1042-2587

Assessing the Relationship between Human Capital and Firm Performance: Evidence from Technology-Based New Ventures

Rod Shrader
Donald S. Siegel

We assess the role of human capital in the growth and development of new technology-based ventures, based on longitudinal data from 198 high-tech ventures. Our empirical results imply that there is a strong relationship between team experience and strategy. Although there is a weak direct link between team experience and venture performance, the findings strongly suggest that the *fit* between strategy and team experience is a key determinant of the long-term performance of high-tech entrepreneurial ventures. For small, technology-based new ventures, the team's technological experience appears to be the most important determinant of the success of a differentiation strategy.

Introduction

Numerous scholars in strategic management have assessed the relationship between the characteristics of managers and the performance of *large* firms (e.g., Bantel & Jackson, 1989; Finkelstein & Hambrick, 1990, 1996; Gupta, 1984, 1988; Hambrick, 1982, 1994; Hambrick, Cho, & Chen, 1996; Hambrick & Mason, 1984; Norburn & Birley, 1988; Szilagyi & Schweiger, 1984; Wiersema & Bantel, 1992). Much of this research is grounded in Upper Echelons theory (Hambrick & Mason, 1984), which asserts that organizational outcomes (strategic choices and performance levels) are partially determined by key attributes of top managers. Characteristics such as job tenure, age, education, or functional expertise are conjectured to be determinants of strategy and performance because they influence decision making. Furthermore, they may constitute critical intangible resources, which can be valuable to the firm. Upper Echelons theory

Please send correspondence to: Rod Shrader, tel.: (312) 996-8732; e-mail: rshrader@uic.edu and to Donald S. Siegel, tel.: (951) 827-4996; e-mail: donalds@ucr.edu

was developed for the purpose of demonstrating that top managers matter, and also to counter the population ecology perspective (Hannan & Freeman, 1977), which asserts that organizations are swept along by inertia and/or responses to environmental circumstances.

The analysis of individual managers, especially those employed by entrepreneurial firms, can also be related to the economic theory of human capital (Becker, 1964; Rosen, 1987). This theory begins with the realization that wage differentials are due to differences in productivity. Labor economists used this theory to reach a fundamental conclusion: labor is heterogeneous and an individual's human capital consists of his/her productive skills and technical knowledge and any other skills that might be useful to the firm (i.e., the full set of characteristics that may enhance his or her salary). Thus, a worker's or manager's compensation can be viewed as return to investment in human capital.

Human capital is likely to be particularly important in the context of technological entrepreneurship. A significant percentage of the value of technology-based new ventures is likely to be determined by the quality of the company's employees, especially the top management team (henceforth, TMT). Furthermore, several authors (Bartel & Lichtenberg, 1987, 1990; Siegel, 1999; Siegel, Waldman, & Youngdahl, 1997; Link & Siegel, 2007) have shown that employees with more human capital (i.e., more education and experience) help firms implement new technologies more effectively.

Many scholars in entrepreneurship have focused on examining relationships between salient characteristics of entrepreneurs and the performance of new ventures (e.g., Birley & Norburn, 1987; Cooper, 1981; Davidsson & Honig, 2003; Ensley & Amason, 1999; Ensley, Pearson, & Amason, 2002; Feeser & Willard, 1990; Hornaday & Aboud, 1971; Palmer, 1971; Ucbasaran, Lockett, Wright, & Westhead, 2003; Vanaelst et al., 2006; Vesper, 1990). These individual attributes can be viewed as aspects of the entrepreneur's human capital.

Unfortunately, there has been little consistency and no consensus among the findings of this research. These results have led some entrepreneurship scholars to conclude that characteristics of entrepreneurs are not important and even to advocate abandoning this line of inquiry (e.g., Gartner, 1988). Such findings and conclusions are puzzling because we might expect that the link between managerial characteristics and performance is stronger for new ventures (Shrader, 2001), given their simpler structures, lack of organizational inertia, and less complex strategies. Consequently, entrepreneurship scholars continue to examine the role of human capital among individual entrepreneurs (e.g., Davidsson & Honig, 2003).

Recently, entrepreneurship scholars have begun to study the importance of entrepreneurial teams, due to the recognition that high potential, high growth firms are typically launched and grown by teams of entrepreneurs, not individuals. An entrepreneurial team is defined as a group working together to launch a new business venture. Such a group often resembles the TMT of a more established firm in that it might include several people with diverse experience and skills in a variety of functional areas. Recent studies have focused on the process of team formation (Clarysse & Moray, 2004; Kamm & Nurick, 1993; Ucbasaran et al., 2003; Vanaelst et al., 2006), team heterogeneity (e.g., Amason, Shrader, & Tompson, 2006; Chowdhury, 2005; Ensley & Amason, 1999; Ensley, Carland, & Carland, 1998), or team cohesion and conflict (Ensley et al., 2002). However, there is a paucity of research on entrepreneurial teams, strategy, and venture performance (Daily, McDougall, Covin, & Dalton, 2002).

Three important differences distinguish the literatures cited above. Strategic management studies have been grounded in upper echelon theory, whereas studies of entrepreneurs' experience have often lacked theoretical grounding. Strategy scholars have examined management teams, while entrepreneurship scholars have mostly concentrated

on individual founders. Finally, strategy scholars have linked managerial characteristics to performance by considering the interaction of these characteristics with the competitive strategies of firms, whereas entrepreneurship scholars have failed to examine these linkages. Therefore, this study will draw upon the upper echelon theory of strategic management to address the following research questions:

1. Are entrepreneurial team characteristics related to the competitive strategies of technology-based new ventures?
2. Is the fit between venture team characteristics and strategy related the financial performance of technology-based new ventures?

Literature Review and Hypotheses

In the entrepreneurship literature, it is well established that the strategies pursued by new ventures have a direct and strong influence on the financial performance of those firms (e.g., Lambkin, 1988; McDougall, 1987; Sandberg & Hofer, 1987). For example, new ventures offering differentiated products to niche markets often outperform other new ventures.

In the strategy literature, strong links have also been found between the characteristics of TMTs and strategies pursued by established firms (e.g., Bantel & Jackson, 1989; Hambrick, 1982; Wiersema & Bantel, 1992). However, these insights have not yet been applied to research on new ventures. While these studies imply that managers and strategies each directly influenced performance, another body of literature suggests that performance was best explained by the fit between managerial characteristics and strategies (e.g., Litschert & Ramaswami, 1991; Norburn & Birley, 1988; Pettigrew, 1992). In other words, superior performance results when managers have backgrounds and experience that are especially relevant to the particular strategies of the firm. For example, a firm pursuing a strategy of radical innovation might require younger, more educated managers (who might be willing to assume more risk), as well as executives with significant technical and marketing experience, which would be useful in product development and commercialization.

A recent paper (Amason et al., 2006) reports that among new ventures, neither innovation nor entrepreneurial team heterogeneity was directly related to performance. However, the authors found that the interaction of innovation and team heterogeneity had a profound influence on multiple measures of firm performance. Such results provide initial evidence that among new ventures, fit between team characteristics, and strategy influences performance. The Amason et al. study examined heterogeneity, in general, rather than the specific characteristics of team members proposed here. Furthermore, it examined only innovation, not a broad range of strategic alternatives.

Given the theoretic reasoning outlined above, it is logical to conjecture that among high-performing new ventures there should be a link between the backgrounds of team members and the competitive strategies of these firms. Furthermore, based on theory and the consensus of the entrepreneurship literature, we expect to observe a positive connection between strategy-experience fit and performance, but not a direct link between team experience and performance.

The theory of human capital also provides support for the view that managerial characteristics such as experience should influence strategic choice and firm performance among technology-based new ventures. That is, human capital theory suggests that an experienced entrepreneurial team should be more productive than a less experienced team,

since experience is a valuable asset that has been shown to increase worker productivity and the economic value of the firm, as well as managerial compensation. Experience also allows managers to make more informed strategic choices.

More specifically, these theories lead us to believe that specialized experience in functional areas relates to the strategies pursued by a new venture. Functional experience represents a resource that can enhance a firm's ability to formulate and implement specific strategies. For example, it would be logical to assume that a firm pursuing a strategy of differentiation based on innovative new product introductions might benefit from the human capital developed though years of experience in technical jobs. Such experience would provide insights into technical advances that might enhance product features. Furthermore, it has been well established that differentiation is achieved as much or more through marketing as it is through actual product attributes (Porter, 1980, 1985). Consequently, it would also be logical to conclude that additional experience in marketing would help to differentiate a firm's products in the minds of buyers. Thus, one would theorize that, regardless of causation, greater emphasis on innovation-based differentiation should be related to greater technical and marketing experience. Causation could, of course, go in either direction in that greater experience in these areas could lead to a greater emphasis on differentiation, or a team attempting to pursue a strategy of differentiation might intentionally recruit team members with appropriate experience in both areas.

Similar reasoning would also lead us to believe that a venture pursing a cost leadership strategy would be concerned about the functional area of financial management and thus, might benefit from greater depth of experience in the finance. In a similar vein, a venture pursuing international markets should benefit from human capital acquired through increased international experience among its team members. However, given the lack of empirical evidence and the somewhat exploratory nature of our research, instead of numerous hypotheses regarding specific strategies and experience, we will examine general hypotheses that will allow us to explore a number of strategic issues and several types of experience among entrepreneurial teams.

Thus, we have three hypotheses:

Hypothesis 1: Among high-performing, technology-based ventures, the experience of the entrepreneurial team will be significantly related to the strategies pursued by those firms.

Hypothesis 2: Entrepreneurial team experience will not be directly related to the performance of technology-based new ventures.

Hypothesis 3: The fit between strategy and entrepreneurial team experience will be significantly related to the performance of technology-based new ventures.

Methodology

Sample

Our empirical analysis is based on a large sample of publicly traded, technology-based new ventures. These are defined as firms that were less than 6 years old and involved in industries defined by the National Science Foundation as high-technology sectors. The wealth of information available on initial public offerings (IPOs) allowed consistent data to be collected from a number of different sources over a relatively extended time period. In this case, we collected performance data for 10 years after the time in which other variables were measured. A sample of 198 publicly traded new ventures was identified

based on investigating and screening an exhaustive list of firms issuing IPOs over a 6-year time period from 1988 to 1993. This time period allowed us to examine a large sample of IPO firms prior to the irrationality introduced by Internet bubble of the mid and late 1990s. It also enables us to assess long-term performance. Performance data were collected up through the year 2003.

Data

Founding team data (total years of previous experience in the industry, in functional areas, and in prior start-ups among the management team at the time of IPO) were collected from IPO prospectuses. The prospectus is a document that all firms file with the Securities and Exchange Commission (SEC) when issuing public stock. This document contains a wealth of information regarding the firm's management, history, risks, and intended strategy. The existence of strict regulations governing the content of the prospectus, as well as the intense use of consultants in preparing these documents, results in highly consistent reporting practices. As a result, prospectus data are considered reliable (Marino, Castaldi, & Dollinger, 1989) and there is a long tradition of using such information in strategy research (Beatty & Zajac, 1994; Filatotchev & Bishop, 2002; Rumelt, 1974) and, more recently, in entrepreneurship research (Robinson & McDougall, 1998, 2001). While prospectuses do not include resumes of each team member, the purpose of the document is to sell stock. Therefore, it is assumed that all *relevant* information will be included.

Michael Porter's typology of generic business strategies (differentiation, low-cost leadership, and focus) and other dimensions of strategy (i.e., strategic aggressiveness and internationalization) were examined based on data in IPO prospectuses. In order to derive these firm-level measures of strategic choice, two researchers independently read and evaluated prospectuses and coded strategy data using uniform, pretested coding sheets, which have already been developed and used in previous studies (Amason et al., 2006; Kunkel, 1991; McGee & Dowling, 1994; Robinson, 1995; Shrader, 1996; Shrader, Oviatt, & McDougall, 2000). Researchers indicated whether or not each strategy was emphasized in the prospectus as being a competitive weapon of the firm. Inter-rater reliability exceeded .82 for each measure. Multiple item scales based on precedents within the literature were used to calculate each variable. Industry data, which were included as controls in this study, were collected entirely from archival sources. Performance data were collected from the COMPUSTAT database and averaged for a period of 10 years after each venture's IPO.

The specific items used to calculate each variable and the Cronbach alpha associated with each were as follows: Generic Low Cost was calculated as the mean of the venture's emphasis on low cost, economies of scale and commodity products as strategic weapons (alpha = .72). Generic Differentiation was calculated as the venture's emphasis on differentiation, new product development and innovation as strategic weapons (alpha = .82). Strategic Aggressiveness was calculated based on the venture's growth objective, industry leadership objective, market share objective, and entry position (alpha = .72). Strategic Breadth was measured based on the numbers of market segments targeted, product lines, and customers served (alpha = .74). International Intensity was calculated based on foreign sales in year 6 of the firm's existence, foreign direct investment in year 6, and foreign assets in year 6 (alpha = .94). For a finer-grained analysis of the differentiation strategy, innovation-based differentiation was measured by a single variable indicating the degree to which the firm emphasized innovation-based differentiation as a strategic weapon. Likewise, marketing-based differentiation was computed by a single variable indicating the degree to which the firm emphasized marketing-based differentiation as a strategic weapon. All experience variables were measured as the total years of experience

possessed by the entire entrepreneurial team at year 6. Profitability was calculated as the average return on investment (ROI), return on sales (ROS), and return on assets (ROA) of each venture during the time period of the study. Sales Growth was computed as the average annual growth rate during the period of interest.

Control variables included firm age at the time strategy variables were measured. Industry controls included rate of industry growth during the time period of the study, degree of global integration, technological intensity, and competitive intensity. Global Integration was computed using the percentage of intrafirm to total foreign trade per standard industrial classification (SIC). (Kobrin, 1991) Technological Intensity was based on average patenting activity over 5 years preceding IPO. Competitive Intensity was calculated using the average absolute value of market share change of the top 8 firms per 4-digit SIC times the total number of firms in the top 8 during the same period (Sharfman & Dean, 1991). Industry growth was measured as the average annual growth in sales for the industry during the 5 years prior to IPO.

Analytical Techniques

An analysis of the correlation matrix provides a useful indication of the strength of the experience-strategy fit. In addition, we estimated two types of regressions. The first set of regressions allow us to identify the determinants of strategic choices made by new ventures, i.e., emphasis on low-cost, emphasis on differentiation, strategic breadth, strategic aggressiveness, and international intensity. We also examine the relationship between experience and measures of venture strategy. A second set of regressions constitutes an attempt to explain two indicators of firm performance: profitability and sales growth. Our initial results indicate that technical and marketing experience are both positively and significantly related to the differentiation strategy. Since these results are consistent with a conceptualization of differentiation as being both innovation-based and marketing-based, we decided to also conduct tests with this finer-grained operationalization of differentiation and examined factors related to the firms' emphasis on marketing and/or innovation in addition to other strategy variables.

Results

Our empirical results are presented in Tables 1–3. These findings provide striking evidence of a clear and consistent fit between team backgrounds and competitive strategy among this sample of high-performing new ventures. As has been well established in the literature, the results indicate that industry characteristics and venture strategy are significantly related to venture performance. Also, consistent with the literature, there appears to be a tenuous link between performance and team characteristics. However, we found strong evidence that the fit between strategy and experience is indeed significantly related to new venture performance—even in the long-run.

Table 1 presents correlations among all the variables used in the study. These correlations provide initial indications of strong relationships between team experience and competitive strategy. All variance inflation factor (VIF) scores were less than 1.0. Thus, no evidence of multi-collinearity was indicated.

Table 2 presents the results of regression analyses using continuous measures of strategy as dependent variables and team experience as independent variables. Each model was significant and the econometric results are relatively straightforward and easy to

Table 1

Correlation Matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
1. Firm age																								
2. Industry growth	.14																							
3. Global integration	.14	.04																						
4. Technological intensity	.12	.13	.68																					
5. Competitive intensity	−.07	−.26	−.25	−.24																				
6. Strategic breadth	.04	.04	.34	.28	−.13																			
7. Strategic aggressiveness	.26	.06	.48	.50	−.06	.39																		
8. International intensity	−.09	−.02	.16	.10	−.02	.11	.14																	
9. Low cost	−.09	−.10	−.43	−.50	.14	−.18	−.36	.05																
10. Differentiation	.17	.12	.69	.71	−.19	.36	.63	.11	−.68															
11. Industry experience	.25	.15	.18	.27	−.05	.06	.27	.16	.17	.23														
12. Technical experience	.12	.14	.31	.40	−.15	.11	.29	−.02	−.19	.38	.42													
13. Marketing experience	.06	−.01	.19	.07	−.06	.08	.17	.10	.01	.14	.47	.12												
14. Finance experience	−.01	.00	.06	−.09	−.01	−.11	−.12	.03	.06	.02	.19	.06	.36											
15. International experience	−.03	.12	.13	.19	−.08	.05	.02	.02	−.11	.14	.23	.09	.21	.01										
16. Start-up experience	−.05	−.05	−.06	.10	.01	.16	.10	.17	.04	.01	.19	.10	.12	.09	.05									
17. Breadth start-up exp.	−.06	−.04	.13	.14	−.05	.32	.12	.23	.02	.06	.19	.11	.12	.13	.05	.55								
18. Aggressiveness indus. exp.	.28	.14	.31	.38	−.06	−.19	.56	.20	−.11	.42	.52	.46	.47	.14	.17	.18	.19							
19. Aggressiveness tech. exp.	.14	.13	.33	.41	−.14	.15	.41	.01	−.22	.43	.43	.57	.14	.07	.06	.12	.13	.51						
20. Int'l intensity int'l exp.	−.03	.05	.19	.14	.05	.01	.10	.18	−.06	.14	.26	.07	.31	.04	.40	−.06	−.06	.24	.07					
21. Low cost indus. exp.	−.09	.10	.09	.17	−.08	.00	−.05	.02	.00	.07	.25	.07	.19	.02	.55	.02	.02	.17	.04	.39				
22. Differentiation mktg. exp.	.10	.05	.30	.21	−.01	.10	.26	.14	−.13	.30	.51	.20	.56	.04	.25	.10	.10	.55	.21	.36	.21			
23. Differentiation tech. exp.	.13	.15	.35	.43	−.15	.15	.35	.01	−.26	.48	.42	.97	.13	.06	.10	.09	.11	.48	.58	.08	.06	.22		
24. Profitability	.05	.24	.01	.16	−.03	.07	.05	.06	−.06	.07	.01	.25	−.10	.05	.15	.03	.02	.02	.24	−.12	.16	−.09	.27	
25. Sales growth	.03	.43	−.03	.04	.05	−.01	.03	.01	.07	.01	.09	.05	.06	.05	.07	.03	−.06	.00	.04	−.04	.05	.05	.07	.32

Correlations > 13 = $p < .05$, >17 = $p < .01$, >24 = $p < .001$.

Table 2

Relationships between Strategy and Venture Team Experience (Regression Results)

	Generic Low Cost	Generic Differentatn.	Marketing Emphasis	Innovation Emphasis	Strategic Breadth	Strategic Aggressive.	Int'l Intensity
Constant	2.785***	3.397***	3.621***	3.268***	3.671***	2.257***	1.932***
Team industry exp.	.274***	.030	.001	.007	−.034	.166*	.179**
Team technical exp.	−.175*	.285***	.149*	.360***	−.002	.212***	−.122
Team marketing exp.	−.032	.201*	.299***	.077	.105	.085	.022
Team finance exp.	.060	.016	−.004	.008	−.067*	−.032*	−.026
Team international exp.	−.023	.052	−.060	.096	−.023	−.100	.001
Team start up exp.	.115	−.045	−.011	−.003	.157*	.035	.148**
F	2.785**	4.581***	3.753**	6.853***	2.537*	5.100***	2.159*
Adjusted R^2	.07	.09	.07	.14	.06	.10	.06

* $p < .05$, ** $p < .01$, *** $p < .001$.
T, total experience.

Table 3

Strategy, Experience, Fit and Performance (Regression Results)

	Profitability			Sales growth		
Constant	3.788***	5.201***	4.232***	5.510***	2.128*	4.381***
Control variables						
Firm age	.010	.019	.072	.056	.020	.010
Industry growth	.234**	.361***	.211**	.315***	.502***	.498***
Global integration	–.185*	–.206*	–.112*	–.232**	–.095	–.065
Technological intensity	.258**	.175	.223*	.239*	.146	.202*
Competitive intensity	.047	.010	.234	.030	.181*	.164**
Venture strategy						
Strategic breadth		.045	.069		1.645*	1.970*
Strategic aggressiveness		.080	.095		.032	.215
International intensity		.011	.031		.621*	.546*
Low cost		.102	.031		.231*	.250**
Differentiation		–1.99*	–2.98*		.095	–.059
Team experience						
Industry exp.		–.214*	–.475*		–.239*	–.244*
Technical exp.		.184*	.131		.061	.130
Marketing exp.		.119	.030		.014	.661*
Finance exp.		.010	.039		–.011	–.005
International exp.		.102	–.172		.045	.304
Start-up exp.		.056	.252		–.004	.238
Interactions						
Breadth start-up exp.			.238			.620*
Aggressiveness indus. exp.			.361			.059
Aggressiveness tech. exp.			–1.429*			–1.329*
Int'l intensity int'l exp.			.185**			.177*
Low cost indus. exp.			.415*			.247**
Differentiation hktg. exp.			–.383			.545*
Differentiation tech. exp.			1.626**			1.266***
F	4.488***	2.993***	3.509***	6.650***	2.941***	4.381***
Adjusted R^2	.08	.13	.21	.11	.13	.27

* $p < .05$, ** $p < .01$, *** $p < .001$.
M, mean experience.

interpret. These finding strongly support hypothesis 1. Our empirical tests indicate that team industry experience is positively related to the pursuit of the generic low-cost strategy, whereas technical experience was negatively related to this strategy. Technical experience and marketing experience are positively related to the generic differentiation strategy. Note that differentiation can be achieved via tangible product differences and/or intensive marketing efforts. We also know that some firms in our sample emphasized innovation-based differentiation, while others focused on marketing-based differentiation. Given this stylized fact, and also because marketing experience and technical experience were found to be significantly related to generic differentiation, we decided to take a finer-grained look at this particular strategy to see if there would be any differences between those firms that emphasized innovation-based differentiation versus those that emphasized marketing-based differentiation.

As expected, marketing experience was highly significantly related to the pursuit of marketing-based differentiation, whereas technical experience had a weaker relationship with this competitive strategy. Not surprisingly, a strategy that emphasized

innovation-based differentiation was positively related to technical experience. Teams that emphasized strategic breadth had significantly more start-up experience, but finance experience was negatively related to this strategy. Strategic aggressiveness was positively related to industry experience and technical experience but negatively related to finance experience. Finally, prior industry experience and prior start-up experience were both positively related to internationalization. Surprisingly, however, international experience was not significantly related to international intensity. However, within this sample, nearly all the venture teams had a significant amount of international experience among them, especially those ventures with any level of international sales. The fact that nearly all the ventures had depth of experience in this area could have resulted in restricted variance on this particular variable.

Table 3 contains our firm performance regression results. Note that all models were highly significant ($p < .001$) and in each case, explanatory power was increased significantly by the addition of interaction terms that were used to assess the impact of the experience-strategy fit on firm performance. Our findings indicate that industry characteristics, used here as control variables, are significantly related to firm performance. We also found that industry growth has a positive effect on both profitability and sales growth. Note also that global integration is inversely related to both performance measures, while technological and competitive intensity are both positively associated with performance.

Turning to the strategy variables, we find that differentiation is negatively associated with profitability, yet positively related to sales growth. Strategic breadth, internationalization, and competing on the basis of cost all appear to have a positive influence on long-term sales growth. Strategic aggressiveness was not significantly related to either measure of venture performance—perhaps indicating the risk associated with this approach. Among firms that assume a highly aggressive strategic posture, some will win and some will lose.

The direct effects of team experience on venture performance were weak and inconsistent. Therefore, hypothesis 2 was supported. A somewhat surprising finding is that previous industry experience was negatively related to both proxies for performance.

Following precedents within the literature, hierarchical regressions were used to examine the impact on performance of fit between experience and strategy (Amason et al., 2006; Cohen & Cohen, 1983; Jaccard, Turrisi, & Wan, 1990). For each performance measure, three models were tested. The first examined the effects of control variables only. The second examined the effects of control variables and main effects. The third included the addition of interaction terms. The actual test of hypotheses is the significance of the change in R^2 from the second model to the third (Cohen & Cohen, 1983). In this case, both tests were highly significant ($p < .001$). The strength of the relationship was reflected in the size of the marginal R^2 (Pedhazur, 1982). In this case the addition of interactions explained an additional 9% of the variance in profitability and an additional 14% of the variance in sales growth.

Interaction effects, which indicated the importance of the fit between experience and strategy, were strong and consistent. Thus, hypothesis 3 was strongly supported. Experience with previous start-ups helped ventures pursing broad strategies (i.e., numerous customers, segments, and products) achieve higher sales growth. International experience improved both profitability and sales growth among firms with higher percentages of international sales. Industry experience coupled with an emphasis on low cost enhanced how ventures fared on both measures of performance. Note that technical experience and marketing experience both interacted with differentiation to enhance performance. Finally, technical experience, coupled with strategic aggressiveness (market share target and industry position goal) appears to have had a negative and significant effect on performance. This could indicate that more technically inclined entrepreneurs have an

overly optimistic view of the market potential of their technologies. If so, it would also indicate a need for more technically inclined venture teams to balance their technical knowledge with more realistic market knowledge.

We conducted similar tests using two separate measures of differentiation (innovation-based and marketing-based), although these are not presented in Table 3. These results were nearly identical to those discussed earlier. The one exception is that technical experience, along with an emphasis on innovation-based differentiation, was found to be highly significantly associated with both measures of performance ($p < .001$). Similarly, marketing experience, along with an emphasis on marketing-based differentiation appears to be highly significantly related to both proxies for performance. In other words, results were similar, but stronger when taking a finer-grained approach to operationalizing the differentiation variable.

Discussion and Limitations

This study examined the fit between team characteristics and the competitive strategies of new ventures. With respect to the strategic management literature, this study represents a novel application and modest extension of upper echelon theory. It also contributes to the entrepreneurship literature by highlighting the importance of studying entire entrepreneurial teams and their impact on new ventures. It also demonstrates a consistency between theoretical and empirical studies of the role of human capital in the implementation and use of new technologies (Bartel & Lichtenberg, 1987, 1990; Siegel, 1999; Siegel et al., 1997). These studies, which are based on human capital theory, assert that managers with more knowledge and experience have a comparative advantage in helping firms successfully adapt to new technologies and industries. Such workers are highly useful to high-technology, entrepreneurial firms because of their ability to solve problems and adapt to change in the external environment.

The overall consistency of this study's findings provides a degree of confidence that, among these high-performing new ventures, team experience was indeed significantly related to the competitive strategies pursued by these firms. Some of our results are unsurprising and consistent with the extant literature. For example, marketing experience was found to be positively related to an emphasis on marketing-based differentiation, technical experience was positively related to an emphasis on innovation-based differentiation, and international experience was related to emphasis on internationalization.

Other findings were more interesting. For example, industry experience was related to an emphasis on low cost, strategic aggressiveness, and internationalization, whereas one might expect a deeper immersion in the industry to be more significantly related to differentiation strategies. Another somewhat novel and provocative result is the importance of prior finance experience, which was shown to be negatively related to strategic aggressiveness and strategic breadth. This finding provides an indication that entrepreneurs coming from traditional corporate backgrounds may be more conservative or risk averse in their approach to new venture strategy. Another interesting insight is that our results appear to be more robust, more significant, and more reasonable when we employ more detailed measures of the generic strategy of differentiation (i.e., marketing-based or innovation-based differentiation). Finally, the fact that increased industry and start-up experience are positively associated with internationalization is consistent with the notion that such experience can help reduce the risk associated with early internationalization (Shrader et al., 2000).

A consistent theme throughout these findings was the importance of technical experience to venture strategies and ultimately to performance. In terms of its impact on strategy, technical experience appears to be the most critical type of experience within the sample. Technical experience was related to the low-cost strategy, differentiation, innovation, an emphasis on marketing, and strategic aggressiveness. More specifically, our empirical results imply for small, technology-based new ventures; the team's technological experience appears to be the most important determinant of the success of a differentiation strategy. Apparently, for technology-based firms, technical skills are critical to success regardless of the strategies they pursue.

This article constitutes an important first step in examining the relationship between team experience and competitive strategy. However, future research should be focused on exploring precisely how the experience-strategy fit affects the financial performance of new ventures. We also need to learn more the nature of experience and how it specifically relates to strategy formulation and implementation.

Such research would contribute to upper echelons research, which has generally focused on large, established firms, where TMTs are often difficult to isolate and where the link between management and performance is more heavily confounded by other sources of influence. In addition, strong findings could have practical implications for managers seeking to improve new venture performance through assembling appropriate entrepreneurial teams. Such knowledge would be helpful for those whose job is to select and develop upper level managers. It would also be helpful to strategists trying to predict competitors' moves and countermoves.

REFERENCES

Amason, A.C., Shrader, R.C., & Tompson, G.H. (2006). Newness and novelty: Relating top management team characteristics to new venture performance. *Journal of Business Venturing*, *21*(1), 125–148.

Bantel, K.A. & Jackson, S.E. (1989). Top management and innovation in banking: Does the top team make a difference? *Strategic Management Journal*, *10*, 107–124.

Bartel, A.P. & Lichtenberg, F.R. (1987). The comparative advantage of educated workers in implementing new technology. *Review of Economics and Statistics*, *69*, 1–11.

Bartel, A.P. & Lichtenberg, F.R. (1990). The impact of age of technology on employee wages. *Economics of Innovation and New Technology*, *1*, 1–17.

Beatty, R.P. & Zajac, E.J. (1994). Managerial incentives, monitoring, and risk bearing: A study of executive compensation, ownership, and board structure in initial public offerings. *Administrative Science Quarterly*, *39*, 313–335.

Becker, G.S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. Chicago: University of Chicago Press.

Birley, S. & Norburn, D. (1987). Owners and managers: The Venture 100 versus the Fortune 500. *Journal of Business Venturing*, *2*(4), 351–363.

Chowdhury, S. (2005). Demographic diversity for building and effective entrepreneurial team: Is it important? *Journal of Business Venturing*, *20*(6), 727–746.

Clarysse, B. & Moray, N. (2004). A process study of entrepreneurial team formation: The case of research-based spin-off. *Journal of Business Venturing*, *19*(1), 55–79.

Cohen, J. & Cohen, P. (1983). *Applied multiple regression for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Cooper, A.C. (1981). Strategic management: New ventures and small businesses. *Long Range Planning*, *14*(5), 39–45.

Daily, C.M., McDougall, P.P., Covin, J.G., & Dalton, D.R. (2002). Governance and strategic leadership in entrepreneurial firms. *Journal of Management*, *28*(3), 387–412.

Davidsson, P. & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, *18*(3), 301–331.

Ensley, M.D. & Amason, A.C. (1999). Entrepreneurial team heterogeneity and the moderating effects of environment volatility and team tenure on new venture performance. In P. Davidsson, W.B. Gartner, C.M. Mason, & P.P. McDougall (Eds.), *Frontiers of entrepreneurship research* (pp. 505–517). Babson Park, MA: Babson College.

Ensley, M.D., Carland, J.W., & Carland, J.A. (1998). The effect of entrepreneurial team skill heterogeneity and functional diversity of new venture performance. *Journal of Business and Entrepreneurship*, *10*(1), 1–14.

Ensley, M.D., Pearson, A., & Amason, A. (2002). Understanding the dynamics of new venture teams: Cohesion, conflict, and new venture performance. *Journal of Business Venturing*, *17*(4), 365–386.

Feeser, H.R. & Willard, G.E. (1990). Founding strategy and performance. *Strategic Management Journal*, *11*, 87–98.

Filatotchev, I. & Bishop, K. (2002). Board composition, share ownership, and "underpricing" of U.K. IPO firms. *Strategic Management Journal*, *23*(10), 941–955.

Finkelstein, S. & Hambrick, D.C. (1990). Top management team tenure and organizational outcomes: Moderating role of managerial discretion. *Administrative Science Quarterly*, *35*, 484–503.

Finkelstein, S. & Hambrick, D.C. (1996). *Strategic leadership: Top executives and their effects on organizations*. Minneapolis, MN: West.

Gartner, W.B. (1988). Who is an entrepreneur? is the wrong question. *American Journal of Small Business*, *12*(4), 11–32.

Gupta, A.K. (1984). Contingency linkages between strategy and general managerial characteristics: A conceptual examination. *Academy of Management Review*, *9*(3), 399–412.

Gupta, A.K. (1988). Contingency perspectives on strategic leadership: Current knowledge and future research directions. In D.C. Hambrick (Ed.), *The executive effect: Concepts and methods for studying top managers* (pp. 1147–1178). Greenwich, CT: JAI Press.

Hambrick, D.C. (1982). Environmental scanning and organizational strategy. *Strategic Management Journal*, *3*, 159–174.

Hambrick, D.C. (1994). Top management groups: A conceptual integration and reconsideration of the "team" label. In L.L. Cummins & B. Staw (Eds.), *Research in organizational behavior* (Vol. 16, pp. 171–213). Greeenwich, CT: JAI Press.

Hambrick, D.C., Cho, T.S., & Chen, M. (1996). The influence of top management team heterogeneity on firms' competitive moves. *Administrative Science Quarterly*, *41*, 659–684.

Hambrick, D.C. & Mason, P.A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, *9*, 193–206.

Hannan, M.T. & Freeman, J. (1977). The population ecology of organizations. *American Journal of Sociology*, *82*(5), 929–964.

Hornaday, J. & Aboud, J. (1971). Characteristics of successful entrepreneurs. *Personnel Psychology*, *24*, 141–153.

Jaccard, J., Turrisi, R., & Wan, C.K. (1990). *Interaction effects in multiple regression*. Newbury Park, CA: Sage Publications.

Kamm, J.B. & Nurick, A.J. (1993). The stages of team venture formation: A decision-making model. *Entrepreneurship Theory and Practice*, *17*(2), 17–27.

Kobrin, S.J. (1991). An empirical analysis of the determinants of global integration. *Strategic Management Journal*, *12*, 17–31.

Kunkel, S. (1991). *The impact of strategy and industry structure on new venture performance*. Unpublished doctoral dissertation, University of Georgia.

Lambkin, M. (1988). Order of entry and performance in new markets. *Strategic Management Journal*, *9*(special issue-summer), 127–140.

Link, A.N. & Siegel, D.S. (2007). *Innovation, entrepreneurship, and technological change*. Oxford: Oxford University Press.

Litschert, T. & Ramaswami, K. (1991). The performance impact of strategy manager coalignment. An empirical examination. *Strategic Management Journal*, *12*, 509–522.

Marino, K.E., Castaldi, R.M., & Dollinger, M.J. (1989). Content analysis in entrepreneurship research: The case of public offerings. *Entrepreneurship Theory and Practice*, *13*, 51–66.

McDougall, P.P. (1987). *An analysis of strategy, entry barriers, and origin as factors explaining new venture performance*. Unpublished doctoral dissertation: University of South Carolina.

McGee, J.E. & Dowling, M.J. (1994). Using R&D cooperative arrangements to leverage managerial experience: A study of technology-intensive new ventures. *Journal of Business Venturing*, *9*, 33–48.

Norburn, D. & Birley, S. (1988). The top management team and corporate performance. *Strategic Management Journal*, *9*, 225–237.

Palmer, M. (1971). The application of psychological testing to entrepreneurial potential. *California Management Review*, *13*(3), 38–50.

Pedhazur, E.J. (1982). *Multiple regression in behavioral science research*. New York: Hold, Rinehart & Winston.

Pettigrew, A.M. (1992). On studying managerial elites. *Strategic Management Journal*, *13*(special issue), 5–16.

Porter, M.E. (1980). *Competitive strategy: Techniques for analyzing industries and competitors*. New York: The Free Press.

Porter, M.E. (1985). *Competitive advantage: Creating and the free press*. New York: Sustaining Superior Performance.

Robinson, K.C. (1995). *Measures of entrepreneurial value creation*. Unpublished doctoral dissertation, University of Georgia.

Robinson, K.C. & McDougall, P.P. (1998). The impact of alternative operationalizations of industry structural elements of measures of performance for entrepreneurial manufacturing ventures. *Strategic Management Journal*, *19*(11), 1079–1100.

Robinson, K.C. & McDougall, P.P. (2001). Entry barriers and new venture performance: A comparison of universal and contingency approaches. *Strategic Management Journal*, *22*(6–7), 659–685.

Rosen, S. (1987). Human capital. *The New Palgrave: A Dictionary of Economics*, *2*, 681–690.

Rumelt, R.P. (1974). *Strategy, structure and economic performance*. Boston: Harvard Business School Press.

Sandberg, W. & Hofer, C. (1987). Improving new venture performance: The role of strategy, industry structure and the entrepreneur. *Journal of Business Venturing*, *2*(1), 5–28.

Sharfman, M.P. & Dean J.W., Jr. (1991). Conceptualizing and measuring the organizational environment: A multidimensional approach. *Journal of Management*, *17*(4), 681–700.

Shrader, R.C. (1996). *Influences on and performance implications of internationalization by publicly owned U.S. new ventures: A risk taking perspective*. Unpublished doctoral dissertation, Georgia State University.

Shrader, R.C. (2001). Collaboration and performance in foreign markets: The case of young, high-technology manufacturing firms. *Academy of Management Journal*, *44*(1), 45–60.

Shrader, R.C., Oviatt, B.M., & McDougall, P.P. (2000). How new ventures exploited trade-offs among international risk factors: Lessons for the accelerated internationalization of the 21st century. *Academy of Management Journal*, *43*(6), 1227–1247.

Siegel, D.S. (1999). *Skill-biased technological change: Evidence from a firm-level survey*. Kalamazoo, MI: W.E. Upjohn Institute Press.

Siegel, D.S., Waldman, D.A., & Youngdahl, W.E. (1997). The adoption of advanced manufacturing technologies: Human resource management implications. *IEEE Transactions on Engineering Management*, *44*, 288–298.

Szilagyi, A.D. & Schweiger, D.M. (1984). Matching managers to strategies: A review and suggested framework. *Academy of Management Review*, *9*, 626–637.

Ucbasaran, D., Lockett, A., Wright, M., & Westhead, P. (2003). Entrepreneurial founder teams: Factors associated with member entry and exit. *Entrepreneurship Theory and Practice*, *28*(2), 107–127.

Vanaelst, I., Clarysse, B., Wright, M., Lockett, A., Moray, N., & S'Jegers, R. (2006). Entrepreneurial team development in academic spinouts: An examination of team heterogeneity. *Entrepreneurship Theory and Practice*, *30*(2), 249–271.

Vesper, K. (1990). *New venture strategies* (2nd ed.). Englewoood Cliffs, NJ: Prentice Hall.

Wiersema, M.F. & Bantel, K.A. (1992). Top management team demography and corporate strategic change. *Academy of Management Journal*, *35*, 91–121.

Rod Shrader is associate professor of management and director of the Technology Ventures Program at the University of Illinois at Chicago. His award-winning research on entrepreneurship has been published in numerous book chapters and academic journals, including the *Academy of Management Journal, Journal of Business Venturing*, and *Entrepreneurship: Theory and Practice*. In the past decade, he has played a crucial role in conceiving and launching several highly successful business ventures in the biotechnology, medical device, and information technology industries.

Donald Siegel is professor and associate dean of the A. Gary Anderson Graduate School of Management at the University of California, Riverside. His papers have appeared in journals such as the *American Economic Review, Economic Journal, The Review of Economics and Statistics, Journal of Law and Economics, Journal of Financial Economics, Brookings Papers on Economic Activity, Research Policy, Academy of Management Review, Academy of Management Journal, Strategic Management Journal, IEEE Transactions on Engineering Management, Journal of Business Venturing, Journal of International Business Studies, Journal of Management Studies, Industrial and Corporate Change, The Leadership Quarterly*, and the *Journal of Management*. He recently completed two books for Oxford University Press: *Innovation, Entrepreneurship, and Technological Change* and the *Handbook of Corporate Social Responsibility*.