

RESEARCH NOTES AND COMMENTARIES

HOW DYNAMICS, MANAGEMENT, AND GOVERNANCE OF RESOURCE DEPLOYMENTS INFLUENCE FIRM-LEVEL PERFORMANCE

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To help understand how firms develop and maintain dynamic capabilities, we examine the effects of the dynamics, management, and governance of R&D and marketing resource deployments on firm-level economic performance. In a sample of technology-based entrepreneurial firms, we find that a history of increased investments in marketing is an enduring source of competitive advantage. We also find that managers' firm-specific experience positively moderates the relationship between R&D deployment intensity and economic returns. In addition, institutional ownership boosts economic returns from marketing deployments by subjecting these deployments to increased scrutiny and by sending positive signals to the market about the firm. Copyright © 2005 John Wiley & Sons, Ltd.

Firms differ significantly in their efforts in developing resources and dynamic capabilities, which may have effects on firm-level economic performance (Helfat, 1994; Henderson, 1994). Because resource deployments are converted into rent-generating dynamic capabilities over time, understanding the role of *history* of investments can offer fundamental insights for uncovering the relationship between firm-level dynamic capabilities and superior economic performance. Two firms

with similar current investment strategies may differ in economic performance if one firm also has a history of increased levels of resource deployments. Understanding how firms develop and renew rent-generating dynamic capabilities requires a test of the dynamics of resource deployments over time.¹

Examining how firms develop and maintain firm-level capabilities requires research attention to both *how much* firms invest and how effectively these strategic investments are *managed* and *governed*. Penrose's (1959) resource-based approach suggests a potentially important causal link between top managers' knowledge of the

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¹ In the current paper, the concepts of resource deployments and investments are used equivalently.

firm's resources and capabilities and the superior resource allocation decisions that are unique to each firm. Penrose (1995) also emphasizes that the neglect of agency problems in modern corporations can jeopardize the efficient and innovative processes of resource deployments for building dynamic capabilities. Thus, this empirical paper examines the influence of both management and corporate governance factors on resource deployments in R&D and marketing. Focusing on entrepreneurial firms that completed an initial public offering (IPO), this paper analyzes the impact of firm-specific managerial knowledge and institutional investor ownership on the stock market-based measure of firm-level economic performance.

This paper offers at least three contributions to the strategic management field. First, by focusing on the history of dynamics in resource deployments, this paper highlights and examines the role of path dependency in investments leading to development and maintenance of innovation and marketing capabilities. Second, this paper reveals the role of top management experience on effective deployment of R&D investments. Third, this paper demonstrates the guardianship roles of institutional investors for marketing investments that are potentially more subject to agency problems than R&D investments.

HISTORY OF RESOURCE DEPLOYMENTS

Investments in R&D and marketing constitute *tangible efforts* to build and maintain innovative and marketing capabilities, and firms often differ significantly in the intensity of such tangible efforts (Hill and Snell, 1988; Mosakowski, 1993). The history of resource deployments can be especially important if an entrepreneurial firm's strategic intent is to develop a distinctive innovative capability. The development of R&D processes and organizational routines is evolutionary (Nelson and Winter, 1982), and substantive early investments in R&D capability may produce superior absorptive capacity (Cohen and Levinthal, 1990; Lieberman, 1989). A firm's absorptive capacity for assimilating new information and knowledge is modified through path-dependent processes of human and material resource interactions, and the firm's absorptive capacity is limited by the current

knowledge endowment of the firm (Cohen and Levinthal, 1990; Penrose, 1959). Firms with interrupted past investments may have a smaller and weaker knowledge endowment and consequently a more limited learning capacity at a given point in time. Firms with a history of increased efforts in developing technological know-how over time may gain a strategic competitive advantage over their counterparts that show weak commitment to intense resource deployments (Kor, 2001).

Similarly, an overall marketing capability involves knowledge of and care for current and future needs and wants of customers, informative and differentiating advertising, and commitment to customer service (Mosakowski, 1993), which typically requires persistent and timely investments in marketing. The endowment of investments in marketing and distribution serves as an isolating mechanism (Mahoney and Pandian, 1992), affects a firm's likelihood and timing of entry into emerging markets (Lieberman and Montgomery, 1988; Mitchell, 1989), and makes it more costly and difficult for outsiders to enter the market (Thomas, 1996). Development of an overall marketing capability and brand equity may require augmented investments in marketing for multiple years (Batra *et al.*, 1995). A firm's history of past investments can have continued economic value for the firm in the present and future because these investments help the firm *learn and absorb new knowledge* more efficiently. Thus, a history of increased efforts to build capabilities will have a synergistic effect (or positive spillover effect) on the current economic firm-level performance.

Hypothesis 1a: Firms with a history of increased resource deployments in R&D will achieve superior economic firm-level performance than firms that lack such deployments.

Hypothesis 1b: Firms with a history of increased resource deployments in marketing will achieve superior economic firm-level performance than firms that lack such deployments.

MANAGEMENT AND GOVERNANCE OF RESOURCE DEPLOYMENTS

To identify the impact of R&D strategies on economic performance, it is important to know not only *how much* is spent but also *how* effectively

R&D is deployed (Ettlie, 1998; Schoonhoven, Eisenhardt, and Lyman 1990). This empirical paper thus focuses on the influence of management and corporate governance on the success of resource deployments.

Resource-based theory maintains that managers' firm-specific experience involving tacit knowledge of a firm's resources and capabilities allows managers to make more informed resource allocation decisions that are unique to each firm. Compared to managers who are relatively new to the firm, managers with firm-specific experience are more likely to envision a superior 'subjective opportunity set for the firm' (Penrose, 1959) because these managers have experience-based and often tacit knowledge of existing firm-level capabilities and organizational routines. Because managers with firm-specific knowledge can assess more precisely which opportunities emerging in the environment fit better dynamically with internal firm strengths and weaknesses, these managers know better which opportunities to pursue.

Intimate knowledge of the firm and its organizational capabilities can be critical in the effective allocation of limited financial and human resources of entrepreneurial firms among competing R&D projects. A strategic manager with tacit knowledge of employee skills and interests can more precisely assess the likelihood of success among multiple avenues of R&D investments and thus dedicate resources to high-margin R&D projects in which the firm is more likely to achieve sustainable competitive advantage. Also, managers' knowledge of employees enables these managers to match more effectively employee skills to jobs and employees to each other in team settings (Prescott and Visscher, 1980). Superior matching of employee skills to R&D projects and teams typically boosts the productivity of R&D investments in creating dynamic capabilities and sustainable competitive advantage. Further, managers' experience with firm's products and technology may be critical for efficient and effective deployment of resources to build superior relationships with customers and distributors (Kor, 2003). While prior management experience in the industry may be helpful, it is not a sufficient substitute for tacit managerial knowledge of *firm-specific* relationships between the firm and its buyers. Accordingly, we posit:

Hypothesis 2a: As the executives' firm-specific experience increases, firms will achieve higher economic returns from R&D investments.

Hypothesis 2b: As the executives' firm-specific experience increases, firms will achieve higher economic returns from marketing investments.

While resource-based theory sheds light on appropriate management of a firm's resources, agency theory deals with the proper governance of resource decisions. In public corporations, positive agency theory (Fama and Jensen, 1983; Jensen and Meckling, 1976) indicates potential conflict of economic interest between owners and managers as their agents. In the absence of a proper mix of corporate governance mechanisms (Sundaramurthy, 1996), economic resources of the firm may be deployed inappropriately, and the quality of resource deployment decisions may suffer. Resource-based theory has neglected the potential presence of the agency problem (Penrose, 1995), which may impede sufficient consideration of an efficient deployment of resources and capabilities (Kor and Mahoney, 2000).

In the empirical context of this paper (i.e., in the context of technology firms that have completed an initial public offering), ownership by institutional investors constitutes one of the more visible forms of corporate governance. The ownership structure of entrepreneurial IPO firms receives close attention from the business press and the stock market, and the presence of institutional owners is interpreted as a market signal of the credibility of new business ventures. Unlike other forms of governance where it is more difficult to assess the governance effectiveness (e.g., the independence and objectivity of boards), both product and capital markets can readily observe institutional investor ownership.

Institutional investors can provide effective monitoring and governance because their block ownership and large voting power make it easier and more economically rewarding to influence a firm's strategic decisions (Sundaramurthy, 1996). Institutional owners' overall positive effect on a firm's financial performance (McConnell and Servaes, 1990) may partly be driven by *adoption of proper resource deployment strategies*, particularly in the business context of high-technology entrepreneurial firms. Unlike managers, institutional investors may not become involved in specific

R&D decisions such as allocation of funds among competing projects. However, institutional investors may have an indirect positive influence on the economic returns from R&D because managers arguably act more in the economic interest of shareholders in R&D-related decisions when these managers are under the surveillance of institutional guardians. This agency theory argument is consistent with empirical evidence that institutional investor ownership is positively related to R&D spending (David, Hitt, and Gimeno, 2001; Hoskisson *et al.*, 2002). However, these empirical studies indicate direct effects of institutional investors on returns to R&D intensity, whereas we focus on the *moderating effects* of institutional ownership on the returns to resource deployments.

The presence of institutional investors may be particularly important for the deployment of resources towards building a rent-generating marketing capability. When monitored by institutional investors, managers may be less likely to use marketing investments to pursue nonprofit-maximizing goals such as aggressive sales growth at the expense of future profitability. Also, institutional investors may contribute to the success of marketing deployments by improving the legitimacy of the entrepreneurial firm in the eyes of institutional customers and distributors. Because financial backing of institutional investors is a positive indicator of credibility, stability, and higher survival rates for entrepreneurial firms (Brav and Gompers, 1997; Megginson and Weiss, 1991), customers may be more comfortable in purchasing new, high-technology products from firms with such financial backing. Thus, institutional investor ownership amplifies the positive economic returns from both R&D and marketing deployments.

Hypothesis 3a: As the institutional investor ownership increases, firms will achieve higher economic returns from R&D investments.

Hypothesis 3b: As the institutional investor ownership increases, firms will achieve higher economic returns from marketing investments.

METHODS AND RESULTS

Sample and variables

The empirical data set for this research paper consists of 60 technology-based entrepreneurial

firms that completed an initial public offering in the medical, surgical, and dental instruments industry (SIC = 384) between 1990 and 1995. We collected data on these firms until 1999. We gathered data on investments, management, and governance from prospectus and proxy statements, and we compiled stock market-based performance data from Compustat files.

For the dependent variable, we use a proxy for Tobin's q as a stock market-based measure of firm-level economic performance. As a dynamic, forward-looking measure of firm-level economic performance, Tobin's q reflects the stock market's expectations about the future growth and profitability potential of the company (Montgomery and Wernerfelt, 1988). A stock market-based measure is appropriate in assessing the moderating role of corporate governance on economic returns to resource deployments, where the focus is economic value creation for shareholders. Tobin's q is defined as the ratio of market value of the firm to the replacement cost of its assets, where the extent to which q is greater than one indicates how much economic value a firm creates for shareholders (Montgomery and Wernerfelt, 1988). As a proxy for Tobin's q , we use the ratio of sum of (1) market value of equity and (2) book value of total debt to the book value of total assets. There are more complex measures of Tobin's q that try to capture the replacement value of firm's assets; however, these approaches may induce sample selection bias as a result of data unavailability (DaDalt, Donaldson, and Garner, 2003).

Percentage increase in R&D (or marketing) deployments captures the magnitude of changes in a firm's resource deployments over multiple years. After conducting an in-depth examination of all prospectuses about the discovery process and timing of new product development, it became clear that, in this industry, R&D investments convert into revenue-generating products typically within a period of 3 years. We also project that marketing investments to build a strong brand name and close relationships with customers and distributors have economic performance effects longer than 1 year (Batra *et al.*, 1995). Accordingly, to capture the historical dynamics in investment levels, we calculate the average percentage increase in R&D (and marketing) investments during the previous 3 years. This continuous measure captures relative magnitude of the changes in the *level of dollar investments* in R&D and marketing over 3 years.

Top management firm-specific experience is measured as average firm tenure (i.e., the number of years that managers spent in a particular firm) of the top managers. *Institutional investor ownership* is calculated as the total percentage of ownership by institutional investors (e.g., pension funds, mutual funds, insurance companies, investment firms, venture capital firms) (Mahoney, Sundaramurthy, and Mahoney, 1997).

Based on prior empirical research in the corporate governance and resource deployments literature (e.g., Mahoney *et al.*, 1997; Mosakowski, 1993), we controlled for firm size (total assets), firm age (years since incorporation), separation of CEO and chairperson positions, the ratio of outsider directors on the board, and the stock ownership percentage of top managers. The ratio of outsider directors is calculated as the proportion of outside directors appointed before the current CEO took office. The management stock ownership variable is calculated as the total percentage of common stock owned by the top executives (Mahoney *et al.*, 1997).

Resource deployment intensity, which we use both to calculate the interaction variables and as

control variables, is measured separately for R&D and marketing deployments. Investment intensity variables can be calculated as the level of investments divided by the firm's sales, assets, or number of employees (Ettlie, 1998). We standardize investments by total assets because some firms do not have sales in the early years of product development. Table 1 presents descriptive statistics, and Table 2 presents the results of the regression analysis.

Analysis and results

The hypotheses presented in this research paper are tested using repeated observations on the same set of cross-sectional units. A random effects model is used to analyze the panel data because the alternative dummy approach is costly in degrees of freedom lost. In our sample, Hausman's test for orthogonality of the random effects (Greene, 2000) indicates that estimation results of dummy and random effects are consistent, and individual effects are uncorrelated with the other variables in the model.

Table 1. Descriptive statistics and correlations

Variables	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11
1. Tobin's q_t	3.74	3.42											
2. % Increase in R&D deployments _(t-1,t-3)	0.42	0.53	0.04										
3. % Increase in marketing deployments _(t-1,t-3)	0.79	1.37	0.20	0.31									
4. Firm-specific experience of top managers _{t-1}	6.52	3.42	-0.07	-0.25	-0.24								
5. Institutional investor ownership % _{t-1}	0.22	0.20	-0.01	-0.03	0.02	-0.11							
6. Management ownership % _{t-1}	0.15	0.15	0.05	0.00	-0.05	0.35	-0.31						
7. Separate CEO-chair _{t-1}	0.51	0.50	0.06	-0.08	0.10	-0.01	0.30	-0.01					
8. Board outsiders ratio _{t-1}	0.25	0.28	0.00	-0.09	0.06	-0.42	0.27	-0.42	0.27				
9. Total assets _{t-1}	0.10	0.23	-0.01	0.13	-0.05	0.41	0.11	-0.02	-0.09	-0.20			
10. Firm age _{t-1}	10.65	6.57	-0.18	-0.22	-0.25	0.47	-0.28	0.11	-0.08	-0.16	0.07		
11. R&D deployment intensity _{t-1}	0.16	0.19	0.37	0.13	0.07	-0.21	0.25	-0.17	0.14	0.18	-0.11	-0.09	
12. Marketing deployment intensity _{t-1}	0.46	0.37	0.25	-0.09	-0.03	-0.08	0.12	-0.16	0.01	0.15	-0.09	0.05	0.76

$n = 218$ for all variables. Total assets are in billions of U.S. dollars.

Correlations greater than 0.13 are significant at $p < 0.05$, and those greater than 0.17 are significant at $p < 0.01$.

Table 2. Random effects GLS regression analysis of effects of resource deployments on Tobin's q

	Model 1	Model 2	Model 3	Model 4
% Increase in R&D deployments _(t-1,t-3)	-0.39	-0.31	-0.25	-0.38
% Increase in marketing deployments _(t-1,t-3)	0.34 ⁺	0.21	0.22	0.28
Firm-specific experience of top managers _{t-1}	0.00	0.00	0.12	-0.07
Institutional investor ownership % _{t-1}	-2.11 ⁺	-2.11 ⁺	-5.41 ^{**}	-6.02 ^{**}
Management ownership % _{t-1}	1.78	1.99	1.44	2.15
Separate CEO chair _{t-1}	-0.04	-0.67	-0.37	-0.63
Board outsiders ratio _{t-1}	0.07	0.72	0.71	0.70
Total assets _{t-1}	0.06	-0.29	-0.13	-0.36
Firm age _{t-1}	-0.11 ⁺	-0.11 ⁺	-0.12 [*]	-0.11 [*]
R&D intensity _{t-1}	6.40 ^{**}	-3.15	9.14 ⁺	-1.75
Marketing intensity _{t-1}	0.74	2.39	-1.76	-2.67
R&D intensity _{t-2}	0.10			
Marketing deployment intensity _{t-2}	-0.11			
R&D deployment intensity _{t-3}	-0.84			
Marketing deployment intensity _{t-3}	0.60			
R&D intensity _{t-1} * Firm-specific experience _{t-1}		1.81 [*]		1.90 [*]
Marketing intensity _{t-1} * Firm-specific experience _{t-1}		-0.28		-0.05
R&D intensity _{t-1} * Institutional investor ownership % _{t-1}			-13.87	-6.93
Marketing intensity _{t-1} * Institutional investor ownership % _{t-1}			10.35 ⁺	11.27 [*]
Intercept	2.87 [*]	3.85 ^{***}	3.86 ^{***}	3.82
R ²	0.28	0.20	0.22	0.25
Wald chi-square	52.32 ^{***}	61.86 ^{***}	59.33 ^{***}	68.5 ^{***}

Values are unstandardized regression coefficients; $n = 177$ for Model 1, $n = 218$ for Models 2–4.

⁺ $p < 0.10$; ^{*} $p < 0.05$; ^{**} $p < 0.01$; ^{***} $p < 0.001$

As shown in Model 1 of Table 2, the variable of percentage increase in *marketing* deployments is statistically significant ($p < 0.10$); therefore, Hypothesis 1b is supported. Models 2–4 present the analysis of moderating effects, where centered values of continuous independent variables are used because of the presence of multiplicative interaction terms. In support of Hypothesis 2a, firm-specific experience of top managers has a positive moderating effect on economic returns from R&D (Model 2). Further, in support of Hypothesis 3b, Model 3 indicates that the percentage of institutional ownership positively moderates the relationship between marketing deployment intensity and firm-level economic performance. These two moderating effects are also statistically significant when all interaction variables are included in Model 4.

DISCUSSION AND CONCLUSIONS

We argued that both the historical dynamics and the management and governance of resource deployments influence the economic performance consequences of firms' technology and marketing-related investments. We find that, after controlling

for yearly investment intensities, a history of increased marketing investments over a 3-year period results in an additive, synergistic effect on current firm-level economic performance. The stock market projects that past efforts in development and maintenance of relationships with the buyers contribute significantly to the strength of the current marketing capabilities in generating superior stockholder returns. Thus, with regard to marketing deployments in the medical and surgical instruments industry, a history of increased efforts for developing and maintaining marketing capabilities is an *enduring source of competitive advantage*.

Empirical evidence also shows that, regardless of the recent past resource deployment dynamics of the firm, competitive advantage from R&D investments erodes quickly. Empirical results almost certainly have face validity in the light of the history of global competition, where among the leading U.S., European, and Asian companies only those firms with intense R&D investments were able to attain sustainable competitive positions (Franko, 1989). Essentially, if existing R&D capabilities are not renewed, in a high-velocity business world of time-based competition where players are in a

highly competitive race to deliver superior value to customers, economic rents from prior firm-level capabilities dissipate rapidly.

In addition, the positive moderating effect of management experience on R&D deployments suggests that R&D investments are better managed when strategic managers possess firm-specific knowledge of resources and dynamic capabilities. The stock market reaction suggests a commonly held view that a manager with tacit knowledge of employee skills and interests can more accurately dedicate funds to high-margin R&D projects and also can do a superior job of matching of employee skills to R&D projects, resulting in superior economic performance. This empirical finding corroborates the resource-based view that managers play a crucial catalyst role in the conversion of resources into rent-generating dynamic capabilities (Mahoney, 1995; Penrose, 1959).

Furthermore, our research findings corroborate the view that institutional investors play a guardian role for the IPO firms' marketing investments that are more subject to agency problems than R&D investments. Under low levels of institutional ownership, marketing deployments can potentially be used for non-profit-maximizing goals such as boosting market share in the short term through aggressive promotions to distributors. In the case of IPO firms, institutional ownership sends a positive market signal to both potential and existing clients of the firm about the credibility of the firm and the quality of the firm's products and services. These positive market signals can be critical to the economic success of entrepreneurial firms due to the high level of uncertainty about future economic performance of new ventures and new products.

In conclusion, we have shown that a history of increased efforts and dynamics, and effective management and governance of resource deployments, increase economic returns. Future research that examines the generalizability of these empirical findings and uncovers industry-specific relationships between resource deployments and firm-level economic performance looks quite promising.

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