

REVISITING BURNS AND STALKER: FORMAL STRUCTURE AND NEW VENTURE PERFORMANCE IN EMERGING ECONOMIC SECTORS

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This study examines the effects of formal structure on the performance of new ventures in the emergent Internet sector during the years 1996–2001. Burns and Stalker (1961) argued that in dynamic economic sectors, firms with organic structures are more effective than those with more mechanistic structures. We suggest this proposition does not hold for new ventures in turbulent, emergent economic sectors. Building on Stinchcombe's (1965) arguments concerning new ventures' liability of newness, we hypothesize that new ventures with higher founding team formalization, specialization, and administrative intensity outperform those with more organic organizational structures. Results support these hypotheses.

Since the seminal work of Burns and Stalker (1961), researchers have considered the organic organizational form, characterized by a lack of formally defined tasks and an emphasis on horizontal as opposed to vertical coordination to be the exemplar structure for firms operating in turbulent environments. Although past research supports this proposition for large, established firms, is it also true for small, new organizations in turbulent, emerging economic sectors? In this study, we explore the limits of this conventional wisdom by examining how structural features influence performance during the earliest phase of organizational existence in a turbulent setting assumed to be inhospitable to mechanistic structure.

In dynamic contexts, new ventures and large,

mature organizations face fundamentally different structural challenges (Cameron & Quinn, 1983; Gilbert, 2005, 2006; Kimberly, 1979; Shane, 2003). These differences are particularly evident in emergent economic sectors, which are typically characterized by turbulence and uncertainty (Aldrich, 1999; Sine & David, 2003). As a result of embedded formalized roles and routines, functional silos, and administration by managers insulated by multiple bureaucratic layers from the changing realities of the marketplace, large, mature organizations often have difficulty responding to environmental turbulence (Mintzberg, 1978). In contrast, new ventures in emerging sectors initially lack formalized roles and routines and are small, flexible, and innovative; their employees and founding team have frequent interactions with customers. These firms are, in essence, founded as a reaction to opportunities in a changing environment. Instead of needing more flexibility, these organizations suffer from a *structural* "liability of newness" (Stinchcombe, 1965).

Herein lies the puzzle. On the one hand, both theorists and practitioners suggest that in turbulent environments, organizations should become more organic (Burns & Stalker, 1961). On the other hand, in his classic essay, Stinchcombe (1965) argued that one of the key reasons that new organizations in new economic sectors are at a disadvantage vis-à-vis older, established firms is their *lack* of struc-

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ture, which results in role ambiguity and uncertainty. High levels of uncertainty impede individual and organizational action (David & Han, 2003; O'Toole & Meier, 2003). Formalized organizational roles reduce work ambiguity, enable individual focus, learning, and decision making, decrease the cost of coordination, and increase efficiency (Perrow, 1986), all outcomes of vital importance for new ventures with meager resources. Moreover, Stinchcombe (1965) suggested that new ventures in emerging sectors not only need formalization and specialization, but also require greater managerial resources than mature firms. Whereas mature firms are often impeded by intensive administration and the structural inertia of legacy bureaucracies, new ventures need extensive managerial resources and a structural framework to reduce uncertainty and increase organizational efficiency and responsiveness.

To examine these issues, we reviewed classical and contemporary literature on organizational structure. Focusing on three fundamental structural attributes of new ventures—(1) role formalization in founding teams,¹ (2) specialization in founding teams, and (3) administrative intensity—we assessed their relative contributions to firm performance. We explored these questions using a unique sample of Internet firms, all founded in 1996, the year the Internet sector “took off.” We found that where the benefits of flexibility should have been the greatest, among new ventures in a highly turbulent environment, instead embracing basic structural features was positively associated with strong performance.

By examining these questions, this study contributes to theory about organizational design and structure. Our research demonstrates that Burns and Stalker's classic structural theory is contingent on an organization's stage of development; that is, new ventures have different structural requirements than mature organizations (Cameron & Quinn, 1983). Whereas past research on established firms in dynamic contexts indicated that organizations with more organic structures outperformed those with less organic structures, we found the opposite to be true for new ventures. This research also offers entrepreneurs insight into one of their most fundamental tasks: designing organizational architecture (David & Han, 2003; Donaldson, 1995). Although founding teams are typically resource constrained, our results emphasize the importance

of dedicating precious resources to developing formal structure. Finally, this study reinvigorates work on organizational structure that has received less attention since the rise to popularity of the open-system approach to organizations in the 1980s (Scott, 1981). Our analysis suggests the continued relevance of research on organizational structure and the environment to both theorists and practitioners alike.

THEORIES OF STRUCTURE AND PERFORMANCE

Research on formal structure² in organizations harkens back to the very origins of organizational theory. Weber's classic text on bureaucracy proclaimed that the bureaucratic organization, with its clear-cut division of activities, assignment of roles, and hierarchically arranged authority, is “technically superior to all other forms of organization” (1947: 196). According to Weber, the formal structures that made up the modern organization enabled greater precision, speed, task knowledge, and continuity, while reducing friction and ambiguity. Building on Merton (1949) and Durkheim (1997), Burns and Stalker (1961) proposed a contingent relationship between formal structure and organizational performance, arguing that organizations with organic structures, or loosely coupled networks of workers, are better adapted to dynamic environments. Organizations with Weberian mechanistic structure (bureaucracy), where work is “distributed among specialist roles within a clearly defined hierarchy” (Burns & Stalker, 1961: 6), were viewed as more suitable for static environments.

During the past four decades, a host of studies have examined Burns and Stalker's propositions and have generally confirmed that organizations in dynamic environments do better if their structures are more organic (e.g., Aiken, Bacharach, and French [1980]; Covin and Slevin [1989]; but see Wally and Baum [1994] for an exception). The majority of the empirical tests of this theory have used samples of mature organizations.

Despite this strong research tradition, little is known about whether or not this theory applies to newly created ventures in emerging industries.

² The structure of an organization is typically defined as “the sum total of the ways in which it divides its labor into distinct tasks and then achieves coordination among them” (Mintzberg, 1979: 2). Formal structure is “the documented, official relationships among members of the organization,” and informal structure is the “unofficial relationships within the workgroup” (Mintzberg, 1979: 9–10). We focus on formal structure in this paper.

¹ Founding teams are the initial teams that found and manage organizations for the first several years of operations.

Stinchcombe (1965) suggested that the relative lack of structure that characterizes new ventures is a liability, *not* a benefit. He argued that this liability of newness is particularly difficult to overcome in emerging economic sectors that lack industry norms about work processes and organizational design. In this study, we focused on three attributes of new venture structure³: role formalization, specialization, and administrative intensity (Pugh, Hickson, Hinings, MacDonald, Turner, & Lupton, 1963; Stinchcombe, 1965) and their association with new venture performance.

Role Formalization in Founding Teams

Pugh and a group of colleagues from Aston University identified the formalization of organizational tasks and roles as a key attribute of modern organizational structure (Pugh et al., 1963). Roles are “standardized patterns of behavior” (Katz & Kahn, 1978: 43). Role formalization in founding teams captures “what one is asked to do” (Dalton, Todor, Spendolini, Fielding, & Porter, 1980: 58) and refers to the identification and designation of particular functional roles and their assignment to specific individuals. New ventures are initially characterized by relatively little role formalization and typically lack functional completeness at inception (Aldrich, 1999; Stinchcombe, 1965).

Burns and Stalker (1961) argued that in a dynamic environment, formalization decreases organizational adaptability to environmental changes and increases the risk of organizational failure. By contrast, the organic ideal type emphasizes role flexibility rather than “the breaking down of tasks

into specialisms” and the precise definition of the “duties and powers attached to each functional role” (Burns & Stalker, 1961: 5). Several empirical studies of mature organizations have supported the inverse correlation between formalization and firm performance in dynamic environments (Glisson & Martin, 1980; Wally & Baum, 1994).

Although it may make sense to advise established firms with rigid formal bureaucracies to become more flexible and adaptable in dynamic environments, the same advice may not necessarily be appropriate for new ventures characterized by nascent structure and uncertain roles. Rather, a lack of role formalization may lead to role ambiguity (Stinchcombe, 1965). Role ambiguity causes confusion about *who* is supposed to do particular routine tasks. In contrast, the formalization of roles and behavior enables organizations to reduce, predict, and control variability because role formalization creates a condition in which “everyone knows exactly what to do” and ultimately decreases coordination costs (Mintzberg, 1979: 83). In turbulent and changing environments, role ambiguity may also cause confusion about *what* should be done to adapt to new circumstances. When environmental change necessitates organizational adaptation, new ventures that lack clear boundaries of responsibility will be forced to rely upon decision making by consensus, thereby decreasing the speed and increasing the cost of any particular decision. Role formalization assigns decision-making authority to individuals in particular roles and thereby delineates what founding team members in those roles can and cannot decide. These boundaries empower particular individuals to make decisions on behalf of their organization and result in both decreased coordination costs and increased decision-making speed. Lower costs, which are particularly important to financially strapped new ventures, and increased decision-making speed increase firm performance in volatile environments (Eisenhardt & Schoonhoven, 1990).

Formalization may also increase a new venture’s legitimacy. New ventures are often constrained by their lack of legitimacy, credibility, and acceptance from important external constituents, including providers of financial resources, external marketing partners, suppliers, and distributors (Aldrich, 1999; Stinchcombe, 1965). Past research on new ventures suggests that because their eventual success is highly uncertain, resource providers rely on symbolic signals of competence (Meyer & Rowan, 1977; Stuart, Hoang, & Hybels, 1999). Creating common formal positions such as chief financial officer and vice president of human resources signals management experience and know-how and con-

³ We chose these dimensions because past research suggests they capture important aspects of both horizontal and vertical organizational structure and have special applicability to new ventures (Baron, Burton, & Hannan, 1999). Pugh et al. (1963) identified six primary dimensions of structure: specialization, standardization, formalization, centralization, configuration, and flexibility. We focused our efforts on specialization, formalization, and administrative intensity (capturing both centralization and configuration) because they were the most relevant to new ventures. We did not study standardization because it makes little sense for new ventures in new industries who are experimenting with various processes and technologies to standardize these while they are still evolving. Similarly, we did not include flexibility in this study because there was little variation among firms in this sample in terms of flexibility. Our measure of administrative intensity captures both centralization, defined as the extent to which power is centralized in a few figures or diffused among several administrators, and organizations’ hierarchical configurations.

formity to accepted management structure and practices. Given that access to external resources is critical for new venture growth, the increased credibility and legitimacy associated with role formalization will likely enhance new venture performance.

Drawing on these arguments, we suggest the following hypothesis:

Hypothesis 1. Greater role formalization in founding teams increases new venture performance.

Functional Specialization in Founding Teams

The second structural attribute of new ventures that this study examined is functional specialization in founding teams, which we define as the concentration of the types of tasks assigned to any one founding team member. Role formalization and functional specialization are interrelated, as the former relates to the formal recognition and delineation of tasks within an organization and the latter captures the extent to which individual founding team members focus their efforts on narrower or broader sets of tasks. According to Burns and Stalker (1961), specialization increases coordination costs and decreases the flexibility of an organization and therefore its ability to react to environmental changes. The relationship between specialization and performance has received little attention from empirical researchers and is still undetermined (Dalton et al., 1980).

We argue that new ventures facing the highly volatile environment of an emerging sector benefit from functional specialization of founding teams. Functional specialization allows organization members to concentrate on the execution of specified and narrowly defined tasks and to accumulate task-related knowledge, and thus it enhances information-processing capabilities (Thompson, 1967). Concentration of tasks also increases the accountability of actors and facilitates monitoring. Thus,

Hypothesis 2. Greater functional specialization in founding teams increases new venture performance.

We expect the effects of founding team size and specialization to interact. It is more difficult for small founding teams to specialize than it is for large founding teams because small founding teams lack the managerial resources needed to allow founders to focus on only a few tasks and lack the financial resources necessary to outsource unassigned tasks. Thus, specializing in one function, such as finance, may lead to less attention being

paid to a function of equal importance, such as marketing. Thus, we predict that specialization will be more beneficial for larger founding teams with sufficient managerial resources to cover important functional areas.

Hypothesis 3. The positive effect of functional specialization in founding teams on new venture performance increases with the size of founding teams.

Administrative Intensity

Organic organizations have flat structures with coordination occurring via lateral “consultation rather than vertical commands” (Burns & Stalker, 1961: 121). Classical sociological studies of organizational structure have identified administrative intensity—measured by the ratio of administrators to employees—as an important feature of organizational structure (Bendix, 1956; Blau & Schoenherr, 1971; Melman, 1951). The argument in much of this literature is that this ratio reflects the degree of bureaucratization within an organization (Evers, Bohlen, & Warren, 1976; Parkinson, 1957). According to this research tradition, larger administrative ratios indicate an inefficient expansion of administrative activities in growing organizations and an inertial tendency in declining organizations (Ford, 1980; McKinley, 1987). Using samples of mature firms in established industries, researchers have observed a negative relationship between administrative intensity and organizational performance (Bidwell & Kasarda, 1975; Melman, 1951). Many practitioners and educators have also espoused the negative relationship between administrative intensity and performance, arguing that excess management often stifles innovation and may get in the way of firm productivity (Peters & Waterman, 1987; Timmons & Spinelli, 2003). Whether or not this principle of lean administrative intensity applies to new ventures is largely untested.

In the context of new ventures, we focus on the size of a founding team vis-à-vis the total number of employees in its organization as the key indicator of administrative intensity. Baron, Hannan, and Burton (1999) argued that the founding team is the most fundamental administrative component of a new venture. New ventures are typically small and rarely have middle managers (Mintzberg, 1979). The size of the founding team relative to the size of the organization plays an essential role in the development of a new venture, establishing its bureaucratic intensity. Because of the importance of the founding team, we suggest that administrative intensity in new ventures is best captured by the

ratio of the number of founding team members to employees.

We argue that, unlike mature organizations in dynamic environments, in which high administrative ratios may impede the ability to adapt, new ventures benefit from high levels of administrative intensity. Stinchcombe (1965: 148) attributed the liability of newness in part to the fact that new organizations, particularly “new types of organizations,” must construct and learn new roles that are temporarily filled by employees with “generalized skills” from other firms. In established firms, “former occupants of roles can teach their successors, communicating not only skills but also decision criteria, responsibilities to various people who have relations to the role occupant, . . . what sort of things can go wrong with routine procedures, and so on” (Stinchcombe, 1965: 148). In contrast, founders and employees of new organizations in nascent economic sectors are responsible for inventing new roles, a process that has a “high cost in time, worry, conflict, and temporary inefficiencies” (Stinchcombe, 1965: 148). Moreover, the deficit of knowledge about organizational activities is more difficult to overcome in new sectors, because population-level learning is unavailable (Miner & Haunschild, 1995). The iterative process of role construction requires substantial managerial interaction with employees. In emerging economic sectors, where formal training programs may be relatively unavailable and best practices have yet to be institutionalized, this process demands significant efforts by founders to mentor and train employees. Thus, we argue that new ventures benefit from a larger ratio of founding team members to employees.

New ventures also suffer from a lack of organizational routines, a critical mechanism for increasing reproducibility. The lack of accumulated operational experience and routines in new ventures substantially increases reliance upon managerial discretion to coordinate organizational activities. Higher administrative intensity also enables these administrators to allocate more time and resources to organization-building activities, such as working with employees to set up formal coordination procedures and fine-tuning information-processing systems. In new ventures, therefore, the ratio of founding team members to organization members captures the extent to which founding team members are able to provide employees with important managerial resources needed for development and coordination. We argue that new ventures with greater administrative intensity will have higher performance than their counterparts with lower administrative intensity. Thus,

Hypothesis 4. Greater administrative intensity increases new venture performance.

METHODS

Sample

We tested our hypotheses using panel data from a sample of Internet service ventures founded in 1996 and operating in the United States during the five-year period 1996–2001. We chose the Internet sector as the setting in which to test our propositions about new ventures in dynamic sectors because of the high volatility and turbulence in this market during this time period. Although the Internet (independent, packet-switched communications networks) had existed since the late 1960s, prior to the 1990s it operated largely within the confines of government research centers and non-profit organizations like universities (Abbate, 1999). During the mid and late 1990s, reacting to a series of institutional reforms and technical changes, many new ventures were established to exploit the commercial potential of the Internet, and the sector became characterized by rapid growth and extreme environmental turbulence. Tens of millions of citizens connected to the Internet for the first time and faced bewildering choices among new, unproven technologies vying for market acceptance (Zakon, 2004). From 1994 to 1996, Internet “backbone traffic” expanded a hundred-fold, and during the following five years (1996–2001), traffic increased an additional fifty-fold (Odlizko, 2003). Many firms did not survive this turbulent period and the resulting “dot.com” crash of 2000–2001. Up to \$4 trillion of paper wealth disappeared as stock prices fell (Lowenstein, 2004). Taken as a whole, the commercialization of the Internet in the late 1990s was an extreme instance of environmental dynamism, turbulence, and uncertainty. These features make it an ideal setting in which to test relationships between organizational structure and performance in new ventures.

We constructed a data set for the cohort of Internet firms founded in 1996 in the United States using data from the CorpTech database. This database tracks firms operating in various high-technology sectors and compiles self-reported data on a wide range of organizational characteristics, including organization size, revenue, and management team structure.

Several researchers (Arora & Gambardella, 1997; Stuart, Hoang, & Hybels, 1999) have used the CorpTech database as a source of data. This database was initially created as a marketing vehicle to permit vendors to reach technology-oriented firms.

CorpTech employees maintain a high degree of comprehensiveness in this data by regularly checking for newly founded firms in local telephone directories. For the sample of firms used in this study, CorpTech employees regularly contacted the firms in their database, typically interviewing one member of each management team annually. Because it is unlikely that a newly founded firm proceeds without obtaining a phone number, it was reasonable to expect that the 449 Internet firms that we identified constituted a significant fraction of the 1996 cohort. These start-ups provided Internet services ranging from basic Internet access to more complex Web design, data management, and custom software service for corporate and individual customers. Because of missing data, organizational exits, and our use of a "lead variable" for our dependent variable, our final sample consisted of 1,049 firm-year observations with complete data. The median organizational size was 6 employees, and 70 percent of the firms had 11 or fewer employees. This observation is consistent with other studies that suggest new ventures typically have fewer than 10 employees (Aldrich, 1999). Less than 5 percent of the firms in our sample received funding from venture capital firms.

We checked the accuracy of our data in several ways. First, we used the Lexis-Nexis database of business press releases and business news and also contacted the companies surviving at the time of our study directly via phone and e-mail to confirm elements of the company profile reported in the CorpTech database. However, many companies in the initial sample had since failed and were therefore unavailable for follow-up data collection. Many of these same firms did not release formal business press releases and/or were too small to have received coverage in the mainstream business press. We used the Internet Archive, a digital archive of the World Wide Web, to confirm data reported in CorpTech, to fill in gaps in the CorpTech data (i.e., the names of senior management), and to check the dates of firm entrances and exits.

Dependent Variable: Performance

With 12 exceptions, all of the firms in our sample were privately owned (the exceptions were partially or entirely owned by publicly held firms). The market-based and accounting-based performance measures that are typically used in analyzing the financial performance of publicly held firms were therefore not applicable. Further, interviews with several practitioners suggested that the independent variables of interest (see below) had a rapid impact on the revenues of the firms in this

sector, implying that the typical one-year lag between measuring these variables and revenue was too long. To alleviate this problem, we used the moving average of revenue (in millions of dollars) in years t and $t + 1$ to shorten the lag time between our independent and dependent variables. Revenue data were collected by CorpTech personnel.

Independent Variables

Role formalization. The CorpTech database tracks common functional areas, including corporate development, chief executive officer, chief financial officer, chief engineering officer, human resources, international sales, manufacturing, management and information systems, marketing, purchasing, quality control, research and development, sales, strategic planning, and technology transfers. The role formalization variable was the number of formalized functions in a new venture divided by the potential maximum number of functional roles. Our measure was adapted from Dalton et al.'s (1980) definition of role formalization.

Functional specialization. Our measure of specialization, adapted from Pugh et al.'s (1963) definition of specialization, was the average number of functional assignments per founding team member.

Administrative intensity. We measured administrative intensity as the number of executives in a founding team divided by the number of total employees. This measure was adapted from Blau and Schoenherr's (1971) administrative ratio measure.

Control Variables

We also controlled for other variables that might explain organizational revenue, such as firm size, founding team size, primary business area, product diversity, and market size. *Firm size* was the natural logarithm of the total number of organizational members, including executives and employees. *Founding team size* was the number of executives in a firm.

Because firms with only one founding team member might be fundamentally different from other firms in our sample, we controlled for these firms with the variable *single executive*, which was coded 1 if a firm had only one founder. We also controlled for founder exits because changes in a founding team could cause turbulence that might affect performance. *Founder exit* was coded as 1 for each year in which one of the founders of a firm departed. In our sample, 77 founders left during the observation period.

Past research suggests that the breadth of product offering affects performance (Carroll & Hannan,

2000). *Product diversity* measured the number of business domains (e.g., telecommunication, software, photonics, etc.) in which these firms operated. *Product line* was the number of products or services that these firms provided in the Internet business domains (e.g., Internet access, Web-page design, online shopping, etc.).

Two dummy variables indicate the areas of business in which firms primarily operated. *SIC 4813* was coded as 1 when a firm's primary business was in that category, which covers telephone communications (e.g., Internet service providers) and 0 otherwise. We also coded *SIC 7375* as 1 when a firm's main business area was in this category (e.g., information retrieval services) and 0 otherwise.

We also controlled for effects of market demand and the size of the economic sector in two ways. *Host* was the number of Internet hosts at time t , obtained from the Internet Software Consortium. *Shipment* indicated the potential number of Internet users in the United States, measured with the dollar amount of semiconductor shipments to U.S. markets at time t . We collected this statistic from the Semiconductor Industry Association.

Finally, because 131 firms in our sample eventually exited from the sector because of either merger or bankruptcy during the five-year observation period, we corrected for potential selection biases using a generalization of the Heckman selection model (Lee, 1983). In this correction, we computed the probability of firm exit, whether by bankruptcy or merger, with Cox regression models and included this generated sample correction variable, λ , into our regression models.

Analysis

Our data set consisted of five panels. Following Baron et al. (1999), we used generalized estimating equations (GEE) with unstructured working correlation matrixes to test our hypotheses (Liang & Zeger, 1986). We preferred this estimation method to fixed-effect estimations because some of the variables had little variance over time.

Because role formalization, functional specialization, founding team size, and the interaction term between founding team size and functional specialization were highly correlated, the variance inflation factor for our regressions exceeded the threshold for multicollinearity recommended by Chatterjee and Price (1991). We reduced multicollinearity in our model by orthogonalizing formalization, functional specialization, founding team size, and the interaction of specialization and founding team size using a modified Gram-Schmidt procedure (Saville & Wood, 1991). This technique "partials out" the common variance, creating transformed variables that are uncorrelated with one another. We then tested for multicollinearity and found that variance-inflation factors in all of the models presented below were lower than 5.

RESULTS

Table 1 shows the descriptive statistics and correlations for the dependent, independent, and control variables. Table 2 presents the results of our analysis.

In Table 2, model 1 is the baseline equation con-

TABLE 1
Descriptive Statistics^a

	Mean	s.d.	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Performance	15.03	114.53														
2. Role formalization ^b	0.02	1.00	.30													
3. Functional specialization ^b	-0.05	0.97	.08	.04												
4. Administrative intensity	0.36	0.27	-.17	-.08	-.18											
5. Firm size ^c	0.41	1.31	.52	.50	.47	-.59										
6. Founding team size ^b	0.05	0.98	.10	.01	.04	-.10	.29									
7. Single executive	0.33	0.47	-.07	-.44	-.45	-.09	-.37	-.08								
8. Founder exit	0.03	0.16	.04	.08	.03	-.12	.16	.05	-.04							
9. Product diversity	1.25	0.62	.52	.25	.13	-.12	.34	.02	-.11	.00						
10. Product line	3.34	1.28	.38	.11	-.13	.09	.01	-.13	-.03	-.09	.46					
11. SIC 4813	0.60	0.49	-.13	-.19	-.18	.23	-.31	-.12	.09	-.06	-.23	.17				
12. SIC 7375	0.22	0.42	.02	.05	.10	-.18	.17	.05	-.02	.07	.06	-.30	-.66			
13. Host	1.86E+07	8.99E+06	.09	.09	.04	-.11	.16	.09	-.01	.17	.07	.02	.00	.00		
14. Shipment	3.76E+06	1.67E+05	-.04	-.04	-.03	.06	-.08	-.01	-.01	-.09	-.03	-.04	.00	.00	-.28	
15. Lambda	0.96	0.54	-.07	.03	.09	-.09	.08	.06	-.04	.11	.00	-.09	-.02	-.03	.71	-.26

^a $n = 1,024$.

^b Orthogonalized variable.

^c Log-transformed variable.

TABLE 2
Results of Regression Analyses^a

Variable	Model 1	Model 2	Model 3	Model 4 ^c
Role formalization ^a		10.22** (3.55)	9.42** (3.62)	0.96*** (0.30)
Functional specialization ^a		11.20** (3.64)	8.97** (3.80)	0.56* (0.27)
Administrative intensity		27.09** (10.56)	27.90** (10.79)	2.89** (1.07)
Role formalization × founding team size ^a			5.86* (2.73)	1.66*** (0.21)
Firm size ^b	20.55*** (2.59)	19.83*** (2.96)	20.21*** (3.02)	3.59*** (0.48)
Founding team size ^a	18.92*** (2.92)	19.81*** (2.89)	17.92*** (3.02)	1.09*** (0.21)
Single executive	1.17 (5.08)	18.81** (6.24)	11.67 [†] (7.20)	0.99* (0.56)
Founder exit	-0.89 (7.54)	7.07 (7.31)	4.96 (7.55)	-0.44 (0.99)
Product diversity	49.14*** (7.16)	43.57*** (7.14)	46.08*** (7.32)	-0.13 (0.35)
Product line	15.48*** (3.60)	17.41*** (3.60)	16.60*** (3.65)	-0.15 (0.15)
SIC 4813	11.32 (11.09)	12.83 (11.04)	12.92 (11.15)	0.03 (0.45)
SIC 7375	12.61 (11.74)	16.83 (11.57)	15.36 (11.73)	0.07 (0.52)
Host	1.76E-07 (7.21E-07)	1.44E-07 (7.05E-07)	2.86E-07 (6.86E-07)	2.48E-08 (3.19E-08)
Shipment	1.16E-05 (1.18E-05)	1.26E-05 (1.17E-05)	1.42E-05 (1.12E-05)	1.36E-06* (6.72E-07)
Lambda	1.30 (5.46)	2.01 (5.12)	1.45 (5.24)	0.49 (0.53)
Constant	-207.08*** (55.32)	-226.08*** (54.87)	-232.31*** (52.76)	-12.57*** (3.14)
Wald chi-square	301.14***	341.19***	335.53	547.61***
Change in Wald chi-square		22.64***	4.60*	
Scale parameter	7,862.53	7,832.70	7,944.72	15.97
<i>n</i>	1,049	1,049	1,049	993

^a Orthogonalized variable.

^b Log-transformed variable.

^c Only includes firms with fewer than 150 employees.

[†] $p < .10$

* $p < .05$

** $p < .01$

*** $p < .001$

taining the control variables, and model 2 introduces administrative intensity, role formalization, and functional specialization. Model 3 builds on the previous model by introducing the interaction term between functional specialization and founding team size. Wald joint tests for the differences between the three models were significant, demonstrating that adding the hypothesized variables from one model to the next significantly improved the model fit. Model 4 is a robustness check of model 3 and only includes observations with fewer than 150 employees.

The results of the analysis generally supported all four hypotheses, and we base the interpretation of the results on the coefficients from model 3. Of the control variables, product diversity, product line, and firm size all had a significant, positive effect on revenue. Similarly to Eisenhardt and Schoonhoven (1996) and Baron et al. (1999), we found that founding team size had a positive effect on future revenue.

Hypotheses 1 and 2 suggest positive associations between role formalization and functional specialization in founding teams and firm performance. With all other variables fixed to their means, the

results indicate that an increase of one standard deviation in role formalization and functional specialization increases future revenue by 60.8 percent and 55.8 percent respectively,⁴ supporting Hypotheses 1 and 2. Hypothesis 3 states that founding team size increases the impact of specialization on firm performance. The interaction term between functional specialization and founding team size is positive and significant; a one-standard-deviation increase in team size increases the effect of specialization on future revenue by 37.7 percent, supporting Hypothesis 3. Hypothesis 4 predicts a positive correlation between administrative intensity and future new venture performance. The coefficients in model 3 indicate that an increase of one standard deviation in administrative intensity increases future revenue by 47.7 percent, supporting Hypothesis 4.

We checked the robustness of these findings in the following three ways. First, we ran regression models only with firms employing fewer than 150 organizational members in order to make sure that the largest organizations in our sample did not skew our results. The results of this analysis are presented in model 4 in Table 2. In both analyses, the data suggested significant effects of the hypothesized independent variables on organizational performance. However, it is important to note that the coefficients are much larger in model 3. We tested the significance of the coefficient differences between the two models and found the differences to be significant, suggesting that the impact of the structural measures was significantly higher in larger new ventures. This distinction makes good sense because small organizations are naturally limited in their ability to specialize.

Second, we performed the regressions applying different assumptions about the relationship between panels, assuming, for instance, autocorrelation or independence. We also ran all models using the Huber-White estimator of variance, which produces valid standard errors even if the error terms are heteroskedastic or if the correlations within a group are not as hypothesized by the specified correlation structure (Allison, 1999). The results with these robustness checks remained substantively the same; the direction and significance of the variables did not change. Third, we ran fixed-effects models⁵ for the analysis presented in model 3. The

fixed-effects models accounted for the unobserved heterogeneity related to firm attributes that do not change over time, such as the strengths and weaknesses of a founding team (Greene [2000]; see Bunderson and Sutcliffe [2002] for a review of important top management team attributes). The results for the hypothesized independent variables remained substantively the same in the fixed-effects regression: positive and significant at the .05 level.

DISCUSSION

Our objective in this study was to examine the relationship between the formal structure of new ventures and organizational performance in a dynamic emergent economic sector. Combining arguments based on classical organization theory and entrepreneurial research, we theorized that new ventures with greater founding team formalization, functional specialization, and administrative intensity would outperform those firms that had less of these attributes. We also posited that founding team size would moderate the impact of functional specialization on new venture performance. Results from our research support these hypotheses. Moreover, we found that the impacts of formalization, specialization, and administrative intensity were greater for larger new ventures.

These results stand in contrast to empirical research based on work by Burns and Stalker, indicating that in a dynamic industry, firms with less formal structures (more organic structures) outperform firms with more formal structures (more mechanistic). This contrast is likely a result of the fact that Burns and Stalker's *The Management of Innovation* (1961) was a case study of large, established British and Scottish firms and was never really intended to address this phenomenon in new ventures. Similarly, most of the empirical work on this topic has also used samples of *established* firms in dynamic sectors. Our results suggest a new scope condition for Burns and Stalker's structural theory—namely, that the effects of structure are contingent on an organization's and industry's stages of development. We found that structure increased performance in new ventures, even in the context of a very dynamic emergent sector, substantiating the claims of theorists who have long proclaimed the importance of formal structure to or-

⁴ Our interpretation of the effects of role formalization, specialization, and the interaction variable are based on coefficients from the transformed variables.

⁵ A weakness of fixed-effects models is that they cannot estimate effects for variables that change very little

over time, although they do control for these effects. We were therefore unable to control for team size in these models because team size did not vary substantially year to year.

ganizational performance and the liabilities associated with its absence (Mintzberg, 1979; Perrow, 1986; Stinchcombe, 1965; Thompson, 1967; Weber, 1947).

This research illustrates the intellectual risks of generalizing theories derived from and tested in samples of large, established organizations to the domain of small, new ventures. These findings also support claims put forth by organizational life cycle theorists who have argued for a more nuanced approach to studying organizations because the challenges they face change over their life courses (e.g., Cameron & Quinn, 1983). Echoing these concerns, a growing body of scholars have called for more empirical research on how extant organizational theory applies to new ventures (Aldrich, 1999; Shane, 2003). We therefore build on a recent stream of research that examines new ventures in new sectors (for example, see Eisenhardt and Schoonhoven [1990, 1996] and Sine, Haveman, & Tolbert [2005]), adding additional insight about the relationship between structure and performance.

Our results inform entrepreneurial practice regarding the impact of particular structural features upon firm performance early in the development of new ventures, providing new and important guidance for entrepreneurs forming new ventures in emergent sectors. This study suggests that entrepreneurs should pay particular attention to initial organizational structure. The construction and founding of a new venture are often chaotic events, and organizational design often takes a back seat to the exigencies of the moment (Aldrich, 1999). We argue that the creation and management of a new venture require substantial managerial resources, and our results suggest that larger founding teams are correlated with higher future revenues. Having sufficient managerial resources is particularly important for organizations with more employees, as demonstrated by the large effects of administrative intensity. Our results also demonstrate that new ventures that formalize functional assignments and assign important tasks to team members who specialize in those assignments outperform firms whose founding teams have relatively undefined roles.

Limitations

One of the strengths of this research is that it examines a unique set of firms from founding through their first five years of existence in a turbulent environment, yet using this type of sample also creates some limitations. First, because new ventures have a very high mortality rate (Aldrich, 1999), at least half of the firms in our sample no longer existed by the end of our study; we were

unable to gather information that was not either archival or on the firms' Web sites. Thus, information on attributes of founders was unavailable. We did use various search engines to try to obtain data on founder experience, but these efforts inevitably fell short for our sample of firms. Second, because most of the firms in our sample were private, we were limited to data that these firms were willing to disclose, which in this case did not include common measures of profitability, such as return on investment. Moreover, exit was not a useful indicator of performance because it indicated success as well as failure, and we could not always distinguish between the two. For these two reasons, our indicator of performance was limited to revenue. Third, the Internet sector is an extreme instance of environmental dynamism, turbulence, and uncertainty. In our setting, capital barriers to entry were limited, and the new technology underlying the sector was adaptable to many existing industries and activities, resulting in very high growth. Moreover, the prospects of the sector were constantly changing and went from boom to bust within the time frame of our sample. This dynamism made the Internet sector an ideal setting in which to test relationships between new venture structure, dynamic environments, and performance. However, the extremity of the environment might reduce the generalizability of our results to other sectors. Nevertheless, we believe that the benefits of structure also accrue to new ventures in other turbulent environments, even if they are less extreme.

Conclusion

In dynamic, turbulent, and uncertain environments, new ventures and mature organizations face fundamentally different challenges requiring different approaches to organizational structure. Whereas mature organizations with well-defined structure and embedded practices typically need to become more organic and flexible in order to adapt to dynamic environments (Burns & Stalker, 1961), the opposite is true for new ventures. We argue that new ventures are already extremely flexible and attuned to their environment, but that they often lack the benefits of organizational structure, such as low role ambiguity, high levels of individual focus and discretion, low coordination costs, and generally high levels of organizational efficiency. Moreover, because new ventures in new economic sectors need to develop new roles, activities, and employees, they require greater managerial resources per employee than mature organizations. Our results demonstrate that new ventures that have greater role formalization and specialization

in founding teams, as well as administrative intensity, also show better future performance. This study is only a first step in exploring how the relationship between particular types of formal structure and organizational performance is contingent on both environmental and organizational factors. Our research was limited to a population of firms in their first five years of life. Future research could build on these findings by examining the relationship between structural attributes (including those not studied here), life cycle stages, transitions between life cycle stages, and environmental stability. Understanding these relationships will delineate the environmental and life cycle contingencies that determine the relationship between particular types of organizational structure and firm performance.

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