

UNRELIABLE EVIDENCE: WHY INVESTORS MISJUDGE THE TECHNOLOGICAL EXPERTISE OF FOUNDERS OF HIGH TECHNOLOGY VENTURES

Jonathan Levie: University Of Strathclyde, Glasgow, United Kingdom

Eli Gimmon: Tel Hai Academic College, Glasgow, United Kingdom

~

Contact: Eli Gimmon, Tel Hai Academic College, University of Strathclyde, G1 1XH
Glasgow, United Kingdom, Email: e.gimmon@strath.ac.uk

ABSTRACT

We report the reflections of five venture capitalists and five business angels drawn from US, the UK, and Israel on their evaluation criteria for early stage high tech investments and their interpretations of selected prior research related to evaluation of founder's human capital. We found that these early stage high tech investors tended to focus on harvest potential and miss factors that predict early survival and growth. The interviews confirmed a gap between in use and espoused criteria, and extensive use of gut feeling in decision-making. We offer criteria that investors could consider to improve their funding decision processes.

INTRODUCTION

The subject of this paper is evaluation criteria of investors in early stage high tech ventures, with special emphasis on evaluation of the founder's human capital . We report on interviews with ten investors in early stage high tech ventures, five venture capitalists and five business angels drawn from three countries where this form of funding is relatively highly developed: the US, Israel and the UK (Bygrave, 2005). In this paper, we try to complete a research cycle that, too often, remains incomplete. Research in social science is often portrayed as a two stage process, beginning in exploratory mode, often using case study methodology to induce theory, which is then tested statistically using large scale confirmatory techniques (Eisenhardt, 1989). In the first stage, the researcher typically interacts directly with individuals in the field, while in the second stage, interaction is more indirect, for example through postal surveys or secondary data, and relies on the quality of interpretation in the first stage to direct interpretations in the second stage. Less common but, we assert, especially valuable if the research is to have value to practitioners, is a third stage: that of direct interaction with individuals that are the subject of the study to gain their reflections on the research findings and achieve a resolution of the "insider's view" and the "outsider's" view (Morey and Luthans, 1984, p.28). This paper reports the results of a "third stage" in research on investment in young high-tech ventures.

The capabilities and the attitudes of founding entrepreneurs are critical factors in the performance of new ventures (Hart, Stevenson, and Dial, 1995, p. 92; Greene, Brush and Hart, 1999), but also in investors' decisions (MacMillan, Siegel and Subbaranasimha, 1985; Muzyka, Birley and Leleux, 1996 ; Zacharakis and Dean, 2005). Although some argue that venture capitalists seek good industries over good people (Zider, 1998), researchers have found that for many venture capitalists (VCs), the quality of the entrepreneur ultimately determines the funding decisions: they back the 'jockey' rather than the 'horse' (MacMillan et al. 1985; Muzyka et al. 1996). However, judging the quality of the entrepreneur is difficult for VCs (Kozmetsky, Gill, and Smilor 1985; Smart 1999). The veteran venture capitalist Arthur Rock is quoted as saying "nearly every mistake I've made has been in picking the wrong

people, not the wrong idea" (Bygrave and Timmons, 1992, p.6). In an interview to the business newspaper *Globes* (Feldman, 2005) the Silicon Valley VC Michael Moritz of Sequoia Capital indicated that "VCs have great difficulties in a-priori evaluation of entrepreneurial characteristics and thus quite often they make mistakes in relation to these judgments". In summary, evaluating entrepreneurial human capital is a vital skill for investors, investors recognise their failings in this area and more research is needed (Barney, Wright and Ketchen, 2001, p. 634; Smart, 1999, p.72).

The literature provides two possible explanations for suboptimal judgement of human capital by VCs: use of biases and heuristics (Tversky and Kahneman, 1974; Zacharakis and Shepherd, 2001) and signalling (Spence 1974; Levy and Lazarovich-Porat 1995). In many ways, these two theories are views of the same phenomenon but from different sides of the investment relationship. On the investor's side, prior research suggests that the evaluation criteria VCs espouse can be different to the criteria they use (Shepherd, 1999) and it has long been asserted that venture capitalists often rely to a large extent on their intuition (Dominguez, 1974). VCs may match proposals to past successful or failed investments, demonstrating an "availability bias" that can lead to overconfidence in evaluating new ventures which may lead to wrong investment decisions (Zacharakis and Shepherd, 2001). Even highly experienced VCs may be susceptible to various forms of bias and error due to their intuitive drive and heuristic processing (Shepherd, Zacharakis, and Baron, 2003). These research findings fit with theories of bounded rationality (Simon, 1955) and psychological economics theory (Tversky and Kahneman, 1974; Kahneman and Riepe, 1998, p. 53). Biases and cognitive illusions in intuitive judgment such as overconfidence, optimism, hindsight, and overreaction to random events could cause financial investors to disregard certain types of human capital and pay attention to other types that might have no value in that context. Interestingly, VCs' education in science and humanities was found (Dimov and Shepherd, 2005) to have a positive association with the proportion of ventures going public along with higher prevalence of bankruptcies in their portfolio.

On the entrepreneur's side, founders communicate and signal their resources to financial investors in order to attract funds for their ventures. Venture capitalists and business angels encounter information asymmetry problems when evaluating investment opportunities (Mason and Stark, 2004). Signalling theory (Spence 1974; Levy and Lazarovich-Porat 1995) suggests that it is possible that financial investors may misinterpret the effect of some founder's human capital resources on subsequent performance. One way of minimizing false signals is to deal with familiar entrepreneurs. Shane and Stuart (2002) focused on founders' *social* capital in a study of 134 startups based on MIT inventions and found that prior links with venture capitalists increased the chances of funding. But what do investors do when they have to evaluate first time entrepreneurs who have little social capital? Gimmon (2006) conducted a study of 193 high-tech new ventures nurtured in the Israeli Technology Incubator Program, all of whom were founded by first-time entrepreneurs and sought funding as part of the incubation process. He found that financial investors (both VCs and angels) appeared to ignore certain forms of founders' *human* capital that positively affected short term venture survival, such as being a technologist, bringing one's own technology to the venture, and having transferred the technology to others, and seemed to be attracted by other factors that did not affect short term venture survival or had marginal significance, such as academic credentials (PhD degree, Professor title) and prior P&L responsibility.

While the Gimmon study only measured early survival and growth, and not exit value, his findings may still have implications for investors. By controlling for many factors influencing startup success that normally vary, such as social capital and initial team size, they throw the capabilities of the founder into sharp relief. They suggest that in the early years, strong technological capabilities on the part of the founder can reduce the chances of early venture death. They raise the possibility that investors' understandable focus on founders' human capital factors that are believed to affect long term issues of scalability and harvest could lead them to ignore or assume human capital factors that affect survival and growth prior to exit that could be relatively easily included in their evaluation processes. After all, in order to be harvested successfully, an early stage venture has to survive and grow long enough to demonstrate harvestable value to acquirers or the public markets. Other possibilities raised by previous research are a gap between espoused and in-use criteria, and reliance on gut feeling rather than objective criteria.

In this paper, we confront a sample of ten investors in high tech ventures with the results of the Gimmon study and with the work of Shepherd (1999) and Zacharakis and Shepherd (2001) which we put forward as partial explanations, after asking them first to describe their own evaluation criteria. In

doing so, we can observe whether the phenomena suggested in previous studies are repeated with this different methodology, and seek understanding by directly interacting with investment practitioners rather than by observing their investment decisions indirectly and testing hypotheses. In this sense, the study attempts to close the research circle from earlier theory-building studies, through empirical testing, and back to confirmation/resolution through interaction with practitioners. Note that we could not have conducted this study prior to the second stage, as we would not have known what questions to ask or been able subsequently to get respondents' reflections on prior research. Finally, by splitting the sample equally between venture capitalists and angels, we can check for patterns of similarity and difference between these two types of equity investor.

METHODOLOGY

To generate confirmation of and explain the apparent empirical phenomenon of suboptimal judgement of technological human capital of founders, we interviewed a sample of ten investors using the following multiple sample design: two VCs and two angels from two countries: the U.S. and Israel, and one VC and one angel from a third country, the U.K. These investors were chosen because they were known to invest in early stage high tech ventures; apart from that criterion, they were chosen for reasons of convenience and availability, similar to the method used by Fried and Hisrich (1995). Our method differs from theirs, however, in that we were not trying to build theory *ab initio*, but rather trying to reconcile our theory-based interpretation of the phenomenon of investors' criteria with that of investors themselves. Figure 1 provides descriptive statistics on each investor. Appendix 1 lists the questions asked and the order in which they were asked. Respondents were told the study was on investment criteria in high tech ventures and were not send information or papers on prior research in advance. We first used open-ended questions to elucidate their evaluation criteria generally, and then more specifically asked whether and how they assess the human capital of high tech venture founders in practice. We then presented the results of the Gimmon study and asked the VCs what they thought the reasons might be for these results. Finally, we presented some results of prior research (Shepherd, 1999; Zacharakis and Shepherd, 2001) that might also account for the results, and sought their views. The interviews were taped and transcribed. We then sought patterns in the data by looking for consistencies and inconsistencies in the explanations given by VCs before and after the presentation of our results, by tabulating data and comparing responses across all respondents, as recommended by Myles and Huberman (1994).

The methodology adopted here of reflecting in-use criteria as reflected in actual investment decisions in a sample of new ventures that sought funding against espoused criteria of a sample of investors deliberately chosen to vary by origin and type has some advantages over previous methods used in this area, such as only asking vcs for their evaluation criteria, or simulation exercises that assume the venture capitalist is the decision maker. As one of our US VC interviewees pointed out, "In most VC firms the general partner doesn't make the decisions, it is the entire partnership." Often, one partner can veto an investment proposal, purely on gut feeling. "I have seen venture funds turn down deals because some partner doesn't like the deal. No rhyme or reason outside than their gut just says this isn't the right place for us to invest; just don't do it. I have seen that multiple times". (USVCap2). In this study, patterns of actual investments made, reflecting true "in-use" criteria, are contrasted against espoused criteria which were articulated without prior knowledge of our results. Finally, investors are asked to provide their own explanations for our findings. Some of these conflict with their espoused criteria, reflecting the gap noted by Shepherd (1999) and others are additional to them, reflecting the "limited introspection" also noted by Shepherd (1999, p.85).

RESULTS

Espoused Evaluation Criteria

Figure 2 shows the criteria that were volunteered by the interviewees as used by them. Typically they mentioned one "most important" criterion. Three of the four US interviewees chose market potential as their number one criterion, whereas most of the other interviewees mentioned "The Entrepreneur" or "The Management" as their top criterion. There was not a clear difference between vcs and angels on evaluation criteria.

Figure 3 shows that while most investors agreed with the Gimmon research findings once they were presented with them individually, there were some differences of opinion. Three of the four US investors were not convinced about the importance of the founder being a technologist, but the other

investors agreed. This may reflect the greater weight these US investors placed on the market rather than the initial management. As one US investor put it: “I would say that in general we do take for granted their technical knowledge in the long run and we will weigh more heavily on management and go with what management wants over the technologist. It’s one of the hardest parts of doing our job.” (USVCap2). This suggests that in weighing founder’s technological expertise over longer term issues of management capability, the latter wins. This view was raised independently by a US angel: “We’re looking to harvest investments not commercialise technologies, so we have to think about – Ok the *assumption* is that this product will make it to the marketplace; now, will anybody buy it? Will somebody have the leadership to develop this firm?” (USAng 1). This US angel pointed out that possibly the lack of discrimination on this feature might be a result of the due diligence process, where assessment of the potential in the technology is separate from the assessment of management.

Similarly, three out of the four Israeli investors disagreed with the research findings that founder’s tacit knowledge of technology was important, although the other investors tended to agree, even though, apart from the two US VCs and the UK angel, they had not mentioned it previously as an espoused criterion. Reflecting the opinion of the US VC quoted above in relation to the founder being a technologist, an Israeli investor commented: “Tacit knowledge is “nice to have” with the founder’s human capital, but it does not relate to the founder’s execution capabilities which are more important.” (IsraVC1).

Investors tended to take issue with the findings that academic credentials attracted financial investment, and their explanations of the findings conflicted, with some suggesting that having a PhD might make a difference, especially if it was in a relevant domain, and others suggesting that professors might have value in R&D. Some investors suggested that having a PhD or being a professor might make them more likely to assume domain expertise.

Responses to the issue of gender divided along gender lines, with males stating it made no difference and females favouring female entrepreneurs. Only the UK investors (both Scotland-based) favoured immigrants, with others being either neutral or expressing concern about language ability or networks of immigrants. On age, most investors said that experience was what mattered, not age, but three respondents would not invest in people in their late 50’s or older and two would not invest in people in their 20’s.

Investors offered a range of other human capital features they looked for in the entrepreneur. Three US investors mentioned the issue of succession and two (one angel and one VC) stated they explicitly looked for people who would be willing to recognise when it was time to step aside.

“We are not particularly skilled at coming up with a good appraisal of their willingness to build a leadership team and step aside at the right time. If an entrepreneur smells the fact that coachability is important, they can hide that for a long time, surely until after they get the money. I think technology skills, especially for a PhD or someone are much more transparent. I mean, gosh you’ve written 20 papers let’s see if we can call around and see what we can find out about you”. (USAng1)

The pattern of responses in Figure 3 suggests that Israeli investors were more likely to look for team players, but this may stem from similar concerns over the ability of the founder entrepreneur to grow a professional management team. As the UK angel said: “The big cause of failure has usually been personality issues, something with the team that started to crumble and fall apart. I think it’s because the entrepreneur tends to ride roughshod over others.” (UKAng1)

Investor compatibility was also a general theme across the three countries and both types of investor. Some investors linked this to the subjective aspect of investment decision-making, and several noted that this took a long time to assess and was a “deal killer”.

When faced with propositions from three pieces of research: the Gimmon (2006), Shepherd (1999) and Shepherd and Zacharakis (2001) studies, investors tended to agree with the propositions from the latter two studies that related to a gap between espoused and in-use evaluation criteria and availability bias, as in these comments.

“[The] traditional approach, P&L based - that’s the one they talk to. When you get them in private conversation, it’s more about private judgement it’s more about gut feeling about the personalities. I think that’s a problem because while the mathematical approaches have been refined and developed,

they other bits haven't, but they play an equally if not more important part in the judgement process. So because people are not talking about them, not open about them, they are not being developed. There's probably a lot that could be contributed from academia as to how those subjective decisions are made, but nobody's willing to talk about those subjective decisions." (UKVCap1)

"No-one ever talks about the subjective side of your analysis, but its there as well. Sometimes it weighs more heavily because sometimes some of the subjectivity comes from the partnership. So they'll look at the objective data but they'll have a subjective reason for not wanting to do the deal. I do think there is a gap because of that but no-one ever talks about it." (USVCap2)

One Israeli investor (IsraAng1) suggested that the gap may arise because of a tendency for investors to "follow the herd" rather than adhere to their espoused criteria.

Investors were divided on the first proposition, with four disagreeing with the proposition that investors often misjudge founders' human capital, specifically the technological expertise of founders of high-tech ventures, four agreeing, and two saying yes and no. Here is a selection of opinions:

"It's a bit tricky. You just meet them a few times and get a bit of a feeling about their attitudes but you can't really know how they are going to behave when their back is against the wall. You have got to take some of that on trust. That's probably the trickiest thing actually is assessing the individual." (UKAng1)

"Unless you have done business with them before, it is very very difficult, and probably one of the hardest things to judge... and even doing due diligence on them and reference checks, you really don't know somebody until you have rolled up your sleeves and really been in business with them for a while." (USVCap2)

"I think it's easy. Studying the financials, that's just made up. Studying the entrepreneur, there's a lot of data to go on. I look for what they've done in the past, what other people say about them and I look a lot at how they deal with me as a potential investor as a potential board member. I have a little bit of a bias in that direction as I [have] a doctorate in psychology. How they try to sell me, work with me, how they respond, do they get defensive – all those kinds of things to me are just more data." (USVCap1)

"I think that by far and away the toughest piece of due diligence is trying to appraise the quality of the team and that hasn't much changed much over time; it is a very time-consuming, difficult analysis. I think the more experience an entrepreneur has in starting and running companies the easier the due diligence is because there are more other investors you can go to and talk about. So I would say more experienced, serial entrepreneurs are easier to judge than the new ones." (USAng1)

This suggests that while investors recognise that they do rely on gut feeling alongside more objective criteria, and don't always make decisions in the way they say they do, some of them think that they do a pretty good job of assessing founders on average, and some of the US investors suggested that due diligence was much better now than it used to be.

Improving assessment of human capital

All except one investor felt that the process of assessing founders human capital could be improved. The one dissenter (who had a PhD in psychology) felt that the problem lay with some individual investors, not with available processes. There was little agreement over possible solutions. Suggestions included involving headhunters and HR experts in the process, as they were found to be more objective (three investors); sharing of experiences among investors, courses or seminars, spending more time with the entrepreneurs, and further research.

In summary, several possible explanations were provided by investors for the research findings they were presented with:

1. Investors seek exits rather than early survival and growth, and the former has precedence in assessment
2. Investors rely on both gut feeling and rational criteria
3. Investors are subject to their own biases and heuristics and see these as inevitable constraints
4. Founders send signals which misrepresent their effective human capital resources and thus mislead investors

Finally, there were clear differences of opinion between investors on the issue of technology-related human capital factors, the very issues that showed the greatest difference between in-use evaluation

criteria and venture early survival and growth. These issues are considered in the next section, and recommendations made for practitioners and for further research.

DISCUSSION

Espoused versus In-use evaluation criteria

The geographical split between the US and other investors in espoused criteria, with US investors focused on market potential and others focused on what they variously called “the entrepreneur”, “the management”, or “the people” is interesting, and may reflect either the more developed equity investment industry in the US, or a greater availability of venture management talent, or both. Reflecting these country differences, one Israeli VC called for more research and data on venture capital outside of the US.

Shepherd (1999) called for research that investigates whether vcs are more accurate in their assessments of survival potential as profit potential. There are contrasts between what investors said they were looking for (summarised in Table 2, Table 3 and Table 4) and their comments on our in-use research findings. In several instances, factors that investors did not mention were subsequently held to be important after we had raised them as research findings. This suggests that there is a gap between their in-use criteria and their espoused criteria, something that was almost universally recognised by the investors we interviewed. Eight out of ten agreed with the proposition of a gap between what in-use and espoused criteria, and all agreed to a greater or lesser extent that investors rely on gut feeling (several volunteered the term before it was mentioned by the interviewers) alongside more objective criteria. However, this was not always seen as a bad thing. Several investors suggested that, as one put it, “success breeds success”, although other experienced investors also stated they were increasingly trying to objectify their decision-making, and would welcome more objective metrics on how to measure, in particular, the characteristics of the entrepreneur. Specifically, the willingness of the entrepreneur to step aside once the business was growing to allow more experienced management to take it to the next level was mentioned by several US investors. Investors did not look forward to having to do this, and this feature weighed heavily in their decision-making.

Venture Capitalists versus Angels

There was little difference between VCs and angels in evaluation criteria, possibly because they were all investing in seed or early stage ventures. Several respondents did mention however that the evaluation criteria of later stage or non high tech investors would be different. Also, the growing phenomenon of angel syndicate investing has professionalized angel investing in the US, and this might accentuate the difference in evaluation between the US investors, both VCs and angels, who generally engaged in rigorous due diligence and the less structured approach of the other investors.

Towards Improved Investment Decision-making

Based on the views of the investors themselves, the results of this study suggest that they do use heuristics and biases to save time and simplify complex data, and they are aware of their use, though perhaps less aware of their possible effects. For example, investors may tend to use academic titles as a proxy for the technological human capital of founders, given that commercializability has lower priority over issue of market potential and harvest for the limited due diligence time available. Investors should be made more aware of the suboptimal nature of this heuristic and encouraged to examine the general and specific technological human capital of founders, to improve their decision making. Specifically, they should dig deeper than academic titles and seek to understand the extent to which the founder has tacit knowledge of the technology, and general technological expertise. Simple heuristics such as “did the founder bring their own technology to the venture” and “are they a technologist by occupation” and “have they transferred the technology to others” would be more time-efficient than “has the founder got an academic title”.

Limitations

The limitations of this research include the fact that only ten investors were interviewed, and in only three nations, and that the findings on in-use investment criteria were drawn from a cohort in which many factors that were important for investment decision-making were controlled. Thus, the importance of technological expertise of the founder has perhaps more prominence than it would with other samples. On the other hand, this is also an advantage of this cohort. Other samples might be so swamped by other factors that the founder’s technological capability might never have been detected.

While we do not wish to overstate the importance of founder's technological capability, it is not difficult to assess, and merits the short time it would take investors to assess.

Further research will continue and follow-up this iterative process of understanding what matters in investment decision-making in new high tech ventures. Several investors have agreed to fill in score sheets on all the ventures in their portfolio in order to compare actual performance with the original founder's human capital. It is hoped that this may help us in providing practitioners with some of the simple evaluation tools for their decision making process they seek.

REFERENCES

- Barney, J. Wright, M. & Ketchen, D. Jr. (2001). The Resource-based View of the Firm: Ten years after 1991. *Journal of Management* 27(6): 625-641.
- Bygrave, W.D with Hunt, S.A. (2005). Global Entrepreneurship Monitor Financial Report 2004. Babson Park, MA and London, UK: Babson College and London Business School.
- Bygrave W.D. and Timmons J.A. (1992). *Venture Capital at the Crossroads*. Boston, MA: Harvard Business School Press.
- Dimov, D.P. and Shepherd, D.A. (2005). Human capital theory and venture capital firms: exploring "home runs" and "strike outs". *Journal of Business Venturing*, 20: 1-21
- Dominguez, J.R. (1974). *Venture Capital*. Lexington, Mass.: D.C. Heath.
- Eisenhardt, K. (1989). Building Theories from Case Study Research. *Academy of Management Review* 14:532-550.
- Feldman, B. (2005). Entrepreneurs with Ideas in the Field of Internet are Welcome to Contact Us. *Globes* 16 September, p.12 of Capital Market section. Tel-Aviv: Globes Publisher.
- Fried, V. and Hisrich, D. (1995) The Venture Capitalist: A relationship investor. *California Management Review*, 37, 2: 101-113.
- Gimmon, E. (2006). Founder's Human Capital and High Technology New Venture Survivability. Unpublished PhD thesis, University of Strathclyde, Glasgow.
- Greene, P., Brush, C., & Hart, M. (1999). The Corporate Venture Champion: A Resource-Based Approach to Role and Process. *Entrepreneurship Theory and Practice* 23(3): 103-122.
- Hall, J. & Hofer, C.W. (1993) . Venture Capitalists' Decision Criteria in New Venture Evaluation. *Journal of Business Venturing* 8: 25-42.
- Hart, M.M., Stevenson, H., & Dial, J. (1995). Entrepreneurship: A Definition Revisited. *Frontiers of Entrepreneurship Research*, pp. 89-95. Wellesley, MA: Babson College.
- Kahneman, D., and Riepe, M.W. (1998). Aspects of Investor Psychology - Beliefs, preferences, and biases investment advisors should know about. *Journal of Portfolio Management* 24(4): 52-65.
- Kozmetsky, G., Gill, M.D. Jr., and Smilor, R.W. (1985). *Financing and Managing Fast-growth Companies: The Venture Capital Process* . Lexington, MA: Lexington Books.
- Levy, H. and E. Lazarovich-Porat. (1995) "Signaling Theory and Risk Perception: An Experimental Study." *Journal of Economics & Business* 47: 39-56.
- Macmillan, I. C., Siegel, R. & Subbanarasimha, P.N. (1985). Criteria Used by Venture Capitalists to Evaluate New Ventures Proposals. *Journal of Business Venturing* 1: 119-128.
- Mason, C., and Stark M. (2004). What do investors look for in a business plan? A comparison of Bankers, Venture Capitalists and Business Angels. *International Small Business Journal* 22(3): 227-248.
- Morey, N. C. and Luthans, F. (1984) An Emic Perspective and Ethnoscience Methods for Organizational Research. *Academy of Management Review* 9(1): 27-36
- Muzyka, D., Birley, S. and Leleux, B. (1996). Trade-offs in the Decision Making of European Venture Capitalists. *Journal of Business Venturing* 11: 273-287.
- Myles, M.B. & Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook*. Thousand Oaks, CA: Sage.
- Shane, S. & Stuart, T. (2002). Organizational Endowments and the Performance of University Start-ups. *Management Science* 48(1): 154-170.
- Shepherd D.A. (1999). Venture Capitalists' Introspection: A Comparison of "In use" and "Espoused" Decision Policies. *Journal of Small Business Management* 37(2): 76-87.
- Shepherd, D.A., Zacharakis, A., & Baron, R.A. (2003). VCs' Decision Processes: Evidence Suggesting more Experience may not always be better. *Journal of Business Venturing* 18: 381-401.

- Smart, Geoffrey H. (1999). Management Assessment Methods in Venture Capital: An Empirical Analysis of Human Capital Valuation. *Venture Capital* 1(1): 59-82.
- Spence, M.A. (1974). *Market Signaling: Informational Transfer in Hiring and Related Screening Processes*. Cambridge, Mass: Harvard Business Press.
- Tversky, A, and Kahneman, D. (1974). Judgment under Uncertainty: Heuristics and Biases. *Science* 185:1124-1131.
- Zacharakis, A.L., and Dean A.S. (2005). A Non-additive Decision-aid for Venture Capitalist's investment Decisions. *European Journal of Operational Research* 162: 673-689.
- Zacharakis, A.L., and Shepherd, D.A. (2001). The nature of information and Overconfidence on Venture Capitalists' Decision Making. *Journal of Business Venturing* 16: 311-332.
- Zider, B. (1998). How Venture Capital Works. *Harvard Business Review*, Vol. 76 Nov-Dec: 131-139.

Figure 1: Investor characteristics

Respondent Code	US-VC1	US-VC2	US-Ang1	US-Ang2	Isra-VC1	Isra-VC2	Isra-Ang1	Isra-Ang2 (Also VC)	UK-VC1	UK-Ang1
Stage of invested ventures	Seed, early stage	Early stage	Seed + follow-on rounds	Seed + Early stage	Seed+ Early stage	Seed + Early stage	Seed	Seed	Startup, early stage, mature	Seed
Industry sector	Mostly tech	Life science & IT	Any (including hi-tech)	Life Science	IT	IT	DSP + life science	ICT Agrotech	bioscience	Hi tech
Years in investments	5	8	26	15	10	11	5	10	10	12
No. of proposals reviewed	1000	1200	2000	Hundreds	1000	2000	dozens	dozens	350	600
No. investments made	4	12	32 cos., 60-75 investments	10 to 15	dozens	15	5	2	20	20
Average amount of investment	\$1 million	\$1-3million*	Slightly more than \$25k*	Tens thousands \$	\$5million	\$5million	Tens thousands \$	Tens thousands \$	£1-2million	£20k-£25k

*respondent mentioned some much bigger investments that would skew the average

Figure 2. Major investment criteria

Investor Code	US-VC1	US-Ang1	US-Ang1	US-Ang2	Isra-VC1	Isra-VC2	Isra-Ang1	Isra-Ang2 (Also VC)	UK-VC1	UK-Ang1
Industry sector	(+)	(+)		+	(+)	(+)	+	(+)	(+)	(+)
Market potential	+++	+++	+++	+	+	+	+	+	+	
The entrepreneur/the management	+	+	+	+	+++	+	+++	+++	+++	+++
Competitive advantage			+	+	+	+	+	+		
Innovative idea	+			+		(+)	(+)	(+)		+++
Execution feasibility			+		+	+		+		
Against the popular "herd"				+						
\$ required (not too high)			+	+			+			
Protected IP		+					+			
Co-investors		+								
Sales or significant client interest	+		+							
Location	(+)	+	+							

+ this factor was mentioned ⁽⁺⁾ this factor was mentioned implicitly rather than explicitly ⁺⁺⁺ this factor was stated to be the most important

Figure 3: Investors' founder human capital evaluation criteria for funding decisions

Respondent Code	US-VC1	US-VC2	US-Ang1	US-Ang2	Isra-VC1	Isra-VC2	Isra-Ang1	Isra-Ang2 (Also VC)	UK-VC1	UK-Ang1
Founder was technologist	1 for super hightech for startup only (army effect?)	0 no comment	Interesting statistic but not very compelling	1 A1	1 A1	1 A1	1 A1	1 A1	1 A1 but with an eye to getting it to a product	0 A1
Managerial Experience	1 A1 (comfort factor)	1 A1	1 A1	0 A1	1 A1	0 N1	1 A1	1 A1	1 A1	1 A1
Tacit knowledge	1 A1/N0 (arguments for and against)	1 A1	0 A1	0 A1	0 N1	0 A1	0 N1	0 N1	0 A1	1 A1
Academic credentials (Dr. / Prof.)	1 if related to the field and is balanced by abilities	1 if related to the field A0	0 A0	0 A0	0 A0	0 N0	1 A0	0 A0	0 A0	0 A0 PhDs 1 A1 Profs maybe
Gender	0 A0	0 A0	0 A0	0 A0	1 A0 woman interviewee	0 A0	0 A0	1 N0 woman interviewee	0 A0	0 A0
New immigrant/Minority	0 no comments	0 A0	0 A0 need language	0 A0 needs networking	0 A0 needs networking	0 A0	0 A0 needs networking	0 A0 needs networking	0 N1	0 N1
Age	0 A0	0 A0	0 A0	0 A0	0 N1	0 A0	1 N1	0 A0	0 A0	0 N1

Code

1 = this factor was espoused by the investor to be important while he/she presented the founder's human capital investment criteria
 0 = this factor was *not* espoused by the investor to be important while he/she presented the founder's human capital investment criteria
 A1 or A0 = Following presentation of research findings, the interviewee agreed that this factor was either important (A1) or not important (A0) as was found in the research
 N1 or N0 = Following presentation of research findings, the interviewee disagreed that this factor was either important (N1) or not important (N0) as was found in the research

Figure 3 continued Investors' founder human capital evaluation criteria for funding decisions

Respondent	US-VC1	US-VC2	US-Ang1	US-Ang2	Isra-VC1	Isra-VC2	Isra-Ang1	Isra-Ang2	UK-VC1	UK-Ang1
Other: leadership			A leader; integrity	Integrity	Ability to write BP	Leadership	Integrity	Leadership		Focus, strategy
Other: Business orientation				Business orientation & Open minded	R&D management	Open minded	Business orientation	Business & market orientation	Cares about product and customer	global awareness
Other: commitment			Both feet in; passion, commitment	Fully dedicated, total commitment	maturity	Auto-didactic	Fully dedicated & Investing own capital	Ability to execute	Passion; enthusiasm	Global ambition
Other: investor compatibility	Someone I'd like to work with			Compatibility with investors	Compatibility with the VC		Compatibility with investors		Do we like the people	Good personality
Other: Team player				Team work	Team rather than a single		Team work			Team player
Other: fortitude	Can handle adversity						Long runner Work under pressure		stamina	driven
Other: recognises own weaknesses	Will take advice; willingness to step aside		Coachability							
Other: communicator	Communicator, seller									
Other: Entrepreneurial skills	Entrepreneurship generally								Track record in entrepreneurship	

Code: see previous page

Figure 4: Investors' views on research findings

Investor Code	US-VC1	US-VC2	US-Ang1	US-Ang2	Isra-VC1	Isra-VC2	Isra-Ang1	Isra-Ang2 (Also VC)	UK-VC1	UK-Ang1
Investors misjudge founder's HC (Gimmon)	N	N but mgt more important	N	Y	Y & N (over 50% success)	Y	Y & N (over 50% success)	Y	Y	N
In-use vs. espoused criteria (Shepherd)	Y but not sure where the gap is	Y	No comment	Y	Y	Y	Y	Y	Y	They won't tell you what they failed you on
Investors availability bias (Zacharakis and Shepherd)	Y & N success breeds success	Y particularly on downside	Y sounds like life to me	Y	Y	Y	Y	Y	Y it's human nature really	Y
Possible to improve evaluation process?	N is some people not process	Y 1. spend more time 2. if both sides communicated better and were more open on tough areas.	Y 1. Headhunter on the due diligence team.	Y 1. angel clubs 2. VC team work 3. HR experts	Y HR experts	Y 1.referee; 2.pre-seed testing; 3.research findings	Y don't rely on gut feelings	Y 1.learning curve 2.course/studies 3.VC team work	Y 1. Some structure to allow investors to talk about it.	Y 1. Probably are metrics that could be used

Code: Y: Yes N: No

Appendix 1

Subject: Investment Criteria in High-tech New Ventures

Section 1: Interviewee's Experience:

1. Name and date of interview: _____
2. Firm Name:
3. Sort: VC / Angel/ Advisor
4. Sort: Seed / Early stage / mezzanine
5. Industry sector: _____
6. Years in investments:
7. Number of proposals reviewed:
8. Number of investments made:
9. Average amount per investments:

Section 2: Evaluation Criteria

- 1a: What, in your opinion, ultimately determines your funding decisions as an investor (specify VC or angel)? In other words, what criteria do you use in making your funding decisions?
- 1b: Do you think your view would be a typical view in your industry? (If no: What in your opinion typically determines funding decisions by VCs/angels in this country?)
- 2a: How easy or difficult is it for VCs/angels to judge the quality of the entrepreneur as part of the funding decision? Why?
- 2b: How accurate do you think VCs/angels are in evaluating entrepreneurs as part of the funding decisions? Why?
- 3a: What do you look for in evaluating the entrepreneur in high-tech ventures? (Assume there is one clear leader, who is a first-time entrepreneur.)
- 3b: Do you rely on third party independent data, and in what form?
- 3c: Are there any criteria you used in the past that you no longer use, or criteria you use now that you haven't used in the past? What are these, and why have you changed your criteria?
- 3d: How typical would this be of evaluation by VCs/angels generally?
- 3e: Do you know of other specific criteria that other VCs/angels use that are different to the ones you use?
- 3f: If the entrepreneur had a PhD, would that make any difference to your funding decision?
- 3g: If the entrepreneur was a professor, would that make any difference?
- 3h: Do you think the entrepreneur needs to have an in-depth understanding (tacit knowledge) of the how the technology works in practice or can he delegate this to others?
- 3i: Have you known VCs/angels to say they make investment decisions in one particular way but actually use other methods? If yes: can you give me some examples?
- 3j: To what extent do you always apply your investment criteria in your actual investment decisions? If not always: can you give me some examples?

Section 3: Findings from our research on the founder's human capital and Investors' attraction to founder's human capital

We investigated a sample of 193 high-technology start-ups in Israel, based on a homogeneous cohort of the Israeli Technology Incubators Programme (ITIP). Findings show that if a venture founder was a technologist by background, or has previous P&L responsibility (for example, as a CEO, from being self-employed, or being a project manager) or developed the technology that the business is based on, the probability of venture survival is increased. Having early sales, patents applied for, multiple fund rounds or transferring technology to other businesses also positively affect venture survival.

We also explored whether the human capital factors that affect the performance of new high-tech ventures are also those that attract financial investors. Findings show that financial investors appear to be attracted by certain founder-based human ceremonial resources, such as academic titles, which have no effect on venture survivability, while ignoring certain founder-based instrumental resources, like the founder being a technologist, and the founder bringing their own technology to the venture, which enhance survivability.

I would now like to go through each of these findings in turn, and ask you what you think of them, and if you can think of an explanation for our findings. At the end, I'll tell you what researchers have suggested might be the reasons for our findings.

1. Industry-related experience

If the founder is a technologist by background, this has a positive effect on new venture survival – accepted.

If the founder is a technologist by background, this attracts financial investors - not supported

2. Managerial experience

Founder's prior P&L responsibility has positive effect on new venture survivability – marginally accepted.

Founder's prior P&L responsibility attracts financial investors – accepted.

3. Tacit knowledge

If the founder brings their own original technology to the venture, this has a positive effect on venture survivability – accepted.

If the founder brings their own original technology to the venture, this attracts financial investors - not supported

4. Academic credentials

Founder's academic titles do not affect venture survivability – accepted.

Founder's academic titles attract financial investors – accepted.

5. Gender

Founder's gender does not affect venture survivability – accepted.

Founder's gender has effect while women attract financial investors less than men - not supported.

6. Immigration status

Founder's immigration status has no effect on venture survivability - accepted.

Immigrant founders attract financial investors less than non-immigrants - not supported.

7. Age

Founder's age does not affect venture survival – accepted.

Founder's age has no effect on attracting financial investors - accepted.

Findings on organizing activities and investor's attraction to organizing activities:

8. Technology transfer to other party – positively affects venture survival, but it was not found to affect venture funding.

9. Attaining early sales – positively affects both venture survival and venture funding.

10. Number of fund raising rounds – positively affects venture survival.

11. Number of Patent applications – positively affects both venture survival and venture funding.

12. Findings on geographical location of the incubator where the venture was nurtured: was not found to have a significant impact on venture survival but was found to have a marginally significant effect on venture funding in favour of centrally located ventures.

Section 4: Evaluation bias

1. Do you agree or disagree with the proposition that VCs/angels often misjudge founders' human capital, specifically the technological expertise of founders of high-tech ventures? Why?

2. VCs' in-use criteria vs. espouse criteria: Shepherd's (1999) research on investors' evaluation processes suggests that there is a gap between evaluation policies VCs *use* in their actual decisions and the intended criteria they *espouse* as reported by them. What do you think of this view?

3. VCs rely on “gut feelings”: Zacharakis and Shepherd (2001) studied the phenomenon of VCs' heuristics and biases. They found evidence of an “availability bias” in VCs' decision-making while VCs rely on how well the current decision matches past successful or failed investments. VCs, they argue, are overconfident in their prediction of either very high or very low likelihood of venture success. This high level of overconfidence in success or failure predictions may encourage the VC to make wrong funding decisions. What do you think of this view?

4. How do you think the accuracy of investors' evaluation of founders' human capital might be improved?