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**WHEN DO VENTURE CAPITAL FIRMS LEARN FROM
THEIR PORTFOLIO COMPANIES?**

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ABSTRACT

In this study we examine when venture capital firms (VCFs) learn from their portfolio companies (PFCs). Relying primarily on learning and behavioral theories, we develop hypotheses regarding the effects of prior experience, knowledge overlap, trust, and PFC performance on learning by VCFs. We use a combination of primary and secondary data from 298 U.S.-based VCFs to test the hypotheses. Interview data are used to illuminate the results and to guide our discussion of implications. Many of our results were surprising. For example, we found that the VCF's overall experience is negatively related to VCF learning, and we found trust in VCF-PFC dyads also negatively associated with VCF learning. Whereas we expected to observe a curvilinear relationship between knowledge overlap and learning, we found that lower levels of knowledge of overlap were associated with greater learning in a linear fashion. Finally, we found that VCFs perceive greater learning to occur in higher performing PFCs. We discuss the limitations and implications of our findings, and also suggest avenues for future research.

INTRODUCTION

Over the years, venture capital firms have invested billions of dollars in high-potential companies, including such notable businesses as Apple Computer, Microsoft, and Intel. More than 1,000 U.S. venture capital firms (VCFs) have active portfolios into which they have invested more than \$350 billion in the last 20 years and have experienced great variation in return and longevity. Given the importance of high-growth companies for the economy and the role played by VCFs in the success of these companies, it is important to understand how VCFs sustain and renew themselves. Various theorists have suggested that VCFs exist because of their specialized knowledge that gives them a competitive advantage in selecting portfolio companies (PFCs), building their value, and bringing them to market (e.g., Amit et al., 1990; Gupta & Sapienza, 1992; Sahlman, 1990). Little is known at present about how or when VCFs most add to their knowledge base via their interactions with PFCs. Our intention is to fill this gap by examining the factors contributing to learning by VCFs during the post-investment phase.

Some researchers have suggested that because the technological basis for competition is continuously changing, it is essential for VCFs to interact intensively with their PFCs in order to develop critical expertise (Sapienza & De Clercq, 2000; Wright & Robbie, 1998). The post-investment relationship between the VCF and its PFCs may enable the VCF to develop knowledge in a number of technological areas or stages of PFC development (Gupta & Sapienza, 1992). In this study we argue that VCF experience itself, the specific configuration of the knowledge bases of the two parties, the quality of the relationship, and the ongoing performance of the venture will affect the amount of learning a VCF will derive from a specific investment.

In order to develop our learning model, we rely primarily on learning and behavioral theory. However, given the importance accorded to trust in the dynamics of inter- (Zaheer et al. 1998; Ring & Van de Ven, 1994; Yli-Renko et al. 2001) and intra- organizational relations (Nahpiet & Ghosal, 1996) we also draw on theories of trust. Our study is set in the U.S., the oldest and most fully developed market for venture capital. Our data include quantitative secondary and primary data on 298 VCF-PFC pairs as well as interviews conducted with venture capitalists. The paper is organized as follows: first, we develop the theoretical framework; we then explain the methods employed and report the results; finally, we discuss the implications of our results for theory and practice.

THEORY AND HYPOTHESES

We define organizational learning by the VCF as the extent to which a principal in a VCF believes s/he (or the VCF as a whole) has gained new insights or broader understandings via interaction with a particular PFCⁱ. Our hypotheses predict the relationship between perceived organizational learning and four factors: (1) the VCF's prior investment experience, (2) the level of knowledge overlap between VCF and PFC, (3) the trust held by the VCF in the PFC, and (4) the PFC's current performance. Whereas the VCF's experience and knowledge overlap are explicitly 'knowledge-based' factors, trust and current performance include knowledge-based elements along with relational and behavioral ones, respectively. We first discuss the effect of the two 'knowledge-based' factors; we then turn to the role of trust and current performance.

The role of knowledge-based factors

Our interest is learning that takes place at the venture capital *firm* level. That is, we seek to understand better how learning by individuals can generate learning at the firm level. Some have argued that learning only takes place within individuals and that organizations learn via its members (Simon, 1991). However, others have argued that organizational learning involves both individual learning efforts and team-based activities (Grant, 1996). In this view, organizational learning depends both on individuals' ability to learn and on the integration of knowledge among individuals. We adopt this latter view and build our hypotheses both on individual and organizational characteristics (Spender, 1996).

Prior research has found that organizational learning is greatest when the firm's existing knowledge base is extensive (Cohen & Levinthal, 1990) and when the new knowledge to be assimilated is related to the existing knowledge structure (Bower & Hilgard 1981; Cohen & Levinthal, 1990). Several theorists have suggested that for a firm to learn from *another* party, it must hold sufficient 'general' knowledge and sufficient knowledge in common with the other party (Cohen & Levinthal, 1990; Lane & Lubatkin, 1998; Levinthal & March, 1993). However, in order to be competitive a firm also needs to continuously update its existing knowledge base by acquiring new external knowledge (Cohen & Levinthal, 1990; Levinthal & March, 1993).

Amount of prior investment experience

A firm's knowledge base involves both the breadth and depth of its knowledge (Cohen & Levinthal, 1990). Whereas knowledge breadth refers to the variety of expertise of a firm (e.g.,

different industries, different functional areas), knowledge depth refers to the level of understanding one has in a particular area. In this study, the amount of a VCF's knowledge base refers to the breadth and depth of VCF's experience in the venture capital industry.

Learning theory suggests two reasons that the amount of a VCF's prior investment experience should be related to how much the VCF learns from its investments. First, prior knowledge enhances the ability to recognize and assess the value of external knowledge (Cohen & Levinthal, 1990). Previous research has suggested that the VCF-PFC relationship is characterized by agency risk due to high information asymmetry (Eisenhardt, 1989; Sahlman, 1990; Cable & Shane, 1997). Prior investment experience should reduce these barriers to learning. VCFs with greater breadth and depth of prior experience will be less susceptible to being misled and will be more capable of accurately utilizing and assimilating new external knowledge. In other words, prior investment experience may help the VCF to overcome agency risk and provide the VCF with broader access to relevant information regarding the PFC, which ultimately stimulates effective knowledge exchange between the parties.

Second, prior investment experience may help the VCF to develop a more specialized *understanding* regarding the information provided by the PFCs, above and beyond any agency considerations. Prior research has shown that once an investment is made, the VCF, represented by a lead investor, often plays an active role on the board of the PFC or in other less formal ways (Gorman & Sahlman, 1989; Sapienza, 1992). The more the VCF has developed expertise in dealing with PFCs based on its prior investments, the more efficient it will be in identifying relevant information. Similarly, prior investment experience may increase the extent to which the VCF gains new *understandings* from its interactions with a PFC since the VCF has a broader knowledge base to draw from, and therefore a more extensive amount of existing knowledge with which to combine the new information (Cohen & Levinthal, 1990). For instance, VCFs' experience in dealing with PFCs should increase the ability to assess the business plan or monthly reports of the PFCs.

In short, the greater VCFs' prior experience, the better able they should be to ignore disinformation and to draw out important information to build new knowledge:

H1: *“The VCF’s prior investment experience is positively related to the amount of learning by the VCF.”*

Knowledge overlap

We expect that two counter mechanisms will be at work to determine the relationship between VCF-PFC knowledge overlap and VCF learning. On the one hand, some knowledge overlap is necessary for learning; on the other, too much redundancy can limit the development of new combinations to be learned (Cohen & Levinthal, 1990). For example, Sapienza et al. (2003) found that the greatest level of sales growth was realized by industrial spin-offs at moderate levels of knowledge overlap between the spin-offs and their industrial parents. Employing learning theory, Sapienza et al. argued that new learning would be optimized at intermediate levels of knowledge overlap; this learning, they reasoned, is translated into greater sales via process and product innovation.

Behavioral theory explains the propensity of firms to search for learning in the vicinity of existing knowledge. It holds that because firms avoid uncertainty, they search for information close to the existing knowledge base (Cyert & March, 1963). Therefore, firms are less resistant to external information close to their own knowledge bases. Also, Cohen & Levinthal (1990) argued that in order for firms to learn optimally, knowledge is developed in an incremental fashion. Similar know-how enhances the quality of the exchange and transferability of knowledge between firms because when one *understands* the assumptions underlying external information, one will be more able to relate this information to previously gained insights (Lane & Lubatkin, 1998). Further, the extent to which a firm possesses similar internal expertise will facilitate the transferability of external knowledge because the firm is more familiar with the nature of the external knowledge and its value for future use (Nelson & Winter, 1977). In the context of this study, when the VCF has some knowledge in common with the PCF, it may better understand the assumptions that shape the PFC's actions and therefore be in a better position to successfully relate the own knowledge base to the PFC's knowledge.

At the same time, some researchers have emphasized the importance of new external knowledge to learning (Levinthal & March, 1993). Because we conceive of learning as the amount of *new* insights and understandings gained by the VCF, new external knowledge should also be pertinent. The limitations of knowledge overlap to the amount of new insights gained may seem obvious, or even tautological, since *new* insights appear only plausible when some new knowledge is brought to the table. However, as mentioned earlier, greater distance in knowledge bases poses two barriers to learning: first, it makes communication and clarification increasingly

difficult between two parties; second, it results in increasingly strong resistance to putting forth the effort to use or combine the new information

In sum, the relationship between knowledge overlap and learning is likely to be curvilinear. Where there is little or no overlap, little learning can occur because of barriers to comprehension and processing; where there is too much overlap, little learning can occur because of knowledge redundancy. Therefore, we hypothesize:

H2: “The relationship between the level of knowledge overlap between VCF and PFC and the amount of learning by the VCF is curvilinear, such that up to a certain point increases in knowledge overlap increase the amount of learning; beyond that point further increases in knowledge overlap lead to decreases in the amount of learning.”

The role of trust

Previous research has not studied in depth the impact of trust on the behavior of VCFs and their PFCs, yet trust has generally been considered as being present in cooperative VCF-PFC dyads (Cable & Shane, 1997). For instance, Sweeting (1991) found that venture capitalists considered the benefits of mutual understanding and trust were evident even before the deal was made. Further, some research has emphasized the importance of trust as a governance mechanism in VCF-PFC relationships (Sapienza, 1989; Sapienza & Korsgaard, 1996). Sapienza (1989) showed that successful venture capitalists tried to build social, trusting relationships with their entrepreneurial CEOs. Our position here is that the primary benefit of trusting is that it facilitates information exchange and learning.

Whereas many definitions of ‘trust’ exist (e.g., predictability, integrity, and reliability), we will focus on the learning effects of ‘goodwill’ trust. Goodwill trust denotes the belief that a given party will act with benevolence. In our case, trust indicates the extent to which the VCF (or its representatives) is confident that the PFC (or its representatives) will act with honesty and goodwill, even when the possibility for opportunism exists.

High levels of goodwill trust between VCF and PFC increase the amount of learning by the VCF because it facilitates openness in information exchange and reduces uncertainty regarding the meaning of ambiguous signals. For example, Sapienza and Korsgaard (1996) found that when entrepreneurs provided more timely feedback and information, venture capitalists had

greater trust in the entrepreneurs and tended to support their decisions more fully. Given norms of reciprocity (Ring & Van de Ven, 1994), trust also creates a context in which the VCF is likely to have greater access to a higher *amount* of information from the PFC. That is, the VCFs' very trust in the PFC is likely to induce greater sharing on the part of the VCF and vice versa. Further, if indeed trust induces information sharing across a range of information, this increased exposure to the PFC's knowledge base may increase the VCF's *insights* into the information received. Thus, trust indirectly increases learning potential by increasing the range of information shared and the ability to process or interpret knowledge exchange.

In summary, we argue that the presence of trust between VCF and PFC creates a context in which the VCF will gain more new insights as a result of its interaction with the PFC. Therefore, we hypothesize that the level of trust between VCF and PFC will increase the amount of learning by the VCF.

H3: *“The VCF’s trust in the PFC is positively related to the amount of learning by the VCF.”*

The role of the PFC’s performance

Organizational learning involves attempts to make sense of how actions are related to outcomes (Cyert & March, 1963). Organizations tend to repeat actions that led to positive outcomes and drop or change actions that led to negative outcomes (Cyert & March, 1963, Levinthal & March, 1981). Firms are less apt to question or examine their existing mental models when they succeed, but they may spend considerable time re-examining the sequence of events or searching for alternative paths or new modes of operating when things have gone wrong (Lant and Mezas, 1992; Tushman & Romanelli, 1985). Given these behavioral tendencies, it would seem reasonable to expect that VCFs will be more apt to re-examine and learn from the mistakes made by PFCs.

However, the unique circumstances of the management of a portfolio of venture capital investments lead us to a different expectation. The typical behavioral assumption of risk aversion may not fully apply in the venture capital context. That is, most individuals expend significant energy to ensure to limit downside risk, but venture capitalists must maximize the upside of a few investments in order to realize adequate returns. Prior research in the VC literature has indicated that VCFs often devote more time to their successful investments in order to realize the returns

necessary to make the fund a success (Sahlman, 1990; Sapienza et al., 1994). Supporting this view, Sapienza (1992) found that the time devoted to portfolio companies was positively related to PFC performance. As Gifford (1997) noted, venture capitalists face serious time allocation dilemmas with regard to supporting portfolio companies, raising new funds, and locating and closing new investment deals; it is not, therefore, surprising that venture capitalists should economize on time devoted to poorly performing ventures. Furthermore, we expect that in the context of venture capital financing, PFC performance will be positively related to how much the VCF learns from its investments because the chance to have a high return will increase VCF effort. Also, since 'home run' investments (i.e., investments with more than average returns) are not as likely to occur, VCFs may perceive greater learning from extremely high performing ventures (Sapienza et al., 1994). That is, the rarity of 'homerun' investments will make the 'lessons' drawn from them more salient.

Learning theory suggests that the acquisition of new knowledge requires not only prior related knowledge and knowledge in common but also a certain intensity in the processing of new knowledge (Cohen & Levinthal, 1990). Thus, because VCFs are expected to interact more intensively with their high performing ventures, they are likely to learn more from these ventures. It is, of course, possible that the tendency not to question things when they are going well will dampen VCFs' learning, but on balance we expect learning to be greatest with high performing PFCs. Thus, we hypothesize:

H4: *“The PFC’s current performance is positively related to the amount of learning by the VCF.”*

METHODOLOGY

Sample and data collection

Based on Venture Economics' VentureXpert database, we randomly selected 1,400 US-based VCFs who invested funds raised from external investors; we excluded business angels, corporate venture capitalists, and corporate venturing programs. We sent a survey to a randomly selected member of each VCF. The respondents were asked to choose one PFC that met the following criteria: (1) the initial investment in the PFC was made in the period 1998-2000, and (2) the respondent was actively involved in the post-investment relationship with the PFC. To

maximize randomness, we asked the respondents to select the venture that met the above criteria and came first alphabetically.

We adapted the total design method as suggested by Dillman (1978) for the mailing process. Two weeks after the initial mailing, we gave a ‘thank you’ call to respondents and a reminder phone call to non-respondents. Four weeks after the initial mailing, a letter and replacement questionnaire was sent to the non-respondents. Several questionnaires were returned uncompleted because the respondents were no longer with the firm, the VCF had moved to another location, or the VCF did not exist any more; the number of potential respondents then equaled 1,251, and we received 298 completed surveys (24%). In order to test for possible non-response bias, we compared the characteristics of the respondents versus non-respondents, in terms of VCF age, the total capital under management, the average size of the investments, the total number of PFCs, and the number of recent investments (i.e, investments during the last five years). An independent-samples t-test did not generate any statistical differences between the two groups except that the responding VCFs were slightly younger than the non-responding VCFs (Table 1).

Insert Table 1 About Here

We examined the validity of our measures in several ways. First, we found that our test measures correlated significantly with secondary data and with alternative measures in our survey. Second, after an 8-month lag, we sent a follow-up survey with a shortened format of the original questionnaire; the follow-up used single-item proxies of the original (Yli-Renko et al. 2001). We received 129 responses to the follow-up survey (43%); all follow-up measures correlated significantly with the original measures. We now describe our measures and how we assessed validity; the reliability of the measures is shown in the bottom row of Table 2, which also gives the means of and correlations among variables in the study (see Table 2).

Insert Table 2 About Here

Measures

Amount of learning by the VCF: To measure the amount of perceived new insights or broader understandings the VCF has gained from its interaction with a particular PFC, we adapted 12 items from research in venture capital (Gupta & Sapienza, 1992; Sahlman, 1990; Wright & Robbie, 1998) and technological learning (Zahra, Ireland and Hitt, 2000) [see Appendix]. For instance, the respondents were asked on a five-point scale to what extent new insights or broader understandings were gained in terms of how to *better* set critical milestones for firms in the PFC's industry. The composite measure is the average of the 12 item, 5-point scale (mean= 3.54; alpha= .88).

Our follow-up survey provides some evidence of validity. We found a significantly positive correlation of $r = .462$ ($p < .001$) between the original composite measure and the single item global measure.

Prior investment experience: To measure VCF prior investment experience, we combined individual level experience of the responding venture capitalist (two items) and of the firm (two items) because we believed that individual experience accumulated over time may be shared among the individuals within the VCF [see Appendix]. Since the items were measured on different scales, the four items were standardized and averaged (mean= .01; alpha= .74).

In order to check for the validity of the final measure, we calculated its correlation with several alternative measures drawn from the VentureXpert database, such as 'the total number of investments made by the VCF' ($r = .421$ [$p < .001$]), 'the total number of funds raised by the VCF' ($r = .405$ [$p < .001$]), and 'VCF age' ($r = .588$ [$p = .001$]).

Knowledge overlap: To measure knowledge overlap between VCF and PFC we asked respondents to indicate (on a 5-point scale) the degree of similarity in operational expertise and technological knowledge between the PFC's CEO and themselves; these items were adapted from prior research on interfirm cooperation in technological environments (Lofstrom, 1999; Teece, 1986; Teece, 1992 [see Appendix]). A composite measure was calculated by averaging the scores across the four items (mean= 2.23; alpha= .73).

As a validity check, the respondents were asked to indicate the number of years of *operational* experience they had in the PFC's industry. We found a positive and significant correlation of $r = .387$ [$p < .001$] between this single measure and the composite measure.

Further, the (single-item) measure from the follow-up survey correlated strongly with the (composite) measure from the original survey ($r = .473$ [$p < .001$]), suggesting construct validity.

Trust: Drawing on the literature on interpersonal trust (Larzelere & Huston, 1980; Rempel et al., 1986) and interfirm trust (Morgan & Hunt, 1994; Yli-Renko et al., 2001), we developed seven items to measure the level of goodwill trust between VCF representatives and members of the PFC's top management team [see Appendix], e.g., 'The TMT members are perfectly honest and truthful with us.' A composite measure was calculated by averaging the scores across the seven items (mean= 4.09; alpha= .91). The relatively high mean value of this measure was consistent with the exploratory interviews which indicated that, overall, venture capitalists only invest in top management teams in which they have a high level of trust. The (single-item) measure from the follow-up survey correlated strongly with the (composite) measure from the original survey ($r = .603$ [$p < .001$]), suggesting construct validity.

PFC performance: PFC performance was measured by (1) a multi-criterion *satisfaction* scale and (2) a rating of *performance* (Sapienza, 1992). First, for the multi-criterion scale, venture capitalists were asked to assess their satisfaction with the PFC's performance along six dimensions, such as 'sales' and 'market share.' Second, they were also asked to assess four items in terms of the PFC's overall performance (e.g., 'Considering this venture's stage of development, the venture has done very well'). Both sets of items had five-point Likert scales [see Appendix]. In order to test whether 'satisfaction' and 'performance' represent two dimensions of the same construct, i.e., 'PFC performance,' we undertook confirmatory factor analyses on a two-factor model with fully correlated factors. The good statistical fit of this model (NFI = .91) showed that it was reasonable to combine the satisfaction and performance scores into one measure for 'PFC performance' (mean= 3.24; alpha= .88). The (single-item) measure from the follow-up survey correlated strongly with the composite measure from the original survey ($r = .672$ [$p < .001$]), suggesting construct validity.

Control variables

We included four control variables which might affect learning by VCFs. (1) *Years in portfolio:* agency theory suggests that information asymmetry between VCF and PFC may be greatest in early stages as (Sapienza & Gupta, 1994). Therefore, we included 'years on portfolio' as a control variable (mean= 2.75 years). (2) *CEO experience:* the quality of knowledge exchange may be affected by the CEO's experience. We gauged CEO experience in three steps: no prior

new venture experience; prior new venture experience but not as founder or CEO; and, prior founding or CEO experience in a new venture. The categories were coded as dummy variables, and we used the first category as the base case in the regression analysis. (3) *PFC stage of development*: prior research has suggested that PFCs in early stages may require more knowledge exchange (Sapienza, 1992). Respondents indicated the current stage of the PFC as ‘seed,’ ‘startup,’ ‘other early stage,’ ‘expansion development,’ ‘buy in/buy out,’ and ‘turnaround.’ The categories were coded as dummy variables, and we used the ‘seed stage’ as the base case. (4) *Industry*: we controlled for industry sector since knowledge-intensive industries may lead to more learning; the following categories were used: communications; computer & electronics; biotechnology & medical devices; materials and resources; services; consumer-related businesses; and miscellaneous. The industries were coded as dummy variables; ‘communications’ served as the base case.

RESULTS

Table 2 displays the correlation’s among the variables in our study. The results for the hypotheses are shown in Table 3. First, contrary to Hypothesis 1, we found that the VCF’s prior investment experience has a negative rather than a positive impact on the amount of learning by the VCF. In order to test the curvilinear relationship predicted in Hypothesis 2 (moderate levels of knowledge overlap would be related to more learning than low or high levels of overlap) it was necessary to introduce the linear term in step 1 and the squared term in step 2; to support our prediction we would observe a significant negative coefficient for the squared term. Table 3 shows that there is a weakly significant linear term in step 1 and no relationship for the squared term. Thus, Hypothesis 2 is not supported. Hypothesis 3 predicted that learning would increase with increasing levels of trust; however, Table 3 shows that trust is significantly *negatively* related to learning; thus, we also reject Hypothesis 3. Lastly, Table 3 indicates solid support for Hypothesis 4. That is, the PFC’s current performance is positively related to VCF learning.

Insert Table 3 About Here

DISCUSSION

This study explored the effects of VCF experience, VCF-PFC knowledge overlap, trust, and PFC performance on how much learning VCFs achieve via individual investments. We adopted a primarily learning theory perspective to build and test our model. Only one of the four relationships results was exactly what we predicted. We found support for the hypothesis that learning would increase with PFC performance. Contrary to our expectations, VCF experience and trust in the PFC were negatively related to learning. Finally, whereas we thought that learning would increase as knowledge overlap increased from low to moderate levels and would decrease from moderate to high levels of overlap, the relationship was strictly negative. Employing insights from our interviews, we discuss interesting results below.

Prior investment experience and learning

Our exploratory interviews indicated that venture capitalists believe that experience is related to greater accumulated knowledge:

‘Having a feeling about the appropriate pace and growth are important, and this feeling really comes from experience. Young venture capitalists can be great, they know about strategy, but not about pace, that is, how to spend a given amount of money over time. Will I spend more money faster or will I spend it slower and in a more qualitative way? In order to invest again, entrepreneurs need to meet some benchmarks, and the venture capitalist can be very helpful in this respect.’

How, then, can we explain the negative, rather than the hypothesized positive, relationship between the VCF’s overall experience and the amount of learning by the VCF (Hypothesis 1) from a particular PFC? The explanation may relate to the difference between the stock of existing knowledge and the relative acquisition of new knowledge. In other words, our finding may indicate that our measure for organizational learning captured the extent to which the knowledge base of the VCF could be updated and *extended* rather than how this knowledge base could be used to acquire new knowledge. Thus, a very experienced venture capitalist may not perceive that much truly novel information is being assimilated as they build on an already deep knowledge base. whereas a less experienced venture capitalist may process even small additions to the knowledge base as novel and significant.

Thus, one possible explanation is that perceptions of additional learning may be conditioned to notice only certain obvious types of changes in the knowledge base. A second possibility may be that experienced venture capitalists may be susceptible to a certain level of hubris, believing that as their experience grows they have little new to learn. Future research might seek alternative measures of learning that better tap into the subtle types of learning that might occur. It could also attempt to determine whether experienced investors are susceptible to adopting dominant logics that filter out new information or even whether they may be guilty of assuming that their experience obviates the need to communicate internally as intensively.

Knowledge overlap and learning

Our exploratory interviews with several venture capitalists revealed the importance of shared knowledge bases between the VCF and PFC:

‘I can help out the PFCs a lot more when they are in the healthcare business, because my entire career was in that business. If you are raising money in healthcare, you want someone like me, because I am very knowledgeable about this field.’

‘Our focus is very much oriented towards early-stage investments. Therefore, our people are specialized in looking at many new facts, especially for seed stage investments, since detailed reports do not exist at that stage. Further, you do not only have little information to make decisions and predict the future for this type of ventures, but you also need to be a company builder. Therefore, we have built an expertise in helping firms to put together a top management team, or to find strategic partners.’

The zero-order correlation of knowledge overlap (in terms of specific individual expertise) and PFC performance is consistent with these stories (Table 2; $r = .142$; $p < .01$). This indicates that experience may have some positive relationship with outcomes. Despite this positive correlation, we did not find support for the hypothesized inverted U-shape relationship between knowledge overlap and the amount of VCF learning (Hypothesis 2).

As with our explanation for the results for Hypothesis 1, the reason may be that VCFs perceive less learning the more they share industry and stage experience with the PFC. Again, this may be an artifact of the 'new' learning to be occurring only in new environments. Alternatively, our results could suggest simply that more new knowledge is being taken on the farther the VCF is from its existing knowledge base. However, the correlations of PFC

performance with knowledge overlap suggest that the productive use of that knowledge may be better the greater the knowledge in common (Cohen & Levinthal, 1990).

Trust and learning

Contrary to Hypothesis 3, we found a negative relationship between trust and VCF learning. We had reasoned that greater trust facilitated learning through openness and understanding. Though we continue to believe this reasoning, one of several factors may be behind the negative relationship observed here. First, trust is uniformly high in this setting (4.09 mean on a 5-point scale); it could be that at extremely high levels of trust less need is felt to engage in penetrating discussions and information exchange. In other words, it could be that when the investor has full confidence in the PFC's honesty and truthfulness, the investor is less likely to scrutinize decisions and less learning is taking place. Yli-Renko et al. (2001) also observed a negative relationship between trust and learning in supplier-customer dyads; they argued that the presence of trust might limit cognitive conflict in such pairs. Prior research on the role of social capital in exchange relationships has indicated that in very tight relationships, the phenomenon of 'group think' may take place, i.e., the different parties become less critical about each other's actions and opinions, and this may ultimately decrease the quality of information flows or decisions (Janis, 1972; Yli-Renko et al., 2001). Thus, it is possible for VCFs to develop a level of trust that actually serves to reduce the likelihood of learning because it reduces the diversity of views and the intensity of processing information in the VCF-PFC dyad.

PFC performance and learning

Behavioral theory suggests that poor performance may lead to more organizational learning since poor performance alerts the firm to the ineffectiveness of past decision processes (Cyert & March, 1963; Levinthal & March, 1981). To the extent that individuals attempt to correct their perceived failures, they will increase efforts to learn. However, in the venture capital context we expected that performance would have a positive relationship with learning because the chance to score a 'big win' promotes VCF effort. Another reason that VCFs may perceive greater learning from extremely high performing ventures is the relative rarity of such events. The very rarity of such 'homeruns' is likely to make the circumstances and 'lessons' surrounding them more salient. The downside of a venture investment is limited to the capital committed to such an investment; the upside can be 10-, 20-, or 50-times or more of the original investment.

Finally, it is possible that VCFs learn more from such ventures because the human capital in such ventures both drives their success and provides more valuable knowledge to be assimilated.

Limitations, Implications, and Future Research

This study's limitations should be taken into account when interpreting the results. First, the nature of many of the variables (e.g., 'amount of learning by the VCF' and 'trust') required the use of primary sources and limit replicability. We relied mostly on self-reported, single-respondent data. Nonetheless, we undertook several efforts to help ensure the validity of our data. For example, we used previously validated scales wherever possible; we sought to validate as many of the variables as possible with secondary data available from the VentureXpert database or alternative data sources; we also examined the validity of our measures by alternative measures from the primary data. These approaches collectively support the validity of our measures and relieve, to some degree, concerns regarding common-method variance.

Because of the difficulty of obtaining data in this setting, we collected data from only venture capitalists and not from members of the PFC's top management. Thus, we have but one side of the picture. It would indeed have been interesting to examine whether there was an alignment between the VCF and PFC in terms of some of the key variables of this study, such as the level of trust and the PFC's current performance. Finally, the cross-sectional nature of the research design requires caution in drawing causal inferences, in that some relationships may be susceptible to reverse causality. For instance, the positive effect of PFC performance on VCF learning may indeed indicate that high performance motivates the VCF to dedicate substantial efforts towards the PFC; however, an alternative explanation is that the performance of a particular investment may be high *because* the VCF has learned extensively from its interactions with the PFC. Future research efforts could focus on collecting 'performance' and 'learning' data over time in order to clarify causality.

Several important implications are suggested by our study. First, our results suggest that extremely high levels of trust in the goodwill of the PFC's management team may lead the VCF to become 'overconfident' in the quality of the PFC's decisions; this overconfidence may ultimately harm the fruitfulness of VCF-PFC interactions. Whereas close social relationships may facilitate the openness of communication between VCF and PFC, becoming too close may bias the venture capitalist's perception about the PFC and therefore decrease the VCF's ability to learn new things from its interactions with the PFC.

A second implication is that venture capitalists should be aware that in order to be competitive and valuable in quickly changing technological environments, they ought to promote within their firm a willingness to continuously update the existing expertise. One of the conclusions from the negative relationship between the knowledge overlap between VCF and PFC and the amount of VCF learning may be that the search for new, relevant knowledge by the VCF may sometimes be limited by a too narrow investment focus. An important challenge for VCFs may be to continuously store and utilize expertise developed over time by its individual investors, and to develop a dynamic, flexible knowledge-generating culture within the VCF.

Several suggestions can be given in terms of how future research can further enhance the understanding of how VCFs learn from their investments. First, future research efforts could focus on longitudinal data in order to clarify the hypothesized relationships pertaining to the antecedents of organizational learning. One of the implicit assumptions of this study was that the amount of learning by the VCF – resulting from its interactions with a particular PFC – would ultimately lead to better outcomes once the PFC leaves the VCF's portfolio; however, such VCF learning may also affect the performance of *future* PFCs which have characteristics in common with the focal PFC. Therefore, a longitudinal examination of performance and organizational learning across a variety of PFCs of a given VCF could shed more light on how VCFs are able to transfer knowledge from one venture to another.

Second, a longitudinal design would also facilitate an examination of whether learning occurs uniformly across the stages of the venture or develops in punctuated, or increasing, or decreasing fashion. Sapienza (1992) speculated that VCFs' value-added may be greatest in early stages, but little is known about whether stage is also an important component in learning. While we have measures of stage in this study, we cannot test stage effects on learning given the cross-sectional design. Further, the exploratory interviews showed that the period around the undertaking of a new investment round is critical in terms of the intensity of the interaction between both parties. Future research could examine the effects of financing rounds on learning.

Third, an interesting question would be to examine how successful VCFs create conditions and mechanisms that encourage quality interactions with their PFCs. For instance, what is the importance of establishing knowledge-sharing routines before the initial investment is made? How can the investor motivate the entrepreneur to provide useful inside information in a

continuous and spontaneous manner, especially when the PFC has not been able to achieve pre-set performance targets?

Fourth, future research could also examine how representatives of the PFC perceive the nature of their interactions with the VCF, and to what extent they consider these interactions to be useful for their firm's survival and performance. Although the focus of this study was on the learning by VCFs from their interaction with PFCs, it should be remarked that both VCF and PFC may alternatively play the role of 'student' and 'teacher' (De Clercq & Sapienza, 2001). That is, the focus of this study was on how the VCF can learn from the combination of its existing expertise with the PFC's entrepreneurial know-how. However, it would be equally interesting to examine how entrepreneurs learn from their interactions with their investors.

Finally, and more generally, future research could examine in greater detail how the quality of interfirm relationships (i.e., in terms of the extent of trust) affect learning outcomes. Our surprising findings of a negative relationship between trust and learning is intriguing. As mentioned in the discussion section, this result suggests that trustful relationships may result in a diminished rather than increased capability to gain new insights. Future research on interfirm relationships could attempt to further examine the combined effect of trust, several dimensions of the process of knowledge exchange (i.e., its costs, intensity, frequency, openness, or variety in terms of the communication channels used) *and* learning outcomes in order to better gauge the dynamics that lead to success in such relationships. For instance, an interesting question for future research is: At what point does extensive communication become a burden for learning, given the costs associated with extensive information processing? Also, future research could explore factors determining the *timing* for the exchange of information. For instance, how does the quality of an exchange relationship (e.g., reflected in the level of trust) affect the parties' willingness and capability to plan *early on* in the relationship which type of information needs to be exchanged in the subsequent stages of the relationship?

CONCLUSION

This study contributes to the literature on venture capital by highlighting several factors that affect the learning process of VCFs – i.e., the VCF and PFC's knowledge bases, the nature of the relationship between the VCF and PFC, and the performance of the investment in the PFC. We found that less experienced VCFs learned more from their PFCs and that extensive knowledge overlap limited learning. Further, we found that whereas both parties have to strive for good social relationship, too much confidence in the goodwill of the PFC may diminish effective knowledge exchange between the two parties and decrease VCF learning. Finally, VCFs appear to learn most from their successful PFCs; this result may simply reflect extra effort put into such investments; alternatively, it could be that this learning reflects the capacities embedded in high performing ventures. Our hope is that the insights revealed by this study will lead to further investigation of the knowledge exchange and learning in a variety of types of interfirm relationships.

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APPENDIX

Amount of learning by VCF

Please indicate on a scale from 1 to 5 your agreement or disagreement with each of the following statements:

As a result of our investment in this PFC, we have gained new insights or broader understandings about how to better:

- 'Set critical milestones for firms in the PFC's industry.'
- 'Time new product introductions in the PFC's industry.'
- 'Evaluate the R&D process in the PFC's industry.'
- 'Evaluate new technologies in the PFC's industry.'
- 'Evaluate proprietary advantages in the PFC's industry.'
- 'Assess the right timing to market technology in the PFC's industry.'
- 'Assess market potential for new technologies in the PFC's industry.'
- 'Price new products in the PFC's market.'
- 'Set appropriate growth goals for ventures like the PFC.'
- 'Assist firms in the PFC's stage of development.'
- 'Manage the relationship with the TMT of ventures like the PFC.'
- 'Resolve conflict with the TMT of ventures like the PFC.'

Prior investment experience

The measurement of this variables was based on the following four items:

- 'The respondent's years of experience as a venture capitalist'
- 'The total number of investments by the respondent'
- 'The average years of venture capital experience to date by all general partners within the VCF'
- 'The total number of investments made by the VCF to date'

Knowledge overlap

Please indicate on a scale from 1 to 5 your agreement or disagreement with each of the following statements with regard to the PFC's CEO and yourself:

- 'The CEO and I have worked in very similar functional areas.'

‘Overall, our backgrounds are very different.’ (reverse scored)

‘We have different areas of industry expertise.’ (reverse scored)

‘Our experience is based on very similar technological areas.’

Trust

Please indicate on a scale from 1 to 5 your agreement or disagreement with each of the following statements:

‘The Top Management Team (TMT) members are perfectly honest and truthful with us.’

‘The TMT members are truly sincere in their promises.’

‘The TMT members treat us fairly and justly.’

‘The TMT members cannot be trusted at all times.’ (reverse scored)

‘The TMT members can be counted on to do what is right.’

‘The TMT members have high integrity.’

‘The TMT members would not take advantage of us even if the opportunity arose.’

PFC performance

Please indicate on a scale from 1 to 5 how satisfied you are with the venture’s progress over the last year on the following criteria.

‘Sales’

‘Market share’

‘Gross margin’

‘Return on investment’

‘New product development’

‘Market development’

Please rate on a 5-point scale to what extent you agree with the following statements:

‘We are very satisfied with the progress of this venture.’

‘So far, I would rate this venture’s performance as very poor.’

‘Considering this venture’s stage of development, it has done very well.’

‘Market conditions aside, the value of our investment in this venture has greatly increased.’

TABLE 1**Comparison between respondents and non-respondents**

	Sample (n = 1,409)	Respondents (n = 298)	Non- respondents (n = 1,111)	t-value (p-value; 2-tailed)
VCF age	10.60	9.39	10.89	-2.397 (.017)
Total capital under management (\$ mio)	499.22	412.47	522.25	-.827 (.408)
Total number of PFCs to date	30.44	30.73	30.37	.089 (.929)
Average investment per PFC (\$ 1,000)	5,650.57	6,555.67	5,418.32	.949 (.343)
Number of investments in				
- 1997	7.96	9.39	7.60	1.484 (.140)
- 1998	7.93	8.81	7.70	.985 (.326)
- 1999	9.12	9.61	8.99	.487 (.627)
- 2000	10.03	10.40	9.93	.418 (.676)
- 2001	5.68	5.49	5.74	-.399 (.690)

TABLE 2

Correlation matrix (N = 298)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. VCF learning																						
2. Prior investment experience	- .13*																					
3: Knowledge overlap	-.07	.00																				
4: Trust	- .12*	.14*	.19**																			
5: PFC's current performance	.10	.06	.14*	.49**																		
6. Years in portfolio	-.01	.35**	.00	-.04	-.06																	
7. No new venture experience	-.10	.01	-.16**	.02	-.06	.05																
8. New venture exper. But not as founder	.10	.10	.10	-.02	-.06	.07	-.40**															
9. Founder experience.	.01	-.09	.06	.00	.11	-.10	-.60**	-.50**														
10. Seed stage	.00	.05	.21**	.02	.10	.02	.03	-.10	.06													
11. Start-up stage	.01	-.08	.02	.01	-.08	.00	-.08	.09	.00	-.34**												
12. Early stage	.07	.00	.00	-.15**	-.05	-.06	.01	.00	-.01	-.29**	-.29**											
13. Expansion stage	-.08	-.11	-.14*	.01	.01	-.01	-.08	.14	-.04	-.26**	-.26**	-.23**										
14. Buy-in/buy-out stage	-.04	.18**	-.10	.13*	.03	.07	.15**	-.15**	-.02	-.20**	-.20**	-.18**	-.16**									

15. Turnaround stage	.07	-.01	-.09	.02	.00	.01	.02	-.01	-.01	-.08	-.08	-.07	-.06	-.05								
16. Communications	.01	.03	.04	.09	.02	-.10	-.05	-.04	.08	.12*	-.03	-.07	.11	-.14*	-.07							
17. Computer & Electronics	.00	-.01	0.02	-.09	-.08	.00	-.04	.06	-.02	.00	.04	.06	-.08	-.03	.00	-.26**						
18. Biotech & Medical	-.02	.03	-.04	.06	.15**	.12*	-.13*	.09	.04	.10	.01	.03	-.01	-.15**	-.07	-.27**	-.25**					
19. Resources	-.09	-.02	-.05	-.09	-.02	-.01	.05	-.05	.00	-.13*	-.06	.09	.11	.02	-.03	-.12*	-.11	-.11*				
20. Services	.10	-.04	-.07	-.07	-.10	.01	.15**	-.03	-.12*	-.10	.00	.07	-.07	.15**	-.03	-.13*	-.11*	-.12*	-.05			
21. Consumer	.11	.05	-0.04	.04	.06	.03	.02	0.04	-.06	-.02	-.09	-.06	.07	.13*	.07	-.14*	-.13*	-.13*	-.06	-.06		
22. Other	-.07	-.04	.06	.01	-.08	-.02	.09	-.10	.00	-.09	.06	-.07	-.09	.17**	.12*	-.28**	-.24**	-.27**	-.12*	-.13*	-.14*	
Mean	3.54	0.01	2.23	4.09	3.24	2.75	.32	.25	.43	.25	.25	.20	.17	.11	.02	.22	.19	.21	.05	.05	.06	.22
Standard deviation	.66	0.78	0.95	0.77	1.02	.96	.47	.43	.50	.43	.43	.40	.37	.31	.13	.42	.39	.41	.21	.23	.24	.42
Minimum	1.17	-1.08	1.00	1.00	1.00	1.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
Maximum	5.00	2.96	5.00	5.00	5.00	5.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Alpha	.88	.74	.73	.91	.88	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Zero-order correlation coefficients; ** p [two-tailed] = .01; * p [two-tailed] = .05

TABLE 3

Regression results (N = 298)

<i>Dependent variable →</i>	<i>VCF Learning</i>	
H1: Prior investment experience	-0.15*	-0.15*
H2: Knowledge overlap	-0.10⁺	-0.07
H2: Knowledge overlap squared		-0.06
H3: Trust	-0.17*	-0.17*
H4: PFC's current performance	0.22**	0.22**
Years in portfolio	0.05	0.05
CEO experience: new venture but not as founder ¹	0.19**	0.18**
CEO experience: founder	0.10	0.10
PFC stage: start-up ²	0.01	0.01
PFC stage: early	0.05	0.05
PFC stage: expansion	-0.11	-0.11
PFC stage: buy-in/buy-out	-0.02	-0.02
PFC stage: turnaround	0.05	0.05
Industry: computer & electronics ³	-0.05	-0.05
Industry: biotech & medical	-0.08	-0.08
Industry: resources	-0.09	-0.10
Industry: services	0.08	0.08
Industry: consumer	0.08	0.08
Industry: other	-0.06	-0.06
<i>F-value (degrees of freedom)</i>		
<i>R²</i>		
<i>Adjusted R²</i>		

Standardized regression coefficients; ** p = .01; * p = .05; + p = .10

¹ 'No new venture experience' used as base case

² 'Seed stage' used as base case

³ Industry category 'communications' used as base case

¹ In practice, 'objective' learning is nearly impossible to verify (Spender & Grant, 1996), whereas perceived learning lends itself to measurement and is likely highly correlated with learning itself (see e.g., Sapienza et al., 2003; Yli-Renko et al. 2001).