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MANAGEMENT, STRATEGY AND INDUSTRY STRUCTURE AS INFLUENCES ON THE SUCCESS OF NEW FIRMS: A STRUCTURAL MODEL

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Abstract

This study develops a five equation structural model to trace the interactions of management characteristics, business strategy and industry structures as influences on the performance of thirty-six new, technology-based companies. Existing theories are divided on the scope of management's ability to influence the firm, with "natural selection" theorists believing managers have relatively little room to change the strategic position of the business unit, and "strategic management" theorists believing the opposite. Their competing ideas have received few, if any, direct tests. This model and sample afford an opportunity to do so. The results indicate that the managers in this sample had only a weak influence on the quality of their industry/strategy positions, with the influence being primarily through the choice of industry. New firms represent a limited, though important, segment of the economy and the results should be interpreted cautiously.

The model suggests that studies of industry/strategy which do not incorporate management variables may obtain biased results. For this sample the relationships were significantly changed when any part of the model was omitted. Whether these results extend to established firms is a matter of conjecture, but researchers should give explicit consideration to the likely effects of omitting managerial variables in studies of industry and strategy. Similarly, studies of organizational effectiveness should take explicit account of industry/strategy differences within their samples.

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Introduction

New ventures can be an important part of strategy research for at least two reasons. First, the initial choices of a fledgling firm (or a new business unit in an existing firm) may well influence its direction for many years. Second, new ventures may simplify the problems of tying together results and strategic choices, giving clearer tests of theory. Such simplicity has several sources: a starting point, at which major strategic choices occur, is easily identified; the business is often relatively simple with a narrow product line, a small organization, and a limited set of markets; business plans often articulate the strategic choices prior to inception providing a set of measures unencumbered by any tendency to "rewrite history" in light of subsequent events; accounting and other data are often available for the business unit alone, instead of combining it with other entities.

To date, most studies of new ventures have focused on those backed by venture capitalists (see for example, Sandberg and Hofer (1987); although MacMillan and Day (1987) and Biggadike (1979) studied new ventures of existing firms; Stuart and Abetti (1987) studied new firms housed at an "incubator" and Van de Ven, Hudson, and Schroeder (1984) examined new firms with a single corporate sponsor). In so doing they incorporated the views of venture capital investors – specialists in creating new firms – who have generally placed great emphasis on the abilities of the firm's managers. Most academic studies of new firms include managerial attributes along with traditional strategic choices as to market, product characteristics, marketing plans, production methods, etc. Thus the typical model (perhaps first applied to new firms by Van de Ven et al. (1984), and given a mnemonic form by Sandberg and Hofer (1987)) views new venture performance as a function of entrepreneurship, industry structure and strategy, i.e., NVP= f(E,IS,S).

Empirical findings are broadly consistent with the model, but contain many unresolved results including an inability to show that all three areas influence performance of the business. For example Sandberg and Hofer (1987), using non-parametric tests on 17 new firms, find that choices of business strategy and industry characteristics influence results in the manner they would expect based on prior research in business strategy. However, they are unable to demonstrate that the managerial attributes which they considered have any influence on results. Stuart and Abetti (1987), using multivariate regressions on 24 new firms, found that strategic choices influenced success, but the most influential choices shifted widely depending on their measure of success (they used two) and some of their findings ran counter to their

hypotheses (which were based on a survey of prior strategy research). Their measure of managerial ability was important in both cases.

The current authors, in three earlier studies (Roure and Keeley, 1988a, 1989), presented and tested a model similar to those cited above. It hypothesized that a successful new firm must select an attractive industry, develop an advantageous strategy and execute it well. It focused on new, technology-based firms and developed views of industry attractiveness, strategic advantage and managerial qualifications appropriate to such firms. A single equation, multivariate test of the model, using data from the original business plans of 36 firms, showed a strong ability to explain subsequent performance. Managerial, industry and strategy variables made roughly equal contributions to the firms' performances. By its nature the model did not address the connection between management ability and the firm's strategic choices. It simply showed that they are all important.

The connection between strategic choices and management attributes has been a source of controversy for over a decade with three competing theories:

1. Strategic management proponents (e.g., Bourgeois, 1984) emphasize the role of management choices in setting the business unit's competitive posture in response to its environment.
2. Supporters of natural selection (e.g., Hannan and Freeman, 1977, or Brittain and Freeman, 1980) view the firm as being largely shaped by the industry niche into which it initially falls. The room for management discretion is limited.
3. The resource dependency theory of Pfeffer and Salancik (1978) stresses the importance of the firm's access to and control over critical resources. On balance they feel that the manager's ability to choose the business unit's direction is significantly limited by the environment.

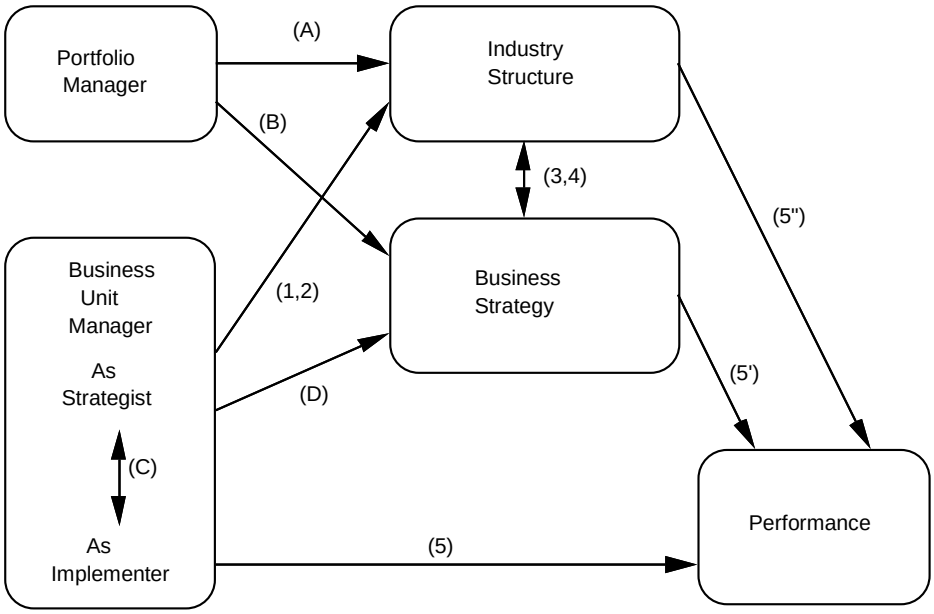
Empirical studies have not tested these three directly, though they provide a wealth of indirect evidence. Studies of general managers (e.g., Kotter, 1982; Mintzberg, 1973) provide vivid evidence of the organizational and competitive forces which constrain managers. Recent studies by Gupta and Govindarajan (1984), White (1986), and Zahra and Pearce (1988) all find relations between the performance of a firm and the degree to which its management processes fit its strategic position. Fombrun and Wally (1988) find a fit between management processes and strategic position, but the fit has little apparent impact on performance. All of these take the strategic position as given so they do not directly address the ability of the business unit's managers to change its strategy and environment. A large, longitudinal study by Miller and Friesen (1984) finds that the strategic position, the environment, the organizational structure and the decision processes of the firm evolve together, though it cannot say to what extent the firm initiates the changes.

Many studies address the connection between strategic position and performance (e.g., Hambrick, MacMillan, and Day, 1982; Anderson and Zeithaml, 1984) without including managerial qualities. In so doing they implicitly assume that managerial variables, which affect performance, have no correlation with strategic variables, an assumption which conflicts with the findings of most studies cited above. This raises the possibility of reaching erroneous conclusions when managerial variables are omitted from studies of strategic position and environment. Such errors are possible whether the association between management and strategic position is causal or non-causal. In the extreme, studies of strategy/environment, which leave out management, could actually be measuring management's operating competence in a very indirect way (and drawing the wrong conclusions).

To gain more insight into the importance of environment/strategy and management's role in shaping it, one would like to have a model incorporating environment, strategy, management as a formulator of strategy, and management as an implementer. Qualitatively, such a model is described in Figure 1. The role as strategist is shared between the business unit manager and a "portfolio manager" – a party whose task is the allocation of resources among business units. This "portfolio manager" may be corporate management in a multi-business firm or a venture capitalist in the case of a new venture. The strategic choices are represented by the boxes "Industry Structure" – representing the choice of an industrial environment – and "Business Strategy" – representing the firm's broad plan for meeting its objectives. The arrows represent paths which connect the various influences with the firm's performance.[1] Numbers associated with an arrow refer to an equation number in the model which is tested later in this paper. Letter refers to links which are not tested. For now the numbers and letters provide an easy way to trace associations within the model. Thus, if one observed the relationship between industry attributes and performance, it would include a direct effect (5") and several indirect effects (4 x 5'; 1 and 2 x C x 5; 1 and 2 x D x 5'; 4' x D x C x 5). In principle management's role as implementer (5) might be the key determinant of performance, but in a test considering only industry structure this influence would be mistakenly ascribed to industry structure if the relationships (C) and (1 and 2) were reasonably strong. A multivariate regression, incorporating managerial, structure and strategy variables, will help the situation but we would really prefer to understand all the linkages in Figure 1. Only then can we appreciate the likely impact of ignoring managerial variables in strategy research. Additionally, the results may influence policies for managerial development, for finding new business directions, and for responding to changes in the competitive environment.

Figure 1

Sources of Performance of a Business Unit



[1] The links to performance should include one link from each of the three influences to risk and from risk to performance, in addition to the direct links to performance. For the sample of new firms tested in this paper, we have no way to measure risk (because there are no public markets or operating histories); therefore no separate link to risk is identified. In the section on Results we present evidence that the sample firms are roughly equal in risk, which suggests that, if risk could be explicitly included, it would not have much impact on our results.

This study applies the model of Figure 1 to a sample of new, technology-based firms. It examines the respective influences of managerial attributes, industry choices and business strategies on the subsequent performance of a business unit. In so doing it provides a relatively direct test of the theories of strategic management and natural selection. The results for new firms should not be naively extended to established firms, which have many more constraints and resources, nor to non-technical new firms. Nonetheless, one may argue that the managers will never have more freedom to select the strategic direction of the firm than at its foundation.

The results suggest that industry attractiveness and the quality of the business strategy strongly influence performance. Managerial attributes also have a strong direct influence on performance, and a weaker influence on the choice of industry. They do not directly influence our measures of business strategy, though they exert an indirect (constraining) effect via the choice of industry.

The findings of the full, structural model are compared with those from single equation, multivariate models and from a set of bivariate comparisons. The results are strikingly different. Nonetheless, the connection between managerial variables and industry/strategy [links (1), (2), and (D) in Figure 1] are weak enough to suggest that studies which leave out management variables may not cause any great bias.

A Model of Firm Performance

We will use the model described by Figure 1, which is implicit in the studies of Van de Ven et al. (1984), Sandberg and Hofer (1987), and others. In this case three management roles are identified; those of strategy formulation, implementation, and resource allocation ("portfolio management)". The study is cross sectional with measurements of management, industry structure and business strategy being taken at a single point – the time at which the firm seeks its first significant funding. Performance is assessed some years later. No account is taken of subsequent changes in management, industry or strategy. Thus we are examining how the initial management characteristics influence the initial choices of industry attributes and business strategy, and how these, along with management, influence performance over the ensuing several years.

To the extent that management attributes influence the choice of industry and strategy, this test will support the strategic management theories. To the extent that they do not, our results will support the natural selection view. Regardless of the outcome, we would hesitate to extrapolate to established firms and to other industries. However, we believe this setting – with new, technical firms – is favorable to the strategic management school of thought for several reasons:

1. The environments for technology-based firms change rapidly, conveying an advantage to firms which adapt quickly (see Eisenhardt and Bourgeois, 1985).
2. A new firm cannot afford to make mistakes. Managers who are able to select the best industry/strategy combinations should do much better than those who do not – newness amplifies the effects of good choices compared to poor ones.
3. Founders will typically have spent their careers in an industry close to the one they enter – which in this case means an environment of rapid change. People who have succeeded in such environments sufficiently to attract financial support for a new firm probably have an unusual aptitude for finding attractive strategy/industry opportunities.

To cast Figure 1 into a testable form a few modifications are needed and suitable measures must be defined. In our sample the "portfolio manager's" influence will not be observable, so links (A) and (B) will be eliminated. To some extent we can infer the effect of the "portfolio manager." For example, if industry structure and strategy are important influences on performance, and they are not influenced by the quality of the business unit's management [i.e. links (1), (2) and (D) are weak], then either they are influenced by the quality of the "portfolio manager" or they are randomly set (in the sense that managerial ability as we measure it has no effect on the quality of the strategy).

A second group of modifications deals with the iterative way in which a business plan typically evolves. In reality the choice of industry, formulation of the strategy and selection of a management team take place over time with changes occurring in all three areas, until a suitable combination is agreed upon. This study does not consider the process of creating the plan, but looks only at the final product. Therefore, the iterative nature of the process is ignored and a recursive model is defined in which management attributes are exogenous. Management selects the industry structure and business strategy, though industry structure is allowed to influence strategy as well. If the links (1), (2), and (D) are relatively strong, we will find that the industry and strategy variables are endogenous, being determined by the management variables. If (1), (2), and (D) are weak, they will be exogenous. They may be a mix of endogenous and exogenous variables as well. For example, managers may tend to stay with the industry they know best (which means they will inherit certain industry characteristics rather than choose them), but select strategies to take advantage of those characteristics. In such a case industry characteristics would be exogenous, but strategy variables would be endogenous.

An inherent problem with any statistical study of management, industry structures, or strategy is that no set of variables can hope to capture all relevant aspects; that is, there will always be omitted variables, and their effects will be reflected in the included variables with which they are correlated. We hope to draw inferences about the respective importance of management as strategist, of management as implementer, and of industry structure and business strategy. Ideally, we would like to interpret the direct effect of our managerial variables on performance as the effect of implementation. However, to the extent that they are proxies for omitted strategy or industry variables, this would be wrong. Our approach will be to identify, if possible, some extra variables in each category which have significant simple correlations with performance and are not highly collinear with other variables in the same category. These should be better at capturing the effects of omitted variables in their categories than a variable from another category. To the extent that these become insignificant in the multivariate model, we will suggest that the remaining variables in other categories are proper reflections of their categories, and not proxies for some other category. This is admittedly an informal argument, one which can be tested further by developing additional measures in follow-on studies.

The resulting model has five equations (which are identified by number in Figure 1). Two describe the link between management qualities and the industry which a company enters. Two describe the links to business strategy from management and industry. The fifth incorporates the influence of all three areas on performance.

The choice of appropriate measures of managerial characteristics, industry structure, and business strategy is discussed in Roure and Maidique (1986). Each measure had proven useful in prior empirical work, or had a theoretical base suggesting its efficacy. Measures which had generally failed in prior studies were avoided. This particularly suggested avoiding measures of individual aptitudes for entrepreneurship. Instead the managerial measures focused on

management as a team. Each measure had to be available in every business plan, and be easily assessed. None should require expert judgment, and no adjustment would be made to the statements in the business plans. The intent was to accurately reflect the data in each business plan, and to obtain *ex ante* measures. One would guess that this imparts an optimistic bias, though securities laws and the fact that investors carefully scrutinize the plans will tend to limit such biases. With these criteria we hope that the study can be readily replicated on other samples. The measures are described in Table 1.

Table 1

Description of Independent Variables[2]

Management Variables

Job experience: the percentage of founders[3] with experience in a position similar to the one to be assumed.

High growth experience: the percentage of founders with experience in rapidly growing (over 25 percent annual growth in sales) companies.

Team completeness (X_1): the percentage of key positions which were filled at the time of the first major (over $300,000) outside funding. Key positions are the president and functional managers for marketing, engineering, operations, finance (or a second technical manager in place of one of the latter two if the venture involved two technologies, such as electronic and mechanical design).

Prior joint experience (X_2): This reflects the extent to which founders had previously worked together in the same organization for at least six months. Several measures were tested; the one used here considers the leader (usually the CEO) and the three other founders with the greatest joint experience. For each prior relation between the leader and another founder a value of 20 is given. For each prior relationship among the three other founders a value of 10 is given. The combination produces a range of 90 points which is arbitrarily set from 10 to 100.

Founders' Equity Share: the share of the company retained by the founders after the first financing.

Industry Characteristics

Competitor strength (Y_1):[4] assessed on a 5 point scale (using information in the business plans).

1 = no existing competition

2 = one competitor exists, or a few may enter

3 = a few (2-4) competitors exist, but are either small or not attentive to the market niche

4 = several small, or a few large, competitors exist, but no clear leader has emerged

5 = several companies are serving the market and a clear leader exists.

Forecast market share in the fifth year: an indirect measure of competitive conditions.

Buyer concentration (Y_2): a measure of the number of potential customers in the target market during the first two years of sales. It is rated on a five point scale.

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[2] Variables which are used in the final model are identified as X (if exogenous) or Y (if endogenous). All other variables are not statistically significant for the sample used in this paper.

[3] Founders are those employees, who, as indicated by the business plan, are expected to: 1) play a key role in the development of the firm; 2) become employees of the company within the first year after the initial funding date, and 3) share in the ownership of the company in a significant manner.

[4] In the statistical analysis the scores noted above are converted to percentiles of the sample. This has been reported to improve their properties as regressors - see Terza, 1987.

1 = very low concentration (over 300 customers)

2 = low concentration (100 to 300 customers)

3 = medium concentration (30 to 99 customers)

4 = high concentration (10 to 29 customers)

5 = very high concentration (less than 10 customers)

Strategy Variables

Quality of the technical development plan: The technical plan is selected as a variable rather than the business plan because almost every firm in this sample has a complete, high-quality business plan. The approach to technical development plans varies considerably, allowing the following measures:

1 = no mention of how the venture will develop its technology

2 = general statement how the technology will be developed without milestones or schedules

3 = milestones, schedules and tasks are described in a general way

4 = a detailed development program has quarterly schedules with an outline of the more important tasks

5 = a monthly development program includes details of important tasks

Product development time (Y_3): the number of months from the initiation of development to the initial sale as forecast in the business plan.

Product superiority (Y_4): measured on a five point scale:

1 = a product's benefits match those of its competitors or potential substitutes

2 = a product incorporates minor improvements

3 = it incorporates significant improvements in performance

4 = it represents a major improvement

5 = it will clearly be the industry leader

Table 1 includes variables which, contrary to our expectations, did not prove useful in earlier single equation studies (Roure and Keeley, 1988a, 1989); however, we wish to explore their possible value in a structural model. For example, a managerial variable may not be useful in explaining performance, but it may influence the choice of strategy which in turn affects performance.

Because this study deals with new firms, it enjoys the rare opportunity of employing the most relevant measure of performance – a discounted return to the investors on the funds which they provide to the firm. Specifically, this study uses the internal rate of return (with some adjustments for statistical reasons) earned by the firm's owners (investors, founders and employee shareholders). As discussed in every text on finance (see, for example, Ross and Westerfield, 1988), such discounted returns on investment are the true measures of value. Usually they are not available, because the value of new investments cannot be separated from the value of existing ones. Thus we are accustomed to relying on indicators of value such as the company's return on the book value of assets, or share of market, growth in sales, or even a subjective assessment. Such indicators are conceptually inferior to direct measures of market values, especially for new activities which often show negative returns in their financial reports for several years (Biggadike, 1979, reported that his sample of new corporate ventures required

seven years to reach a break-even point. A similar sample studied by MacMillan and Day, 1987, showed negative returns were continuing on the average into the fourth year).[5]

The internal rate of return is calculated by viewing every round of investment in the firm as a negative cash flow. Any dividend payments or repurchases of shares are positive cash flows – these are generally small in new companies. The value of the company at the time of its first public offering or when it is acquired is treated as a cash inflow. If the company was still privately held in mid-1988, the value at its last round of private financing was treated as a cash inflow on the date of that financing.

The Sample

The relationships among management qualities, industry characteristics and business strategy are tested on a sample of 36 new firms. They were founded between 1974 and 1983, and were funded in part by two venture capital funds (who made the business plans available to the authors on the condition that they and the sample companies remain anonymous). The variables shown in Table 1 were recorded from information in the business plans. Financial histories were obtained from legal documents associated with each round of financing. The mean values and standard deviations of each variable are presented in Table 2.

The thirty-six represent all but four of the new companies in which the venture capitalists invested during the period; business plans for the other four were missing. An informal review of those four did not reveal any obvious differences from the 36 which were available – for example, one was highly successful, one was a failure, and two were moderately successful.

All companies in the sample are technology based. Twenty-five make electronic or electromechanical equipment, including 5 semiconductor companies and 15 producers of computer products. Eight are in biotechnology or medical equipment, and three produce computer software.

As typifies companies funded by venture capitalists, they received several rounds of funding over a period of years with additional investors being added at each round. An average of 6 venture capital funds invested in each sample company; altogether the 36 companies had 119 venture capital investors. Unsuccessful companies averaged more rounds of private funding (5.3 rounds) than successful ones (4.0 rounds), and remained in the venture capitalists' portfolios longer (64 months versus 57 months). As of December 1988 none of the surviving companies (5 had failed, and 8 had been acquired) had diversified beyond their original businesses, though a few had significantly changed their emphasis. The largest had sales of over $1 billion, and several were over $100 million. Fourteen had completed public offerings, and one was about to.

[5] Benston (1985) and Beaver (1981) provide excellent discussions of the drawbacks of accounting measures. Beaver covers the advantages of market-based measures in some detail.

Table 2

Means and Standard Deviations of the Variables

	Variable	Type	Mean	Standard Deviation
1.	Experience in Similar Position	M	85.58	16.53
2.	High Growth Experience	M	89.39	24.12
3.	Team Completeness (X_1)	M	70.96	19.02
4.	Principals' Joint Experience (X_2)	M	55.56	29.03
5.	Founders' Equity Share	M	47.83	19.10
6.	Competition (Y_1) (scale 1 to 5)	I	3.06	1.07
	" (percentile)		50.00	27.67
7.	Projected Market Share	I	9.36	6.20
8.	Buyer Concentration (Y_2) (scale 1 to 5)	I	2.78	1.22
	" (percentile)		50.00	28.54
9.	Quality of Technical Plan	S	3.67	1.21
10.	Product Development Time (Y_3)	S	12.28	6.10
11.	Product Superiority (Y_4) (Scale 1 to 5)	S	3.42	1.18
	" (percentile)		50.00	28.34
12.	Rate of Return x Time (Y_5)		317.00	527.80
13.	Rate of Return		104.82	177.06

Results

Although the managerial characteristics (particularly team completeness, X_1) were known from previous studies (Roure and Keeley, 1988a, 1989) to strongly influence performance, their influence on industry characteristics and strategy variables proved much weaker. The best relationship is a single variate, linear expression between principals' joint experience (X_2) and the industry variables. Development time and product superiority, strategy variables, were not influenced significantly by any combination of the management variables but were related to competitiveness of the target market.

Possible non-linear relations among the variables were considered by incorporating dummy variables and polynomial regressors (a form using dummy variables is presented in an earlier version of this paper (Roure and Keeley, 1988b)). The improvement was questionable when compared to the added complexity (adjusted R^2 was improved by less than 0.10 in all cases). Certain technical changes in the variables improved the fit to a minor degree, and were incorporated. These included:

1. Replacing the raw scores of the qualitative variables with their percentile ranks within the sample (see Terza, 1987).

2. Replacing the internal rate of return with the internal rate of return multiplied by the time the investment was held. This eliminated heteroskedasticity in the residuals of equation 5 which should improve the efficiency of the estimators and make the significance tests more valid. The resulting measure of performance is not as easily interpreted as the internal rate of return. It is, roughly speaking, the logarithm of the average multiple earned on the investment.

Several variables exhibited no explanatory power in any of the equations. The two variables describing managers' backgrounds, similar experience and high growth experience, typically have very high values as reflected in Table 2. We suspect that almost all firms were above a "threshold" on these qualities, where they cease to matter very much. Founders' equity share may be too crude a measure of the incentive provided by ownership, or it may not matter much; in any case it does not influence the strategic choices or performance of the firms in this sample.

Among the industry variables, projected market share was expected to provide an indication of competitive pressure, and it showed a negative correlation with competitiveness of the market (Y_1). However, it did not add any explanatory power beyond that of (Y_1).

The quality of the technical plan, a strategy indicator in this study, was intended to reflect management's way of running the firm – carefully planned (and controlled) or loosely planned. Other studies have considered the quality of the planning process (e.g., Van de Ven et al., 1984), with good results. Perhaps the process rather than the resulting plan is what matters, or perhaps the business plan and not the technical plan is what matters (in our case the business plans were almost all of high quality so a measure based on them would not have varied much).

The resulting five equation models, incorporating five variables with significant explanatory power, is shown in Table 3. The model was estimated via ordinary least squares.

Statistically it seems reasonably well specified. The residuals (e_1 to e_5) have very low correlations, as required in structural models. They appear to be homoskedastic with respect to all explanatory variables. They do not appear to be normal, but do not exhibit the "fat tails" which are perhaps the greatest concern with respect to significance tests. Multicollinearity is not a problem; the quadratic variables (Y_2) and (Y_3) show very high correlations between their two components as one would expect, but not high enough to cause large variations in parameter estimates.

One final technical matter is whether the sample can be viewed as homogeneous. That is, did the investors view them as having the same expected payoff and the same risk? We have two forms of indirect evidence that they did. First, if investors recognized differences among the companies (based on the attributes considered here), the companies would be valued differently and the returns to investors would diverge systematically from the total returns on the companies. The standardized coefficients in the last equation would vary depending on whether (Y_5) was the total return or only the return to investors – in fact, they are nearly the same (for brevity the analysis using returns to investors is not included). Second, if investors perceived differences in risk versus potential gain, the resulting variations in pricing of the companies would lead to a sizeable random component when return to investors is regressed on total return (because of the omission of the variables which reflected differences among the companies). For this sample, such a regression produces an adjusted R^2 of 0.998. Although not conclusive, we feel these results justify our treating the sample as coming from one population.

Table 3

Estimates of the Structural Equations [1,3]

								Adjusted R^2
Y_1					= 79.64	-0.515X_2	+e_1	0.271***
						[-0.540]		
					(9.26)	(3.741)***		
	Y_2				= 276.1	+1.908X2	+e_2	0.101*
						[0.356]		
					(5.143)	(2.221)*		
2.592Y1	Y_3			= 359.2			+e_3	0.203**
[0.475]								
(3.150)**				(7.541)				
0.60Y_1			+Y_4		= 82.03		+e_4	0.324***
[0.586]								
(4.218)***					(9.959)			
	-1.00Y_2	-1.00Y_3	-4.315Y_4	+ Y_5	= -1386.8	+12.28X_1	+e_5	0.608***
	[-0.294]	[-0.286]	[-0.232]			[0.443]		
	(3.30)*,[2]	(3.19)+,[2]	(1.771)+		(5.129)	(3.438)**		

1. Standardized coefficients are in [ ]. The t statistics are in ( ). Two tail t statistics are in ( ). Significance is (+) p<0.10, (*) p<0.05, (**) p<0.01, (***) p<0.001.
2. Variables Y_2 and Y_3 are quadratic combinations in order to capture a non-linear relationship.
   Y_2 = 22.71* (Buyer concentration) – 0.229* (Buyer Concentration).[2] Optimum is 49 percentile (about 3.0)
   Y_3 = 67.57* (Development time) – 3.225* (Development time).[2] Optimum is 10.5 months.
   F statistics for 2.29 degrees of freedom are in ( ) for Y_2 and Y_3 in equation 5.
3. The absolute value of correlations among the residuals averaged 0.0531 with the largest -0.156.

The results contain a number of surprises. Management teams with a high level of joint experience tend to choose industries with relatively low competition and with a medium concentration of buyers, but only to a limited extent. The relationships are statistically significant but, as indicated by the low R^2 in the first two equations, the selection of industry is largely random (i.e., outside this model). The low correlation between the residuals (e_1) and (e_2) – which is 0.000 – suggests that any outside influences do not actively steer the company toward attractive combinations of (Y_1) and (Y_2). One interpretation is that company founders tend to stay in the industries where they have worked, but make limited shifts toward niches in those industries with favorable conditions. The more they share experience in the same industry, the better they are at identifying such niches.

Even more surprising than the limited ability of management to select industry niches with favorable conditions, is the absence of any direct influence of management characteristics on our strategy variables. Individually the strategy and management variables have strong relationships with performance, as shown in column (2) of Table 4. Thus we conclude they are important variables, but they simply are not related (in this sample).

Table 4

Effect Analysis of Relationships between Explanatory Variables and Performance (Y_1), Using Standardized Coefficients[1]

Variable name	(1) Mult. Regression Coefficient	(2) Gross Effect	(3) Non-causal Effect	(4) Total Effect	(5) Direct Effect	(6) Indirect Effect
X_1 Team Complete	0.412**	0.669***	0.226	0.443	0.443	0
X_2 Joint Exper.	0.466+	0.616***	0.365	0.251	0	0.251
Y_1 Competition	-0.139'	-0.539***	-0.267	-0.272	0	-0.272
Y_2 Buyer Conc.	0.386***	0.438***	0.144	0.294	0.294	0
Y_3 "Devel. Time"	0.227'	0.429**	0.143	0.286	0.286	0
Y_4 Prod. Superior	0.372*	0.546***	0.314	0.232	0.232	0

1. Column (2) is the coefficient of a single variable regression on Y_5.
   Col(2)=Col(3)+Col(4)
   Col(4)=Col(5)+Col(6)

2. Column (1) refers to separate multiple regressions of X_1 and X_2 on Y_5; and Y_1 through Y_4 on Y_5.

3. Significance levels are shown for columns (1), (2) because they have not been presented elsewhere. They are (+) p<0.10; (*) P<0.05; (**) P<0.01; (***) P<=0.001.

One possible explanation lies in the screening process of the "portfolio managers" of Figure 1. If their evaluation process combines managerial and industry/strategy characteristics into a "figure of merit," the companies which barely surpass the minimum acceptable level will tend to have a negative correlation between managerial and industry/strategy characteristics. This will impart a downward bias to managerial variables in equations (3) and (4). Such a screening mechanism seems likely; however, it should be evident in divergences between the total return and the return to investors. That is, founders of companies with high "figures of merit" should be able to capture a larger share of the value with a corresponding widening of the spread between total return and the return to investors. As noted above, no such divergence is detectable in this sample.

A third surprise is that competitiveness in an industry (Y_1) is negatively associated with the strategic choices (Y_3 and Y_4). Apparently, competitive industries are already near the technological frontier, limiting the possibility for developing superior products. A plot of competitiveness against development time shows a widening spread among development times as competition increases, but no average change. Our results imply an optimum development time of about ten months. Shorter times are apparently associated with products having limited proprietary features (though we would note that product superiority and development time are only weakly related in this sample), and longer times with increasing odds of failure or market shifts. As competitiveness increases, the response seems to be to rush to market ("before the window closes") or to take extra time ("to find the right product").

The fifth equation has no surprises. As expected, performance (Y_5) is strongly influenced in the expected directions by an industry attribute (Y_2), by strategic choices (Y_3 and Y_4) and by management (Y_4). The relative equality of the standardized coefficients testifies to the importance of each aspect.

In the fifth equation team completeness is important and joint experience is not (not even as an added dimension beyond completeness). This probably adds weight to the importance of management as implementers rather than as formulators of strategy. Essentially all management teams in the sample had a president, a key technical person, and (usually) a marketing person. These would be expected to be the main strategists. The more complete teams added operating and financial people or (occasionally) additional technical depth. These functions seem to be associated with the effective operation of the firm. The absence of joint experience in this equation suggests that a willingness to hire outsiders, although it may initially hurt the team's efficiency, probably adds to its ability to expand rapidly (it will have a broader set of outside contacts from whom to hire new employees; it will know more prospective customers; etc.).

Viewing the model as a test of the "strategic management theory" versus the "natural selection theory," it favors natural selection. Contrary to our expectations, company managers seem to have little influence of industry/strategy choices, even at a firm's inception.

We began with the statement that bivariate comparisons or even single equation models could lead to incorrect conclusions, especially if management were ignored and the links between management and strategic choices were strong. So far the links are not strong; nonetheless, a comparison of simpler approaches with the structural model is useful and is shown in Table 4, using standardized coefficients. Column (1) presents separate multivariate regressions of the management characteristics on performance and of industry/strategy attributes on performance. Single variable regressions of the variables on performance are in column (2). Columns (4) and (5) show the causal influence of the variables on performance, divided into direct and indirect effects. The difference between the causal influence and the single variable effect of column (2) is shown as the non-causal influence of column (3).

By comparing columns (2) and (4) we see that the single variable regressions badly overestimate the importance of most variables. This is somewhat mitigated by the single equation multiple regressions, though they still show sizeable errors. For example, the industry/strategy equation underestimates the importance of industry competitiveness (which is not significant and would be accorded no importance), and overestimates the importance of product superiority by 60% (i.e., 0.372 is 1.6 x 0.232). A two equation structural model of just the strategy and industry variables would restore the role of competitiveness and provide important insight into its relationship with product superiority; though product superiority would still be overstated. On balance the

implication seems to be that empirical studies of industry/strategy choices do not require incorporation of management variables, though a structural model can still be very useful.

Table 4 also implies that a study which only looked at organizational variables (as in the top two rows of column 1) would badly overestimate the importance of joint experience, and would no doubt misunderstand its role. For example, one might easily associate it with effective team operation; whereas the structural model suggests it promotes a better choice of industry – a strategic role, not an operating one. The structural model clearly improves our understanding in this situation.

Table 4, in combination with the specific values of Table 3, allows us to make some explicit tradeoffs (for this discussion it is easier to work with the rate of return rather than Y_5. The values in Table 4 would be nearly same). Dropping the rate of return by 0.45 standard deviations below its mean of 104 percent per year reduces it to 24% per year, about the minimum that might be attractive in a new venture. This implies that team completeness could be one standard deviation below the mean (if other variables were at their mean values) or 50%. Greater "sacrifices" are possible with other variables; any one could be reduced to its worst case. Even so, the implication is that a proposed new venture must score well on multiple dimensions. It is not enough to have a great management team alone, or a brilliant product idea.

Concluding Comments

If these results are extended beyond this sample, and if venture capitalists' experience is a useful guide to the generation of new business activities in general, several implications follow:

1. Generation of ideas, screening of ideas and management of the new venture can be decoupled. Management is the single most important determinant of success, but its role is not primarily in formulation of the initial strategy.
2. The limited influence of managers on strategic choices (in this sample the managers generated the ideas as well as managing the firms) suggests that their vision is narrowly constrained. Even highly qualified (operating) management groups are unlikely to generate great strategies for new business activities.
3. Venture capitalists report devoting a large proportion of their time each year to finding one or two new investments (see, for example, Rock, 1987), reviewing from 50 to over 100 plans for every investment they make. This is clearly a highly random process, not a directed search; it emphasizes the difficulty, noted in point 2, of finding good opportunities. The implication is that any organization wishing to develop new businesses needs to obtain many ideas from many sources. It should develop inexpensive ways to obtain ideas, screen them for their strategic merit, and then assemble a (relatively complete) management team. Means should be found to reward the creators of ideas, without necessarily providing management roles to them.

Any sample of thirty-six can only provide tentative results. But they raise some interesting issues. Is management's strategic role in a new, technical firm as limited as this model suggests? We are expanding the sample and obtaining resumes of the founders in order to study the matter further. So far the results suggest that, for these types of firms, managers are heavily constrained in their abilities to affect the quality of major strategic choices.

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