just 13 per cent of the shares; founders are no longer the largest shareholders.

By this stage, Business Angels have retained a significant share (29 per cent) but the dominant shareholders are now the Micro Funds, accounting for 50 per cent of the shares.

The typical financial pathways and equity shareholdings show overall trends in the participants of external financing and how these participants can influence the direction of the firm through the size of their share ownership. However, these average illustrations do not reflect the variety of experience and use of Micro Funding across the portfolio sample.

Ten portfolio firms from the sample were selected for in-depth case studies designed to unpack the relationships between company development and resources.

3.4 Conclusions about how Micro Funds finance the development of NTBFs

We draw four conclusions from this analysis of the successive rounds of fundraising.

3.4.1 Micro Funds are the main source of external funds for firms in which they invest

The results show that for the firms investigated, Micro Funds play a major role in financing new technology-based firms. Micro Funds are the most important external equity financiers of firms that require multiple rounds of funding. NTBFs have long development trajectories – they are usually seeking to commercialise novel innovations with complex product and market development needs. These firms require funding over successive time periods. Micro Funds are the main source of external funding for these firms.

3.4.2 Angels can and do follow

Business angels play a significant role in NTBF financing. In the firms investigated, they were either the first equity investors, arriving in the round before other investors, or in the same round as the first Micro Funds. Business angels maintain their investment activity in these firms over successive fundraising rounds. They were the largest group of private investors in the weighted financial pathway (Figure 8) and in firms with three fundraising rounds accounted for 29 per cent of the shareholdings.

3.4.3 NTBF founders face significant dilution in ongoing funding rounds

Often the risk to investors is mentioned in the financing of NTBFs, but this risk is also shared by the founding team. The founding teams' shareholding is significantly diluted over successive rounds.

The granting of options is essential in motivating founders and management, but options only gain value when exercised.²⁴ It is not possible to tell from the figures presented in this section whether the founding team, management or employees' shareholding results

24. These shareholdings do not take account of unexercised options in an options pool. Options which are a key incentive for founders and management are only noted in the shareholdings in these diagrams when they are granted through a valuation event.

from granted options. However, from the shrinking shareholding in each category this does not look likely. Creating value in the firm is just as important for the founders and for the investors.

3.4.4 The shareholding structure of the firms changes significantly with multiple rounds

Successive rounds of equity financing have dramatic effects on the shareholding structure of NTBFs, particularly for the founders. This means that the equity investment experience is different for each firm and cannot be approached in the same way.

3.4.5 Firms draw upon a wide range of funding sources to support their development

The research shows that firms access funding for product and market development from a wide range of sources, in addition to equity finance. Grants, loans and revenue are all important.

That grant funding increases over the successive fundraising rounds probably reflects the requirement for matched funding. This raises the question as to what types of activities grant should support. Would it not be more useful if grants were provided for more prototype and concept development?

The presence of revenue, particularly from round two, shows that firms are attracting early customers, a good sign of market development. The unweighted model shows that revenue growth after round two is particularly strong for a few firms. For others these revenues seem insufficient to fund all further development work, requiring further fundraising rounds.

4. How do firms use Micro Fund investment?

The previous section highlighted the importance of Micro Funds in the financing of new technology-based firms. Micro Fund financing was particularly important in firms that required three or more fundraising rounds. In an average of the firms investigated, by round three, Micro Funds provided the most capital and had the largest shareholding.

NTBF development is rarely a linear process – it is much messier, interactive and marred by unexpected setbacks. Development always takes longer and costs more than anticipated.

This is where we see the ideal and actual financial pathways discussed in the previous section diverge. This section analyses the individual experiences of firms with Micro Fund investment, determining how they use this investment and in what context for their development.

4.1 Linear versus interactive firm development

In the introduction, we distinguished between ‘hard’ and ‘soft’ technology incubation strategies. But most strategies are somewhere in between. This same is true of linear versus interactive firm development, with most firms’ development being on a continuum between the two positions, rather than being firmly one or the other.

4.1.1 Investigating firms using the systemic approach

The case studies investigated the progress made by firms since their foundation. Although the information was collected at one point in time, every effort was made to be dynamic. This is meant to reflect the historical development of the firm as well as its current context.

Whilst it is difficult to categorise the development experience of individual firms, the case studies identify four themes of influence in the firms’ financing pathway. They are:²⁵

1. The origins of the firm.
2. The market opportunity the firm was seeking to address.
3. Technology appropriation and development of complementary assets for technology product.
4. Flexibility of the business model.

4.1.2 Firms aligned with the linear or interactive development perspective

Four typologies of firms emerge from the case studies. These are closely related to each end of the continuum of company development.

The first two typologies – springboard and last step firms – are those where financing had hitherto progressed close to its planned trajectory. They differ in their financial pathways depending on market opportunities and technology.

25. Further details on the case study analysis are available in ‘Appendix D – Detailed case study results’ available from the NESTA website at www.nesta.org.uk. This appendix includes details of the definition of ‘market opportunity’ and ‘technology opportunity’ used in the following case study descriptions.

26. Lesser in the extent that later stage VC investment still has higher levels of risk attached than revenue funding from customers, however the presence of these investors implies a more favourable risk/return ratio.

Springboard firms, uses Micro Funding to secure early technology milestones and then move on to larger funding sources usually in the form of later stage venture capital. The second typology, Last Step firms, uses Micro Funding for the last stages of technology and market development until revenue. In both cases these firms only have one to two rounds of Micro Funding. They have a strong sense of market contact, reflected in the presence of revenue and to a lesser extent later stage venture capital.²⁶ They also have robust business models either based on well defined and established previous business and revenue models or on products that are close to their markets.

The third and fourth typologies are more closely aligned with an interactive development model. Technological and market development has not progressed in a linear way but rather through reworking of technology and the reorientation of business and revenue models in response to technical difficulties or feedback from potential customers. The path to market is not as clearly delineated. These firms are usually seeking to commercialise more radical technological innovations for which new markets need to be identified, or they are using new business and revenue models.

In the third typology, Kaleidoscope firms are characterised by the multiple sources of funding they access to fund their product and market development, including a range of Micro Funds, business angels, grants and R&D contract revenue. Here, Micro Funds were one of many sources but important in the sense that they continued to participate in multiple funding rounds over five years or more. The presence of multiple funding partners and the need for multiple funding rounds can seriously distract the management team in developing the business.

The fourth typology is Solo source firms. They use Micro Funds as their main source of funding from inception to the time when revenue is first generated. Further details and examples of each of these typologies are given in the following sections.

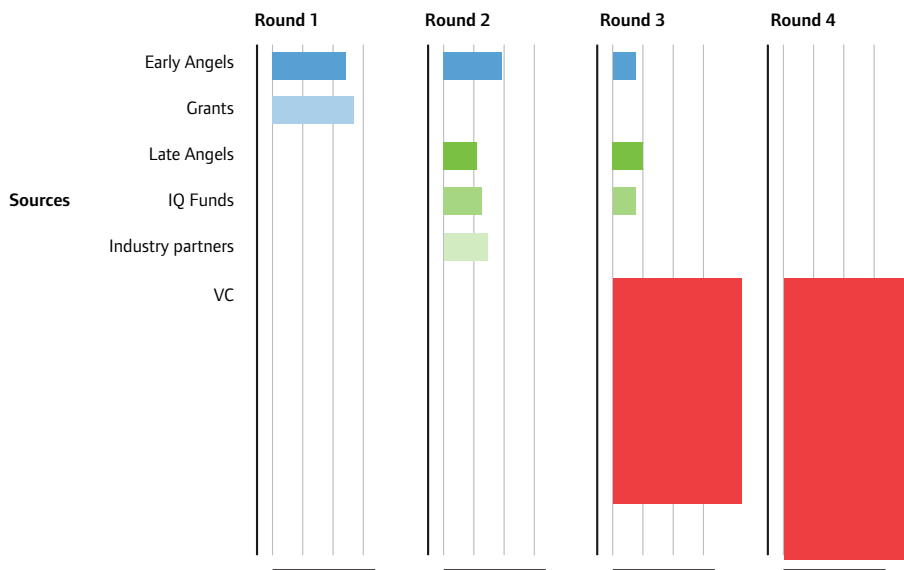
4.2 Springboard firms

Springboard firms use Micro Funds as a stepping stone to greater capital investments from mainstream venture capital funds. Their capital requirements are high, as is the market opportunity and company ambition. Micro Funding is used in the seed stages to achieve conceptual or theoretical proof of concept. Micro Funds are investing at the riskiest period, before technological milestones are met that will attract these later stage investors.

This technological uncertainty is matched by the threat of dilution. The ambition of the firm requires other larger equity partners to be involved, which increases the risk that the early investors will see their control reduced with terms dictated by later investors.

However, if the firm is successful in the commercialisation stage and in capitalising on a massive market opportunity, there is a good chance that the Micro Fund will make good on its initial investment. Moreover, the presence of other and mainstream venture capitalists will also help the firm progress to an opportunity for the investors to realise their investment. Springboard firms are probably the most celebrated pathway for new technology-based firms. Figure 13 and 14 displays the financial pathway and equity breakdown of an exemplar Springboard firm.

Figure 13: Financial pathway of exemplar Springboard firm



Case summary 1: Springboard firm profile

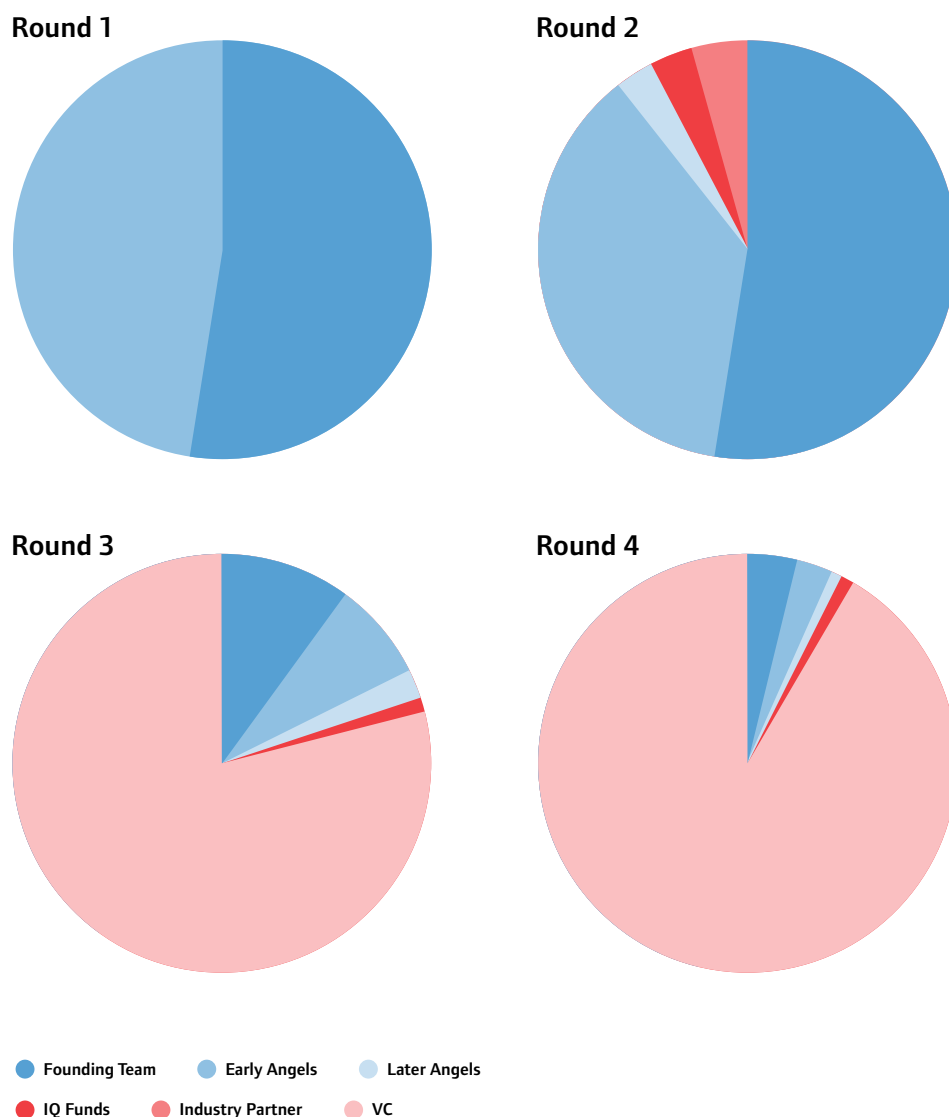
Case A is a fabless semiconductor company. A fabless business model achieves its advantage by outsourcing the fabrication of semiconductors to a specialised semiconductor manufacturer which may have several fabrication facilities, or ‘fabs’. There are several examples of successful ‘fabless’ companies within the Cambridge Cluster. It is unsurprising then that Case A was a start-up by team formation. Case A’s founding team had strong technical, financial and entrepreneurial skills sets and experience brought together in a very strategic manner to commercialise new technology. The ambitions of the company were clear from the beginning – to become a world leading technology player in an emerging technology market.

Case A secured £470,000 in seed financing within its first year, followed by £7.5 million Series A (first round VC) funding. The financing rounds paid for technology development work, and when technology milestones were reached this triggered a further funding round, as this quote illustrates:

“The technology and finance timelines of the company were clearly linked. This kind of operation is finance intensive, we could not do anything without the money.... The key development stages of the company, the inflection points have all been the financing rounds, it was a really key development point for us when we got Series A financing” (Interview with Case A).

Firm A put together an attractive proposition to get funding. Micro Funding in this case was used to follow and bolster business angel support. The investment supported the firm over a short period of time and was used to get to a technology milestone allowing the firm to access further funding from major venture capital firms. External funding was always going to be critical because of the sector. However the ambitions of the firm to grow and grow quickly manifested themselves in its financing strategy.

Figure 14: Springboard exemplar equity shareholdings by rounds



4.3 Last step firms

These firms typically only have one round of equity financing from Micro Funds. These firms are already in the commercialisation stage, and use the capital investment from Micro Funds and business angels to get them through the final stages to ongoing revenue through product sales.

These firms are seeking to commercialise products that are almost ready to go on the market which reduced their riskiness, although there is always still some uncertainty at the time when the investment is made. This uncertainty particularly relates to the overall customer demand and the ability of the firm to meet this demand in a timely and efficient manner. And while achieving revenue and break-even status for the firm is a positive for the investor, it does not necessarily mean that the investor will be able to realise their investment easily, unless the firm becomes an attractive acquisition target.

Figure 15: Financial pathway of a Last Step exemplar

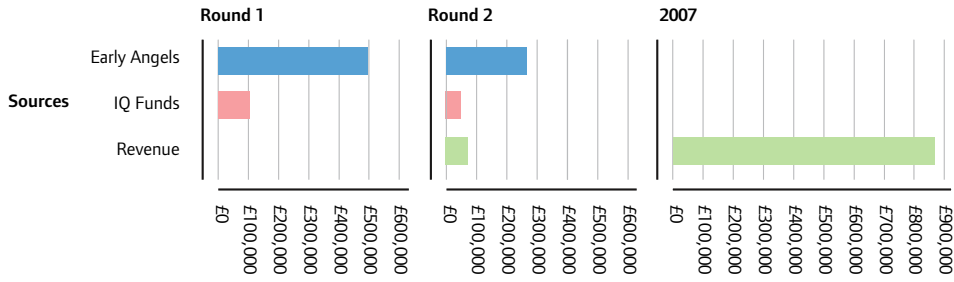
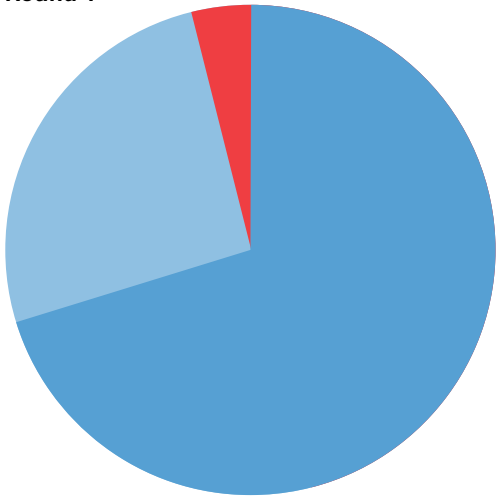
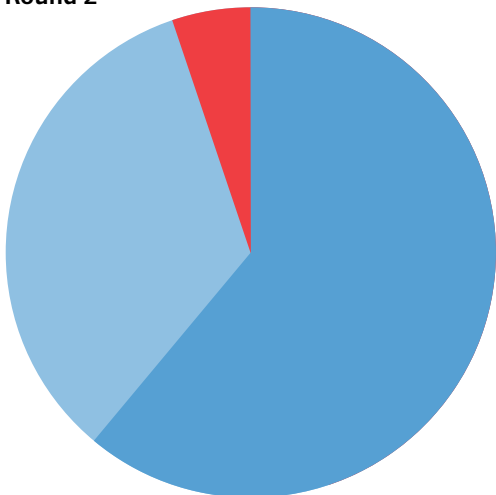


Figure 16: Last Step exemplar firm equity shareholding by rounds

Round 1



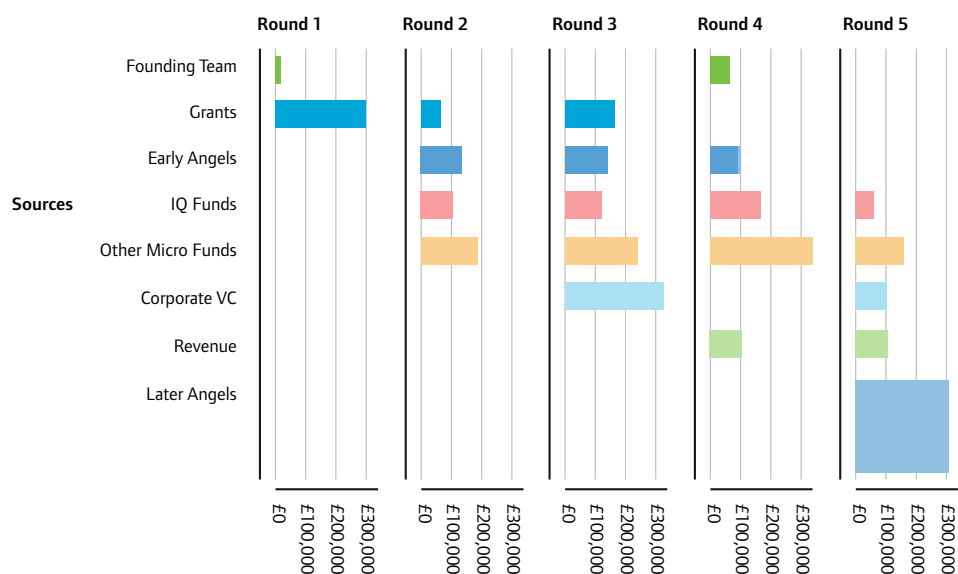
Round 2



- Founding Team
- Early Angels
- Later Angels
- IQ Funds

27. This was not a function of age of the firm.

Figure 17: Financial pathway of Kaleidoscope firm



As only one or two rounds of financing are required, the founding team usually retains the majority of the shares. This model is the one most likely to leave the founders with a significant stake. Figure 15 presents an exemplar financial pathway for a Last Step firm, while Figure 16 represents the shareholding.

These two typologies present the story of firms from start-up to a particular point in time. These are real firms, and they will continue through later stages of the development process and seek and sell products to customers. If we were to come back in five years time and look at their story again, all the pathways and levels of shareholding would have changed. These are just snapshots; whilst a firm may align with one typology now, it is unlikely to find itself permanently in this position.

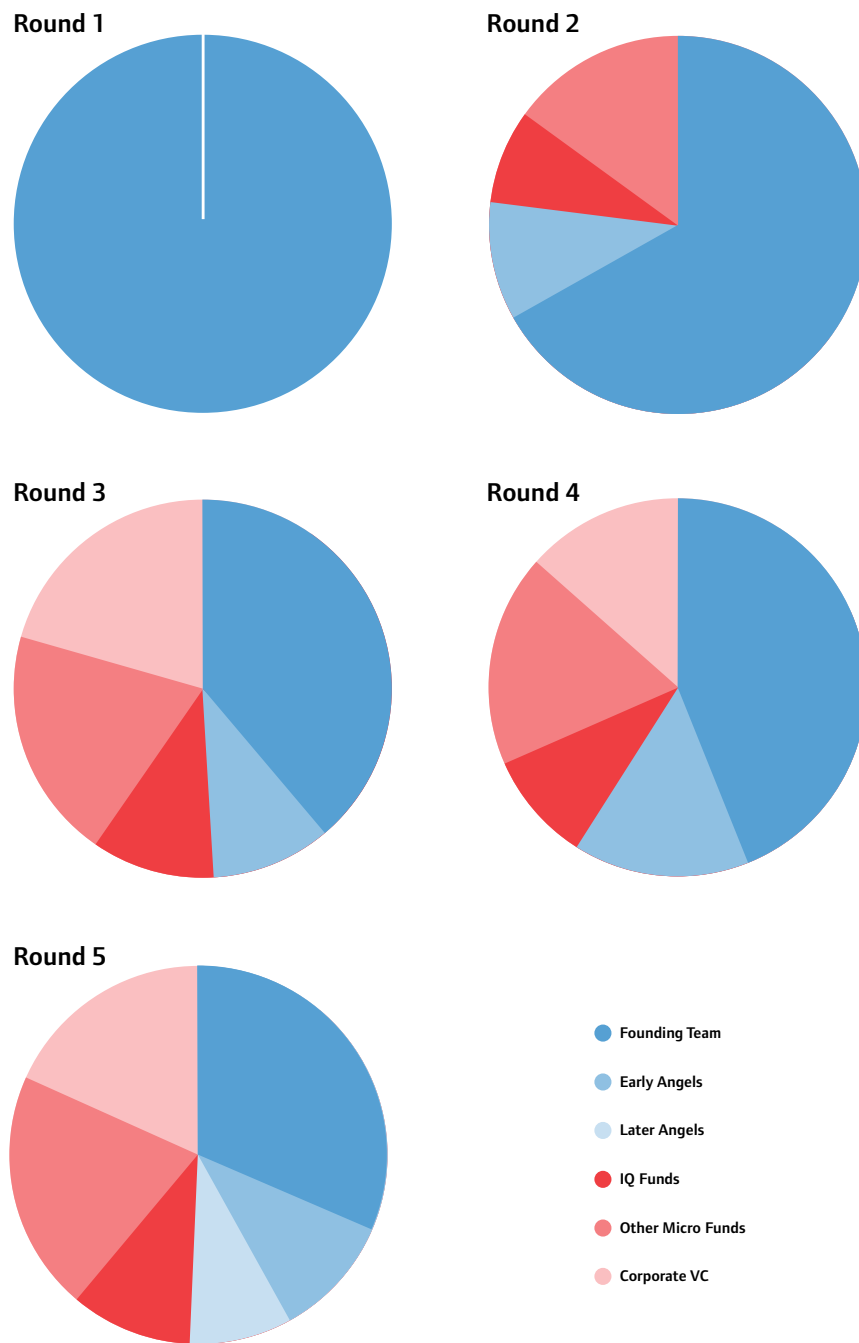
4.4 Kaleidoscope firms

The most distinctive feature of Kaleidoscope firms is their multiplicity of sources of finance. In the case studies most Kaleidoscope firms were in the Healthcare and Life Sciences sectors, where regulatory requirements lengthen the time involved in bringing products to market.

These firms access financing from an array of grants and other supported development opportunities. Micro Funds and business angels are the most prominent sources of equity capital and both maintain their shareholdings through successive fundraising rounds. Of all the firms investigated in this research, Kaleidoscope firms had the most fundraising rounds.²⁷

These firms often also display the ‘soft’ incubation strategies, supporting their product development through research and development contract revenue. They are able to use their considerable R&D expertise to fund aspects of continuing product and market development. In some cases this revenue stream can become a major organisational component of the business. This offers the firm and its investors the opportunity to reduce uncertainty. By focusing on demanded R&D services the firm can stay in touch with market needs.

Figure 18: Kaleidoscope exemplar firm equity shareholding by rounds



However, the focus on contract research and the multiple sources of investment can divert attention from developing the core offer of the firm which can slow growth. As one company interviewee said:

“Contract research is difficult because most investors look at it and say ‘...that revenue is incremental, I am not going to make three times my money out of that...’ but the issue is that many companies start like that, they do that (contract research) to get things off the ground, but later down the track it becomes hard because how do you sort it out, how do you exit from it?”

Case summary 2: Kaleidoscope firm profile

Case study firm H is developing a medical diagnostic device. The firm was founded in 2002 as a corporate spin-out and acquired worldwide licences to develop its product from original research completed in a hospital lab. As part of the spin-out both the managing director and technical director left the parent company to take up the same positions with the new spin-out firm. The spin-out was located on the same premises as the parent company.

Initial seed funding was accessed from the founders and business angels. Three further rounds of funding were received in the following six years, including from further business angels, three Micro Funds and one corporate investor.

Technical development of the diagnostic product took much longer than was initially planned. Although the firm had acquired the technology under licence, the technology did not work in the same way as established in the patent. As a result it spent longer in development.

The firm's business model involved developing a simple, relatively inexpensive manual diagnostic device for the healthcare market in the developing world. However, due to the long development time, further financing was needed. This created a dilemma for the firm: it could no longer focus on the developing world; in order to be attractive to potential investors and on the advice of potential distributors (customers) it was advised to refocus on the large US market. To enter that more sophisticated market would require a fully automated product and Food and Drug Administration (FDA) approval, both of which would require further product development, time and resources.

"In terms of getting additional finance after our seed finance we needed to have the pull of the US market...So we had one manual instrument that we had to put on the shelf and then we turned our attention to the additional things we needed to do to get into the US market...We still have not lost the vision of fully developing a system for the developing world, because the market for that instrument is at least as big as the US, but this (fully automated product) had to be our focus first" (Interview with Firm H).

The multiple funding sources can also create problems when different investors on the board disagree over the strategic direction of the company. This is further compounded when different sources of capital and other resources are put into the firm. As one firm noted: "...we have ten investors in our company, ten people that we have to make happy and make look good" (Firm interview).

4.5 Solo source firms

Micro Funds and business angels are the main sources of external financing for Solo Source, all the way through to revenue generation. These firms operate in moderate to significant market opportunities and have innovation involving the recombination of existing products

Figure 19: Financial pathway of solo sourced firm

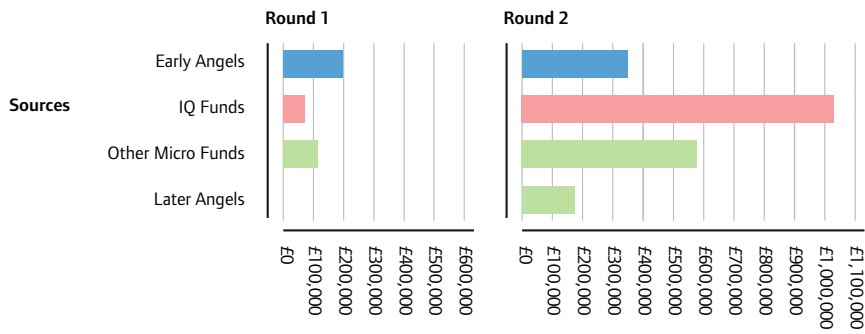
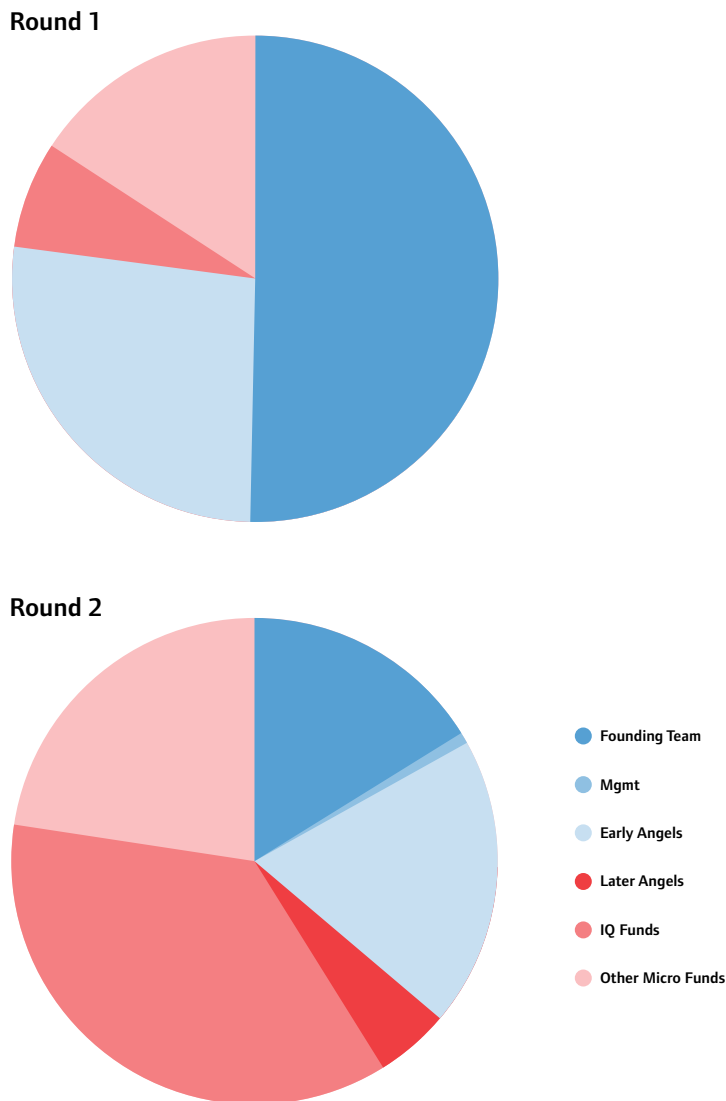


Figure 20: Solo source exemplar firm equity shareholding by rounds



Case summary 3: Solo source firm profile

Case study I is a software company specialising in internet content. The company was founded in 2003 and is currently in the final stages of Beta testing its first product. Innovation and product development in the internet content market is strongly influenced and directed by user activity.

The early business strategy of Case I was to access a small amount of capital (£100,000) to produce an early version. Revenue from product sales would then be used to fund the development of later versions. This strategy was refocused when the emerging market for user-generated internet content expanded rapidly in 2004-2005, with the emergence of YouTube and blogging. Viral marketing and user referral have been prominent in online activity, but really came into their own in these last few years (Howard 2005).

Case I responded – “the best way in which we can capture the enthusiasm of our early users is through internet community spaces, including web forums.... (We) need to be able to create more effective and sticky community spaces on the web for our users... We would put extra effort into building the online community and forum space for our earliest users, as a catalyst for marketing, PR and product improvement” (Case I business planning documents).

Reflecting on this, one company interviewee commented: “in software businesses today there is a minimum quality threshold – I ignored advice to get early revenues by putting out an early bit of product, you cannot cheat this business and you only get one chance” (Firm interview).

In Case I, complementary assets in the form of web user community spaces, particularly web forums needed to be developed and maintained. This required upfront and ongoing resources to start and update these forums. The forums, however provided the firm with a mechanism for beta testing their product with users, as well as ability to capture user feedback and user innovations.

as well as the development of new ideas. They are concentrated in the Communications and Software industry sectors.

Interviewees suggest that this group of firms suffers most from a lack of external financing. Micro Funds are less likely to see their control diluted with these investments, yet the moderate to significant market opportunity and relatively weak IP environments make them less attractive investment propositions for mainstream venture capital. This results in a volatile financing environment with access to a limited set of investors.

As one firm commented: “What do the Micro Funds do, they know the company needs more money, they know that if they let other investors in they are going to get diluted – it is almost like despair sets in, and they hold back, see what happens, maybe we will deliver a product and then they can invest again at a lower risk” (Firm interview).

A key focus for these firms is market development activity such as the creation and support of user communities. The costs associated with these kinds of activities are not always well understood in the equity investment environment, nor supported through grant funding.

Case summary 4: Solo source firm profile

Case study C is a communications software company. Founded in 2005 by three Cambridge-based technology professionals. The three founders previously worked together for the same silicon chip manufacturing company before being made redundant when the company closed its UK operations.

The trio decided to create a company using their combined financial reserves (from redundancy payments) and technical experience in high volume hardware development. The company provides a software/hardware package integrating telephony functions with Customer Relationship Management (CRM) software.

In its first year of operations, Firm C secured business angel investment from a prominent Cambridge entrepreneur. As the initial resources of the firm were primarily technical, the investor provided commercial/entrepreneurial experience to the board, as well as the network and reputation benefits of having such a prominent individual associated with the company.

The lack of market focus however at the early stages was not so easily overcome. The firm's first group of products was not well received by the market. This was not because of technical deficiencies but because customer demand had not been properly analysed: "...Our business plan was wrong, I made the mistake of accepting it when I arrived as being tested but it wasn't. There was no due diligence done on the plan, we had big targets for the product, used the funding to make the product, we were looking to sell at 50 per cent margins, difficult market conditions, the largest company in the market had just done a deal with the major supplier, which effectively cut us out of the market" (Firm interview).

The company has since refocused its product in line with market demand and expectations following a dialogue with distributors and customers.

This can further increase volatility in the amount of funding offered to firms: *"I understand the pressure on Micro Funds, they need to deliver returns and they need to maintain control, but there is tension from my side as well, we need the money, in a six month period the amount of money available to us has changed by a factor of five."* (Firm interview).

4.6 The experience of Micro Fund investment

This section analysed the individual experience of firms with Micro Fund investment. It examined both how firms used Micro Fund investment and how this investment fitted into the firms' financial pathway. We identified four typologies of Micro Fund investment; Springboard firms, Last Step firms, Kaleidoscope firms and Solo Source firms.

4.6.1 Four typologies of Micro Fund investment

Where adequate funding, one or two funding rounds and sequential technological and market development represent the ideal pathway, the first two typologies, Springboard and Last Step firms, come closest to that ideal.

Springboard firms use Micro Funding to achieve technology milestones before accessing much larger sources of funding, usually from later stage venture capital. Last Step firms use Micro Funding to get through their final development stages and to start earning revenue. These firms are usually commercialising technologies that are almost market-ready, whilst Springboard firms are developing more radical technological applications.

The final two typologies, Kaleidoscope and Solo Source, are more closely aligned with an interactive model of development. Firms within these typologies may have started off with the expectation of being Springboard or Last Step firms, but technological and market difficulties in commercialising their product changed their financial pathway.

4.6.2 Impact of these typologies on Micro Funds

These typologies offer a snapshot of how firms progress from start-up through successive funding rounds. They are, as a function of their uncertainty, liable to change in the future. A Kaleidoscope firm could achieve major technological milestones that open up alternative funding sources. The firm's financial pathway could then align more closely with the Springboard typology. On the other hand, a Springboard firm could run into technological difficulties or external challenges in the current financial environment, which will mean its future pathway, will align more with the kaleidoscope typology.

The challenge for the Micro Funds is matching their fund and portfolio objectives to the development of their portfolio firms. Success and failure of firms in each of these typologies will have different consequences for the Micro Funds.

5. Defining success for funds and firms?

The development of new technology-based firms is rarely a linear process. The previous section set out the experience of portfolio firms with Micro Fund investment. The uncertainty of NTBF development means the position of individual firms within the four typologies identified in the last section is liable to change over the firm's lifetime.

Success and failure within these typologies represent different scenarios for the Micro Funds. This section looks at how Micro Funds see themselves, how they see their role and what defines success and failure. We use information collected from interviews with Micro Fund managers and portfolio firms on their perceptions of Micro Fund managers.

5.1 How do funds see their role?

"I see the real role of Micro Funds is to be intelligent money, to be much more hands-on and productive than other forms of funding such as debt providers" (Investor interview).

The way in which funds see their role is shaped by the mandate of investment activity attached to their fund. There are five major government funding sources of venture capital: Early Growth Funds; Regional Venture Capital Funds; EU Co-investment funds; Enterprise Capital Funds; and University Challenge Funds.²⁸

Each fund has a different size – from £5 million up to £30 million – and focus. This means that each has different boundaries to their investment activity. Their size affects their ability to invest in different sectors, the stage of investee firm development, the position of their investment lead investor, following business angels, part of co-investment syndicate and their ability to follow successful investments.

Focus is also determined by policy objectives. Regional Venture Capital Funds have a geographical focus, EU funds have a focus on disadvantaged areas, Early Growth Funds on following business angels, and Enterprise Capital Funds on bringing in private money (both from angels and funds) to the early stage and making competitive returns.

The role of funds and their success in this role needs to be considered within these boundaries. Figure 21 provides shows the limits of these boundaries with two important factors: stage of development; and market opportunity.²⁹

On the whole, Micro Funds see their role as investing at the early stage of a firm's development. They favour high technology firms and firms with exit timelines of between three and seven years. Different investors seek different milestones in a firm's development. Some funds will only invest after proof of concept milestones, others will invest earlier. There are similar differences of expectation with exit timelines.

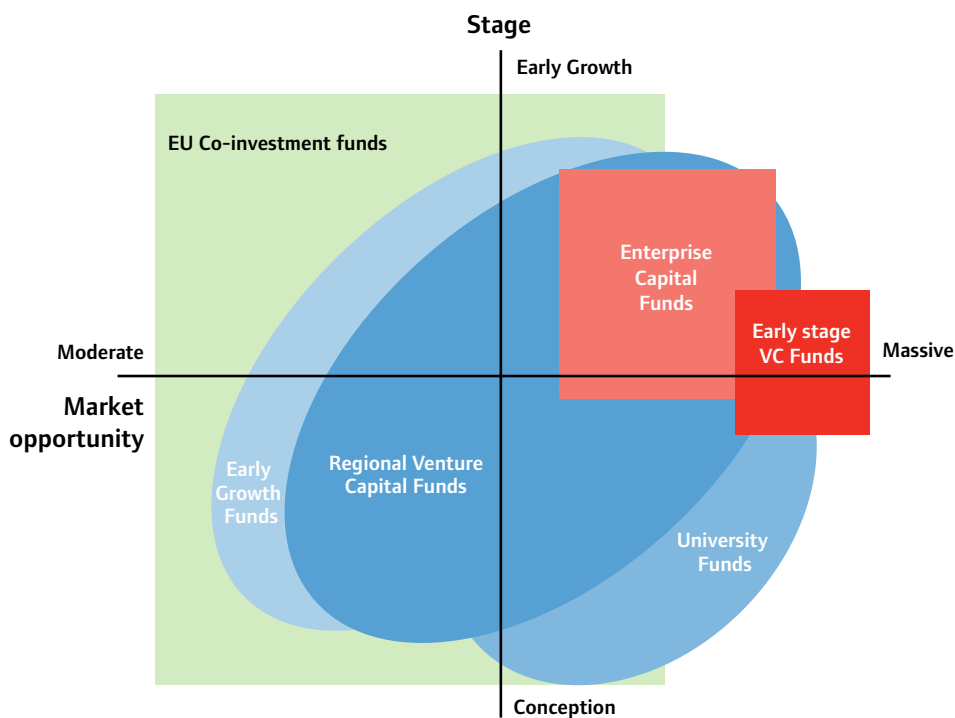
This diversity is essentially driven by fund size, and to a lesser extent the need to balance the portfolio. These three factors are also important in defining the success for the funds.

28. Please see 'Appendix C – Overview of Government policy and support' (available for download from www.nesta.org.uk), particularly section 1 for further description of the different types of government-sponsored Micro Funds.

29. This research is based on the analysis of three different government-backed funds managed by one fund manager. Figure 21 is the result of an assessment of these funds, the firms they invested in and the co-investment partners of these firms.

30. With EU Co-investment funds a non-financial objective includes employment creation measures.

Figure 21: Fund positions



5.2 Fund performance

What defines success for an investor can be assessed on two levels: success with individual portfolio firms; and the overall success of the fund. At both levels, financial success is the key objective, but its interpretation reflects the fund's mandate (what they were set up to do) and may include non-financial objectives.³⁰

5.2.1 Financial performance

Table 2 summarises information about the three funds under investigation in this research. Since 2003, over £10 million has been invested in portfolio firms in the three funds. In December 2007 the portfolio was valued at £10,207,307. The oldest of the funds was set up in 2003, so there is still at 5-10 year wait for the full portfolio to reach maturity. The future performance of the portfolio firms and funds will also need to be considered in the light of the financial crisis and current economic downturn. Although equity investments are long term investments, due to the fixed nature of fund activity (10 year funds) investment performance is affected by cyclical economic activity.

Perhaps a better way to look at the funds' performance is to consider the individual performance of firms and whether they have created value. Table 3 shows the status of portfolio firms in four groups: those that have increased in value; those that have decreased in value; those that have remained the same; and those that have been written off (where the value of the investment is now zero).

Interestingly, the same percentage of firms has increased in value as has decreased, each representing 21.2 per cent of the portfolio. The value of the increased firms is more than the loss of value in the decreased firms.

Table 2: Portfolio summary information

31. Valuations calculated as per BVCA Valuation Guidelines.

Total amount invested to date	£10,227,157
Total current market value ³¹	£10,207,307

Table 3 also gives the average (mean) age of the investments in the four groups. The investments that have increased in value are two months older than those that have decreased.

Investments that have stayed the same are the youngest of all the categories. This is partly explained by a number of recent investments by the IQ Fund. This fund was only established in 2006 and made its first investments in 2007. There are also investments which have remained at the same value that have been within the portfolio for several years. Portfolio firms that have the same value are the largest of the four status categories with 45.5 per cent of the portfolio.

The investments that were written off had an average age of 2.4 years and made up 12.1 per cent of the portfolio. The spread of increases and decreases in value of portfolio firms over time is shown in Figure 22. The points in the circles mark investments that have been exited – either sold or liquidated.

Figure 22 reinforces the long term nature of equity investing as well as the associated risks. From the chart we can detect that there is a critical time period for the portfolio firms of around three years during which the value is either created or lost.

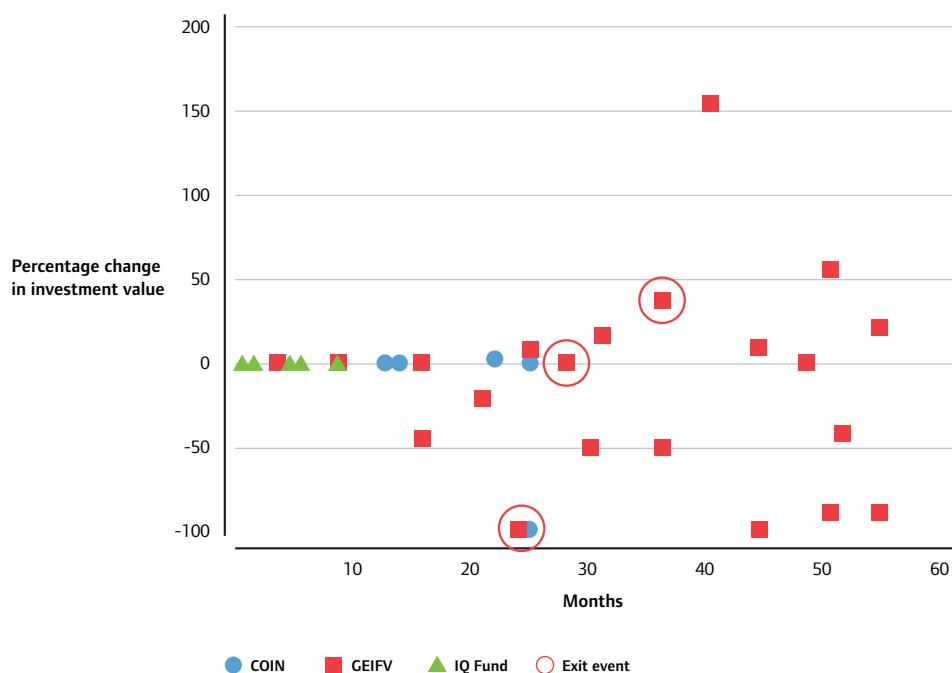
5.2.2 The power of one or two winners

It is hard to assess performance of a fund and the portfolio firms within the window of active investment. Many of these portfolio firms are still developing product and market, therefore their valuation and what it represents may change in the coming years. The picture that Figure 22 gives us however is very similar to the expected returns from venture capital; a few big winners, some losers with the rest breaking even or staying the same.

Table 3: Portfolio performance characteristics

Firm investment status	Percentage (no.) of investments	Percentage value of total invested	Mean time (yrs) value since first investment
Increased	21.2 per cent	12.5 per cent	3.3 years
Decreased	21.2 per cent	-11.5 per cent	3.1 years
Same	45.5 per cent	59.9 per cent	1.2 years
Written off	12.1 per cent	12.1 per cent	2.4 years

Figure 22: Change in individual portfolio firm investment value (percentage)



The issue for Micro Funds is whether the returns from the successful investments will cover the losses and still make returns for investors. From Figure 22 it would seem that this is not possible. This is backed up by one company interviewee: “...there is lots of money in the system but no one knows how to get any return on it. Most funders want you to be in that sweet spot (of creating value), and there is a gap between conception and that spot, and that is where the early stage firm is. If you don’t get the funding you won’t get to that spot, but then again you might not be ready for it anyway, so the funders cannot make their money work...” (Firm interview).

5.2.3 Non-financial returns

Money, time and other professional activities have been invested along with capital over several years. If no financial returns have been made from these investments, are there any other returns? The individual mandates and objectives of the funds suggest there are. Employment and regional economic development are often cited returns, but there is also entrepreneurial competence building, and the transfer and diffusion of start-up experience, technology and market knowledge.

These are considered valuable returns. Much policy is focused on generating such activities in economies. And these returns don’t always accrue with corresponding commercial returns.

However, there is no consistent framework to measure them, particularly in the first three to five years of investment. Given the paucity of early stage commercial returns, more effort needs to focus on identifying and measuring these non-commercial returns to justify the continuing activity of these funds.

5.3 Limitations of Micro Funds

5.3.1 Punitive dilution and Micro Funds

"I would love to be able to avoid dilution, because it really destroys the incentives for early stage investors, but there is no easy answer, but fund size does have a lot to do with it for Micro Funds" (Investor interview).

Dilution – or loss of control – is a concern for all early stage funds because of the strong likelihood that most investments will not increase significantly in value in the early rounds. This is expressed in the following quote: *"Dilution, we don't like it, so we have become much more focused on putting money where it will work and cutting it where it is not. If you cannot follow your winners then you are putting yourself in a vulnerable position with regards to dilution" (Investor interview).*

Early stage investors accept that there is a strong chance that other investors will come on board at a later stage, if the firm is successful. This is not necessarily a problem when the portfolio firm is creating value and any reduction in equity share is compensated for by an increasing share price. The problem of dilution arises when the share price is not increasing.

A critical activity for early stage investors is the initial valuation of a portfolio firm. A first round valuation that is too high will not allow the investor to earn on the investment. Too low a valuation makes the investment unattractive to the founding team. Initial valuations are also made more complex by the participation of multiple investors.

"Our attitude has really changed to dilution – we stopped thinking of ourselves as victims and said well if this is how it is done, we will only put money into building value. We work hard to make sure there is a proper valuation done at the first round, rather than rushing to get the deal done...I notice at the early stage there is a tendency to over-value businesses..." (Investor interview).

5.3.2 Experience of co-investment

"...co-investment is important, we want the company we are investing in to be funded properly, we don't want the company always out there looking for money, they get the culture of constant fundraising rather than building the company..." (Investor interview).

Co-investment activity in the early stage environment has increased markedly over this decade. In 2007 it accounted for 37 per cent of early stage deals compared with 10 per cent in 2001 (Pierrakis and Mason 2008). For government-backed funds co-investment is the norm.

Co-investment increases the funding available to portfolio firms at the early stage. As funds operating at this stage are small, co-investment provides further financial capacity. Co-investment also signals confidence in a firm. If one investor or set of investors is prepared to invest, this encourages other investors, as well as reducing the total risk of each investor.

But, co-investment can also create another set of issues for both firms and investors, not least where multiple investors are represented on the board, each with their own views on the strategic direction of the firm.

One investor noted: *"... we are dealing with companies in their critical stages, you cannot be on the board just because you put money in, there needs to be something else..." (Investor interview).*

Interviews with both portfolio firms and investors suggest that this is a recognised area of change in early stage equity investment. The relationship dynamics between investors, and between investors and the firm, can direct the performance of the firm, its strategic

32. The TTP Ventures £30m ECF Fund was announced in December 2008.

direction and its access to further funding. The dynamics of co-investment relationships will require continuing research.

5.3.3 Selecting and developing firms

“The big lesson that we have learnt over the years is about investing in companies with too early stage technology and you get the risk of the classic ‘crossing the chasm’ type problem. Unless you have already got at least the fast followers interested it is going to be difficult to be sure that you have a real market for the product. In many ways it is less whether the technology is unique or original than is it meeting a real point of pain in a market out there, not just providing consumer delight” (Investor interview).

This investor highlights the space where Micro Funds operate. It is after the initial technology development phase, again raising the issue of how these early stages are funded.

The investors interviewed agreed that public grants played a major role in funding this pre-investment period: *“...public funds are very important at the early pre-proof of concept stage, usually in the form of grants, because it is commercially unviable to be involved at this stage. This is really important to get things going for the companies, getting things going right” (Investor interview).*

Yet, we have seen that grant income increased over success equity rounds. In the light of these comments from investors, one would expect the bulk of grant funding to occur in the early stages before equity financing.

The current financial crisis will provide further challenges to new technology-based firms and early stage investors. *“There is definitely going to be significant changes. Series A is going to be harder to get, revenue projections for some of our portfolio firms will not turn out, it will mean that more companies will have cash flow problems, and in some cases we may have to look at doing another round” (Investor interview).*

5.3.4 Fund size and focus – the main issue

“One of the most painful lessons we had to learn was that all the funds we were involved with were too small to protect their interests in really successful companies, £50 million is really the point of critical mass, anything below that you cannot protect yourself adequately” (Investor interview).

There was general consensus that fund size is the most critical limitation for Micro Funds. There was also broad consensus that funds under approximately £30 million were unsustainable.

“Sub-£25 million makes a lot of difference...it is all to do with track record, ability to follow, the credibility within the industry to attract deal flow, money, good people, if you don’t have enough money to get the people, you cannot do a good job” (Investor interview).

Government-sponsored funds appear to be aware of this need for critical mass; fund sizes have been growing. The most recently announced Enterprise Capital Fund (ECF) is worth £30 million.³² Whether this amount would protect Fund Managers from loss of control will require further evaluation.

Fund size affects not only the ability of the fund to select a range of investors and follow successful firms, it also helps determine the type of fund managers that can be attracted to the industry. However, this latter point is somewhat mitigated by the presence of so many experienced fund managers who are involved because of other non-financial reasons, as illustrated by one investor:

"I think it is of course, up to a point about money but the thing that distinguishes some Micro Fund managers from say a 'city' private equity manager is that it is not only about money and not about maximising money. If it were we would be doing something else and certainly not in a Micro Fund context" (Investor interview).

33. Business practice discipline refers to activities such as board meeting reports, agendas, documenting business and market planning etc.

34. See Large, D. and Muegge, S. (2008) Venture capitalists' non-financial value-added: an evaluation of the evidence and implications for research. 'Venture Capital.' 10:1, pp.21-53. See p.9 for a comprehensive list of non-capital VC contributions.

5.4 Firm views on business development and success

This final section considers portfolio firms' views on the success of Micro Fund investment in their firm. We consider two issues: their view of the non-capital contributions of equity investors to their firms; and the effects of multiple investors (including investor classes) on the firms.

5.4.1 Firms mixed in their opinions on value of non-capital support from Micro Funds

One often discussed aspect of equity investment is the value to portfolio firms of non-capital contributions by investors to the firm. These contributions can include business practice discipline,³³ strategic advice, access to network contacts, introductions to potential customers and suppliers, assistance in supplementing the management team and contacts with potential future financiers.³⁴

Previous research has shown that venture capitalists play a role in highlighting unconscious and ill-considered behaviour in their portfolio firms (Berglund, Hellstrom et al. 2007). This occurs when portfolio firms act without a clear purpose or on unverified assumptions (Berglund, Hellstrom et al. 2007).

These actions associated with business practice discipline and changing behaviours in portfolio firms are of an unconscious nature and therefore hard to evidence directly. But interview data can provide evidence on the other forms of non-capital contributions and whether a portfolio firm receives and values these contributions. Portfolio firms have mixed views about the extent to which their equity investors deliver these non-capital contributions, as these quotes show:

"...the funds are good in terms of the other assistance they can give you, leverage with contacts, giving you recommendations...all these small ways of pushing you forward..."

"...no, they only provide money. I had to laugh when they said they were giving us the money plus all these other things that they said they were going to do for us...not true, absolutely no involvement in the business development..." (Firm interviews).

These anecdotes show the divergence of view and reflect previous research findings that identified a significant gap between the perceptions that entrepreneurs have of the non-capital contributions that fund managers will make and what they actually provide (Berg-Utby, Sorheim et al. 2007).

Other research shows that firms' perception of the value of non-capital contributions from fund managers was affected by their own performance. In this case fund managers were seen as fire fighters, contributing more to firms when the going was tough.

"We tend to get involved with our portfolio firms most when something critical is happening...clearly the most successful funds are the ones that are most involved with their portfolio firms...but it is also about how the firms relate to us, if firms are prepared to open up and get us more involved...it is a random process, you cannot plan out how these relationships will occur" (Investor interview).

5.4.2 Multiple investors sometimes difficult to manage

Firms also have mixed views about co-investing. All the portfolio firms have multiple investors over the different investor classes (angels, Micro Funds, venture capital); they often have multiple investors in each class.

When we examined investors' perspectives of the risks associated with co-investing, we saw that different investors had different methods of monitoring their investment, including through taking on board positions. This had the potential for mixed messages regarding a firm's strategic direction. The comments from firms reflect this concern:

"...we have five investors, each of them with a different paradigm in their head, chairman different as well, the mix is phenomenal..." (Firm interview).

This has had the effect of slowing down business development through the inability to act on board agreements: *"...I had 19 investors including some that are out of the country – I had to hire a private detective to find one of the investors so that I could get sign off on an agreement..." (Firm interview).*

Or the gaining of board agreement in the first place: *"...when investors have agreements where they want veto rights on a 1 per cent shareholding it makes it very hard to bring in other investors because you need unanimity..." (Firm interview).*

Even though most firms could highlight examples of where multiple investor relationships had either slowed down or stopped business development, they generally acknowledged that managing these multiple relationships was part of receiving equity investment. In some cases, having multiple investors can be positive, such as when a round needs to be put together quickly or when the firm is in difficult circumstances and not all investors want to re-invest.

5.5 Success and limitations of the Micro Fund model

This research has investigated the experience of a group of current Micro Funds and their portfolio firms. Our aim has been both to characterise current experience and to look forward and identify areas of limitation in how Micro Funds support NTBFs. This section has highlighted two inter-related limitations of the Micro Fund model.

5.5.1 Fund size

The first relates to size. Fund size affects every aspect of Micro Fund activity. Though we are not proposing any particular size from the research, investors suggest in interviews that £50 million is the optimum level that provides critical mass and some protection from dilution.

5.5.2 Fund model

The second limitation is the fund model. Can financial returns from a couple of highly successful firms carry the Micro Fund, as with later stage venture capital investing? Or is a new model, specifically designed to support early stage firms and early stage investors needed? The evidence suggests a new model is required.

6. Micro Funds as technology incubators: conclusions and policy implications

1. What is the Micro Fund investment model?
2. What has been the experience of the new technology-based firms?
3. What role does Micro Fund investing play in their financial pathways and why?
4. Is government sponsorship of these funds a suitable method of NTBF support?

This section begins by reviewing the definition of Micro Funds. The section then summarises our conclusions and makes policy recommendations in four areas: financial and non-financial returns; the Micro Fund model; business angels; and the wider program of government support for innovative businesses. This research shows that the role of Micro Funds in the development of new technology-based firms is primarily one of technology incubation.

6.1 Defining Micro Funds

This research defines Micro Funds as small venture capital funds managing £30 million or less. The funds are typically investing £2 million (including follow-on investments) in portfolio companies.

Whilst Micro Funds are defined by their size, they also have two other common characteristics.

- They usually have government sponsorship – where a proportion of the fund comes from a government source, either British or European.
- They specialise in early stage investing – by function of their size or their government sponsorship.

Micro Funds play an important role in providing early stage equity. Government sponsorship of many of these funds has highlighted their activity in recent years. Micro Funds are not the only early stage funds; specialist private funds also provide such investments and tend to be much larger than Micro Funds (£30-£100 million) and therefore invest larger amounts in their portfolio firms. This has created a clear segmentation of the early stage equity market, where Micro Funds play a major role in the financing of a specific set of early stage firms.

35. There has been a decline in the share of total VC/PE investment by value that is accounted for by early stage investments since 2000, falling from 11 per cent of total investment by value to 4 per cent in 2007. In 2001 private sector funds accounted for 85 per cent of all deals less than £2 million in rounds 1-3 (proxy for early stage) and although these private funds in 2007 invested roughly the same £ amount, this accounted for only 53 per cent of early stage deals.

6.2 These firms have complex development paths

The early stages of these firms are associated with considerable research and product development as well as market exploration. A high level of uncertainty is attached to these firms; the technology is usually yet to be proven and the market and customers are still to be identified.

This 'trial and error' technology development process should not be confused with a lack of 'investment-readiness' (the experience and development of the entrepreneur). They are two distinct sets of challenges.

External risk capital investment in these firms is a critical source of funding and survival. The long path to earning revenue and the high cost of research and development exhaust any early investments by the founders, their families and friends. Other forms of external finance, such as debt, are unsuitable due the largely intangible nature of the assets that these new technology-based firms possess. Consequently equity capital is critical for these firms.

6.2.1 Their development rarely goes to plan

New technology-based firms diverge in their development paths. A few have a relatively linear development path progressing in a planned pattern from early technological development, through prototyping, market development, before eventually acquiring customers and sales.

But most of these firms have a more complex development path where technical difficulties, or issues with market entry and demand force constant re-workings of their business plans. These firms are more interactive in the development path, in the sense that they must respond to feedback regarding technology and their market. Developing novel technology to meet an often new commercial market is intensely difficult and no amount of entrepreneur training can eliminate it.

These more complex development patterns require ongoing funding, although not always at the scale of activity evident in later stage venture capital. They also need support over a significant period (5-10 years). As an example, our research shows that firms with three or more investment rounds had at the completion of the third round raised on average £2.3 million over two to three years. This is well below the entry threshold for mainstream early stage venture capital activity.

6.2.2 Structural changes have altered the role of participants in the early investment environment

Recent research into the UK early stage equity environment (Pierrakis and Mason 2008) highlights structural changes in the environment in recent years. Private sector investors, including funds and business angels, are now responsible for proportionately less investment in early stage financing. Within this private investor category, business angels are more likely to fulfil the role of investors than private sector funds.

The public sector is now funding more new technology-based funds, though their total investment is still less than half of the amount invested in the early stage (Pierrakis and Mason 2008). The public sector invests through their sponsorship of Micro Funds. Co-investment between these public and private investors is now the norm.

There are two main reasons for the lack of interest³⁵ in early stage investments by successful venture capital funds. First, successful fund managers are able to raise progressively larger funds from investors. This inevitably leads to a concentration on larger and later stage deals.

The second and more important factor is the poor investment returns of early stage investments over the past 20 years relative to risk. The lack of interest in the early stage by institutional fund of fund investors is therefore economically rational.

36. CRIL (Cambridge Research Investment Limited) and early funds of Prelude are both examples of previous Micro Funds operating in the Cambridge area.

6.3 The role of Micro Funds in the financing of NTBFs

Micro Funds are not new. There are numerous examples of small venture capital funds specialising in early stage investment.³⁶ However, the current focus on government sponsored funds has increased their prominence and frequency.

6.3.1 The Micro Fund investment model has similarities with other equity investors

The evidence in this report suggests that there are both areas of similarity and difference with the established venture capital investment model. There is some difficulty in assessing the current Micro Fund investment model, because most are still in operation, and are first generation funds. We cannot therefore assess the entirety of the fund with all investments exited and capital returned to the original investors.

However a number of conclusions can be drawn from the funds analysed in this research.

Micro Funds operate in similar ways to the traditional venture capital model in their deal screening processes. They look for firms with products that have technological merit and have developed prototypes. They also look for management teams that have previous experience and some knowledge of the equity environment.

6.3.2 Size and fund mandates limit Micro Fund activity

The relatively small fund size constrains their activity in investing, follow-on investing and completing due diligence to the same level as later stage private funds. The capacity to follow and attract good fund management expertise is the critical point limiting Micro Fund success. These limitations are primarily a function of size.

Micro Funds typically use the limited partnership model with a lifespan of up to ten years. Some Micro Funds have demonstrated some flexibility in this respect, negotiating funds with longer life spans. As with later stage venture capital, Micro Funds also expect the majority of the returns to the fund, to be provided by one or two highly successful investments from their portfolio.

Government backed Micro Funds however also have additional objectives (including amount invested, geography of investment activity, employment and economic development outcomes). These mandates and the limits on the size of investments allowed in individual portfolio firms restrict Micro Funds' investment activity. These constraints, together with a focus on very early stage and technology firms mean that portfolio 'winners' will not be as straightforward or as quickly evident as in later stage private funds.

6.3.3 Co-investment is the norm for Micro Funds

Micro Funds co-invest in new technology-based firms with other different kinds of investors including business angels, other Micro Funds (each often with different investment mandates), later stage private venture capital funds, corporate venture capitalists and various industry partners.

Co-investment potentially brings a great deal of depth and experience to the portfolio firm, as well as overcoming some of the funding limitations that these investors may have individually in supporting the firm. However co-investment can also complicate the firm's strategic direction, with multiple investors having different objectives.

Evidence collected for this research shows that the existence of multiple investors can slow the progress of the firm, occupying management time in meeting investor inquiries and expectations, while existing investors can also block later, larger investors.

6.4 The experience of firms receiving Micro Fund investment

The second research question investigates where Micro Funding fits into the overall financial pathway of new technology-based firms.

6.4.1 Micro Funds are the most significant investors in the firms in which they invest

The research provides average financial pathways and levels of equity shareholding across successive funding rounds. For most of our surveyed firms, Micro Funds were the most significant external equity funding providers.

For firms with longer development trajectories requiring three or more rounds of financing, Micro Funds provided the largest amount of funding at round three and accounted for 57 per cent of the firms' shares after this round.

But Micro Funds are not well equipped to make large follow-on investments for the long periods of incubation often required. The combined impact of their size, early stage focus and investment capacity mean that although they invest at the riskiest stage of the firms' development, they are not in a position to recoup adequate rewards from successful investments.

6.4.2 Business angels are key co-investment partners alongside Micro Funds

Business angels also play a significant role in the financing of these firms. They tend to be the largest private sector investors (although second to public-sponsored Micro Funds) in the firms investigated, investing in the round before or at the same time as Micro Funds and maintaining their investment into later rounds.

For firms with more than three fundraising rounds, business angels had more than a quarter of the shares in the NTBFs after round three. This suggests that they are important co-investment partners with Micro Funds in supporting complex new technology-based firms in their long development trajectories.

6.4.3 Firms' development path influences experience of funding

The firms investigated diverge in their development paths. All firms start off with a planned pattern of development, which is essentially linear. Most firms diverged from these plans as a result of technical and production difficulties or misjudgement of market demand and customers, or a combination of both.

Four typologies of firms were identified. The first two aligned closely with the linear pattern, but diverged in terms of their technological and market opportunities.

Springboard firms used Micro Funding to achieve early technological milestones before moving on to significantly larger funding sources usually in the form of later stage venture capital. Last step firms used Micro Funding to fund technology and market development until revenue. These firms had strong market traction and were commercialising near-to-market products and services.

The third and fourth typologies were more interactive. Although they may have started out with clear plans, technical and market difficulties forced those plans to be reconsidered and revised. These firms were commercialising newly developed technologies, often needing to develop completely new markets.

Kaleidoscope firms were characterised by the multiple sources of funding they accessed to support their development. Micro Funds were one of many sources, though they were important in their ability to maintain their investment over multiple rounds and for at least five years.

Solo Source firms use Micro Funds as their main source of funding from inception to earning revenue. Their mix of new technology, lower traditional intellectual property protections (patents) and their need to spend significant resources on developing market/user relationships made them less attractive to other later stage equity investors.

The challenge for Micro Funds is to match their fund and investment objectives to the development path of their portfolio firms. Success and failure of firms in each typology will have different consequences for the Micro Fund. For example a Last Step firm may move quickly to profitability yet offer little opportunity for an early exit for investors, whereas a Solo Source firm could need multiple investment rounds over 5-7 years but have the potential for significant returns in a trade sale.

6.5 Are Micro Funds a suitable method of NTBF support?

The final research question addressed whether continuing government sponsorship of Micro Funds is an effective mechanism through which to support these firms? This research can only provide limited evidence from our in-depth investigation and interviews with other fund managers; these conclusions would need to be tested on a wider range and geography of firms and funds.

Early stage investing is characterised by high degrees of uncertainty. This is represented by the number of firms, who despite clear plans often develop in more complex ways. This complexity emerges from their specific technical and market difficulties as well as the wider economic environment. All this requires flexibility and longevity from investors.

Below we present policy recommendations based on this research. Whilst the development of precise policy instruments was beyond the scope of this study, we identify what those instruments should be designed to achieve.

6.5.1 Returns of Micro Funds

This research shows that Micro Funds invest in financing these complex technology firms. However, the financial returns for supporting these firms do not appear to be on track to meet the commercial expectations of investors in the light of the higher risk of this form of investment. However, in the absence of a complete picture for the first generation of funds (including for the three case study funds in this research) it is not yet possible fully to assess total returns to the funds.

In sponsoring early stage funds the Government is seeking to encourage other activities beyond financial returns. It is also interested in non-financial results or 'spillovers' including the regional stimulation of pre-commercial investment activity in new technology, the development of serial entrepreneurs, the formation of business angel networks, the support of a new generation of fund managers and the provision of start-up business experience to entrepreneurs and managers. Over time and through networks, these types of activity support the development of innovative communities.

These other objectives have been partially captured in the funds' mandates through investment restrictions in terms of geography, technology, size of investment and co-investment requirements.

The production of these additional benefits is an important potential contribution of Micro Funds, and these spillovers may occur independently of the financial success or failure of individual firms. Indeed, while the majority of financial returns to funds will come from a small number of their very successful portfolio firms, these non-financial returns are distributed more widely.

Yet there is no clear definition or explicit expectation of these non-financial returns. Nor is there any mechanism to assess how different funds perform with respect to these activities. Public fund remuneration policy is also not aligned with the achievement of these non-financial returns. As a result the 'spillover' experience of these Micro Fund managed firms and the wider communities that surround them varies widely.

Whilst this research has not examined mainstream early stage UK venture capital funds, it seems likely that the same arguments apply; namely that average financial returns are inadequate to attract investors, but the benefit to the broader economy through non-financial returns are significant.

Whilst these 'non-financial' spillovers may be important to government the same is not true for the private investors. The public/private 'hybrid' fund model provides a further commercial check to the investment activity of public funds. This is beneficial in ensuring government funds retain a commercial focus; but may restrict its ability to deliver maximum non-financial returns. There may be an inevitable conflict of objectives and goals between the two sets of investors.

Private investors are often encouraged to invest in these funds through a subsidy, usually tax deductions on their investment gains or through the two-tiered return structure designed into Enterprise Capital Funds. This level of subsidy however may need to fluctuate in line with the balance of financial and non-financial returns expected by publicly-backed venture funds.

Recommendation 1: Where government seeks non-financial returns in addition to financial returns it should explicitly acknowledge them by:

- Evaluating both financial and non-financial returns generated by these policies that support the early stage development of technology businesses.
- Recognising the consequences for the funds' financial returns of the restrictions imposed on funds by their mandates.
- Augmenting the mechanisms for risk reduction (e.g. Government first loss) and enhanced prospective private returns (e.g. Government returns capped) in order to incentivise private investors into these funds.

6.5.2 The Micro Fund model

This research highlighted a widespread sentiment of conflicting objectives between successful Micro Funds and the support and development of sustainable technology-based businesses. The success of the former does not guarantee the achievement of the latter. These two objectives are often incompatible. Micro Fund portfolio firms with the greatest potential for commercial success often require significant levels of follow-on investment that dilutes the return to the funds. On the other hand, those portfolio firms with lower, and slower, success remain in the portfolio.

Through our fund analysis and discussions with Micro Fund managers, we have identified three factors as significantly constraining:

- Fund time limits and their effects on investment activity.
- Fund selection and remuneration.
- Fund size.

The Micro Fund model and lifespan further limits the ability and opportunity of funds to make adequate financial returns. The lifespan of the funds forces fund managers to make investments early in the fund life even if it is not the best time to do so. The life span also forces funds to exit investments and the firms are often not allowed adequate time to develop to their full potential.

Developing a track record for fund managers is essential in enhancing their ability to raise further funds in later years. This gives an incentive to fund managers to exit from investments within a set time-period, rather than developing a firm to full potential.

In this research, questions have also been raised over whether the dominant ten-year Limited Liability Partnership agreement model is the best vehicle through which government-sponsored venture capital funds should operate.

There is already a degree of flexibility built into some government-sponsored funds that allow a longer lifespan. However an investigation of other fund structures, such as evergreen funds and investment trusts, is necessary to ensure that the most suitable model, rather than just the dominant industry models, is used.

The second area of Micro Fund model constraint concerns Micro Fund management selection and remuneration. If a Micro Fund has policy objectives and the government is seeking additional non-financial returns as well as financial returns from their investment, then government should consider whether the benefits from making these policy objectives clear to potential fund managers outweigh the costs from having multiple objectives. If this is the case, then the ability of a particular fund management team to achieve both non-financial and financial returns should be part of the selection process for government-backed funds.

It is clear that there are enough differences between the Micro Fund investment model and that of mainstream early stage private venture capital funds for Micro Funds to be considered as a separate asset class. Micro Funds are investing in different types of firm, at different stages and with different risks and uncertainties. The remuneration structure for these funds should also acknowledge these differences.

The industry standard for fund remuneration is cost recovery through a management fee worth 2-2.5 per cent of funds under management for the first five years, and a percentage amount of the portfolio value (potentially lower than 2-2.5 per cent) from year 6 onwards. Fund returns are then awarded as a percentage (20 per cent) of returns above a certain hurdle rate (usually 6-7 per cent).

This remuneration structure incentivises deal discovery and negotiation. The reduction in fee in the later stages of the funding cycle usually leads to fund team reduction and less emphasis on supporting and developing the portfolio firms to become sustainable businesses. The early concerns about fund management and track record also mean a focus on an early exit.

37. The latest Government-sponsored ECF announced is the TTP Ventures managed £30 million fund.

38. Evergreen funds operate over much longer time limits. Returns to evergreen funds are re-invested providing a continuous source of capital available for investment in new firms or current portfolio firms. Investment trusts operate as listed companies and invest in shares of unquoted firms. As a listed company, the investment trust model allows individual investors to enter and exit the trust at varying points of time via the sale of their shares.
39. Fund of Funds model sees the fund invest in other investment funds. The Fund of Funds builds a portfolio of other investment funds (in early stage firms in this case) rather than portfolio firms.

The third area of Micro Fund constraint relates to fund size. Evidence presented in this report shows that firms need successive rounds of funding over a long period. Micro Funds are limited by their size in their ability to invest further and adequately protect themselves from dilution or loss of control in successful portfolio firms, despite their initial risk burden in investing early.

The appropriate size for these government-sponsored early stage funds is an ongoing issue. Certainly the trend in government funds over the past decade has been towards larger funds.³⁷ Evidence from this research suggests that fund sizes may have to increase to a minimum of £50 million to avert these limitations.

Refinement of the Micro Fund model can occur through fund model innovation and developing examples of 'best practice'.

This is where government should be bold. Broader changes to the Micro Fund model were suggested by a range of participants in this research. They argued that one option worth studying was for government-only funds to focus more specifically on non-financial returns relating to policy objectives yet still provide an opportunity for government risk to be rewarded over the long term, while investment trust-type models with the government as core investors would allow private investors to come in and out (although not frequently). Early stage Micro Fund activity is a separate area of investment. There is opportunity to break from the confines of the established venture capital model.

Recommendation 2: Evolution of the Micro Fund model

- The defined 10-year Limited Partnership model may be too short to allow the adequate development of new technology-based firms, so alternatives including evergreen funds³⁸ and early stage investment trusts should be investigated.
- Where government seeks non-financial and financial returns from their sponsorship of Micro Funds it should consider fund managers' ability to achieve both of these in the fund selection process and fund remuneration structure.
- To allow for follow-on investing in successful Micro Fund portfolio firms government should be prepared to fund larger, possible national funds (possibly within a fund of funds model).³⁹ The aim should be to provide access to finance for these technology firms in their early stages of growth, beyond the capacity (e.g. time and size restrictions) of Micro Funds – thus providing an alternative to those trade sales that might prejudice the portfolio firm's development and growth.

6.5.3 The role of business angels

Business angels are clearly important early stage investors. Government supports their activity through tax concessions on capital gains. There is no doubt that this support is a valuable encouragement. Co-investment is now the dominant model for early stage investing, and angels are the key private investment partners to the government-sponsored funds.

It is clear that the current credit crisis is affecting the availability and participation of business angels in investing in new technology-based firms in the future. Ongoing attention to business angel activity will be crucial.

Recommendation 3: Continued support for the co-investment model should:

- Recognise the important role business angels play in providing a commercial filter to co-investment partners and business support to early stage firms.
- Consider mechanisms supporting angel groups that allow them to share knowledge among themselves, specifically mechanisms that encourage increased deal screening and syndication.

6.5.4 Joined-up policy environment

The government's sponsorship of Micro Funds is just one aspect of a wider environment of policy support for innovative businesses and the development of the UK's knowledge base. This research has highlighted two areas of government policy that are perhaps not working in the joined-up way that offers the best support to the development of new technology-based firms.

In the typical financial pathway, funding from grants increases as firms progress through successive rounds of funding. This is most likely explained by the need for matched funding to access the grants. Companies undertaking early stage development may not have sufficient cash to provide the matched funds required. The need for matched funding may be making grant less supportive of these early development projects than expected.

The Micro Funds investigated favoured firms that had completed technology milestones, such as having developed prototypes, when selecting investments. This raises the question how do firms fund their development in their concept stage?

One model of alternative external funding for the concept stage is the US Small Business Innovative Research (SBIR) programme which uses government R&D contracts, providing 100 per cent funding to bridge this gap. The programme invests over US \$2 billion a year and is arguably the most important source of funding for early stage science and technology ventures in the world (Connell 2006).

The UK has begun implementing a modified version, the Small Business Research Initiative (SBRI) programme, but has a long way to go before it mirrors the US model in supporting pre-prototype, market-focused research and development support. Procurement based innovation contracts of this kind are important because they play to the 'soft start-up' model and fill an important funding gap.

Government's 'Innovation Nation' White Paper highlights access to finance as a critical area of government support for business innovation. The paper notes government's intention to 'build an escalator of financial support for innovative businesses at different stages of their growth' (DIUS, 2008, p.37).

This is a good metaphor. New technology-based firms need different kinds of support depending on their stage of development and a continuity of that support through the stages. Different policy tools need to be available for these different segments, but this needs to be collected under overarching strategy. This strategy needs to be communicated effectively. Care should also be taken in developing the long term nature of this overarching strategy, so that whilst individual policies may evolve in line with evaluation, the overall objectives remain stable.

Recommendation 4: A holistic approach to government policy for the development of new technology-based firms should integrate policy for:

- Public procurement-based innovation contracts.
- Government-backed lending.
- Grants for business.
- Public equity investment.
- Policies promoting business angel groups.

It may be too much to expect a holistic policy for the creation and growth support of new technology-based firms, but at least measures should be taken to ensure that the above policies work in harmony and are applied at the appropriate stages of firm development. For example, a decision to expand public procurement support for innovation along the lines of the SBIR programme in the US would have implications for each of the other areas.

6.5.5 Continuing need for research into Micro Funds

This research has shown that Micro Funds are important funders of new technology-based firms. They are often also incubators.

The importance of Micro Funds to these firms, and the importance of new technology-based firms to the vitality of the UK's knowledge economy, will ensure that this remains an area of continuing research interest. The current financial crisis only brings their funding into sharper relief.

This research on a small sample of firms has highlighted two issues: the operation of grants and the requirement of matched funding; and how firms fund initial prototype development work. Further work on a larger sample of firms is required to see if they are also an issue more generally for these firms. The policy implications from this work would be significant given current government expenditure on these programs.

If we are going to turn to innovation and new technology-based firms as one of the sources of growth to pull the UK economy through recession (Leadbeater and Meadway 2008) this must be with the recognition that funding their incubation period will be much more challenging and require a more imaginative and supportive approach from government.

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