Strategic Management Journal, Vol. 16. 565–580 (1995)

COOPERATIVE STRATEGY AND NEW VENTURE PERFORMANCE: THE ROLE OF BUSINESS STRATEGY AND MANAGEMENT EXPERIENCE

JEFFREY E. McGEE
College of Business Administration, University of Nebraska at Omaha, Omaha, Nebraska, U.S.A.

MICHAEL J. DOWLING and WILLIAM L. MEGGINSON
Terry College of Business, University of Georgia, Athens, Georgia, U.S.A.

This paper reports the results of a study of new ventures which examine the relationships between performance and the experience of a new venture's management team, its choice of competitive strategy, and its use of various cooperative arrangements. The findings of the moderated regression analysis indicate that cooperative arrangements are most beneficial to those new ventures whose management teams possess the most experience.

In recent years, increasing attention has been given to the widespread use of strategic alliances (Borys and Jemison, 1989) and cooperative interorganizational relationships (Galaskiewicz, 1985; Oliver, 1990). This research has addressed a variety of relationships ranging from mergers to joint ventures to informal networking. However, most of this literature has been based on research involving large established firms. More recently, researchers have recognized that small firms or new ventures are also adopting cooperative strategies with increasing frequency (Brokaw, 1993; Rothwell, 1991; Forrest, 1990). A variety of reasons for the increased use of cooperative arrangements in new ventures have been suggested. These include the need to complement existing internal resources, the need to quickly gain the technical capabilities to compete in rapidly changing markets, and the desire to minimize the fixed costs associated with acquiring capital assets (Jarillo, 1989).

Researchers have suggested two different theoretical frameworks for analyzing the impact of cooperative behavior on performance: transaction cost economics and strategic behavior theory. The transaction cost approach emphasizes cost minimization by focusing on organizational and contracting efficiency (Williamson, 1975). Williamson argues that firms will internalize market transactions through hierarchies as the cost of transactions increase because of uncertainty or investments in transaction-specific assets. This framework suggests that cooperation could actually be detrimental to firm performance since the transaction costs of cooperative arrangements would be higher than internal transactions.

But Kogut (1988) argues that the strategic behavior of the firms' management team may affect the relationship between use of cooperative arrangements and performance. According to

Key words: entrepreneurship; new ventures; cooperative arrangements; interfirm arrangements

CCC 0143–2095/95/080565–16

Received 30 July 1993
Final revision received 24 September 1994

strategic behavior theory, firms form cooperative arrangements in order to maximize long-term profitability by improving competitive position. Consequently, strategic behavior theory predicts that firms will engage in cooperative activities as a means of achieving overall strategic objectives regardless of its effect on specific transaction costs. Furthermore, Jarillo (1989) argues that the transaction cost approach underemphasizes the intentions of management in determining the benefits of engaging in cooperative strategy. Jarillo suggests if managers can lower costs through cooperation *relative* to competitors, firms will be more profitable even though the transaction costs of cooperating are higher than building an internal hierarchy.

Both the transaction cost and strategic behavior approaches suggest the effects of cooperative behavior may be driven by the experience and capabilities possessed by the management team. For example, transaction costs can conceivably be lowered if the management team writing and enforcing the cooperative contracts is more knowledgeable about competitive trends. Furthermore, the risks of developing transaction-specific assets can be reduced if the management team possesses greater familiarity with the industry, market, and/or the technology since other potential applications can be more readily identified. Strategic behavior theory suggests that a management team will choose partners and types of cooperative activities in order to improve a firm's competitive position. More experienced management teams are more likely to make better decisions about such partners and activities.

Together these two theoretical perspectives frame the central research question of this study:

Should inexperienced managers cooperate simply to gain new knowledge and experience, or should they not cooperate unless they are experienced enough to know what they don't know?

This paper addresses this question by reporting the results of a study of new ventures which examine the relationships between performance and the experience of a new venture's management team, its choice of competitive strategy, and its use of various cooperative arrangements. In the following section the theoretical underpinning for this research is discussed, along with the specific hypotheses tested. Finally, the results of the analysis are presented and implications for research and practice are discussed.

THEORETICAL DEVELOPMENT AND HYPOTHESES

There exists a body of empirical research that addresses both the transaction cost and strategic behavior perspective in studying cooperative strategies by new ventures. For example, Mosakowski (1991) found support for the transaction cost view that cooperation can be detrimental in an analysis of 122 entrepreneurial computer firms. The analysis found that performance was, in general, negatively associated with one type of cooperative strategy, namely contracting for R&D, sales, or service.

Other researchers, using strategic behavior theory, found that management motivation and capabilities are equally important for studying the effects of cooperative behavior and should be used to complement the transaction cost approach. For example, Shan (1990) found that firms with underdeveloped internal capabilities were more likely to embrace cooperative behavior because external market transactions with other firms were more efficient than developing the required assets internally. McGee and Dowling (1994) found additional support for this hypothesis in an empirical study of R&D cooperative arrangements in high-technology new ventures. Furthermore, a study by Dollinger and Golden (1992) explicitly attempted, but failed, to find a relationship between cooperative strategy and performance in small firms. They speculated that the experience of managers might be a key determinant in the successful use of cooperative strategies by small companies.

Strategic management literature also suggests a linkage between management experience and choices concerning both competitive and cooperative strategy. Increasingly, researchers in strategy have stressed the importance of a firm's unique resources, skills, and assets for achieving competitive advantage (Barney, 1986, 1991; Rumelt, 1991). In addition, a variety of studies have linked internal organizational resources to the successful implementation of different competitive strategies (Govindarajan, 1988, 1989; Hitt, Ireland and Palia, 1982; Miles and Snow, 1978; Snow and Hrebriniak, 1980; Thomas,

Litschert and Ramaswamy, 1991). This research suggests that since management's functional expertise often dictates an organization's primary distinctive competence it also influences the firm's choice of competitive strategy. Furthermore, this research suggests that firms whose choices of competitive strategy are more reflective of that functional expertise will enjoy higher performance. For example, Snow and Hrebriniak (1980) matched certain areas of managerial expertise to the Miles and Snow (1978) strategic typology. Specifically, they discovered that firms characterized as 'Defenders' had greater expertise in the areas of general management, production, applied engineering, and financial management; while firms characterized as 'Prospectors' placed greater emphasis on the areas of general management, product R&D, and basic engineering. Thomas *et al.* (1991), in their study of 224 computer-manufacturing firms, found that the performance of 'Prospector' firms was greatest when the management team members had experience in 'output' functional areas such as marketing. 'Defenders', on the other hand, achieved superior performance when the management team possessed experience in 'throughput' functional areas such as manufacturing.

Porter (1980), in presenting his generic strategy typology, emphasizes the managerial expertise requirements for successfully pursuing each strategy type. For example, Porter (1980) states that achieving differentiation requires creating something unique. Often, successful differentiation strategies require that managers emphasize R&D activities to develop unique products or services and marketing activities to communicate uniqueness to the marketplace. On the other hand, a cost leadership strategy requires that managers aggressively lower costs through scale economies, cost control, and efficient production. The linkage between Porter's (1980) competitive strategy types and management expertise in particular functional areas has been shown in a number of studies (Govindarajan, 1988, 1989; Gupta and Govindarajan, 1984, 1986). For example, using data collected from 121 strategic business units, Govindarajan (1989) found that functional experience in R&D was positively related to the successful implementation of a differentiation strategy, whereas functional experience in manufacturing was positively associated with the successful implementation of a low-cost strategy.

Taken together, these bodies of research suggest the degree of management team experience in functional areas such as marketing, R&D, and manufacturing influences the strategic behavior of firms. In our study we expected new venture managers to choose cooperative strategies to support their basic competitive strategies. For example, we expected that managers successfully deploying a differentiation strategy would typically possess strong technical and/or marketing skills and managers pursuing a cost leadership strategy would possess strong manufacturing skills. Furthermore, we anticipated that new high-technology ventures whose management teams possess more functional experience in the area most closely linked to the venture's choice of competitive strategy should be more successful in their use of cooperative activities chosen to support that strategy. More experienced managers should be better able to recognize the benefits and potential pitfalls of adopting cooperative behavior to help improve their firm's competitiveness.

Hence, more experienced managers would better understand what they don't know and what they could learn from cooperation. For example, the managers of new ventures emphasizing technical differentiation who possess more R&D experience should be better able to determine the strategic advantages of licensing certain technical applications to help ensure their own firm's competitiveness. Likewise, a firm pursuing marketing differentiation would more likely benefit from various marketing cooperative arrangements if the management team possessed more marketing expertise. Finally, a reduction in potential transaction costs should occur in new high-technology ventures whose management teams possess more experience in the functional areas most important for the effective use of a cost leadership strategy such as efficient manufacturing.

These arguments can be summarized in the following hypotheses:

Hypothesis 1: New ventures emphasizing marketing differentiation, and with more experienced marketing managers, will show a greater impact of marketing cooperative arrangements on firm performance.

Hypothesis 2: New ventures emphasizing technical differentiation, and with more experienced R&D managers, will show a greater impact

of R&D cooperative arrangements on firm performance.

Hypothesis 3: New ventures emphasizing low-cost production, and with more experienced manufacturing managers, will show a greater impact of manufacturing cooperative arrangements on firm performance.

METHODOLOGY

The sample

This study examined the following three high-technology industries: (1) communication equipment and electronic components [SIC#s 3661, 3671, and 3678]; (2) office and computing machines [SIC# 3571]; and (3) professional and scientific instruments [SIC#s 3823 and 3825] (U.S. Department of Commerce, 1983). The National Science Foundation's (NSF) definition of high-technology industries was used. The NSF defines high-technology industries as those with firms that on average employ 25 or more R&D employees per 1000 total employees, and that devote 3 percent or more of total revenues on R&D (Littler and Sweeting, 1990).

These industries were chosen for three primary reasons. First, high-technology manufacturing companies in these industries have similar capital assets and other internal resource requirements. Second, the selection of three similar, yet different, manufacturing industries allows for greater generalizability of this study's findings while still controlling for potential industry effects. Third, the National Science Board has identified these high-technology industries as three of the most important for continued U.S. global competitiveness (National Science Board, 1987).

New ventures were identified in these industries from a list of all firms that executed an initial public offering (IPO) between January 1980 and December 1989. The *Investment Dealer's Digest* provides a listing of all these firms, along with a brief description of their primary business. We then examined the detailed registration statements filed with the SEC of the selected firms based on the following criteria. First, the firm must have executed an IPO between 1980 and 1989. Second, the firm must have been an independent start-up, since prior research indicates significant performance differences between independent ventures and corporate-sponsored ventures (Fast, 1981; Weiss, 1981). Third, the firm's year of incorporation must not have been more than 8 years prior to the IPO date, since prior research indicates that new ventures take at least 8 years to achieve performance levels comparable with mature firms (Biggadike, 1976; Weiss, 1981). Fourth, the firm's founding management team must still have been intact at the time of the IPO as discussed in the 'Management' and 'Statement of Ownership' sections of the IPO documents. Fifth, the firm must have been actually selling products, not just conducting start-up R&D.

From this population of new ventures, 210 firms which met the aforementioned criteria were identified. These firms were used for the final statistical analysis. The sample size provided a variable-to-observation ratio of roughly 10 to 1, satisfying the most conservative multiple regression requirements (Neter, Wasserman, and Kutner, 1990).

Data used in this study were collected directly from the IPO statements, including SEC forms S-1, S-18, and F-1. The use of IPO registration statements as a source of data is considered relatively reliable due to reporting requirements, SEC scrutiny, and sanctions for falsification (Marino, Castaldi, and Dollinger, 1989; Mosakowski, 1991). Accounting data were recorded from financial statements and accompanying footnotes included in the filing documents. Other data, such as the founders' previous work experience and cooperative arrangement usage, required a content analysis of the SEC documents.

The variables collected from the IPO statements included continuous measures of firm performance, and control measures for size, age, and industry. Additionally, the prior functional experience (in years) possessed by its management team was tabulated. Finally, categorical measures of cooperative arrangements usage and the firm's choice of competitive strategy were coded from descriptive portions of the IPO documents. Each of the variable measurements are discussed in Table 1 and provide a summary of the independent variables.

Measures of performance

No commonly accepted set of performance variables or methods by which new ventures should

Table 1. Description of independent variables

Variable	Description
MKTEXP	Management's combined years of marketing experience
MKTAVE	Management's combined years of marketing experience divided by the number of managers
R&DEXP	Management's combined years of technical experience
R&DAVE	Management's combined years of technical experience divided by the number of managers
MFGEXP	Management's combined years of production experience
MFGAVE	Management's combined years of production experience divided by the number of managers
MKTCOOP	Indicated the use of external marketing arrangement ('1' = external marketing activities)
R&DCOOP	Indicated the use of external R&D arrangement ('1' = external R&D activities)
MFGCOOP	Indicated the use of external manufacturing arrangement ('1' = external manufacturing activities)
YINC	The firm's year of incorporation
ASSETS	The total tangible and intangible assets at the time of IPO

be evaluated exist (Biggadike, 1976). Frequently used variables include sales growth, employment growth, asset growth, profitability, and return on assets. Each variable has strengths and weaknesses. Profitability, for example, is a commonly used performance measurement in the management literature since it purports to reflect aggregate firm performance (e.g., Mosakowski, 1991; Smith, Bracker, and Miner, 1987). However profitability is dependent on sales and costs which are often distorted due to changes in accounting procedures. In addition, new high-technology ventures simply do not have profit histories and are often not expected to exhibit profitability during the initial years of existence due to large initial capital investments (Mosakowski, 1991).

Average growth in sales (SALES) was adopted as the measure of performance since it has been suggested that sustained growth in revenues is often indicative of technical quality, market acceptance, and overall new venture success (Feeser and Willard, 1990). Specifically, we calculated a 3-year compounded annual rate of sales growth for each firm. Annual sales included all annual income generated for the provision of goods and services, not including liquidation of assets and other extraordinary items. The following formula was used:

$$\text{Average sales growth} = ((\text{Sales}_3/\text{Sales}_1)^{1/3} - 1)100$$

where Sales_3 and Sales_1 were the annual sales of the firm at the time of the IPO and the annual sales 3 years prior to the IPO, respectively.

Measures of management experience

Two measures of management experience were used in this study. The first measure was intended to reflect the prior functional experience possessed by members of the management team in three functional areas: marketing, R&D, and manufacturing. Management experience was measured using an adjusted summation of the total years of functional experience possessed by each management team member in order to reduce the potential bias of those managers possessing considerably more years of experience. This adjustment technique involved adding the years of experience to the mean of the subsample. Each year beyond was proportionally adjusted so the years falling one standard deviation from the mean equalled zero. All subsequent years were also assigned a value of zero.

The second measure of management experience was intended to correct for the number of members in each management team. An 'average' measure was calculated by dividing the team's total years of experience by the number of management team members. The adjusted summation was used as the denominator in this proportion to correct for potential bias in teams with relatively well-experienced individual managers.

Measures of cooperative arrangement usage

Based on prior research (Forrest, 1990; Porter and Fuller, 1986; Oliver, 1990; Borys and Jemison, 1989), cooperative arrangements were defined as any of the following activities: *Collab-*

orative Arrangement—a noncontractual agreement between the new venture and another company to collaborate on certain functional activities; *Licensing Arrangement*—a contractual agreement by which the new venture is granted access to another company's functional resources through a license; *Contractual Arrangement*—a legally binding contractual agreement that allows the new venture to pay another company to perform certain functional activities; and *Joint Venture*—an independent third enterprise formed by the new venture with another firm to perform or develop certain functional activities. These arrangements represent a continuum from informal collaborative arrangements to more formal joint ventures where assets are contributed by both parties who also share the risk.

The use of cooperative arrangements in the functional areas of marketing, R&D, and manufacturing was coded using three dichotomous indicator variables (e.g., '1' = use of cooperative arrangement). Identification of key phrases in the IPO documents served as the basis for this codification. For example,

> *To this end, the Company has entered into agreements with Central Supply for the distribution of the 'EAGLE/ONE'.*

was indicative of a firm engaged in marketing cooperative arrangements.

Measures of competitive strategy

Porter's (1980) strategic typology, slightly modified, was used to classify the new venture's competitive strategy. Three basic types of competitive strategy were recognized: marketing differentiation, technical differentiation, and cost leadership. A firm's choice of competitive strategy was coded after a thorough review of the IPO statement, with special attention given to the information contained in the IPO document's 'Market' and 'Strategy' sections.

Key phrases contained in the IPO documents were used to identify a firm's choice of competitive strategy. For example, the following phrase was indicative of a firm's emphasis of the technical features of their products primary differentiating factors:

> *The Company believes that its advanced technical features are the primary competitive factors that customers desire. To this end, the 1020 series has been developed with state-of-the-art components to insure that the Company maintains its technology leadership role.*

Similarly, the following phrase was reflective of firms whose primary differentiating factor was marketing capabilities:

> *Our well-trained sales force gives the Company a decided competitive advantage.*

Finally, the IPO statements of firms competing with lower costs contained phrases such as:

> *The EAGLE/ONE, at present, appears to enjoy a price advantage over the equipment of most other manufacturers.*

Since this classification process relied on the judgement of the researchers, a second coder (not familiar with the hypotheses being tested, but trained in strategic management) independently classified the competitive strategy of a subsample of the data base by content analyzing the IPO statements of 52 new ventures. The two researchers agreed on the strategic emphasis classifications in nearly 90 percent of the cases. The interrater agreement produced a Cohen's kappa = 0.83 (Holsti, 1969).[1] Disagreements were resolved by reexamining the IPO documents and determining if one of the researchers overlooked a key piece of information.

Control variables

Year of incorporation (YINC) and total assets (ASSETS) were chosen as controls for timing of entry into the industry and size effects, respectively. These measures represent a number of possible scale and size effects which can influence a firm's performance, such as learning curve effects and economies of scale.

[1] The results of a second study conducted by the authors corroborated the strategic emphasis classifications used in this research. The focus of the other study differed from the research described in this paper but both samples contained 38 common firms. The second study used primary data and the survey instrument contained questions concerning a firm's competitive strategy. Of the 38 common firms, 32 identified strategy classifications identical to the classifications used in the current study. In the six responses that differed, the survey respondents stated that R&D and marketing differentiation were equally important components of their firm's competitive strategy. In any event, the strategy classifications were the same in nearly 85 percent of the cases.

Data analysis

To test the hypothesized relationships between performance, prior functional experience, and the use of specific types of functional cooperative arrangements given the venture's choice of competitive strategy, the data base of 210 firms was divided into three subsamples. These subsamples reflect the venture's choice of competitive strategy and included marketing differentiation ($n = 71$), technical differentiation ($n = 92$), and cost leadership ($n = 47$).

Moderated regression analysis was used to test individual hypotheses since they suggested that the relationships between individual variables and new firm performance was moderated by an additional independent variable. A number of authors (e.g., Schoonhoven, 1981; Darrow and Kahl, 1982; Covin and Slevin, 1989) advocate the use of moderated regression analysis when investigating contingency relationship since it allows the interaction terms, which are implied in all contingency relationships, to be explicitly examined. According to Arnold (1982), moderated regression 'provides the most straight forward and the most general method for testing contingency hypotheses in which an interaction is implied'. Moderated regression is generally regarded as a conservative method for identifying interaction effects since the interaction terms are not tested for significance until the main effect independent variables are first entered into the regression equation. Hence, the interaction effects are found to be significant only if it adds to the main effect regression model's explanatory ability (Covin and Slevin, 1989). Third, partial F-tests for increments in R^2 for cross-product terms are valid even when the terms are correlated, thus minimizing the effects of serious multicollinearity (Cohen and Cohen, 1975). The basic form of the regression equation for the first two hypotheses was:

$$Y = \beta_0 + \beta_1 X_{i1} + \beta_2 X_{i2} + \beta_3 X_{i3} + \beta_4 X_{i4} + \beta_5 X_{i3} X_{i4} + \epsilon$$

where:

Y = average sales growth (SALES)
β_0 = intercept
β_1 = year incorporated (YINC)
β_2 = average assets (ASSETS)
β_3 = cooperative arrangement usage, either:
marketing cooperative arrangements (MKTCOOP),
R&D cooperative arrangements (R&DCOOP), or
manufacturing cooperative arrangements (MFGCOOP)
β_4 = prior functional experience, either:
marketing experience (MKTEXP or MKTAVE),
technical experience (R&DEXP or R&DAVE), or
production experience (MFGEXP or MFGAVE)
β_5 = interaction term.

In the analysis of the data, partial F-tests on the cross-product terms were initially performed to determine if the hypothesized interactions were present. If the interaction term proved significant, two lines representing the two separate response functions were plotted. In one, the cooperative arrangement usage variable = '1', and in the other, the variable = '0'. The low and high endpoints of the two lines were placed at zero and two positive standard deviations from the mean, respectively. Considering a normal distribution, this range included roughly 95 percent of the sampled ventures.

To help control for the effects of other variables in the equation that were not of primary interest (e.g., year of incorporation), the mean values were multiplied by the respective coefficients and summed to form the Y-intercept. This procedure created a graphical representation of the differences in the slope and intercept of the response function when the moderator effects were present (i.e., cooperative arrangements usage = '1') and was used to determine if, in fact, the successful use of cooperative arrangements was moderated by the amount of experience possessed by the management team.

After the models were developed, diagnostic tests were administered to ensure that the data were appropriate for multiple regression analysis and the regression models fit the data. Specifically, plots of the residuals revealed that a natural logarithmic transformation of the dependent variable was warranted. Studentized Deleted Residuals and Cook's Distance Values were used to determine that no influential outliers were present. Variance Inflation Factor analysis pro-

Table 2. Descriptive statistics

	Total sample (N = 210)		Marketing differentiation subsample (N = 71)		Technical differentiation subsample (N = 92)		Low-cost production subsample (N = 47)	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Average assets ($000)	21,274	93,965	9,086	8,075	26,437	115,631	26,690	106,307
3-year average sales ($000)	14,464	27,632	11,391	15,553	15,773	34,920	16,228	32,425
Average sales growth (%)	156.8	177.2	154.3	167.2	111.2	161.9	203.5	206.2
Marketing experience (years)	9.4	9.0	8.6	7.3	8.6	8.9	11.7	10.4
Technical experience (years)	10.2	7.8	10.7	7.8	11.0	8.3	8.6	6.5
Production experience (years)	6.8	7.0	5.9	5.3	7.2	7.7	7.2	7.4

vided evidence that multicollinearity among the independent variables was minimal. Finally, an ANOVA was performed on the sample of new ventures to detect performance differences across the three industries. No significant industry effects were detected.

RESULTS

Table 2 provides the key descriptive statistics from all three subsamples. Table 3 presents the correlation table and Tables 4–6 present the regression results.

Table 4 provides the regression results used to test Hypothesis 1. The year of incorporation was consistently, positively, and significantly ($p < 0.01$) associated with average sales growth. This finding was expected since later-entering firms in an industry are typically smaller than incumbent firms. Therefore, the smaller firms should realize higher relative sales growth simply because it can experience rapid initial growth yet remain quite small compared with older, more established competitors.

Hypothesis 1 predicted the use of marketing cooperative arrangements would enhance the performance of ventures pursuing marketing differentiation and whose management teams possessed relatively more marketing experience. The MKTCOOP term coefficient in Model 1a was statistically significant and positive, indicating that marketing cooperative activities were beneficial to *all* firms emphasizing marketing capabilities.

Table 3. Pearson correlations[a]

Variables	1	2	3	4	5	6	7	8
1. 3-year average sales growth (log %)								
2. Year incorporated	0.25***							
3. Average assets ($000)	0.06	−0.13						
4. Marketing experience (years)	0.10	0.06	−0.10					
5. R&D experience (years)	0.07	−0.01	−0.13	0.25***				
6. Manufacturing experience (years)	0.16*	−0.03	−0.09	0.44	0.41***			
7. Marketing cooperative arrangements	0.26***	0.10	0.03	0.09	−0.13*	0.09		
8. R&D cooperative arrangements	−0.33***	0.02	0.16*	−0.17	−0.06	−0.16*	−0.24***	
9. Manufacturing cooperative arrangements	0.18**	0.28	0.07	0.04	−0.22	−0.05	0.23***	−0.19**

[a] N = 210
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 4. Results of regression analysis: Marketing differentiation subsample ($N = 71$)

Marketing experience × Marketing cooperative activities = Average sales growth

	Model 1a	Model 1b	Model 1c	Model 1d	Model 1e
Intercept	−5.044	−5.055	−5.224	−5.058	−4.598
	(4.192)	(4.214)	(4.006)	(4.219)	(4.115)
YINC	0.114*	0.116*	0.127*	0.116*	0.116*
	(0.052)	(0.053)	(0.050)	(0.053)	(0.051)
ASSETS	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MKTCOOP	0.547*	0.509	0.410	0.525	0.415
	(0.278)	(0.305)	(0.467)	(0.306)	(0.433)
MKTEXP		0.018	0.126**		
		(0.026)	(0.028)		
MKTAVE				−0.091	−0.215
				(0.152)	(0.487)
MKTCOOP·MKTEXP			0.146**		
			(0.058)		
MKTCOOP·MKTAVE					0.630*
					(0.326)
R^2	0.1855**	0.1933**	0.2856**	0.1913**	0.2484**

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 5. Results of regression analysis: Technical differentiation subsample ($N = 92$)

R&D experience × R&D cooperative activities = Average sales growth

	Model 2a	Model 2b	Model 2c	Model 2d	Model 2e
Intercept	−5.798*	−5.736*	−5.784*	−5.709*	−6.825*
	(2.538)	(2.553)	(2.457)	(2.543)	(3.580)
YINC	0.128***	0.127**	0.130***	0.126***	0.142***
	(0.032)	(0.032)	(0.031)	(0.032)	(0.031)
ASSETS	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R&DCOOP	−0.661***	−0.668***	−1.388***	−0.652***	−1.373***
	(0.199)	(0.200)	(0.432)	(0.199)	(0.323)
R&DEXP		0.005	−0.018		
		(0.011)	(0.013)		
R&DAVE				0.040	−0.028
				(0.044)	(0.049)
R&DCOOP·R&DEXP			0.060**		
			(0.021)		
R&DCOOP·R&DAVE					0.286**
					(0.103)
R^2	0.2075***	0.2097***	0.2767***	0.2152***	0.2812***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

Table 6. Results of regression analysis: Cost leadership subsample (N = 47)

Manufacturing experience × Manufacturing cooperative activities = Average sales growth

	Model 3a	Model 3b	Model 3c	Model 3d	Model 3e
Intercept	−5.317	−5.099	−1.955	−5.174	−1.920
	(4.193)	(4.236)	(4.372)	(4.254)	(4.362)
YINC	0.135*	0.131*	0.077	0.132*	0.076
	(0.054)	(0.055)	(0.059)	(0.055)	(0.033)
ASSETS	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
MFGCOOP	−0.800*	−0.747*	−0.112	−0.772*	−0.516
	(0.359)	(0.373)	(0.675)	(0.374)	(0.685)
MFGEXP		0.010	0.101*		
		(0.017)	(0.046)		
MFGAVE				0.032	0.421*
				(0.106)	(0.185)
MFGCOOP·MFGEXP			0.106*		
			(0.050)		
MFGCOOP·MFGAVE					0.678*
					(0.306)
R^2	0.1351*	0.1405	0.2075*	0.1366	0.2108*

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

However, because interaction effects between the level of marketing experience and marketing cooperative arrangements were anticipated, a simple examination of the MKTCOOP term's coefficient did not suffice. To examine the hypothesized relationships, the interaction terms in Models 1c and 1e were examined. The MKTEXP·MKTCOOP and the MKTAVE· MKTCOOP coefficients were both significant ($p < 0.01$ and $p < 0.05$, respectively). In terms of additional contribution to the main effects model's adjusted R^2s, the cross-product terms explained an additional 0.09 and 0.05 of the variance, respectively.

This method of analysis confirms the desirability of adding interaction terms to the main effects models, but does little to explain how the additional variable influences performance. To investigate this phenomenon, separate lines representing the two sets of response functions were graphed. In one, MKTCOOP = '1', and in the second, MKTCOOP = '0'. The management teams of this subsample of ventures possessed, on average, 8.6 years of combined marketing experience, so the low and high endpoints of the two lines representing the response functions containing the measure of aggregate marketing experience were set at 0 and 23 (0 and the mean plus two standard deviations, respectively). The low and high endpoints of the lines representing the response functions containing the proportional measure of marketing experience were set at 0 and 3.8 (0 and the mean plus two standard deviations, respectively). This procedure enables visual inspection of the difference in the slopes and intercepts of the response functions when marketing cooperative arrangements were present (i.e., MKTCOOP = '1') and it also determines if, in fact, marketing cooperative arrangements did improve new venture performance by leveraging prior marketing experience possessed by the firm's management team.

Figure 1 illustrates how the slopes and intercepts differ when MKTCOOP = '1'. These graphical depictions show that the intercepts are higher when marketing cooperative arrangements were used. More importantly, inspection of the lines reveals that the use of marketing cooperative arrangements is associated with substantially higher performance when the management team possesses relatively more marketing experience. Hence, the first hypothesis was supported since the results suggest that the relatively *more* experienced management teams were better able to identify and exploit the advantages of engaging in marketing cooperative behavior than were their less experienced counterparts.

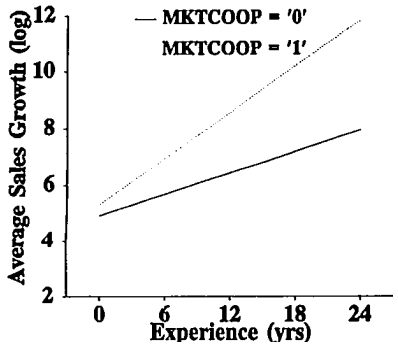

Figure 1a. Interaction effects of marketing cooperative arrangements and experience on performance.
Note: Experience = the adjusted summation of total years of marketing experience possessed by the members of the management team. $n = 71$.

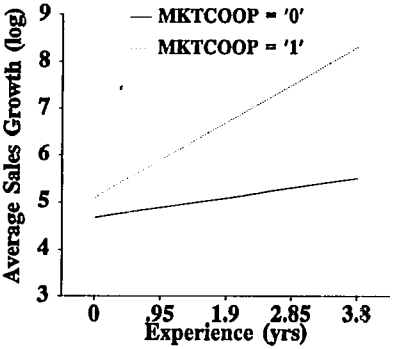

Figure 1b. Interaction effects of marketing cooperative arrangements and experience on performance
Note: Experience = the adjusted summation of total years of marketing experience possessed by the members of the management team divided by the number of managers. $n = 71$.

The regression results used to test the second hypothesis are presented in Table 5. Again, the year of incorporation was the only statistically significant control variable. Hypothesis 2 predicted that the use of R&D cooperative arrangements would be associated with higher average sales growth of ventures emphasizing technical differentiation and whose management teams possessed relatively more technical expertise. Although the R&D cooperative arrangement term's coefficient in Model 2a was significant and negative, indicating that R&D cooperative behavior detracted from performance, the hypothesis was still supported since the cross-product variables (i.e., R&DEXP·R&DCOOP and R&DAVE·R&DCOOP) were significant and positive ($p < 0.01$) (Models 2c and 2e). In terms of additional contribution to the main effects model's adjusted R^2s, the interaction terms each explained an additional 0.07 ($p < 0.01$) of the variance.

Graphical representations of the interaction effects clearly illustrate that the use of R&D cooperative behavior is associated with substantially higher performance when the management teams possess relatively more technical experience (Figure 2). The management teams of the ventures competing through technical differentiation possessed, on average, 11 years of combined technical experience, so the low and high endpoints of the two lines representing the response functions containing the measure of aggregate technical experience were set at 0 and 28 (0 and the mean plus two standard deviations, respectively). The low and high endpoints of the lines representing the response functions containing the proportional measure of technical experience were set at 0 and 5.6 (0 and the mean plus two standard deviations, respectively). The intercepts are both lower when R&DCOOP = '1', but the slopes increase much faster than when R&DCOOP = '0', indicating that management teams seemed to complement their existing levels of technical expertise through the use of R&D cooperative arrangements. In other words, it appears that R&D cooperative arrangements were best used in instances where the founding management team was relatively well versed in the technical aspects of their business. Furthermore, Figure 2(b) suggests that the use of R&D cooperative activities were especially advantageous when a relatively large proportion of the management team possessed technical experience. In any event, the results support Hypothesis 2.

Regression results used to test the final hypothesis are contained in Table 6. As with the two previous subsamples, the year of incorporation coefficient was significant ($p < 0.05$). This hypothesis predicted that the use of manufactur-

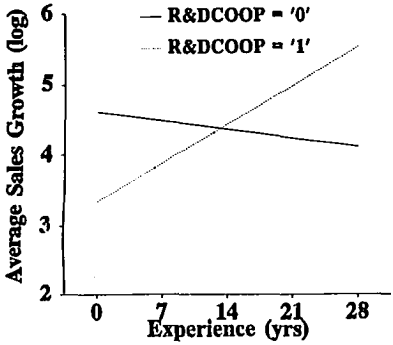

Figure 2a. Interaction effects of R&D cooperative arrangements and experience on performance.
Note: Experience = the adjusted summation of total years of R & D experience possessed by the members of the management team. n = 92.

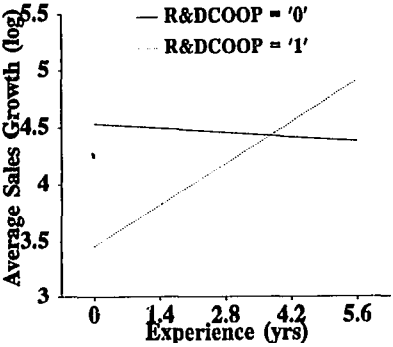

Figure 2b. Interaction effects of R&D cooperative arrangements and experience on performance
Note: Experience = the adjusted summation of total years of R & D experience possessed by the members of the management team divided by the number of managers. n = 92.

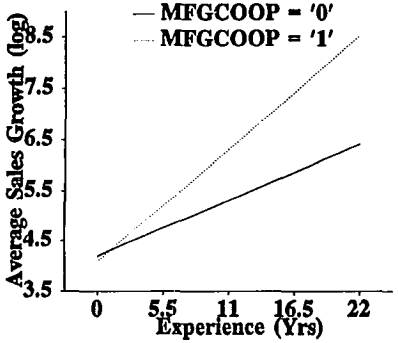

Figure 3a. Interaction effects of manufacturing cooperative arrangements and experience on performance.
Note: Experience = the adjusted summation of total years of manufacturing experience possessed by the members of the management team. n = 47.

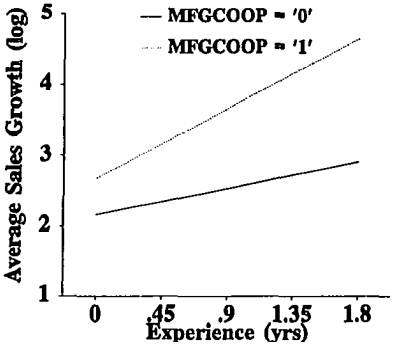

Figure 3b. Interaction effects of manufacturing cooperative arrangements and experience on performance
Note: Experience = the adjusted summation of total years of manufacturing experience possessed by the members of the management team divided by the number of managers. n = 47.

ing cooperative arrangements would be associated with higher average sales growth of ventures competing through cost leadership and whose management teams possessed relatively more production experience. This relationship was supported since the coefficients for the two interaction terms in Models 3c and 3e were both significant ($p < 0.05$).

Figure 3 reveals that the use of cooperative arrangements is positively associated with performance in nearly all cases. However, performance was substantially higher when the management teams possessed relatively more production experience. The management teams of those ventures competing through cost leadership possessed, on average, 7.2 years of combined manufacturing experience, so the low and high endpoints of the two lines representing the

response functions containing the measure of aggregate production experience were set at 0 and 22 (0 and the mean plus two standard deviations, respectively). The low and high endpoints of the lines representing the response functions containing the proportional measure of production experience were set at 0 and 1.8 (0 and the mean plus two standard deviations, respectively). The intercept in Figure 3(a) is slightly higher when MFGCOOP = '0', but the slope increases much faster when MFGCOOP = '1' suggesting that manufacturing cooperative activities were associated with higher sales performance in all instances except those in which the management team was relatively very inexperienced in the area of manufacturing. However, the use of manufacturing cooperative arrangements was associated with higher performance in all cases when a relatively large proportion of the management possessed production experience (Figure 3b). So, the final hypothesis was supported since it appears that manufacturing cooperative arrangements were best used in instances where the founding management team was relatively more knowledgeable about the production aspects of their business. This was especially true when more of the venture's managers possessed prior production experience.

DISCUSSION

Overall, the results of this study support our central argument that new high-technology ventures, whose management teams possessed more functional experience in the area most closely linked to their choice of competitive strategy, were more successful in their cooperative activities chosen to support that strategy. Taken together, these findings suggest that firms benefit from more experienced managers who better understand what they don't know and what they might learn from cooperation.

In the case of firms emphasizing marketing differentiation, marketing cooperative arrangements were positively associated with the average sales performance. Moreover, the relationship between higher sales growth and marketing cooperative behavior was consistently stronger when the venture's management team possessed relatively more marketing experience. This result suggests that cooperative marketing activities were beneficial regardless of the experience of the new venture's managers, but were the most beneficial when managers had more extensive marketing experience. Perhaps marketing is an activity where cooperation is always useful as a way to find additional customers, new channels of distribution, etc., but more experienced marketing managers can best take advantage of such opportunities.

Second, our examination of the relationship of R&D cooperative activities, and R&D experience in firms emphasizing technical differentiation, provided an intriguing result. In this case, firms with inexperienced technical managers pursuing cooperative R&D activities actually had worse performance. Only firms with relatively experienced managers saw benefits from collaboration.

We can speculate on several reasons for this finding that may provide useful guidance to future research. First, this result may be unique to high-technology industries. In such industries, R&D capabilities are almost by definition 'core competencies' (Prahalad and Hamel, 1990) that are key to developing competitive advantage. Furthermore, Hamel (1991) has suggested that interfirm cooperation may be one way to acquire such competencies through organization learning. However, based on case research of international alliances, Hamel (1991) also found that not all partnering firms are equally adept at such learning. Taking advantage of learning opportunities may be especially difficult in industries involving complex and rapidly changing technologies. If new ventures in this industry with inexperienced managers attempt to gain additional capabilities through cooperation but do not 'know what they don't know' they may only succeed in giving away rather than gaining technological skills and capabilities. Reich and Mankin (1986) have argued that this has been often the case between U.S. and Japanese partners.

Size of the firm may also play a role here. We did not have complete data on the size of the partner firms for these new ventures, but in many cases smaller new ventures were cooperating with more established larger competitors. Perhaps these larger more experienced partners can more easily capture the technical skills of inexperienced R&D managers without giving much in return.

Finally, this result may also be explained by

the nature of the technological innovation process. The process of developing new technologies is highly uncertain and investments in technology or investments in collaboration about technology are inherently risky. Perhaps only experienced technology managers in these firms were equipped to deal with such uncertainty and made better choices about risky R&D investments in order to improve firm performance.

In the case of firms emphasizing cost leadership strategies and using manufacturing cooperative activities, results were similar to the marketing subsample; i.e., cooperative arrangements were increasingly beneficial over the range of manager experience. Again we can speculate as to why the manufacturing subsample results were more similar to the marketing subsample rather than the technical differentiation group. Again, firm size may play a role here. Many of the cooperative manufacturing arrangements involved the new venture contracting for manufacturing from larger assembly firms. In a sense, the new ventures outsourced their manufacturing in order to take advantage of the greater economies of scale that larger assemblers provided, much like the marketing arrangements that often involved larger partners with more extensive distribution channels or marketing programs. Inexperienced new venture managers involved in such relationships were not likely to hurt their firms, but the more experienced managers were better able to take advantage of such relationships.

Together, the results lend support to the strategic behavior approach of explaining the effectiveness of cooperative behavior. Further analysis suggests that firms whose management teams were presumably more knowledgeable about the various aspects of their firm's choice of competitive strategy were better able to identify the potential risks and benefits of engaging in various functional cooperative activities and better able to position their respective firms *vis-à-vis* their less experienced counterparts given the firm's choice of competitive strategy.

Transaction cost theory also lends itself to the interpretation of the results of this study. Transaction costs generally rise as the level of uncertainty and the need to acquire transaction-specific assets increases. On the other hand, transaction costs will decrease if managers are more certain about the circumstances surrounding the transaction contracts. The findings of this research indicate that relatively more experienced managers may be better able to lower the costs associated with market transactions since those managers are more knowledgeable about the functional areas in which the cooperative activities occurred. However, because this study's research design did not explicitly address reductions in transaction costs, this argument is somewhat tentative.

Although this analysis is only preliminary, it does present some interesting implications for practicing new venture managers. For example, this study suggests that when an entrepreneur is putting together a management team, or when an existing team is considering pursuing cooperative opportunities, special consideration should be given to the functional experience of the venture's managers. In particular, in order to gain much advantage from cooperative relationships, firms need to be sure they have the functional skills to match the type of relationship being considered. It does not appear that inexperienced managers can expect to 'learn' much through cooperation. As Hamel (1991) suggested, with an increasing emphasis being placed on skill-based competition, all firms need to look at alliances as a means for skill acquisition, and our study suggests that it takes experienced managers to know which skills to acquire through the relationship and how to benefit from those skills. More importantly, for firms in high-technology industries considering cooperative activities concerning technology, inexperienced technology managers may actually damage firm performance by letting more experienced partners capture technical skills and knowledge which form the basis for their competitive advantage. Whereas in the case of marketing and manufacturing cooperation, it appears that inexperience doesn't necesarily directly hurt performance, but it may prevent firms from fully taking advantage of cooperation.

This study also has a number of limitations. The use of the IPO documents served as an effective means of obtaining a wide array of data on new ventures. However, the use of such documents also limits the types of ventures examined and the type of data analyzed. Consequently, only new ventures attempting to go public were studied and measurements of the independent variables were fairly coarse grained. Some ventures, for example, may choose to remain private, so a potentially important set of

firms may have been omitted from the study. Also, the data collected did not allow for explicit examination of the intentions of the new high-technology venture managers. In the future, research using primary data collection techniques such as interviews or questionnaires should be conducted to examine the intended use of cooperative arrangements.

CONCLUSIONS

These findings suggest that the answer to the stated research question is, for marketing and manufacturing cooperative activities, new ventures usually benefit. But those with experienced managers benefit more. For technology cooperation, it is really important to know what you don't know because it may really hurt you. Exactly why this is the case could not be tested directly using the data from this study, but one obvious hypothesis is that because experienced managers better understand what they can learn and/or lose from cooperation, they are therefore better positioned to take advantage of such activities. Additional research using primary data from new venture managers should be used to study this question further.

Research examining the actual intentions of new venture managers would provide much greater insight into why new ventures engage in cooperative activities and what goals are specifically targeted (i.e., cost reduction or profit maximization).

Finally, this study suggests that both the strategic behavior and transaction cost approaches are useful frameworks for analyzing the cooperative behavior of new high-technology ventures. Understanding the costs and benefits of such arrangements will continue to be an important area of research and of interest to practitioners.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the financial support provided to this project by the University of Georgia Research Foundation and the Center for Entrepreneurial Studies at New York University. The prospectuses used in this study are part of the Terry College of Business Initial Public Offering Database.

REFERENCES

Arnold, H. J. (1982). 'Moderator variables: A clarification of conceptual, analytic, and psychometric issues', *Organizational Behavior and Human Behavior*, **29** (2), pp. 143–174.

Barney, J. (1986). 'Strategic factor markets: Expectations, luck, and business strategy', *Management Science*, **32**, pp. 1231–1241.

Barney, J. (1991). 'Firm resource and sustained competitive advantage', *Journal of Management*, **17**, pp. 99–120.

Biggadike, E. R. (1976). 'Corporate diversification, entry, strategy and performance'. Unpublished dissertation, Harvard University.

Borys, B. and D. B. Jemison (1989). 'Hybrid arrangements as strategic alliances: Theoretical issues in organizational combinations', *Academy of Management Review*, **14** (2), pp. 234–249.

Brokaw, L. (March 1993). 'The truth about start-ups'. *Inc.*, pp. 56–64.

Cohen, J. and P. Cohen (1975). *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. Erlbaum, Hillsdale, NJ.

Covin, J. G. and D. P. Slevin (1989). 'Strategic management of small firms in hostile and benign environments', *Strategic Management Journal*, **10** (1), pp. 35–47.

Darrow, A. L. and D. R. Kahl (1982). 'A comparison of moderated regression techniques considering strength of effect', *Journal of Management*, **8**, pp. 35–47.

Dollinger, M. and P. Golden (1992). 'Interorganizational and collective strategies in small firms: Environmental effects and performance', *Journal of Management*, **18**, pp. 695–715.

Fast, N. D. (1981). 'Pitfalls of corporate venturing', *Research Management*, **24** (2), pp. 21–24.

Feeser, H. R. and G. E. Willard (1990). 'Founding strategy and performance: A comparison of high and low growth high-tech firms', *Strategic Management Journal*, **11** (2), pp. 87–98.

Forrest, J. E. (July 1990). 'Strategic alliances and the small technology-based firm', *Journal of Small Business Management*, pp. 37–45.

Galaskiewicz, J. (1985) 'Interorganizational relations', *Annual Review of Sociology*, **11**, pp. 87–98.

Govindarajan, V. (1988). 'A contingency approach to strategy implementation at the business-unit level: Integrating administrative mechanisms with strategy', *Academy of Management Journal*, **31** (4), pp. 828–853.

Govindarajan, V. (1989). 'Implementing competitive strategies at the business unit level: Implications of matching managers to strategies', *Strategic Management Journal*, **10** (3), pp. 251–269.

Gupta, A. K. and V. Govindarajan (1984). 'Business unit strategy, managerial characteristics, and business unit effectiveness of strategy implementation', *Academy of Management Journal*, **27**, pp. 25–41.

Gupta, A. K. and V. Govindarajan (1986). 'Resource sharing among SBUs: Strategic antecedents and

administrative implications', *Academy of Management Journal*, **29**, pp. 695–714.

Hamel, G. (1991). 'Competition for competence and inter-partner learning within international strategic alliances', *Strategic Management Journal*, Summer Special Issue, **12**, pp. 83–103.

Hitt, M. A., R. D. Ireland and K. A. Palia (1982). 'Industrial firm's grand strategy and functional importance: Moderating effects of technology and uncertainty', *Academy of Management Journal*, **25**, pp. 265–298.

Holsti, O. R. (1969). *Content Analysis for the Social Sciences and Humanities*. Addison-Wesley, Reading, MA.

Jarillo, J. C. (1989). 'Entrepreneurship and growth: The strategic use of external resources', *Journal of Business Venturing*, **4**, pp. 133–147.

Kogut, B. (1988). 'Joint ventures: Theoretical and empirical perspectives', *Strategic Management Journal*, **9**(4), pp. 319–332.

Littler, D. and R. C. Sweeting (1990). 'The management of new technology based businesses: The existentialist firm', *Journal of Management Science*, **13** (3), pp. 231–240.

Marino, K. E., R. M. Castaldi and M. J. Dollinger (1989). 'Content analysis in entrepreneurship research: The case of initial public offerings', *Entrepreneurship: Theory and Practice*, **15** (1), pp. 51–66.

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

Miles, R. E. and C. C. Snow (1978). *Organizational Strategy, Structure, and Process*. McGraw-Hill, New York.

Mosakowski, E. M. (1991). 'Organizational boundaries and economic performance: An empirical study of entrepreneurial computer firms', *Strategic Management Journal*, **12** (2), pp. 115–133.

National Science Board (1987). *Science and Engineering Indicators—1987*. U.S. Printing Office, Washington, DC.

Neter, J., W. Wasserman and M. H. Kutner (1990). *Applied Linear Statistical Models* (3rd edn.). Irwin, Homewood, IL.

Oliver, C. (1990). 'Determinants of interorganizational relationships: Integration and future directions', *Academy of Management Review*, **15** (2), pp. 241–265.

Porter, M. E. (1980). *Competitive Strategy*. Free Press, New York.

Porter, M. E. and M. B. Fuller (1986). 'Coalitions and global strategy'. In M. E. Porter (ed.), *Competition in Global Industries*. Harvard Business School Press, Boston, MA, pp. 315–344.

Prahalad, C. K. and G. Hamel (May–June 1990). 'The core competence of the corporation', *Harvard Business Review*, pp. 71–91.

Reich, R. and E. Mankin (March–April 1986). 'Joint ventures with Japan give away our future', *Harvard Business Review*, **2**, pp. 78–86.

Rothwell, R. (1991). 'External networking and innovation in small and medium-sized manufacturing firms in Europe', *Technovation*, **11** (2), pp. 93–112.

Rumelt, R. (1991). 'How much does industry matter?', *Strategic Management Journal*, **12** (3), pp. 167–185.

Schoonhoven, C. B. (1981). 'Problems with contingency theory: Testing assumptions hidden with the language of contingency theory', *Administrative Science Quarterly*, **26**, pp. 349–377.

Shan, W. (1990). 'An empirical analysis of organizational strategies by entrepreneurial high-technology firms', *Strategic Management Journal*, **11** (2), pp. 129–139.

Smith, N. R., J. S. Bracker and J. B. Miner (1987). 'Correlates of firms and entrepreneur success in technologically innovative companies', *Frontiers of Entrepreneurship Research*. Babson College Press, Wesley, MA, pp. 57–71.

Snow, C. C. and L. G. Hrebriniak (1980). 'Strategy, distinctive competence, and organizational performance', *Administrative Science Quarterly*, **25**, pp. 307–335.

Thomas, A. S., R. J. Litschert and K. Ramaswamy (1991). 'The performance impact of strategy–manager coalignment: An empirical examination', *Strategic Management Journal*, **12** (7), pp. 509–522.

U.S. Department of Commerce, International Trade Administration (1983). *An Assessment of U.S. Competitiveness in High Technology Industries*. Government Printing Office, Washington, DC.

Weiss, L. A. (1981). 'Start-up businesses: A comparison of performance', *Sloan Management Review*, **23** (1), pp. 37–53.

Williamson, O. (1975). *Markets and Hierarchies, Analysis and Antitrust Implications: A Study in the Economics of Internal Organizations*. Free Press, New York.