

## THE MEDIATING ROLE OF KNOWLEDGE-BASED CAPITAL FOR CORPORATE ENTREPRENEURSHIP EFFECTS ON PERFORMANCE: A STUDY OF SMALL- TO MEDIUM-SIZED FIRMS

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*Even though research suggests that a firm's pursuit of corporate entrepreneurship directly contributes to its performance, we develop a deeper explanation, based on the insight that this pursuit develops and extends the firm's knowledge-based capital. Specifically, we first demonstrate that the pursuit of corporate entrepreneurship enhances the firm's knowledge-based capital residing in people (human capital), relationships (social capital), and systems (organizational capital). Then, we examine the mediating role of each capital type for corporate entrepreneurship effects on performance. We test our hypotheses using multisource data from a sample of CEOs and their top management teams in 125 firms, including a time-lagged measurement of knowledge-based capital and performance. Our findings provide general support for this theory and indicate that corporate entrepreneurship is positively associated with knowledge-based capital and through this, with performance. Copyright © 2011 Strategic Management Society.*

### INTRODUCTION

Among strategic entrepreneurship researchers studying firm-level entrepreneurial behavior and outcomes, corporate entrepreneurship (hereafter CE) has emerged as a central construct for explaining performance differences across firms (Sathe, 2003; Zahra, 2008). Although researchers have diversely conceptualized the content and character of CE, it is often defined as a set of firm-level activities that center on the discovery and pursuit of new opportunities through acts of innovation, venturing, and renewal (Sharma and Chrisman, 1999; Guth and

Ginsberg, 1990; Morris, Kuratko, and Covin, 2008; Zahra, 1996; Ling *et al.*, 2008). Research generally builds on the assertion that despite the inherent risks and uncertainty involved, the firm can create new markets and adapt and change to meet new market imperatives by pursuing CE (Dess, Lumpkin, and Covin, 1997; Ireland, Covin, and Kuratko, 2009). Indeed, the direct association between CE and performance has been widely examined (Dess *et al.*, 2003) and a few studies have begun to specify the contingencies in which this association might be shaped (e.g., Zahra and Covin, 1995; Chandler, Keller, and Lyon, 2000; Antoncic and Hisrich, 2001). At the same time, theory and evidence about the specific mechanisms that govern the contribution of CE to performance have generally been lacking.

In an effort to enrich theoretical explanations of the association between CE and firm performance, we propose a deeper explanation, based on the premise that pursuing CE is a dynamic capability that involves

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stretching and extending the firm's knowledge-based resources (Zahra, Nielsen, and Bogner, 1999; Dess *et al.*, 1997; Phan *et al.*, 2009). Consistent with this view, Teng (2007: 122) notes, 'the whole point of CE is to seek opportunities that stretch the resource base of the firm without entirely breaking with its resource base,' thus entailing the development of new knowledge while shedding old routines, systems, and processes (Zahra *et al.*, 1999; Hayton and Kelley, 2006). Therefore, we argue that knowledge-based capital, defined as the sum of all knowledge firms utilize for competitive advantage (Nahapiet and Ghoshal, 1998), is a generative mechanism or conduit through which CE contributes to firm performance. Even as the elements of a firm's knowledge-based capital might take many forms and emphases (Borch, Huse, and Senneseth, 1999; Floyd and Wooldridge, 1999; Hitt, Ireland, and Lee, 2000), they are fundamentally distinct in how they accumulate and distribute knowledge—namely, through individuals (human capital), relational ties (social capital), and organizational systems (organizational capital).

Beyond research on intellectual capital, where these elements play a central theoretical function in explaining interfirm performance variances (Subramaniam and Youndt, 2005; Reed, Lubatkin, and Srinivasan, 2006), the fact that a firm's knowledge-based capital has its foundation in people, relationships, and systems/routines is emphasized in numerous literatures including the resource/knowledge-based view (Grant, 1996), organizational learning (Crossan, Lane, and White, 1999; Huber, 1991), and dynamic capabilities (Adner and Helfat, 2003; Sirmon and Hitt, 2009). To resource-based theorists, the firm is a bundle of commitments to systems, human resources, and social processes all blanketed by firm-specific knowledge (Alvarez and Busenitz, 2001). Likewise, from a knowledge-based perspective, Leonard-Barton (1992) suggests that knowledge is primarily embedded in employees (human capital) and technical systems (organizational capital). For organizational learning theorists, human, social, and organizational capital are each integral to the creation, development, and renewal of knowledge. Finally, scholars adopting a dynamic capabilities perspective highlight the centrality of human capital, social capital, and organizational capital as core drivers of observed variances in performance across firms (Adner and Helfat, 2003; Sirmon and Hitt, 2009).

Building on this three-dimensional knowledge-based foundation, we first argue that the firm's pursuit

of CE contributes to the renewal and enhancement of all three types of capital—by enriching/extending organizational members' knowledge and skills (i.e., human capital), fostering/cultivating patterns of social exchange throughout the firm (i.e., social capital), and creating/modifying knowledge embedded in systems, routines, and processes (i.e., organizational capital). Then, we demonstrate that CE's influence on performance is transmitted through these knowledge-based mechanisms. Finally, we test this mediational model using multisource data from 125 CEOs and top management teams of small- to medium-sized firms, including a time-lagged assessment of the firm's knowledge-based capital and performance. After controlling for the firm's initial stock of knowledge-based capital, we find that the firm's pursuit of CE is positively related to its knowledge-based capital and, through this effect, to performance, especially in the case of human and social capital.

Our study contributes to research by developing a mediational model that tests a theoretical explanation of the CE-firm performance relationship. We draw on theoretical insights from knowledge-based and dynamic capabilities literatures to explain how engaging in CE leads to improved firm performance by augmenting and renewing the firm's knowledge-based capabilities. In doing so, we offer new insights about CE, not only as a discrete pursuit but as a dynamic capability that shapes, extends, and stretches the firm's resource base. We also contribute to the literature by studying these effects in the context of SMEs, as prior studies of CE have predominantly focused on large firms.

## THEORETICAL BACKGROUND

Because CE is an integral part of the strategic management of the firm (Barringer and Bluedorn, 1999; Burgelman, 1983; Teng, 2007), both scholars and practitioners are interested in understanding its relationship with performance (Dess *et al.*, 2003). Even as most researchers concur that CE is a multidimensional firm-level concept (Sharma and Chrisman, 1999; Guth and Ginsberg, 1990; Morris *et al.*, 2008; Zahra, 1996; Ling *et al.*, 2008), they differ as to its (1) individual dimensions and (2) relations between the overall construct and its individual dimensions (Law, Wong, and Mobley, 1998; Edwards, 2001; Wong, Law, and Huang, 2008).

Regarding the first difference, researchers have advanced several types and labels for CE, including

corporate venturing, intrapreneurship, and organizational entrepreneurship (see Sharma and Chrisman, 1999; Morris *et al.*, 2008). At the same time, researchers have recognized that CE is fundamentally represented in three entrepreneurial acts: innovation, venturing, and renewal (Guth and Ginsberg, 1990). Innovation refers to a firm's commitment to creating and introducing products and production processes (Zahra, 1996). Venturing concerns the firm's creation of new business by expanding operations in new or existing markets (Zahra, 1996). And finally, strategic renewal involves activities aimed at redefining the firm's relationship with its markets or competitors by fundamentally altering how it competes (Covin and Miles, 1999). In contrast to related notions of restructuring and rejuvenation that capture discrete initiatives, strategic renewal involves fundamental repositioning efforts by the firm within its competitive space.

As to the issue of the relationship among these dimensions and the overall CE construct, researchers initially treated them as distinct concepts with no discussion of their interrelationships or a possible common core (Zahra, 1996). Thus, although acts of innovation, venturing, and renewal are all located within existing firms, each might have its own antecedents and consequences (Sharma and Chrisman, 1999). Yet, treating individual components of CE as independent ignores their potential complementarity—that is, the extent to which CE activities are mutually supportive and reinforcing. For example, the benefits derived from venturing activities—entering new product, geographic, and technological market spaces—are likely to be enhanced to the extent that firms renew their competitive approach and capabilities. Similarly, the benefits of renewing resources are likely to be stronger to the extent that firms exploit these investments by introducing new products. Thus, some have recognized a common core among these dimensions, defining CE as a unitary, encompassing construct that reflects the firm's innovation, renewal, and venturing acts (Ling *et al.*, 2008). To these researchers, although the foci of these activities differ somewhat, they are: (1) similarly subjected to considerable risk, uncertainty, and ambiguity intrinsic to entrepreneurial action (e.g., McMullen and Shepherd, 2006); (2) involve fundamental choices that firms make, and that have widespread and significant implications for the firm's resource base (Phan *et al.*, 2009); (3) involve building new resource combinations (Guth and Ginsberg, 1990); and (4) encompass a focus on the

discovery and creation of opportunities (Teng, 2007). These characteristics suggest a considerable common core among acts of innovation, venturing, and strategic renewal, so they 'are all important and legitimate parts of the concept of corporate entrepreneurship' (Morris *et al.*, 2008: 12).

Accordingly, we here view CE as a latent, unitary construct that gives rise to three distinct, but complementary, entrepreneurial acts: innovation, venturing, and renewal. As defined, CE is distinct from the commonly used construct of entrepreneurial orientation that refers to the predispositions (as opposed to actual behaviors or entrepreneurial acts) of firms with respect to their strategy-making processes, practices, and activities (Lumpkin and Dess, 1996). It is because of this key distinction that some even argue that entrepreneurial orientation can, in fact, be a pivotal antecedent to stimulating effective CE (Dess and Lumpkin, 2005).

## HYPOTHESES

Our model (Figure 1) posits that the firm's pursuit of CE is directly related to its performance and knowledge-based capital, as well as indirectly related to performance through knowledge-based capital. Given that CE may indeed, be a 'generally effective means for improving long-term company financial performance' (Zahra and Covin, 1995: 44), we do not hypothesize, but instead test, for the direct association between CE and firm performance. We begin by relating CE to each type of knowledge-based capital and then to performance.

### CE and human capital

Knowledge is primarily embedded within human capital (Lepak and Snell, 1999), defined as the knowledge, skills, and experience of employees and managers throughout the firm (Subramaniam and Youndt, 2005). Although human capital might contribute to CE (Hayton and Kelley, 2006), CE also serves as an important basis for the creation of new knowledge and learning by promoting such processes as the refinement and continuous updating of skills, experimentation, competence acquisition, and boundary spanning. Or as Hayton and Kelley (2006: 407) explain, 'successful corporate entrepreneurship involves simultaneous attention to both innovation [exploration] and exploitation and therefore involves an array of activities and processes.' Perhaps most

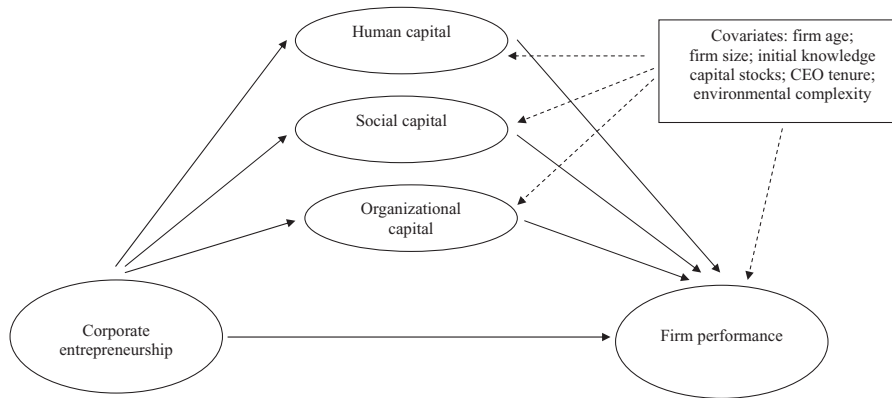


Figure 1. Tested model

frequently, CE involves activities aimed at new applications of existing products and technologies to new markets or customer segments, those that build on current technological, business, and product-service trajectories (Benner and Tushman, 2003). Although such exploitative activities create limited new knowledge, they deepen the grooves of employees' existing knowledge and skills. Because practice helps people understand processes more fully and develop more effective skills (Argote, Beckman, and Epple, 1990), engaging in CE activities should be positively associated with the accumulation of tacit and explicit knowledge bases among employees (e.g., Zollo and Singh, 1998).

Additionally, as firms shift to new and different technology, business, and product-service trajectories (Kyrgidou and Hughes, 2010), CE activities invariably invoke processes of search and experimentation that culminate in new knowledge and insights among employees. According to Ireland and Webb (2007: 471), 'creativity, experimentation, and a broad search of knowledge stocks beyond what is captured in the firm's existing competences are examples of the activities that are part of the exploration process.' To learning theorists (e.g., Crossan *et al.*, 1999), new experiences and insights serve as the basis for individual and group learning. In particular, corporate entrepreneurs might encourage individual and group learning by motivating others to question assumptions, be inquisitive, and take intelligent risks, as well as come up with creative observations (Vera and Crossan, 2004). As these new insights are articulated, shared, and integrated, the stability of existing knowledge structures is threatened and new frames of reference that rec-

oncile existing and new knowledge must be developed (Ahuja and Lampert, 2001). And when new knowledge structures become more widely disseminated and deeply embedded, they contribute to the development of complex procedural knowledge among employees (Floyd and Wooldridge, 1999). Accordingly, we expect that:

*Hypothesis 1 (H1): The firm's pursuit of CE is positively associated with its level of subsequent human capital.*

### CE and social capital

Knowledge is not just embedded in the skills and experiences of employees, but also in the web of relationships that connect employees and managers at different levels throughout the firm (Nahapiet and Ghoshal, 1998; Subramaniam and Youndt, 2005). From a social capital perspective (Nahapiet and Ghoshal, 1998), firms can be seen as sets of interdependent roles connected by social networks that transmit knowledge, resources, and influence. The literature on organizational renewal (Floyd and Lane, 2000; Morris *et al.*, 2008) suggests that firms engaging in CE activities are likely to invoke 'a cascading yet integrated set of entrepreneurial actions at the senior, middle, and first-level of management' (Hornsby *et al.*, 2009: 238). It follows that engaging in CE will trigger a complex and multi-level array of social exchanges within the firm encompassing the exchange of substantive information, coordination, collaboration, and joint decision making between different units. Because managers at different levels in firms play distinct but interde-

pendent roles (see Morris *et al.*, 2008; Floyd and Lane, 2000), engaging in CE also provides the opportunity and impetus for social exchanges across managerial levels (Adler and Kwon, 2002). For example, CE activities promote interactions between first- and middle-level managers in refining and shepherding entrepreneurial initiatives (Kuratko *et al.*, 2005), and also between middle- and senior-level managers in further legitimizing, shaping, and resourcing entrepreneurial initiatives (Morris *et al.*, 2008).

Apart from vertical exchanges, we argue that pursuing CE also promotes lateral exchanges among organizational members. The articulation and refinement of CE ideas is a social process grounded in chaotic and confusing competitive imperatives, in which ‘interaction between individuals typically plays a crucial role in developing these ideas’ (Nonaka, 1994: 15). In so doing, CE facilitates the development of novel interaction patterns, in which ‘formerly weak or nonexistent social ties may develop into strong, recurrent relationships’ (Floyd and Wooldridge: 134). In particular, corporate entrepreneurs will need to access and integrate different sources of knowledge from across the organization (Hayton and Kelley, 2006) and, in doing so, forge social ties with disparate actors and units, thus enhancing the firm’s social capital. By contrast, firms that less frequently engage in CE might have fewer opportunities for vertical and horizontal social exchanges, providing a narrower scope for the development of social capital. Thus:

*Hypothesis 2 (H2): The firm’s pursuit of CE is positively associated with its level of subsequent social capital.*

### **CE and organizational capital**

Organizational capital, a third form of knowledge-based capital refers to the institutionalized knowledge and codified experience residing within and utilized through databases, patents, manuals, structures, systems, and processes (Subramaniam and Youndt, 2005). Broadly defined, it is what is left behind in the firm when people go home in the evening (Roos and Roos, 1997), or simply organizational memory (Huber, 1991). Engaging in CE activities provides an important means for updating and revising organizational capital. Although knowledge is widely dispersed in a variety of tangible forms, much of a firm’s knowledge is deeply embedded in routines. To Nelson

and Winter (1982: 99), ‘the routinization of activity in an organization constitutes the most important form of storage of the organization’s specific operational knowledge.’ Because routines and the knowledge they contain change in response to experience (Levitt and March, 1988), engaging in CE, by enabling diverse and novel experiences—whether related to new products, markets/customer groups, or technologies—offers a means for updating, revising, and refining knowledge held in organizational routines. Experiential learning occurs as corporate entrepreneurs learn from new experience and accumulate and codify those insights (Holcomb *et al.*, 2009). Depending on the novelty of CE experiences and the legitimacy of prior institutionalized knowledge, routinized knowledge may then be revised and updated or abandoned completely.

As well as providing access to new experiences, engaging in CE activities offers exposure to new insights and ideas that may trigger the renewal of knowledge structures held in various formats throughout the firm. CE might expose the firm to entrepreneurial errors that trigger the revision of assumptions, beliefs, and previous insights held in routinized and other formats. Small losses, unlike successes or major failures, contribute to effective learning (Sitkin, 1992). Learning from errors is promoted in entrepreneurial firms and is a sign of experience, learning, and progress (Morris *et al.*, 2008). Consequently, policies, operating practices, and manuals, might be revised and updated to incorporate newly discovered insights. Or as Augier and March (2008: 3) explain, ‘experience is embodied in standard operating procedures, rules reflecting solutions to problems that the firm has managed to solve in the past and negotiated resolutions of past conflicts.’ In this way, CE precipitates a process of renewed institutionalization, in which routines, systems, and procedures are revised to accommodate new initiatives and sources of knowledge. As Zahra and colleagues (1999) observe, CE provides the firm with opportunities for embedding newly acquired knowledge into its cultures, systems, and operations. Obviously, the degree to which CE contributes to the renewal of organizational capital will depend on the extent of institutionalization of existing knowledge, as well as its perceived legitimacy. Overall, however, we expect that:

*Hypothesis 3 (H3): The firm’s pursuit of CE is positively associated with its level of subsequent organizational capital.*

### Mediating role of knowledge-based capital

So far, we have argued that CE entails the extension and renewal of capital residing in people, relationships, and systems. As noted, research findings indicate that the pursuit of CE influences firm performance (frequently measured in terms of growth and profitability). Synthesizing these arguments, we here envision that each capital type will also serve as a partial conduit by which CE contributes to firm performance.

In particular, human capital has long been recognized as a critical resource in most firms (Hitt *et al.*, 2001; Pfeffer, 1994). Human capital theory suggests that increased worker knowledge, skills, and experience are associated with improved firm performance (Becker, 1964). More knowledgeable employees have the ability to improve firm performance by increasing customer benefits and decreasing production and service delivery costs. To Youndt and Snell (2004: 344), human capital can help lower costs (and improve firm performance) by developing new process innovations that ‘eliminate costly steps, reduce inputs, and increase utilization.’ Additionally, because they are a source of new ideas in firms and bring the greatest repertoires and diversity of skills (Subramaniam and Youndt, 2005), human capital is an important contributor to strategic competitiveness (Ireland and Hitt, 1999).

As a result, human capital has been shown to increase the returns to various firm strategies by contributing to competitive advantage and creating value for owners (Hitt *et al.*, 2001; Hitt *et al.*, 2006). For example, in a study of the internationalization of law firms, Hitt and his colleagues (2006) found that human capital positively moderated the relationship between internationalization and firm performance, such that internationalization’s effect on firm performance was bolstered when human capital was high. By contrast, at low levels of human capital, internationalization was found to have no effect on firm performance. Similarly, firms with stronger social capital are likely to leverage and accrue the performance gains from knowledge located disparately through the firm than firms with weaker social capital. By encouraging communication and collaboration among individuals and units, having a strong base of social capital enables firms to coordinate diverse skills and integrate multiple strands of wisdom as well as leverage knowledge from one part of the firm to another (Youndt and Snell, 2004). Youndt and Snell (2004: 345) argue that social

capital ‘enable(s) organizations to more efficiently utilize their knowledge base by leveraging it across the entire organization.’ Thus, firms with strong social capital are better able to leverage their knowledge for competitive advantage. Finally, the knowledge-based view suggests that tacit and contextualized knowledge embedded in systems throughout the firm, because of its inimitability, facilitates superior firm performance (Youndt, Subramaniam, and Snell, 2004). Organizational capital can enhance performance by increasing a firm’s capacity to efficiently and effectively process, leverage, and commercialize knowledge. For example, organizational capital can reduce operating costs by minimizing repeat mistakes, increasing knowledge utilization, and facilitating better information processing and sense-making (Youndt and Snell, 2004).

It follows that when a firm pursues CE, its knowledge-based capital is enhanced and renewed, thus remaining a source of competitive advantage rather than a core rigidity that impedes the firm’s ability to explore and create new value (Conner and Prahalad, 1996; Grant, 1996). Indeed, both the resource-based (Penrose, 1959; Wernerfelt, 1984) and knowledge-based (Grant, 1996) views of the firm similarly suggest that the possession of superior knowledge-based foundations are necessary for sustaining performance over time. Thus, because a firm’s capital residing in its people, relationships, and systems is valuable, rare, inimitable, and non-substitutable, we envision that the pursuit of CE leads to improved subsequent performance through its beneficial association with each element. Specifically:

*Hypothesis 4 (H4): Knowledge-based capital mediates the relationship between the firm’s pursuit of CE and its subsequent performance. Specifically;*

- a) The level of the firm’s human capital mediates the relationship between the firm’s pursuit of CE and its subsequent performance.*
- b) The level of the firm’s social capital mediates the relationship between the firm’s pursuit of CE and its subsequent performance.*
- c) The level of the firm’s organizational capital mediates the relationship between the firm’s pursuit of CE and its subsequent performance.*

## METHODOLOGY

To test our model, we collected survey data from a sample of firms located in the Republic of Ireland.

A broad group of firms and industries was included in the study to maximize the variation of variables and increase the generalizability of findings. However, only single business, small- to medium-sized companies were included in the sampling frame (i.e., 50 to 500 employees). On average, firms in our sample had 345 employees. Focusing on SMEs provides a more direct litmus test of our model since the impact of CE on knowledge-based capital and firm performance might be diluted at larger firms by a broad range of extraneous ecological influences. As Baker and Pollock (2007: 298) suggest, testing theory in this domain is advantageous because these firms are 'relatively compact systems of activity,' making it easier to describe and examine causal inferences. We also focused on single-business firms since CE, knowledge-based capital, and performance may differ across business units in a multiunit setting.

Survey-based studies of CE have typically suffered from small sample sizes, lack of temporal precedence, and over-reliance on single informants. To overcome these limitations, we surveyed a relatively large sample of top management teams. To that end, we initially selected all 3,679 firms meeting these criteria from the Kompass Business Directory, which provides the most comprehensive listing of all firms in Ireland. The use of such a pool of firms minimizes discrepancies between the population and sampling frame, and minimizes the extent of coverage error. We gathered our data at two points in time. Initially, we sent questionnaires measuring firms' initial stocks of knowledge-based capital and pursuit of CE to CEOs. Then, one year later, we sent questionnaires to the top management teams (defined by the CEO) to measure the three types of capital and firm performance. We collected data at two points for a stronger case for true correlations and mitigating reverse causality concerns. We recognize, however, that like most CE studies, our design does not address all causality concerns.

To develop our survey, we asked a panel of seven management scholars familiar with the literature and three CEOs to review our survey and provide feedback. Based on their feedback, we modified the questionnaire and then pretested it on 76 participants in an executive MBA class. This confirmed the reliability and factor structure of our measures. Based on this, we first sent a questionnaire to the CEOs of each of the 3,679 firms in our sampling frame with a letter endorsed by the director and alumni officer of a nationally reputable business school. These

letters explained the research project, encouraged participation, and promised that each participating firm would receive an executive summary of the findings. After one phase of follow-ups and telephone calls, 504 CEOs agreed to participate, representing a response rate of 14 percent consistent with the 10 to 12 percent rate typical for mailed surveys to top executives (Hambrick, Geletkanycz, and Fredrickson, 1993). An independent sample t-test indicated no significant differences in firm size between participating and nonparticipating firms.<sup>1</sup> Additionally, we compared early and late respondents. Known as the wave analysis approach to non-response bias (Rogelberg and Luong, 1998: 63), late respondents—those who returned the survey after the specified deadline—are considered as 'similar to non-respondents in that they would have been non-respondents if the survey deadline had been observed.' Using the two-sample Kolmogorov-Smirnov test, we examined differences between early and late respondents in terms of human, social, and organizational capital, as well as CE and performance. The test revealed no significant differences for any variable, thereby attenuating concerns of nonresponse bias (Combs and Ketchen, 1999; Kanuk and Berenson, 1975).

To ensure consistency across firms, and following the procedure suggested by Finkelstein and Hambrick (1996), we asked the CEO of each firm to identify members of their TMT, defining the team as those persons typically involved in deciding the significant strategic issues facing the firm. A year later, a letter was sent to each of the 504 CEOs thanking them for their participation and inviting them to participate further by distributing a questionnaire to each member of their top management team. To ensure privacy and confidentiality of responses, we provided a return envelope for each member of the team, thus all responses were returned directly without CEO oversight. Overall, TMT members from 158 firms in our initial sample responded, representing an initial response rate of 31 percent. To ensure representativeness, we included only those firms where at least two members of the top

<sup>1</sup> Because our sample comprised small- to medium-sized firms, on which financial data is generally not available, we were unable to conduct a complete test of nonresponse bias using full financial information. However we were able to gain access to profitability data on a small subsample of responding and nonresponding firms from a credit rating agency. We compared the gross profits of 20 responding and nonresponding companies. A t-test revealed no significant difference.

management team (in addition to the CEO) responded. This resulted in a usable sample of 125 firms, representing an effective response rate of 25 percent. The TMTs in our sample ranged in size from two to 11 members, with an overall average of 6.5 members. An average of 4.5 TMT members responded from each firm, for an overall internal response rate of 75 percent. On average, respondents were 42 years old and tenured in their position for seven years, their company for 11 years, and their industry for 16 years. Given the attrition of firms in the second phase of our study, we compared firms that responded in only the first phase with those that responded to both. The two-sample Kolmogorov-Smirnov test indicated no differences in human, social, organizational capital or CE and performance, suggesting the absence of attrition bias.

## Variables and measurement

### *Corporate entrepreneurship*

Consistent with our earlier discussion on CE, we measured *the firm's pursuit of CE*, using previously established items and scales (Zahra, 1996; Simsek, 2007), as a latent construct represented by 17 items rated on a seven-point scale, ranging from 1 ('strongly disagree') to 7 ('strongly agree'). Respondents were asked to assess, over the last three years, the extent of their firm's pursuit of *innovation*: (1) spending heavily (well above the industry average) on product development; (2) introducing a large number of new products to the market; (3) acquiring significantly more patents than its major competitors; (4) pioneering the development of breakthrough innovations in its industry; and (5) spending on new product development initiatives; *venturing*: (1) entering new markets; (2) acquiring companies in different industries; (3) establishing or sponsoring new ventures; (4) finding new niches in current markets; (5) financing start-up business activities; and (6) creating new semi-autonomous and autonomous units); and, finally, *strategic renewal*: (1) divesting unprofitable business units; (2) changing its competitive approach; (3) reorganizing operations, units, and divisions to ensure increased coordination and communication; (4) redefining the industries in which it competes; (5) introducing innovative human resource programs; and (6) first in the industry to introduce new business concepts and practices.

The univariate distributions of each of the items indicated five items that departed significantly from

normality (acquiring significantly more patents than major competitors; acquiring companies in different industries; financing start-up businesses outside the organization; creating new semi-autonomous and autonomous business units; and divesting several unprofitable business units). Importantly, these five items are also less relevant to small- to medium-sized firms and, thus, were excluded from the modified CE scale. While it might be possible that SMEs engaging in these unconventional CE activities might be more successful, both in terms of their stocks of knowledge capital and subsequent performance, than firms not engaging in these activities,<sup>2</sup> our analyses suggested no significant correlations between the five excluded items and knowledge-based capital stocks (HC, SC, and OC) or performance.

To assess the measurement validity of our *modified CE scale*, we conducted a confirmatory factor analysis. The results of the revised model suggested acceptable model fit [ $\chi^2(47, n = 125; p < 0.001) = 97$ ; CFI = 0.90; IFI = 0.91; RMSEA = 0.09]. Following from our theoretical discussion, we examined the efficacy of two alternative characterizations of the CE construct: (1) innovation, venturing, and renewal as independent constructs; and (2) innovation, venturing, and renewal as first-order factors with CE specified as a second-order factor. Supporting CE as a latent construct that captures the complementarity of innovation, venturing, and renewal, the second model ( $\chi^2(49, n = 125; p < 0.001) = 90.2$ ; CFI = 0.92; TLI = 0.89; IFI = 0.92; RMSEA = 0.08) outperformed the first model ( $\chi^2(52, n = 125; p < 0.000) = 172.4$ ; CFI = 0.77; TLI = 0.71; IFI = 0.77; RMSEA = 0.14), as evidenced by a significant chi-square difference test ( $\Delta\chi^2(3) = 82.2; p < 0.001$ ). Because CFAs require a large sample size we also tested our model on the complete sample of CEOs and TMT members ( $n = 560$ ), which produced a similar pattern of findings both in terms of model fit and factor loadings. The coefficient alpha for the CE scale is 0.85.

### *Knowledge-based capital*

Using the scale and validation efforts of Youndt and colleagues (Youndt *et al.*, 2004; Subramaniam and Youndt, 2005) among others (e.g., Hayton, 2005; Reed *et al.*, 2006), we measured the three elements of knowledge-based capital independently. In particular, to measure *human capital*, we asked top

<sup>2</sup>We thank an anonymous reviewer for this insight.



managers of the firms in our sample to assess the extent to which employees in the organization are: (1) highly skilled; (2) widely considered among the best in the industry; (3) creative and original; (4) experts in their particular jobs and functions; and (5) a source of new ideas, products, and innovations. The scale demonstrated acceptable measurement validity at the individual ( $\chi^2(4, n = 435; p < 0.01) = 17$ ; CFI = 0.98; IFI = 0.98; RMSEA = 0.09) and firm level of analysis ( $\chi^2(5, n = 125; p < 0.10) = 11$ , CFI = 0.98; IFI = 0.98; RMSEA = 0.09). The scale has a coefficient alpha of 0.88. Because we measured human capital using the responses of members of the top management team, we used James, Demaree, and Wolf's (1984) agreement index [*Rwg* (*j*)] to justify aggregating individual members' responses to the team level. Median *Rwg* values higher than 0.70 are generally considered sufficient evidence of agreement to support aggregation (Chan, 1998). The median *Rwg* value for human capital is 0.94. We also calculated the scale intraclass correlations ICC (1) and ICC (2). ICC (1) indexes the reliability of individual ratings and ICC (2) represents the reliability of a group average rating (Chen, Bliese, and Mathieu, 2005). The intraclass correlations suggested acceptable reliability (ICC1 = 0.28; ICC2 = 0.57;  $F = 2.337; p < 0.001$ ).

We similarly measured *social capital* using an eight-item scale: (1) our employees are skilled at collaborating with each other in problem solving; (2) our employees share information and learn from one another; (3) our employees interact and exchange ideas with people from different areas within the company; (4) our employees partner with customers, suppliers, and alliance partners to develop solutions; (5) our employees apply knowledge from one area of the company to problems and opportunities that arise in other areas; (6) we regularly have departmental meetings to discuss market trends and developments; (7) we often convene cross-departmental meetings to discuss market trends and developments; and (8) strategic information spreads quickly throughout all levels in this organization. These eight items reflected an organization's overall ability to share and leverage knowledge among and between networks of employees, customers, and suppliers (Youndt *et al.*, 2004). The scale demonstrated acceptable measurement validity at the individual ( $\chi^2(16, n = 435; p < 0.001) = 60$ ; CFI = 0.98; IFI = 0.98; RMSEA = 0.08) and firm levels of analysis ( $\chi^2(19, n = 125; p < 0.01) = 43$ , CFI = 0.93; IFI = 0.94; RMSEA = 0.10), reliability ( $\alpha = 0.89$ ; ICC1 = 0.17;

ICC2 = 0.41;  $F = 1.699; p < 0.001$ ), and inter-rater agreement (median *Rwg* = 0.93).

Finally, we measured *organizational capital* using a six-item scale. Specifically, we asked top managers to rate the extent to which the most important knowledge in the firm: (1) is protected by patents, knowledge-based property rights, licenses, contracts, and trade secrets; (2) exists in the know-how of employees; (3) exists in procedures, policies, and protocols; (4) is articulated in our value system; (5) is contained in written form; and (6) is manifested in structures, systems, and processes. These six items reflect the ability of organizations to appropriate and store knowledge in organizational-level repositories. However, the first item, reflecting knowledge embodied and protected by intellectual property, did not load significantly on the OC construct. Our examination of the reliability statistics further suggested that this item reduced the overall internal consistency of the scale. Thus, we deleted this item from the scale. The revised scale demonstrated satisfactory measurement validity at the individual ( $\chi^2(5, n = 435; p < 0.01) = 20.8$ ; CFI = 0.97; IFI = 0.97; RMSEA = 0.08) and firm level of analysis ( $\chi^2(5, n = 125, n.s) = 6.8$ ; CFI = 0.99; IFI = 0.99; RMSEA = 0.05), and acceptable reliability ( $\alpha = 0.77$ ; ICC1 = 0.21; ICC2 = 0.54;  $F = 2.2; p < 0.001$ ), and inter-rater agreement (median *Rwg* = 0.92).

To establish any potential bias that might arise from relying on executive assessments of knowledge-based capital, we examined the frequency distributions and skewness and kurtosis statistics of human capital, social capital, and organizational capital, for both CEO and TMT responses. To the extent that our measures of knowledge-based capital might have been biased by relying on executive assessments, we would have expected significant skewness in responses. In all cases, responses were normally distributed across the response scale and skewness and kurtosis statistics were within normal range, suggesting the absence of any systematic bias in knowledge-based capital evaluations. As a further measure, we correlated CEO and TMT evaluations of human, social, and organizational capital, and in all cases they were positively correlated, suggesting that knowledge-based capital evaluations were consistent both across informants (CEOs vs. TMTs) and across time periods.

#### *Firm performance*

We assessed *firm performance* in the current year by asking top management team members to compare

their performance relative to that of other major competitors on profitability and growth, using an eight-item scale developed by Gupta and Govindarajan (1986), which was later used by researchers such as Covin, Prescott, and Slevin (1990) and Lubatkin *et al.* (2006). The measure included items such as growth in sales, growth in market share, return on equity, and return on total assets, which were rated using a scale from 1 ('much worse') to 5 ('much better'). We used this scale because objective data on the financial performance of firms in our sample were not available, largely because SME owners are not legally required to publish this data. While we recognize that managerial assessments of firm performance might produce unstable estimates, evidence suggests that such executive self-reports of performance tend to be significantly correlated with objective measures of firm performance (Dess and Robinson, 1984; Robinson and Pearce, 1988). Moreover, to demonstrate the stability of the measure, we computed its test-retest reliability by correlating CEO and TMT assessments of firm performance a year apart. As we expected, both CEO and TMT assessments of performance are positively and significantly correlated ( $r = 0.32$ ;  $p < 0.001$ ), providing evidence of the stability of the firm performance measure.<sup>3</sup> Additionally, the scale demonstrated satisfactory measurement validity at the individual ( $\chi^2(16, n = 435; p < 0.001) = 63$ ; CFI = 0.98; IFI = 0.98; RMSEA = 0.08) and firm level of analysis ( $\chi^2(17, n = 125; p < 0.001) = 57$ ; CFI = 0.94; IFI = 0.94; RMSEA = 0.14), as well as reliability ( $\alpha = 0.91$ ; ICC1 = 0.42; ICC2 = 0.76;  $F = 4.253$ ;  $p < 0.001$ ) and inter-rater agreement (median  $Rwg = 0.96$ ).

#### Covariates

Consistent with previous theory, we controlled for initial resource stocks of knowledge-based capital, firm age, firm size, CEO tenure, and environmental complexity. We first controlled for initial capital stocks by assessing knowledge-based capital during the first phase of our study. We created a measure of

initial knowledge-based capital stocks by combining measures of HC, SC, and OC, as assessed by the CEO during the first phase of our study. Overall, the scale demonstrated acceptable reliability ( $\alpha = 0.87$ ) and measurement validity ( $\chi^2(121, n = 125; p < 0.001) = 176.6$ ; CFI = 0.92; IFI = 0.93; TLI = 0.90; RMSEA = 0.06). Controlling for the influence of initial resource stocks enables more robust inferences concerning the additive impact of CE on HC, SC, and OC. *Firm size* was measured as the number of full-time employees, which was then log transformed because the distribution departed from normality. *Firm age* was the log-transformed number of years since a firm's founding. Youndt and colleagues (2004) also controlled for firm size and age because they predicted that knowledge creation and diffusion are inherently evolutionary in nature and would be influenced by an organization's age and access to resources (Reed *et al.*, 2006). We measured *CEO's tenure* as the number of years the CEO has been in office because longer tenured managers tend to be less willing to undertake risky CE activities (Miller and Shamsie, 2001). We assessed *complexity* using Miller and Friesen's (1983) four-item measure ( $\alpha = 0.74$ ). Using a scale ranging from 1 ('not at all') to 7 ('a great extent'), CEOs were asked to assess the extent to which changes occurred in various aspects of their primary industry. We controlled for complexity because knowledge-based capital development may systematically vary across different levels of environmental complexity (Youndt and Snell, 2004).

## ANALYSES AND RESULTS

Table 1 presents means, standard deviations, and correlations for the measures. Given that no inter-factor correlation is above the recommended level of 0.70 (Tabachnick and Fidell, 1996), multicollinearity and, hence, problems created by a lack of discriminant validity are not likely to bias our data. Nonetheless, we examined the variance inflation factors (VIF) of each individual predictor in our model, which ranged from 1.01 to 1.61, suggesting no multicollinearity (Neter *et al.*, 1996). To examine the measurement component of our model, we ran a confirmatory factor analysis (CFA) to fit the observed data. The criteria examined include chi-square ( $\chi^2$ ), the comparative fit index (CFI), the incremental fit index (IFI), the Tucker-Lewis index (TLI), and the root-mean-square error of approximation (RMSEA).

<sup>3</sup>Although this correlation might suggest a low degree of consensus or agreement between CEO and TMT members, correlation is not indicative of agreement. Instead, we calculated the *Rwg* index to assess whether all members of the TMT (including the CEO) exhibited agreement in their evaluation of firm performance. The *Rwg* index using combined CEO and TMT responses was 0.97, suggesting a high degree of consensus in their assessment of firm performance.

Table 1. Means, standard deviations, and correlations

	Mean	S.D.	1	2	3	4	5	6	7	8	9
1. Firm performance	3.60	0.51	(0.91)								
2. Human capital	3.72	0.53	0.43**	(0.88)							
3. Social capital	3.51	0.51	0.28**	0.58**	(0.89)						
4. Organizational capital	3.35	0.45	0.17†	0.40**	0.59**	(0.66)					
5. Corporate entrepreneurship	4.42	1.0	0.19*	0.22*	0.20*	0.07	(0.85)				
6. Firm age (log)	3.34	0.93	0.17†	0.03	0.13	-0.01	-0.04	—			
7. Firm size (log)	5.26	1.3	0.10	0.06	0.14	0.10	0.03	0.24**	—		
8. Initial knowledge capital stocks	3.63	0.48	0.04	0.20*	0.17†	0.21*	0.56**	-0.04	0.04	(0.86)	
9. Environmental complexity	3.96	1.1	-0.17†	-0.17†	-0.14	-0.06	0.16†	-0.27**	0.05	-0.01	(0.75)
10. CEO tenure	22.2	9.9	0.05	0.07	0.13	0.19*	-0.04	0.12	-0.11	0.06	-0.05

*N* = 125; †*p* < 0.10; \**p* < 0.05; \*\**p* < 0.01; Coefficient alpha coefficients are on the diagonal in parentheses.

When a hypothesized model fully captures the data from a sample population, the CFI, IFI, and TLI are expected to have values of 1.0, and the RMSEA, a value of 0.0. Although standards for such indices are difficult to establish, a value of 0.90 or higher for the CFI, IFI, and TLI, and a value of 0.08 or lower for the RMSEA are typically suggested as having adequate fit (Hu and Bentler, 1998). The values of the fit indices indicated that our measurement model had adequate fit ( $\chi^2$  (625, *n* = 125; *p* < 0.001) = 821.61; CFI = 0.91; IFI = 0.91; TLI = 0.90; and RMSEA = 0.05). Hair *et al.* (1998) note that given a best-fitting CFA model, 'each of the constructs can be evaluated separately by: (1) examining the indicator loadings for statistical significance and (2) assessing the construct's reliability and variance extracted' (Hair *et al.*, 1998: 652). Results for our CFA indicate that the relationship between each indicator and its respective variable was statistically significant (*p* < 0.001), verifying the posited relationships among indicators and constructs, and thus, convergent validity.

We first compared the hypothesized measurement model with a null latent model that constrains the relationships between all latent factors to zero. A significant chi-square difference between the fit of the two models ( $\Delta\chi^2$  (10, *n* = 125; *p* < 0.001) = 107.48) indicates that sufficient covariance exists between the latent variables to warrant testing the hypothesized model. We further examined the discriminant validity of the constructs by performing a series of confirmatory factor analyses (CFAs) in which we compared one-, two-, three-, four-, and five-factor models in the interests of comprehensiveness. As shown in Table 2, the hypothesized measurement model demonstrates the best fit compared to the alternative models. In all comparisons there were significant differences, providing evidence of discriminant validity (Bagozzi, Li, and Phillips, 1991)<sup>4</sup>.

Having established the fidelity of our measures, we used hierarchical multiple regression to test the hypothesized relationships. Control variables were entered in Step 1 and independent variables and mediators in Step 2 of each regression equation. The results for the first three hypotheses are presented in

<sup>4</sup>We performed these CFA analyses at both the individual (*n* = 560) and firm (*n* = 125) levels of analysis. The results of the CFA analyses, in terms of model fit and convergent and discriminant analysis, were consistent across levels of analysis (results are available from the authors on request).

Table 2. Summary of fit indices for contrasts among alternative measurement models

Model	$\chi^2$	Df	CFI	IFI	TLI	RMSEA	Comparison	$\Delta\chi^2$	$\Delta df$
Model 1 (Single-factor model)	1047.09***	635	0.81	0.81	0.79	0.07			
Model 2 (Two-factor model)	792.30***	634	0.84	0.85	0.82	0.07	Model 1	74.8***	1
1) CE + firm performance									
2) HC + SC+ OC									
Model 3 (Three-factor model)	920.73***	632	0.86	0.87	0.85	0.06	Model 2	51.6***	2
1) CE									
2) Firm performance									
3) HC + SC + OC									
Model 4 (Four-factor model)	901.80***	629	0.87	0.88	0.86	0.06	Model 3	18.9***	3
1) CE									
2) Firm performance									
3) HC + SC									
4) OC									
Model 5 (Five-factor model)	821.61***	625	0.91	0.91	0.90	0.05	Model 4	80.2***	4
1) CE									
2) Firm performance									
3) HC									
4) SC									
5) OC									

$N = 125$ ; \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ ; <sup>†</sup> $p < 0.10$ .

Table 3 (Models 2 to 4). As shown in Table 3 (Model 2), we found that CE was positively associated with human capital ( $\beta = 0.24$ ;  $p < 0.05$ ), supporting our first hypothesis. Consistent with H2, we found that CE is also positively associated with social capital ( $\beta = 0.25$ ;  $p < 0.05$ ). Regarding H3, CE was not significantly associated with organizational capital ( $\beta = 0.16$ , ns). To test H4 (a, b, and c), we followed Kenny, Kashy, and Bolger (1998) and Baron and Kenny (1986) who suggest four steps to establish mediation. Specifically, Step 1 requires that the independent variable is significantly related to the dependent variable; Step 2 requires that the independent variable is significantly related to the mediator; Step 3 requires that the mediator affects the dependent variable while controlling for the effect of the independent variable. And finally, when these conditions are satisfied, Step 4 requires that the effect of the independent variable on the dependent variable is nonsignificant when controlling for the mediator in order to indicate complete mediation; otherwise partial mediation is indicated. The effects in both Steps 3 and 4 are estimated in the same regression equation (Baron and Kenny, 1986). With multiple mediators, it is possible to test their mediating effects

simultaneously or separately—separate estimation is recommended when the mediators are intercorrelated (Kenny, 2009). Given the high correlations among human capital, social capital, and organizational capital reported in Table 1, we opted to estimate their effects independently to better establish their distinct mediational influence. The changes in R-squared ( $\Delta R^2$ ) of each model and step and the standardized regression coefficients are all presented in Table 3.

The first condition was satisfied. As shown in Model 1 of Table 3, there is a positive relationship between CE and firm performance ( $\beta = 0.27$ ;  $p < 0.05$ ). As shown in Models 2, 3, and 4 of Table 3, the second condition for mediation is met for human capital (H4a) and social capital (H4b), but not organizational capital (H4c). As previously reported, CE is not significantly related to organizational capital and, therefore, H4c is not supported. With respect to the third condition, both human capital ( $\beta = 0.39$ ;  $p < 0.001$ ) and social capital ( $\beta = 0.20$ ;  $p < 0.05$ ) are positively related to firm performance after controlling for CE. Finally, in regard to the fourth condition, both human capital and social capital mediate the relationship between CE and firm per-

Table 3. Results for direct and mediational tests

Variable	Model 1: Firm performance		Model 2: Human capital		Model 3: Social capital		Model 4: Organizational capital		Model 5: Firm performance		Model 6: Firm performance		Model 7: Firm performance	
	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$	$\beta$	$\Delta R^2$
<b>Control variables:</b>		<b>0.06</b>		<b>0.10*</b>		<b>0.09<sup>†</sup></b>		<b>0.05</b>		<b>0.06</b>		<b>0.06</b>		<b>0.06</b>
Firm age (log)	0.10		-0.04	0.07		0.07		-0.04		0.10		0.10		0.10
Firm size (log)	0.09		0.08	0.15		0.15		0.11		0.09		0.09		0.09
Knowledge-based capital stock	0.06		0.22*	0.15		0.15		0.13		0.06		0.06		0.06
Environmental complexity	-0.16		-0.19*	-0.14		-0.14		-0.12		-0.16		-0.16		-0.16
CEO tenure	0.05		0.06	0.11		0.11		0.09		0.05		0.05		0.05
<b>Independent variable</b>		<b>0.05*</b>		<b>0.04*</b>		<b>0.04*</b>		<b>0.02</b>						
Corporate entrepreneurship	0.27*		0.24*	0.25*		0.25*		0.16		0.17		0.22 <sup>†</sup>		0.24*
<b>Mediating variables</b>														
Human capital										<b>0.18***</b>		<b>0.08*</b>		<b>0.06*</b>
Social capital										0.39***				
Organizational capital												0.20*		0.17 <sup>†</sup>
<b>R<sup>2</sup></b>		0.11		0.14		0.13		0.08		0.24		0.14		0.14
<b>Adjusted R<sup>2</sup></b>		0.06		0.09		0.09		0.03		0.19		0.09		0.08
<b>F</b>		2.18 <sup>†</sup>		2.79*		2.74*		1.6		4.81***		2.50*		2.34*

$N = 125$ ; \*\*\* $p < 0.001$ ; \*\* $p < 0.01$ ; \* $p < 0.05$ ; <sup>†</sup> $p < 0.10$ .

formance, such that when each variable is included in the model, CE no longer has a significant effect on performance, thus supporting H4a and H4b.

### Post hoc analyses and robustness tests

We conducted a series of *post hoc* analyses to further verify our findings and gain additional insight. First, although we posited that engagement in CE influences the firm's knowledge-based capital, it is plausible that a well-endowed stock of knowledge resources simultaneously enables CE pursuits. To address this concern, we controlled for firms' initial stock of knowledge-based capital when estimating the effects of CE (measured at  $t = 0$ ) on subsequent stocks of knowledge resources (measured at  $t + 1$ ). The significant  $\Delta R^2$  for CE's effect on human and social capital suggests that CE has a significant impact on human and social capital, beyond the enabling influence of initial endowments of knowledge resources. We believe that our theoretical rationale, combined with a lagged research design that establishes temporal precedence, and the measurement and control of initial knowledge resource stocks, permits a robust interpretation of the influence of CE on knowledge-based capital.

Second, given that organizational capital develops gradually, one speculative explanation for the unexpected null Hypothesis 3 finding is that the effects of CE on organizational capital are mediated by other knowledge resources, notably human and social capital.<sup>5</sup> Given the particular contribution we sought, however, we did not formally hypothesize such relationships, but tested for them. The results are intriguing. Although CE is not directly related to OC, we did observe that both human and social capital have significant effects on organizational capital, while controlling for the effects of CE. This suggests that the effects of CE on OC might indeed be indirect (Preacher and Hayes, 2004), mediated by human and social capital, a point we return to in the discussion section. We also examined whether organizational capital in combination with human and social capital might positively influence performance. To explore this, we estimated two regression equations in which we examined moderating influences of human and social capital on the relationship between organizational capital and performance. The results indicated no significant contingent

effects for human or social capital. In addition, we tested for a possible moderating effect for environmental dynamism, but again found no significant effect.

Finally, although the use of a longitudinal research design with multisource data significantly ameliorates concerns regarding common method variance, we took additional precautions to maximize the validity of our inferences. To mitigate any potential biasing effect, we carefully constructed all survey items and in all cases used pretested, valid multidimensional constructs (Huber and Power, 1985). Because all of the constructs were of a higher-order nature assessed by multiple item measures, this reduces the likelihood of respondents artificially inflating relationships among them. To detect the possible influence of common method variance, following Podsakoff *et al.* (2003), we re-estimated the measurement model described in Table 2 with all the indicators loading on a general common method factor. Results indicate that although the general common method factor did improve model fit, none of the individual path coefficients corresponding to the relationships between the indicators and the general method factor were significant, mitigating concern over method bias (Podsakoff *et al.*, 2003).

## DISCUSSION AND CONCLUSIONS

The core of our tested model can be recapitulated as follows: (1) the pursuit of CE extends the firm's knowledge-based capital; (2) such effects may be especially likely to occur in the domain of the firm's capital residing in its people, relationships, and technical systems; and (3) through the influence of human, social, and organizational capital, the pursuit of CE may have important effects on firm performance. The tested model in this article combines this reasoning and is based on a large body of research in several widely received theoretical perspectives including intellectual capital, resource/knowledge-based views, organizational learning, and dynamic capabilities. Taken together, our theory and results advance theory and inform practice while also suggesting promising directions for future research.

### Implications for theory

We contribute to theory and literature on CE by developing and testing a mediational model that provides an explanation of the CE-firm performance

<sup>5</sup>We thank the action editor for this insight.

relationship. To date, several studies have established the link between CE and firm performance, but none has examined the intermediary mechanisms that underlie this relationship (Kuratko and Goldsby, 2004). We developed and tested a mediational model that suggests CE increases firm performance by augmenting, extending, and renewing knowledge-based capital. Thus, we contribute to the CE literature by demonstrating knowledge-based capital as one mechanism for more deeply explaining and understanding the association between CE and firm performance. As previously discussed, although some have suggested that CE activities can augment and stretch a company's existing knowledge base, the firm's pursuit of CE is yet to be linked to the kind of knowledge-based elements that are impacted by CE and that, in turn, enhance performance. We move this stream of research along by exploring the unique roles of human, social, and organizational capital in carrying the impact of CE on performance.

A second contribution of our study is the important insight that CE governs firm performance as a dynamic capability by reconfiguring, extending, and modifying the firm's knowledge-based resources (Eisenhardt and Martin, 2000; Teece, Pisano, and Shuen, 1997). Our results suggest that CE reflects learned patterns of collective activity through which the firm purposefully configures and reconfigures its resources and routines to enhance performance. In particular, our findings suggest that increases in human capital completely mediated the relationship between CE and firm performance. To us, this finding suggests that by engaging in CE activities, firms are instigating a path dependent process that shapes and augments human capital in unique, difficult to imitate ways, that provides a sustainable advantage. In doing so, CE enables the ongoing alignment of human capital with business conditions, mitigating the potential for core rigidities and associated success traps that impede performance. Beyond human capital, our findings reveal that social capital also mediates the relationship between CE and performance. By increasing social capital, firms pursuing CE are able to more efficiently utilize their knowledge base by leveraging it across the entire firm. As theorized, CE places a premium on knowledge sharing and dissemination among individuals and, by so doing, serves as the basis for the formation of instrumental ties between disparate actors in the firm. In essence, CE creates an opportunity for the development of social capital by

creating interdependencies that entail ongoing communication, collaboration, and negotiation within the firm. We believe these findings partly address Zahra *et al.* (1999), Dess *et al.* (2003), and Phan *et al.*'s (2009) concern that CE studies have largely been 'black box' or 'causal gap' studies, which do not adequately address mechanisms governing CE effects on performance.

Finally, and beyond advancing current explanations of the intermediary knowledge-based mechanism that tie CE to firm performance, we enrich research on the origins and antecedents of knowledge-based capital endowments. To date, scholars have proposed that human resource architectures (Kang and Snell, 2009) and investments in HR, IT, and R&D (Youndt and Snell, 2004; Youndt *et al.*, 2004) facilitate improvements in knowledge-based capital. Our findings suggest that engaging in CE might represent an even more fundamental means for enhancing these knowledge-based foundations. Our findings suggest that engaging in CE contributes to the development of human and social capital, but not organizational capital.

### Further implications

Another important contribution of our study is to clarify the conceptual nature and character of the CE construct. Drawing from the literature on multi-dimensional constructs, we argue and find that innovation, venturing, and strategic renewal are complementary components of CE. As a higher order latent construct, CE explains the complementarity among these three dimensions. Another implication of our study is that CE contributes to the performance of SMEs. For the most part, previous studies have emphasized the effects of CE in large, multibusiness firms. Our study suggests that CE, by shaping and renewing a firm's knowledge-based capital contributes to the performance of SMEs. We would argue that this enabling role of CE is particularly salient among SMEs who might lack sufficient slack and absorptive capacity to make large scale investments in knowledge-based capital. While testing in larger firms is needed to verify this insight, we suspect that the statistical association among CE, knowledge-based capital, and firm performance may not be as strong as what we found with our sample of SMEs.

Lastly, another contribution of our findings and *post hoc* analyses concern the null effects of CE on organizational capital and, subsequently, firm per-

formance. In the first instance, the null effect of CE on organizational capital might be due to the fact that knowledge held in organizational repositories, such as routines, is difficult to revise and update in light of new experiences, insights, or knowledge, particularly if existing knowledge is highly institutionalized. Widely held, legitimate knowledge is often resistant to change and is a common source of inertia for firms (Leonard-Barton, 1992). To institutional theory, new knowledge that is supported by broader discourses and is not highly contested by competing discourses is more likely to be institutionalized (Phillips, Lawrence, and Hardy, 2004). A second potential explanation is that organizational capital comprises mostly explicit knowledge that might be more subject to imitation by other firms than other forms of knowledge-based capital. Because knowledge embodied in patents, operating manuals, and the like tends to be observable and codifiable, organizational capital does not offer the same protection against imitation that knowledge contained in human and social capital provide. Therefore, the value obtained from organizational capital is subject to competitive erosion. Additionally, although knowledge contained in organizational capital might be important to firms, it may contribute little to firm performance unless leveraged and commercialized. This suggests that organizational capital might represent a necessary but insufficient condition for the creation of value.<sup>6</sup> Consistent with this insight, our *post hoc* analyses showed that the effects of CE on organizational capital are indirect, mediated by human and social capital, suggesting that organizational capital is partly predicated on advances in human and social capital. This finding is also consistent with the observation that knowledge embedded in technical systems results from ‘years of accumulating, codifying, and structuring the tacit knowledge in peoples’ heads’ (Leonard-Barton, 1992: 113), as well as the insight that organizational capital involves a feed forward learning process in which new knowledge—primarily embedded in human and social capital—slowly and gradually becomes integrated and institutionalized (Crossan *et al.*, 1999; Crossan and Berdrow, 2003; Nonaka, 1994).

Having noted the potential benefits of the pursuit of CE for the firm’s knowledge-based capital, we would be remiss if we also did not call attention to the potential downside of CE to temper any sugges-

tion—perhaps implicit in our discussion in this article—that the effects of pursuing CE on knowledge-based mechanisms and performance are uniformly beneficial. However, it seems unlikely that CE always has positive effects on the firm’s knowledge-based capital. For example, CE might trigger power plays and other negative political dynamics that undermine and damage, rather than build and develop social and organizational capital. As Morris and colleagues (2008: 288) explain, ‘departments are more concerned with protecting their turf than they are with developing new ideas that will benefit the organization.’ The associated competition and conflict might impede information flows such that incentives to share and codify new insights are diminished. And to the extent that CE engenders dysfunctional conflicts among units/actors, it might even be associated with the loss of human capital. In overcoming the many obstacles to CE pursuits, managers ‘can often walk a fine line between clever resourcefulness and outright rule breaking’ (Kuratko and Goldsby, 2004: 14). Kuratko and Goldsby (2004) suggest that in overcoming internal and external obstacles, corporate entrepreneurs might fall prey to careerism and amoral paradigms, which can damage the fabric of social and organizational capital in firms. Furthermore, engaging in CE at very high levels might impede the timely accumulation of knowledge capital and strain cash flows. Future research is needed to address these adverse effects of engaging in CE on firm performance.

### Implications for practice

Given that CE champions, intrapreneurs, and senior executives are interested in realizing CE’s promise (Wolcott and Lippitz, 2007), our findings are valuable since they provide a deeper insight as to how CE might enhance performance. First, the pursuit of CE appears to result in significant knowledge-based capital for the firm. This finding might, in turn, provide additional leverage for those managers, particularly at lower and middle levels, who might need support in instigating and pursuing entrepreneurial initiatives. Second, the positive effects of CE activities on knowledge-based capital might be enhanced to the extent firms put in place institutional arrangements and support structures and processes for capturing the learning benefits. Research has demonstrated that firms vary widely in their ability to assimilate and leverage the lessons of experience (Cohen and Levinthal, 1990; Zahra and George,

<sup>6</sup>We thank the action editor for this insight.



2002). Third, our findings suggest that organizational capital might be difficult to change and might even be a potential source of inertia for firms. Managers need to be cognizant of the fact that knowledge embedded in formal and informal systems needs to be updated on an ongoing basis.

### Potential limitations

We believe that our findings are robust, in that we have designed our study in a way to avoid the various threats to validity associated with survey-based research. To enhance the internal validity of our study's findings, we incorporated temporal precedence by measuring our endogenous variables a year after our independent variable and controlled for initial stocks of knowledge-based capital. We avoided threats of construct validity by using psychometrically sound constructs and collecting data from multiple top management team members, in addition to the CEO. And, we relied on a relatively large sample of firms to bolster statistical conclusion and external validity. Additionally, our theoretical model entails somewhat complex mediational effects that mitigate the probability of drawing incorrect conclusions concerning the direction of causality (Bowen and Wiersema, 1999). Of course, we recognize that CE and firm performance might be reciprocally related, since engaging in CE is a resource-intensive activity that requires financial resources and, therefore, a strong baseline level of performance. With that said, while reverse causality is always a threat to a cross-sectional design, we believe it to be less likely given the theoretical connections we have charted to ground our specific hypotheses and given that we did control for initial stocks of knowledge-based capital. Additionally, because we collected our data from a sample of SMEs from which financial data are typically not available, it was not possible to fully compare respondents' and nonrespondents' financial performance to mitigate selection bias concerns that low performing firms might be less likely to respond to our survey. However, our analysis of a subsample of 20 responding and nonresponding firms revealed no significant difference between them in their gross profitability.

In short, we are mindful that, like most other studies examining CE effects, facets of our research design place certain limitations on the extent to which we can place full confidence on the causal interpretation of our results. Thus, even as our study

is only a first step toward understanding the mediating role of knowledge-based mechanisms for CE effects on performance, it represents a first step from which additional research and managerial understanding might be leveraged.

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