Journal of Operations Management 29 (2011) 116–127

Contents lists available at ScienceDirect

Journal of Operations Management

journal homepage: www.elsevier.com/locate/jom

# Operations management and corporate entrepreneurship: The moderating effect of operations control on the antecedents of corporate entrepreneurial activity in relation to innovation performance

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ARTICLE INFO

*Article history:*
Available online 23 July 2010

*Keywords:*
Operations control
Corporate entrepreneurship
Innovation

ABSTRACT

Research on the topic of corporate entrepreneurship has expanded steadily over the last few decades, in large part due to the increasingly recognized linkages between product-market and technological innovation (i.e., consequences of corporate entrepreneurial activity) and firm success. Likewise, growing evidence suggests that effective operations control is a common quality of successful firms. On the surface the two phenomena—corporate entrepreneurship and operations control—may seem to be inherently at odds. That is, corporate entrepreneurship is aimed at taking the firm in new directions, while operations control is aimed at channeling and often restricting actions. As such, it would be useful to know how operations control variables act in concert with the determinants of corporate entrepreneurial activity to promote the innovation outcomes that facilitate long-term organizational success. In this study of 177 firms operating in a wide variety of industries, we investigate the effect on innovation performance of several commonly-acknowledged antecedents of corporate entrepreneurship, as measured by the Corporate Entrepreneurship Assessment Instrument (e.g., Hornsby et al., 2008, 2002); namely, management support, work discretion/autonomy, rewards/reinforcements, time availability, and organizational boundaries. More importantly, we examine the moderating effects of operations control variables – specifically risk control and process control formality – on the relationships between the antecedents of corporate entrepreneurship and innovation performance. Results indicate that only two of the five antecedents to corporate entrepreneurship have main effects on innovation performance with moderate significance. However, each of the five antecedents significantly interacts with one or both of the operations control variables and, thereby, influences innovation performance. The implications of these results in relation to operations management and corporate entrepreneurship theory and practice are discussed.

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## 1. Introduction

Corporate entrepreneurship refers to the pursuit of entrepreneurial actions and initiatives that transform the established organization through strategic renewal processes and/or extend the firm's scope of operations into new domains, that is, new product-market segments or technological arenas (Guth and Ginsberg, 1990). Firms that exhibit corporate entrepreneurship are typically viewed as dynamic, flexible entities preparing, or prepared, to take advantage of new business opportunities when they arise (Morris et al., 2008). They explore new business domains as well as new ways of conducting business within existing domains. Among such firms, there is a willingness to deviate from prior routines, strategies, business models, and operating environments, and embrace new resource combinations that hold promise as potential enablers of innovation. In general, corporate entrepreneurship flourishes in established firms when individuals are free to pursue actions and initiatives that are novel to the firm. However, to be successful entrepreneurial activity must be integrated into the organization's strategies (Burgelman, 1983).

Operations managers realize that a mixture of formality and discretion is a key to providing both high effectiveness and high efficiency (Naveh, 2007). Yet, the presence of control-related structures, policies, systems, and operating management philosophies

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doi:10.1016/j.jom.2010.07.005

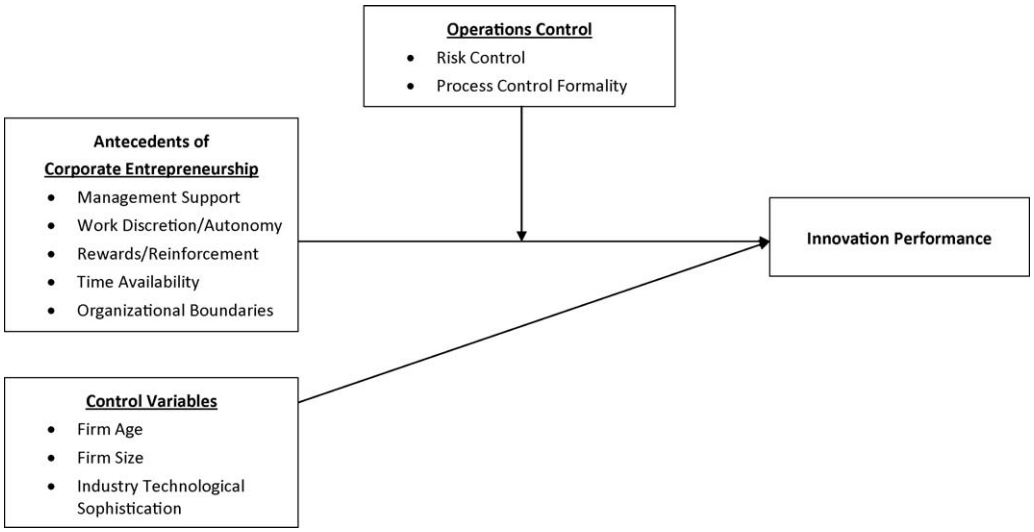


**Fig. 1.** The Impact of operations control variables on the relationship between antecedents of corporate entrepreneurship and innovation performance.

in organizations would seem to be a deterrent to the freedoms needed to successfully promote entrepreneurial behavior in established firms. After all, the control function in organizations exists, at least in part, to counteract the adverse effects of uncertainty on the organizational system, ensure conformity to established routines, correct deviations from expected behaviors, and promote efficiency and exploitative learning within the confines of established operations (Boyer and Lewis, 2002; Devaraj et al., 2004; Krajewski et al., 2010). Nonetheless, those factors that drive entrepreneurial activity in established firms – including, for example, resource support for innovative ideas and high levels of worker discretion in the performance of tasks – may not result in superior innovation performance at the firm level if operations control mechanisms are not in place. This is true because entrepreneurial activity is not inherently focused, cumulative, productive, or strategically relevant. Much has been written over the years about the importance of "unleashing the entrepreneurial potential" of firms by removing constraints on entrepreneurial behavior (e.g., Brandt, 1986; Pinchot, 2000). However, corporate entrepreneurship's exhibition and its success are two separate matters. In the absence of operations control mechanisms, firms that manifest corporate entrepreneurial activity may "tend to generate an incoherent mass of interesting but unrelated opportunities that may have profit potential, but that do not move [those] firms toward a desirable future" (Getz and Tuttle, 2001: 277). Therefore, the ability of those factors that drive corporate entrepreneurship activity to produce high levels of innovation performance is likely contingent upon a firm's ability to judiciously use operations control mechanisms that select, guide, and possibly terminate entrepreneurial actions and initiatives (Morris et al., 2006).

In the current paper, we explore relationships among the antecedents to corporate entrepreneurship, operations control mechanisms, and innovation performance. As conceptualized here, innovation performance refers to the degree of success attained by the firm at achieving its goals pertaining to product-market or technological innovation. A premise of the current research is that operations control mechanisms are not inherently antithetical to the interests of corporate entrepreneurship. Rather, factors that create entrepreneurship in established firms may operate in concert with operations control mechanisms to promote innovation performance. The purpose of this research is to clarify how and why operations control contributes to the innovation performance of firms with entrepreneurship-facilitating organizational qualities. We examine the moderating effect of certain operational control mechanisms on the relationship between the antecedents of corporate entrepreneurship and innovation performance. Our preliminary hypothesis is that operational control will have a distinct moderating effect. The proposed model is presented in Fig. 1.

The rest of the paper is structured in the following manner. In the next section, the literature on corporate entrepreneurship is examined in order to establish the current view of operational control in this field. We then propose a research model of the relationships examined in the study. The literature on antecedents to corporate entrepreneurship is reviewed, and we link those antecedents through hypothesis development to innovation performance. The possible moderating effects of operations control variables on the linkages between entrepreneurship-facilitating organizational qualities and innovation performance are then presented. The sample, measures, and analytical techniques of the study are discussed in the Methods section. In the Results section, we present our findings. Lastly, Section 7 addresses the implications of our work, limitations of our study, and opportunities for future research.

## 2. Operational control and corporate entrepreneurship strategy

Product-market and technological innovation have long been known to contribute to firm success (Covin and Slevin, 1991; Damanpour, 1991; Klein and Sorra, 1996). Correspondingly, top-level managers are increasingly recognizing the need to respond to the entrepreneurial imperatives created by their competitive landscapes (Kuratko, 2009). However, managers at all levels of the organization can be instrumental in fostering entrepreneurial activity leading to productive innovation results (Hornsby et al., 2009). Recognizing the role of an organization's broad membership in the perpetuation of innovation, the concept of corporate entrepreneurship-as-strategy has begun to develop. Ireland et al. (2009, p. 21) define a corporate entrepreneurship strategy as "a vision-directed, organization-wide reliance on entrepreneurial behavior that purposefully and continuously rejuvenates the organization and shapes the scope of its operations through the recognition and exploitation of entrepreneurial opportunity."

Significantly, a corporate entrepreneurship strategy is hard to create and, perhaps, even harder to perpetuate in organizations due to a failure to appreciate how operations control considerations work in conjunction with the drivers of corporate entrepreneurship to facilitate innovation performance. Too often, operations control processes and mechanisms are regarded as, at best, irrelevant to the

exhibition of corporate entrepreneurship or, at worst, antithetical to the interests of corporate entrepreneurship. In fact, the manners in which operations control are manifested in organizations can have great significance for the exhibition and success of innovative behaviors and initiatives. Covin and Slevin (2002) point out that the "hardware" side of organizations (strategy, structure, systems, and procedures) is the contextual framework within which individuals take their behavioral cues. Operations control systems exist as part of this hardware and, therefore, can be of great consequence to how individuals and collectives behave, including their exhibition of corporate entrepreneurial behavior. Ultimately, what is needed in organizations to productively support a corporate entrepreneurship strategy is not the absence of operations control processes and mechanisms, it is the alignment of such factors with the recognized organizational antecedents to corporate entrepreneurship. Consistent with this point, operations management research has often suggested that control systems can be instrumental to the successful introduction of new products and technologies (e.g., Das and Joshi, 2007; Khazanchi et al., 2007; Naveh, 2007).

Still, research that has specifically focused on relationships between particular control mechanisms in organizations and the exhibition of corporate entrepreneurship is sparse. Representative of such research are the studies of Morris et al. (2006), Poskela and Martinsuo (2009), and Perez-Freije and Enkel (2007). Morris et al. (2006) studied the relationships between the level of entrepreneurship exhibited in firms (as reflected in their entrepreneurial orientation (Covin and Slevin, 1991) scores) and their control system formality, control system discretion, and budgetary control tightness. Results based on a sample of 162 firms indicated that curvilinear relationships exist between level of entrepreneurship and both control system formality and budgetary control tightness, but no relationship exists between level of entrepreneurship and control system discretion.

In a study of 133 new product development projects, Poskela and Martinsuo (2009) explored relationships between seven management control variables and the extent to which a new product concept created new product or market development opportunities – what they termed "strategic renewal." Results indicated that input control and intrinsic task motivation (two of the seven management control variables studied) are positively associated with strategic renewal among early-development-stage product innovation projects. Additionally, the relationships between two other management control variables – front-end process formalization and outcome-based rewarding – and strategic renewal were negatively moderated by the level of technology uncertainty.

The need for balance between factors that facilitate innovation and factors that control innovation is most directly apparent in Perez-Freije and Enkel's (2007) study of successful innovation control systems in 12 companies. These researchers focused on exploring the creative tension that exists between concerns for resource efficiency and creativity. Results indicated that effective innovative control systems differ according to the level of dynamism in which the firm operates. For example, among firms in fast-changing industries, successful innovation control systems were characterized by flexible adaptation, autonomy, and metrics focused more on opportunity seeking than risk voidance. Among firms in slower-changing industries, successful innovation control systems were characterized by a focus on risk reduction and efficiency.

From an agency theory perspective, operations control mechanisms are the means through which firms can adroitly balance the interests of principals and agents in the successful pursuit of innovation via corporate entrepreneurship. Additionally, agency theory is a useful theoretical lens through which many of the functional as well as dysfunctional dynamics of corporate entrepreneurship might be understood. Agency problems arise when goal conflict exists between the principal and the agent (Jensen and Meckling, 1976) where the agent works for the principal but does not bear all of the wealth effects of the work outcome (Fama and Jensen, 1983). For example, a manager (agent) might have an incentive to engage in risky decisions under the guise of entrepreneurship, but not suffer the consequences of his/her poor decision-making. If the agent's funding is protected in a secure position, then those risky decisions may be made at the expense of the agent's other rightful responsibilities and duties, creating a "moral hazard" situation (Holmstrom, 1979). Because the firm (principal) can suffer from poor choices on the part of the agent, it will want to monitor the agent's decision making.

The impact of operational control on the costs of the agency problem is a key to understanding how entrepreneurial activity and its innovation performance outcomes are likely affected by operations control mechanisms. Specifically, innovation-focused controls enacted by individuals at the strategy- or policy-making levels of the firm may suppress the positive relationship between entrepreneurial activity and its performance outcomes. This is because such controls often limit the latitude of action available to lower-level organizational members through the centralization of organizational structure and decision-making. According to agency theory, the centralization of organizational structure and decision-making promotes monitoring, behavior-based compensation, and policy- and procedure-driven behavior among organizational employees (Goodale et al., 2008). Consistent with Morris et al. (2006), the restriction in range of the entrepreneurial opportunities recognized and pursued may limit the ability of the firm to achieve its desired innovation objectives because the best opportunities may be systematically weeded out by organizational architecture elements that limit individual discretion.

On the other hand, decentralized control mechanisms chosen and directed at the operational level of the firm will reduce risk premiums of outcome-based incentives by helping to establish clear organizational routines/boundaries for behavior, specifying work tasks, and appropriately administering incentives that more likely promote the long-term innovation interests of the firm. The decentralization of control places the responsibility for action at the level of the individual decision maker, and those on the front lines of innovation are often most knowledgeable about where their firms' most attractive entrepreneurial opportunities lie and how they might best be pursued (Burgelman and Grove, 1996). Thus, innovation-focused controls designed and administered by those responsible for the enactment of innovation grants greater discretionary power to these potential corporate entrepreneurs. Moreover, where there is a strategic focus for the innovative efforts, the existence of an expanded entrepreneurial opportunity set, as would be facilitated by the presence of controls set at the operational level, will increase the likelihood that the organization's membership will collectively allocate their time and efforts to entrepreneurial opportunities of greatest perceived value. This would have the effect of strengthening the relationship between entrepreneurial behaviors and their innovation performance outcomes.

## 3. Organizational antecedents of corporate entrepreneurship and innovation performance

As research on corporate entrepreneurial activity has evolved numerous researchers (e.g., Burgelman, 1983, 1984; Vesper, 1984; Guth and Ginsberg, 1990; Covin and Slevin, 1991; Zahra, 1991; Brazeal, 1993; Kuratko et al., 1993; Zahra and Covin, 1995; Hornsby et al., 1999; Thornhill and Amit, 2001; Antoncic and Hisrich, 2001; Hornsby et al., 2002, 2009) have acknowledged the importance of internal organizational antecedents to promoting and support-

ing innovation performance. Ireland et al. (2009) contend that it takes the right set of organizational antecedents to perpetuate and reinforce the recognition and exploitation of entrepreneurial opportunities. They point out that without specific organizational elements that encourage and support entrepreneurial behavior, systematically recognizing and exploiting entrepreneurial opportunities will not happen regardless of how intensely pro-entrepreneurship an organization's members may be.

Research has been conducted that identifies the specific organizational antecedents of individuals' entrepreneurial behavior. Kuratko et al. (1990) found three factors – management support, organizational structure, and rewards – to be the most important antecedents of managers' entrepreneurial behavior. Hornsby et al. (1999) partially replicated and extended the earlier study as they reported that five antecedents were important determinants of managers' entrepreneurial behavior in a cross-cultural study of Canadian firms. These antecedents included *top management support*, *work discretion/autonomy*, *rewards/reinforcement*, *time availability*, and *organizational boundaries* as the underlying organizational antecedents required for individuals to behave entrepreneurially. Building on these studies, Hornsby et al. (2002) proposed the Corporate Entrepreneurship Assessment Instrument (CEAI)—a survey instrument designed to measure each of the five aforementioned organizational antecedents to corporate entrepreneurship. Ireland et al. (2006a,b) have argued that the CEAI provides a sound basis for managers to effectively assess, manage, facilitate, and improve corporate entrepreneurship activities. The theoretical structure and psychometric properties of the scales within the CEAI have been well established through subsequent research (see, for example, Holt et al., 2007; Hornsby et al., 2008, 2009; Kuratko et al., 2005; Rutherford and Holt, 2007). Collectively, theory and empirical results pertaining to the CEAI support the existence of five stable organizational antecedents of managers' entrepreneurial behavior, as described below.

(1) *Top management support*: the extent to which one perceives that top managers support, facilitate, and promote entrepreneurial behavior; including the championing of innovative ideas and providing the resources people require to take entrepreneurial actions. Top management support has been found to have a positive relationship with an organization's entrepreneurial outcomes (e.g., Lyon et al., 2000; Antoncic and Hisrich, 2001; Kuratko et al., 2001; Hornsby et al., 2002; Morris et al., 2008).
(2) *Work discretion*: the extent to which one perceives that the organization tolerates failure, provides decision-making latitude and freedom from excessive oversight, and delegates authority and responsibility to lower-level managers and workers (Hornsby et al., 2002). Research suggests that entrepreneurial opportunities are often best recognized by those with discretion over how to perform their work as well as by those encouraged to engage in experimentation (e.g., Beal, 2000; Kuratko et al., 2001; Lang et al., 1997).
(3) *Rewards and reinforcement*: the extent to which one perceives that the organization uses systems that reward based on entrepreneurial activity and success (Hornsby et al., 2002). Reward systems that encourage risk taking and innovation have been shown to have a strong effect on individuals' tendencies to behave in entrepreneurial manners (Sathe, 1989; Sykes, 1986; Block and Ornati, 1987). Kuratko et al. (1990) empirically identified "reward and resource availability" as a principal determinant of entrepreneurial behavior by middle- and first-level managers. Similar results have been reported in subsequent studies (e.g., Hornsby et al., 1999, 2002; Morris and Jones, 1995).
(4) *Time availability*: workloads ensuring that individuals and groups have the time needed to pursue innovations, with jobs structured in ways to support such efforts and achieve short- and long-term organizational goals. Research suggests that time availability among managers is an important resource for generating entrepreneurial outcomes (Sykes and Block, 1989; Stopford and Baden-Fuller, 1994; Das and Teng, 1997; Slevin and Covin, 1997). For example, the availability of unstructured or free time can enable would-be corporate entrepreneurs to consider opportunities for innovation that may be precluded by their required work schedules (Shepherd et al., 2007).
(5) *Organizational boundaries*: precise explanations of outcomes expected from organizational work and development of mechanisms for evaluating, selecting and performing tasks. Flexible organizational boundaries can be useful in promoting entrepreneurial activity because they enhance the flow of information between the external environment and the organization as well as between departments/divisions within the organization (Miller et al., 2007). Nonetheless, innovative outcomes emerge most predictably when innovation is treated as a structured and purposeful (vs. chaotic) process (Drucker, 1985). Consistent with this point, organization theorists have long recognized that productive outcomes are most readily accomplished in organizational systems when uncertainty over means and goals is kept at manageable levels (Thompson, 1967), and this can be achieved through setting boundaries that induce, direct, and encourage coordinated behavior across the organization. In short, organizational boundaries can ensure the productive use of innovation-enabling resources.

With the aforementioned observations in mind, we propose the following proposition and hypotheses:

**P1.** The organizational antecedents of corporate entrepreneurship are related to innovation performance.

**H1a.** Management support is positively related to innovation performance.

**H1b.** Work discretion/autonomy is positively related to innovation performance.

**H1c.** Rewards/reinforcements are positively related to innovation performance.

**H1d.** Time availability is positively related to innovation performance.

**H1e.** Organizational boundaries are positively related to innovation performance.

## 4. Operations control's influence on corporate entrepreneurship

Operations strategy research has responded to the flux of changes in the competitive landscape by evolving from key tradeoffs and generic strategies (Skinner, 1969) to a focus on the process of strategy formulation (Paiva et al., 2008). The latter research identifies the means to acquire the knowledge that will enable firms to achieve a competitive advantage. The former, mature, research stream establishes the framework in which researchers and firms can determine the fit between competitive environment, operations strategy, objectives, and decisions. For example, Devaraj et al. (2004) found significant relationships between generic strategies and plant performance using the framework from Kotha and Orne (1989), which had three dimensions for generic manufacturing strategies: process structure complexity, product line complexity, and organizational scope. In service operations, the customer contact model (Chase and Tansik, 1983) describes the essential tradeoffs in service strategy with the dimensions customer contact/customization and complexity/divergence

(Shostack, 1987). Thus, the mechanisms through which operations control is exercised by firms are many and varied. Organizational culture, structure, systems, policies, and procedures can all serve the control function within organizations (Scott, 1998). Of the specific control foci commonly recognized in the literature as constraining and directing behavior in organizations, two are particularly relevant to the successful exhibition of entrepreneurial actions and initiatives – namely, risk control and process control formality.

### 4.1. Corporate entrepreneurship and risk control

The pursuit of innovative initiatives can involve the assumption of risk, herein defined as exposure to the possibility of outcomes involving loss (Knight, 1921). Recent research has examined risk in operations from a variety of perspectives including adverse circumstances (Weiss and Maher, 2009); supply chain agility (Braunscheidel and Suresh, 2009); supply chain disruption (Ellis et al., 2010); and risk management (Narasimhan and Talluri, 2009; Zwikael and Sadeh, 2007). Yet, the process of entrepreneurial activity in relation to operations risk needs to be more closely examined.

In general, organizations control risk through an emphasis on, for example, marketing tried-and-true products and services, pursuing projects involving "normal" rates of return, adopting a "wait-and-see" posture when immediate actions are not demanded, and choosing to incrementally deviate from past behaviors when novel circumstances are encountered (e.g., Miller and Friesen, 1982). In this manner, risk control has predictable influences on the relationships between the organizational antecedents to corporate entrepreneurship and innovation performance.

In particular, management support may have a more positive influence on innovation performance when risk control is low (vs. high) because the endorsement implied by the presence of management support may suggest that any innovative initiatives being pursued have been thoroughly vetted (Zwikael and Sadeh, 2007). When this is the case, the imposition of additional constraints on the process or focus of innovative efforts via risk control may only serve to hamper their success. By contrast, risk control may facilitate the positive effect of work discretion/autonomy on innovation performance because innovative behaviors and initiatives that emerge autonomously, by definition, have not been vetted by higher-level organizational authorities and are, therefore, less likely to be predictably aligned with the firm's strategic interests (Lewis, 2003). As such, lower innovation performance may result when work discretion/autonomy is not tied to the presence of risk control.

The presence of rewards/reinforcements for innovative actions and initiatives, likewise, may best promote innovation performance when risk controls are emphasized. Specifically, innovative behaviors and initiatives that are both rewarded and have been subjected to careful risk evaluation will likely gain impetus within the firm (Balkin and Logan, 1988; Kanter, 1994). The rewards will induce and support innovative behaviors and initiatives that have been consciously judged to have an acceptable risk-return probability, the combination of which would likely result in high innovation performance outcomes.

The moderating effect of risk control on the time availability-innovation performance relationship is likely to be negative. That is, time availability may be more positively related to innovation performance when risk control is low. Alternatively, time availability may be less positively related to innovation performance when risk control is high. This latter wording of a negative moderating effect is, perhaps, most intuitively defensible. Consistent with Hypothesis 1d, if time constraints limit the energy and efforts organizational members can devote to innovative behaviors and initiatives, the overall quantity and quality of innovative outcomes may be low (Schuler, 2006; Ireland et al., 2006a). Under such circumstances, the presence of high risk control may ensure that the innovative behaviors and initiatives chosen for pursuit will be those most likely to contribute to the firm's overall welfare. In short, risk control may attenuate the negative effect that time availability's absence likely has on innovation performance.

Lastly, organizational boundaries may most positively influence innovation performance when risk controls are high. This relationship is suggested by the possibility that the presence of organizational boundaries may implicitly sanction innovative behaviors and initiatives, thereby excusing those behaviors and initiatives from critical review. That is, because organizational boundaries define acceptable behaviors, job-related expectations, standards to be met, processes and procedures to be followed, and the like, innovative behaviors and initiatives that emerge under such circumstances may be seen not as deviations from what is acceptable but part of what is expected (Das and Joshi, 2007). The presence of risk controls when organizational boundaries are high may serve to ensure that innovative behaviors and initiatives are, in fact, consistent with the firm's best interests and likely to result in desirable innovation performance outcomes.

In summary, the following proposition and hypotheses are proposed.

**P2.** Risk control moderates the relationships between the organizational antecedents of corporate entrepreneurship and innovation performance.

**H2a.** The relationship between management support and innovation performance is more positive under low than high levels of risk control.

**H2b.** The relationship between work discretion/autonomy and innovation performance is more positive under high than low levels of risk control.

**H2c.** The relationship between rewards/reinforcements and innovation performance is more positive under high than low levels of risk control.

**H2d.** The relationship between time availability and innovation performance is more positive under low than high levels of risk control.

**H2e.** The relationship between organizational boundaries and innovation performance is more positive under high than low levels of risk control.

### 4.2. Corporate entrepreneurship and process control formality

Process control formality is the second operations control variable posited in the current research as moderating the relationships between the organizational antecedents of corporate entrepreneurship and innovation performance. Processes that are low in process control formality are often difficult to manage and direct with a style that is highly uniform across the business and with highly formal channels of communication. This is in contrast to processes that are high in process control formality, where managing and directing work with a uniform and highly formal management style is more feasible (Naveh, 2007). In general, high process control formality is typical of firms with mechanistic structures, whereas low process control formality is typical of firms with more organic structures (Burns and Stalker, 1961). Under high process control formality, a structured work environment and a focus on following the formally prescribed process eliminates uncertainty in the performance of tasks, but it also reduces worker degrees of freedom in determining how to best achieve

objectives (Germain, 1996). Process control formality is consistent with Kotha and Orne's (1989) concept of process structure complexity.

Process control formality may be high or low depending on the firm's culture and its managers' desire to specify how tasks should be performed (Covin and Slevin, 1988; Thornhill and Amit, 2001). Because high process control formality is often reflected in more centralized organizational control and decision making, the monitoring costs of firms with such high formality may be low. Conversely, because low process control formality is often reflected in decentralized organizational control and decision making, the monitoring costs of firms with such low formality may be high. Consistent with these observations, there are predictable effects of process control formality on the relationships between the organizational antecedents of corporate entrepreneurship and innovation performance.

With respect to management support, it is conceivable that process control formality will negatively moderate the relationship between this variable and innovation performance (Simmons, 1995; Marginson, 2002). Specifically, process control formality imposes constraints on the means through which innovative behaviors and initiatives that have been sanctioned by the firm – via management support – can be pursued, and such constraints may limit the ability of firms to learn about innovation process- and content-related matters, thereby hampering overall innovation performance. Stated differently, the presence of process control formality may limit the paths through which management-supported innovative efforts may proceed, and such process restriction may discourage the learning that facilitates innovation performance (Ettlie et al., 1984).

The expected positive relationship between work discretion/autonomy and innovation performance, on the other hand, may strengthen in the presence of process control formality. This is because such formality may complement worker autonomy for task accomplishment purposes. Consistent with Burgelman's (1983) observations about how lower-level employees must access corporate support for innovative ideas via the formal structure if those ideas are to gain impetus within the firm, process control formality provides the structure, channels, and process needed for autonomously-operating corporate entrepreneurs to have their ideas recognized and potentially validated by important resource providers within the organization.

Likewise, rewards/reinforcements may have their most positive effects on innovation performance when process control formality is high. The presence of process control formality would suggest that innovative behaviors and initiatives that are rewarded by the firm are subject to a disciplined approach to their management, with knowledge of how those initiatives are best supported and facilitated embedded in the structure and processes of the firm (Bisbe and Otley, 2004; Goodale et al., 2008). In other words, process control formality is a mechanism through which prior knowledge pertaining to innovative operations can be leveraged within the innovation process. When the innovative behaviors and initiatives in question are those being rewarded/reinforced by the firm, the predictable result of such formality is high innovation performance (Khazanchi et al., 2007).

Time availability, by contrast, may be less positively related to innovation performance under conditions of high process control formality. This is true because a paucity of time spent on innovative initiatives (as would be indicative of low time availability) can demand that corporate entrepreneurs find alternative, non-sanctioned channels for pursuing their innovative initiatives, and such channels are more typical of firms with low than high process control formality (Hitt et al., 1996). Thus, having to follow the rules (as defined by process control formality) when executing innovative initiatives may be particularly detrimental to innovation performance when the time available to work on those initiatives is limited (Peng et al., 2008).

Finally, high process control formality may augment the hypothesized positive relationship between organizational boundaries and innovation performance. In particular, innovative behaviors and initiatives emerging in the presence of high organizational boundaries will reflect the demands placed on organizational members as a function of their job expectations and definitions (Anand et al., 2007). The presence of high process control formality may further clarify for corporate entrepreneurs how their innovative behaviors and initiatives are to be executed in a pre-defined organizational structure and process sense. As such, process control formality may positively complement organizational boundaries in that both factors suggest the presence of a disciplined approach to innovation, and innovation performance is greatest when innovation is treated as a discipline-based (vs. chaotic) process (Ettlie et al., 1984; Drucker, 2007; Naveh, 2007).

In summary, the following proposition and hypotheses are offered.

**P3.** Process control formality moderates the relationships between the organizational antecedents of corporate entrepreneurship and innovation performance.

**H3a.** The relationship between management support and innovation performance is more positive under low than high levels of process control formality.

**H3b.** The relationship between work discretion/autonomy and innovation performance is more positive under high than low levels of process control formality.

**H3c.** The relationship between rewards/reinforcements and innovation performance is more positive under high than low levels of process control formality.

**H3d.** The relationship between time availability and innovation performance is more positive under low than high levels of process control formality.

**H3e.** The relationship between organizational boundaries and innovation performance is more positive under high than low levels of process control formality.

## 5. Methods

### 5.1. Data

This study uses data from a larger data collection effort conducted by two Midwestern universities to assess how companies determine strategic direction and manage change, which included the extent to which firms exhibited corporate entrepreneurship. In particular, participants who attended various strategic management-related seminars over a 2-year period (seminars related to such topics as Strategic Change, Innovation and Entrepreneurship, and Strategic Human Resource Management) were tasked with identifying firms for inclusion in a study of change management practices. Criteria used for a firm's possible inclusion in the study were that it be a single, independent firm or a business unit within a larger corporation. Non-diversified organizational entities were chosen for examination because change management practices can be quite varied across large multi-business unit firms, and such heterogeneity would preclude the meaningful aggregation of data for the current research purposes.

Data were collected from managers at various levels within the targeted firms using questionnaire-based surveys. The surveys consisted of sections pertaining to demographic and descriptive variables about the firm, the antecedents of entrepreneurial

climate, financial and innovative performance of the firm, and variables related to organizational control. No incentives were given for survey completion. Although this was a sample of convenience, it appeared highly appropriate for this study because of the wide range of companies from which data could be collected. The current research design follows Hales' (2005) study of first line managers and Hornsby et al.'s (2002) study described earlier.

A total of 831 firms were contacted by the seminar participants for possible inclusion in the study. Data were eventually received by the researchers from 667 of those firms, 85 of which furnished data from multiple respondents, for a response rate of approximately 80%. Because of the high response rate, no tests were conducted for non-response bias. Although the survey contained several measures for which the respondent need not be a senior-level executive, the current study is restricted to 177 of those firms in the database for which (1) the principal respondent is the senior-most executive of the firm (e.g., the CEO for single business firms or the division General Manager for multi-business unit firms) and (2) there are complete data on the relevant research variables. The senior-most managers of the firms were chosen as key informants because the research variables relevant to the current study demanded that data be furnished by individuals very familiar with their organizations' overall operations and performance, and knowledge of such matters tends to drop off sharply among managers at lower organizational levels (Hambrick, 1981). The mean age of the respondents is 47.49 years (SD = 8.58), 81.9% are male, and 85.3% have a college degree. The average tenure in-job for the respondents is 6.87 years (SD = 6.44), while the average tenure at the firm is 14.58 (SD = 10.31).

The mean, standard deviations, alpha coefficients, and intercorrelations of the research variables are presented in Table 1. The firms ranged from $250,000 to nearly $7 billion in sales revenue and from 5 to 30,000 employees, ensuring needed diversity in the sample. Forty-eight of the firms identified their principal industries as "high tech," with the remaining 129 firms characterizing their principal industries as "low tech." The most frequently occurring industry classifications for this sample were: Service (27.8%), Manufacturing (30.7%), Financial (17.0%), and Healthcare (15.3%). One hundred and sixteen of the firms are privately owned, while 61 of are publicly traded. Eighty six of the firms are strategic business units within larger organizations and the remaining 91 are independent, free-standing firms.

### 5.2. Measurement

The dependent variable in the current research is innovation performance. This variable was measured by asking the respondent to indicate on a 7-point, Likert-type scale (ranging from [1 = ] "not at all important" to [7 = ] "extremely important") the degree of importance attached by his/her business unit's top managers to the following innovation performance criteria: (1) number of new products or services developed, (2) number of new products or services brought to market, (3) speed with which new products or services are developed, (4) speed with which new products or services are brought to market, (5) ability to respond quickly to market or technological developments, (6) ability to pre-empt competitors in responding to market or technological developments, (7) incorporation of technological innovations into product/service offerings, and (8) incorporation of technological innovations into internal operations. The respondents were then asked to indicate on a seven-point, Likert-type scale (ranging from [1 = ] "not at all satisfied" to [7 = ] "extremely satisfied") the degree to which his/her business unit's top managers are satisfied with how their business unit has performed in reference to these same eight criteria over the last three years. The individual satisfaction scores were multiplied by the importance scores and the products of this step were summed to create a weighted average innovation performance index for each firm. The specific equation used to calculate this index is:

$$\frac{\sum(\text{Criterion satisfaction score} \times \text{Criterion importance score})}{\sum(\text{All criteria importance scores})}$$

Prior to the construction of the preceding index, the raw satisfaction data were re-coded to a −3 to +3 scale in order to ensure that higher performance scores are never assigned to firms whose top managers express dissatisfaction on important innovation performance criteria than to those firms whose top managers express dissatisfaction on unimportant performance criteria.

The Corporate Entrepreneurship Assessment Instrument, developed by Kuratko et al. (1990) and further refined by Hornsby et al. (1999, 2002, 2008), was used to measure the five independent variables examined in the current study – namely, management support, work discretion/autonomy, rewards/reinforcement, time availability, and organizational boundaries. Consistent with prior research (Hornsby et al., 2008, 2002), factor analysis of the current data found support for the theoretical structure of the instrument's scales. All scale items were assessed on seven-point, Likert-type scales ranging from "strongly disagree" (=1) to "strongly agree" (=7). Higher mean scale values indicate stronger presence of the relevant corporate entrepreneurship antecedent.

The operations control-related moderators employed in the current research included measures of risk control and process control formality control. Both measures utilize a semantic differential format, as shown in the Appendix. The measure of risk control includes items previously employed by Miller and Friesen (1982) to measure a firm's risk-taking/aversion propensity. The process control formality scale items are taken from Khandwalla's (1976/1977) organizational flexibility scale. For both scales, the item averages were treated as the scale scores, with higher scores indicating greater control/formality.

Three control variables were included in the analysis: firm age, firm size (employees), and the industry technological sophistication of the firm's principal industry. Because the firm age and size data are skewed, these variables were log transformed in the analysis. Industry technological sophistication was measured as a dichotomous variable, with high tech industries being assigned (by the respondent) a score of 1 and low tech industries a score of 0.

Multiple-rater reliability was investigated for those groups of respondents from the same firms. We used the Interclass Correlation Method to examine inter-rater agreement (see Boyer and Verma, 2000). This method compares within group variance with between group variance and generates an $F$ statistic with which we can determine statistical significance. With one exception, all F statistics were significant ($p < 0.05$) for the items in the study. The exception was the corporate entrepreneurship antecedent of Time Availability. It is possible that the perception of Time Availability is more individual than the other elements. Given that all other items (including the dependent variable) reflected good multiple-rater reliability, we noted the exception and continued with the next phase of analyzing the data.

The sample was asked to self-report their responses, so common method variance was investigated. Harmon's Single Factor Test was used to address this issue. Using the approach described in Podsakoff et al. (2003), we factor analyzed the raw data (including the dependent variable data) using an exploratory factor analysis and inspected the unrotated factor solution. The factor analysis generated five factors (eigen-values > 1.0), with the first factor accounting for less than half the covariance among the measures. Without a single factor emerging, or one factor accounting for a majority of the covariance, we concluded that common method effects were likely not significant within the data.

**Table 1**
Summary statistics and correlations ($n = 177$).

| Variable | Mean | SD | Alpha | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Control variables | | | | | | | | | | | | | | |
| 1. Firm age (years) | 48.410 | 32.716 | na | | | | | | | | | | | |
| 2. Firm size (employees) | 1779.60 | 4259.659 | na | .069 | | | | | | | | | | |
| 3. Industry technological sophistication (HT = 1; LT = 0) | .271 | .446 | na | −.075 | −.095 | | | | | | | | | |
| CE variables | | | | | | | | | | | | | | |
| 4. Management support | 4.669 | .802 | .90 | −.100 | −.165* | .076 | | | | | | | | |
| 5. Work discretion/auto. | 5.573 | .845 | .88 | −.145† | −.104 | .051 | .500** | | | | | | | |
| 6. Rewards/reinforcement | 5.334 | .909 | .80 | −.013 | −.045 | .006 | .534** | .385** | | | | | | |
| 7. Time availability | 3.595 | 1.000 | .76 | −.102 | −.035 | −.058 | .291** | .156* | .224** | | | | | |
| 8. Organizational boundaries | 4.566 | .666 | .65 | −.019 | −.013 | .013 | .314** | .149* | .331** | .291** | | | | |
| OC variables | | | | | | | | | | | | | | |
| 9. Risk control | 4.137 | 1.166 | .82 | −.026 | .167* | −.129† | −.419** | −.255** | −.203** | −.130† | −.048 | | | |
| 10. Process control formality | 3.983 | 1.256 | .71 | .137† | .151* | .123 | −.076 | −.119 | −.013 | −.059 | .265** | .251** | | |
| Dependent variables | | | | | | | | | | | | | | |
| 11. Innovation performance | .280 | 1.009 | .90 | −.076 | −.086 | .016 | .263** | .135† | .215** | .153* | .234** | −.255* | | .118 |

† $p < .10$.
* $p < .05$.
** $p < .01$.

### 5.3. Analysis

The hypotheses were tested using OLS regression, with moderated regression analysis being used to test for interaction effects. Consistent with the recommendations of Cohen et al. (2003), the control variables, independent (main effect) variables, moderator variables, and interaction terms were sequentially entered into the regression equation in four separate steps. The data were conservatively analyzed by concurrently considering each of the ten two-way interaction terms in the same regression equation. Prior to creating the interaction terms the main effect and moderator variables were mean-centered.

## 6. Results

Table 2 presents the results of a series of multivariate regression models. Model 1 indicates that none of the control variables has a significant effect on innovation performance. As shown in Model 2, only two of the five antecedents to corporate entrepreneurship are significantly predictive of innovation performance, and both effects are quite modest. Consistent with Hypotheses 1 and 5, management support ($p < .10$) and organizational boundaries ($p < .10$), respectively, are positively related to innovation performance. There is no support in the data for the hypotheses that work discretion/autonomy (H2), rewards/reinforcements (H3), or time availability (H4) affect innovation performance.

**Table 2**
Moderated regression analysis results ($n = 177$).

| DV: innovation performance | Model 1 | Model 2 | Model 3 | Model 4 |
|---|---|---|---|---|
| Step 1: Control variables | | | | |
| Log firm age (years) | −.010 | .030 | −.025 | .015 |
| Log firm size (employees) | −.069 | .041 | −.045 | −.075 |
| Industry technological sophistication (HT = 1; LT = 0) | .008 | .000 | −.048 | −.051 |
| Step 2: Corporate entrepreneurship variables | | | | |
| Management support (MS) | | .165† | .078 | .079 |
| Work discretion/autonomy (WD/A) | | −.002 | −.002 | .010 |
| Rewards/reinforcement (R/R) | | .061 | .078 | .102 |
| Time availability (TA) | | .049 | .056 | .011 |
| Organizational boundaries (OB) | | .153† | .106 | .180* |
| Step 3: Operations control | | | | |
| Risk control (RC) | | | −.243** | −.193* |
| Process control formality (PCF) | | | .175* | .126 |
| Step 4: Interaction terms | | | | |
| MS × RC | | | | −.273** |
| WD/A × RC | | | | .160† |
| R/R × RC | | | | .100 |
| TA × RC | | | | −.204** |
| OB × RC | | | | .232** |
| MS × PCF | | | | .044 |
| WD/A × PCF | | | | −.074 |
| R/R × PCF | | | | .172† |
| TA × PCF | | | | −.199* |
| OB X PCF | | | | −.079 |
| Model $R^2$ | .005 | .102 | .156 | .312 |
| Change in $R^2$ | | .097 | .054 | .156 |
| Model $F$ | .310 | 2.383* | 3.071** | 3.545** |

Standardized regression coefficients are reported.
† $p < .10$.
* $p < .05$.
** $p < .01$.

Model 3 adds the moderator variables to the prior equations. As shown in Table 2, risk control is negatively related ($p < .01$) to innovation performance, while process control formality is positively related ($p < .05$) to innovation performance.

We next introduced the interaction terms created by multiplying the operations control factors and the antecedents of CE. Model 4 indicates that four of the ten interaction effects are significant at the $p < .05$ level or better, and an additional two interaction effects are significant at the $p < .10$ level. Consistent with Hypothesis 2a, the negative and significant ($p < .01$) beta for the management support × risk control interaction term implies that management support is most positively associated with innovation performance when risk control is low. The positive albeit modestly significant beta ($p < .10$) for the work discretion/autonomy × risk control interaction term is supportive of Hypothesis 2b. That is, work discretion/autonomy best promotes innovation performance when risk control is high. No support is found in the data for Hypothesis 2C; that is, risk control does not moderate the relationship between rewards/reinforcements and innovation performance. The negative and significant ($p < .01$) beta for the time availability × risk control interaction term implies that, consistent with Hypothesis 2d, time availability is most positively associated with innovation performance when risk control is low. Finally, consistent with Hypothesis 2e, the positive and significant ($p < .01$) beta for the organizational boundaries × risk control interaction term indicates that organizational boundaries are most positively associated with innovation performance when risk control is high.

Turning to the process control formality-related results, Model 4 reveals that this operations control variable has no moderating effect on the relationships between innovation performance and management support (H3a), work discretion/autonomy (H3b), or organizational boundaries (H3e). However, consistent with Hypothesis 3c, a modestly positive interaction effect ($p < .10$) on innovation performance exists for the cross-product of rewards/reinforcements and process control formality. That is, rewards/reinforcements have a more positive effect on innovation performance when process control formality is high. Conversely, the negative and significant beta ($p < .05$) for the time availability × process control formality interaction term indicates that time availability best promotes innovation performance under conditions of low process control formality. This last result is consistent with Hypothesis 3d.

## 7. Discussion

This study has explored the relationships between the antecedents to corporate entrepreneurship and innovation performance as well as the moderating effects of two commonly acknowledged operations control variables – risk control and process control formality – on these relationships. An interesting and somewhat unexpected storyline emerging from the observed pattern of results is that the organizational antecedents to corporate entrepreneurship herein explored may not be strong predictors of organizational innovation despite the fact these factors have a long history of theoretical association with innovation. However, when combined with operations control attributes that can facilitate, modify or, potentially, prevent certain innovative behaviors and initiatives, the organizational antecedents to corporate entrepreneurship have, overall, a much more significant influence on innovation performance. Indeed, the $R^2$ for the main effects (of the organizational antecedents to corporate entrepreneurship on innovation performance) equation (i.e., Model 2) is roughly .10, but that jumps to over .30 in the equation where the interaction effects with the operations control variables are included (i.e., Model 4).

These results have several important theoretical implications. First, current theory pertaining to the need to "unleash the entrepreneurial hostages" in organizations by removing constraints on their innovative behaviors (e.g., Hamel, 2000; Pinchot, 2000) is likely under-recognizing or ignoring the importance to innovation performance of variously encouraging, directing, restricting, and prohibiting innovative behaviors and initiatives according to their alignments with the organization's interests. Not all corporate entrepreneurial behavior is good for the organization. Yet the literature in the corporate entrepreneurship area tends to implicitly regard such behavior as inherently virtuous. This is an unfortunate and potentially dangerous bias within the literature. As noted by Kuratko and Goldsby (2004), the encouragement of corporate entrepreneurship can and often does result in counterproductive, rogue behavior by organizational members.

Second, and related to the preceding point, the exhibition of operations control is not antithetical to the interests of corporate entrepreneurship; it is inherent to those interests. As such, observations to the effect that control is the enemy of successful innovation are naïve. The bias in the literature pertaining to the possible adverse effects of operations control-related factors on innovation performance seems to largely emanate from those who study innovation and its determinants (for good reviews of this topic see Hage (1999) and Hauser et al. (2006)). By and large, theorists who focus on operations control-related matters have a much more positive and enlightened view of the role of control in promoting successful innovation (e.g., Perez-Freije and Enkel, 2007; Poskela and Martinsuo, 2009).

A third theoretical implication of this study is that the effects of operations control variables on the relationships between factors that theoretically promote innovation and the realization of successful innovation performance outcomes should not be generalized as being either positive or negative. Rather, different directions to the moderating effects will exist according to the operations control variable and organizational antecedent to corporate entrepreneurship in question. As revealed in the current data, for example, risk control has a strongly positive moderating effect on the relationship between organizational boundaries and innovation performance, but a strongly negative moderating effect on the relationship between time availability and innovation performance. Thus, theory pertaining to how operations control variables contribute to innovation performance outcomes should acknowledge the diversity of effects individual operation control variables can have within organizational systems that pursue innovation.

Three principal managerial implications can be inferred from this study. First, the deliberate design and development of organizational systems with characteristics reflecting the organizational antecedents to corporate entrepreneurship (i.e., the five CEAI variables) may not yield intended innovation performance outcomes. As such, the manager's task is not simply to build an organization whose core qualities are conducive to innovation. Rather, his or her task is to design and develop innovation-facilitating and control-facilitating mechanisms that complement one another such that the entrepreneurial potential that resides within the organization is leveraged for the highest and best organizational purposes.

Second, the current research results suggest that managers should understand and treat innovation as a process that's amenable to the application of structured, disciplined oversight. The successful pursuit of innovation demands that managers approach the innovation challenge with the understanding that the means by which potentially desirable innovation outcomes might be generated can be well understood and deliberately constructed. There are rules, methods, and general process knowledge that can be brought to bear as resources in facilitation of successful innovation efforts. As such, it is often not the absence of rules and well-understood procedures that results in successful innovation

(as one might infer from a cursory review of the popular business press), it is their presence. Managers are well advised to recognize this reality.

Third and finally, the successful and sustained promotion of innovation via the exhibition of corporate entrepreneurship likely cannot be accomplished by relying on single levers/mechanisms, such as, for example, the adoption of organic organizational structures. As suggested by the variety of factors reflected in the five organizational antecedents to corporate entrepreneurship and the two operations control variables in this study, superior innovation performance is arguably a product of organizational systems in which operations control elements and corporate entrepreneurship elements operate in concert. Thus, managers should adopt a systems perspective with respect to the management of innovation, recognizing the interfaces and interdependencies that exist between forces that facilitate the innovation process and forces that control it.

## 8. Limitations and future research

The current study's results and associated implications should be viewed in light of the study's limitations. Three research limitations are, perhaps, most noteworthy. First, the sample for this study was comprised solely of US-based firms. Some evidence suggests that that the organizational drivers of successful innovation may differ from country to country (e.g., Hauser et al., 2006). As such, results of the current research may not be generalizable to other country contexts. Second, the current study relied on the key informant approach to data collection. Tests for inter-rater reliability were encouraging, and the informants targeted were arguably the most appropriate individuals from which to collect data given the nature of the questions being asked. Nonetheless, it can only be assumed that perceptions of relevant organizational attributes and operations control matters were accurately summarized by the key informants. Third, while the variety of organizational factors that theoretically facilitate innovation was well captured in the current research through the CEAI instrument (Hornsby et al., 2002), no comparable control-focused instrument was available for use – i.e., one that broadly captures the various processes and mechanisms through which operations control is manifested in organizations. As such, the current study's focus on risk control and process control formality may under-represent the variety of ways in which operations control-related factors influence the successful exhibition of innovation.

Building from results of the current study, two specific foci are proposed for future research at the corporate entrepreneurship-operations management interface. First, additional research is warranted on the question of how firms effectively balance the facilitation and the control of innovation. As suggested by the current research, these two objectives need not be at odds. Nonetheless, it is important to understand the specific processes through which innovation of potential or known desirability is encouraged while innovation of more questionable desirability is discouraged. Second, research should explore the implications for innovation performance of the use of various control foci within operations control systems. While operations control is generally acknowledged to be the concern of operating managers and involve the allocation and use of financial, physical, and human resources, control systems themselves can focus on process control – i.e., a results-oriented focus based on the measurement of quantitative data – or behavior control – i.e., a process-orientation focus based on direct, personal observation. The issue here is that while operations management practice has traditionally been concerned with the control of process output, successful innovation management has traditionally been viewed as requiring effective behavior control. For example, conventional wisdom in the innovation management field suggests that managers should "manage the process, not the projects" (MacMillan and George, 1985, p. 41). As such, research might fruitfully focus on how operations control systems ought to be designed to account for the unique demands of innovation management. Conversely, explorations of where and how the control of process output can improve innovation management processes should be a top priority among researchers.

In conclusion, the practice of operations management as manifested through operations control mechanisms has a significant yet poorly recognized effect on the innovation performance of firms. This effect occurs via the moderating role operations control variables have on the relationships between the organizational antecedents to corporate entrepreneurship and innovation performance. The clear message from the current research is that operations control can enable as well as inhibit the innovation performance of firms possessing pro-entrepreneurship organizational attributes. Recognizing the relevance to innovation performance of control-related considerations is an operations management imperative.

## Acknowledgements

The authors wish to gratefully acknowledge the valuable feedback offered by three anonymous reviewers. In addition we especially want to thank guest co-editor, Dr. Jill R. Kickul for her expert advice and meticulous guidance. The comments, questions, and suggestions generated in the review process were extremely valuable in improving this manuscript.

## Appendix A.

### A.1. The risk control scale

Please circle the numbers in the following scales which best describe the control orientation of your business unit. Circle number "1" if the statement on the left hand side of the scale best describes your reaction to the item. Circle number "7" if the statement on your right hand side of the scale best describes your reaction to the item. Circle numbers "2" through "6" depending upon your best estimate of an intermediate position.

| | | |
|---|---|---|
| In general, top managers of my business unit have . . . | | |
| A strong proclivity for low risk projects (with normal and certain rates of return) | 1 2 3 4 5 6 7 | A strong proclivity for high risk projects (with chances for very high returns) |
| In general, the top managers of my business unit believe that . . . | | |
| Owing to the nature of the environment, it is best to explore it gradually via cautious, incremental behavior | 1 2 3 4 5 6 7 | Owing to the nature of the environment, bold, wide-ranging acts are necessary to achieve the firm's objectives |
| When confronted with decision making situations involving uncertainty, my business unit . . . | | |
| Typically adopts a cautious "wait and see" posture in order to minimize the probability of making costly decisions | 1 2 3 4 5 6 7 | Typically adopts a bold, aggressive posture in order to maximize the probability of exploiting potential opportunities |
| In general, the top managers of my business unit favor . . . | | |
| A strong emphasis on the marketing of tried and true products or services | 1 2 3 4 5 6 7 | A strong emphasis on R&D, technological leadership, and innovations |

### A.2. The process control formality scale

| In general, the operating management philosophy in my business unit favors ... | | |
|---|---|---|
| A strong emphasis on always getting personnel to follow the formally laid-down procedures | 1 2 3 4 5 6 7 | A strong emphasis on getting things done even if it means disregarding formal procedure |
| Tight formal control of most operations by means of sophisticated control and information systems | 1 2 3 4 5 6 7 | Loose, informal control; heavy dependence on informal relationships and the norm of cooperation for getting work done |
| A strong emphasis on getting line and staff personnel to adhere closely to formal job descriptions | 1 2 3 4 5 6 7 | A strong tendency to let the requirements of the situation and the individual's personality define proper on-the-job behavior |

## References


Anand, G., Ward, P.T., Tatikonda, M.V., Schilling, D.A., 2007. Dynamic capabilities through continuous improvement infrastructure. Journal of Operations Management 27 (6), 444–461.

Antoncic, B., Hisrich, R.D., 2001. Intrapreneurship: Constructive refinement and cross-cultural validation. Journal of Business Venturing 16 (5), 495–527.

Balkin, D.B., Logan, J.W., 1988. Reward policies that support entrepreneurship. Compensation and Benefits Review 20 (1), 18–25.

Beal, R.M., 2000. Competing effectively: Environmental scanning, competitive strategy, and organizational performance in small manufacturing firms. Journal of Small Business Management 38 (1), 27–47.

Bisbe, J., Otley, D., 2004. The effects of the interactive use of management control systems on product innovation. Accounting, Organizations and Society 29 (8), 709–732.

Block, Z., Ornati, O.A., 1987. Compensating corporate venture managers. Journal of Business Venturing 2 (1), 41–51.

Boyer, K.K., Lewis, M.W., 2002. Competitive priorities: Investigating the need for trade-offs in operations strategy. Production and Operations Management 11 (1), 9–20.

Boyer, K.K., Verma, R., 2000. Multiple raters in survey-based operations management research: A review and tutorial. Production and Operations Management 9 (2), 128–140.

Brandt, S.C., 1986. Entrepreneuring in Established Companies. Irwin, Homewood, IL.

Braunscheidel, M.J., Suresh, N.C., 2009. The organizational antecedents of a firm's supply chain agility for risk mitigation and response. Journal of Operations Management 27 (2), 119–140.

Brazeal, D.V., 1993. Organizing for internally developed corporate ventures. Journal of Business Venturing 8 (1), 75–90.

Burgelman, R.A., 1983. Corporate entrepreneurship and strategic management: Insights from a process study. Management Science 29 (12), 1349–1363.

Burgelman, R.A., 1984. Designs for corporate entrepreneurship in established firms. California Management Review 26 (3), 154–166.

Burgelman, R.A., Grove, A.S., 1996. Strategic dissonance. California Management Review 38 (2), 8–28.

Burns, T., Stalker, G.M., 1961. The Management of Innovation. Tavistock, London.

Chase, R.B., Tansik, D.A., 1983. The customer contact model for organizational design. Management Science 29 (9), 1037–1050.

Cohen, J., Cohen, P., West, S.G., Aiken, L.S., 2003. Applied multiple regression/correlation analysis for the behavioral sciences, 3rd ed. Lawrence Erlbaum Associates, Mahwah, NJ.

Covin, J.G., Slevin, D.P., 1988. The influence of organizational structure on the utility of an entrepreneurial of top management style. Journal of Management Studies 25 (3), 217–234.

Covin, J.G., Slevin, D.P., 1991. A conceptual model of entrepreneurship as firm behavior. Entrepreneurship Theory and Practice 16 (1), 7–25.

Covin, J.G., Slevin, D.P., 2002. The entrepreneurial imperatives of strategic leadership. In: Hitt, M., Ireland, R.D., Camp, M., Sexton, D. (Eds.), Strategic Entrepreneurship: Creating a New Mindset. Blackwell Publishers, Oxford, UK.

Damanpour, F., 1991. Organizational innovation: A meta-analysis of effects of determinants and moderators. Academy of Management Journal 34 (3), 555–590.

Das, T.K., Teng, B.S., 1997. Time and entrepreneurial risk behavior. Entrepreneurship Theory and Practice 22 (2), 69–88.

Das, S.R., Joshi, M.P., 2007. Process innovativeness in technology services organizations: Roles of differentiation strategy, operational autonomy and risk-taking propensity. Journal of Operations Management 25 (3), 643–660.

Devaraj, S., Hollingworth, D.G., Schroeder, R.G., 2004. Generic manufacturing strategies and plant performance. Journal of Operations Management 22 (3), 313–333.

Drucker, P., 1985. The discipline of innovation. Harvard Business Review 63 (3), 67–72.

Drucker, P., 2007. Innovation and Entrepreneurship: Practice and Principles. Elsevier B.V., New York.

Ellis, S.C., Henry, R.M., Shockley, J., 2010. Buyer perceptions of supply disruption risk: A behavioral view and empirical assessment. Journal of Operations Management 28 (1), 34–46.

Ettlie, J.E., Bridges, W.P., O'Keefe, R.D., 1984. Organizations strategy and structural differences for radical versus incremental innovation. Management Science 30 (6), 682–695.

Fama, E., Jensen, M.C., 1983. Separation of ownership and control. Journal of Law and Economics 26 (2), 301–325.

Germain, R., 1996. The role of context and structure in radical and incremental logistics innovation adoption. Journal of Business Research 35 (2), 117–127.

Getz, G., Tuttle, E.G., 2001. A comprehensive approach to corporate venturing. Handbook of Business Strategy 2 (1), 277–279.

Goodale, J.C., Kuratko, D.F., Hornsby, J.S., 2008. Influence factors for operational control and compensation in professional service firms. Journal of Operations Management 26 (5), 669–688.

Guth, W.D., Ginsberg, A., 1990. Corporate entrepreneurship. Strategic Management Journal 11 (4), 5–15.

Hage, J.T., 1999. Organizational innovation and organizational change. Annual Review of Sociology 25, 597–622.

Hales, C., 2005. Rooted in supervision, branching into management: Continuity and change in the role of first-line manager. Journal of Management Studies 42 (3), 471–506.

Hambrick, D., 1981. Strategic awareness within top management teams. Strategic Management Journal 2 (3), 263–279.

Hamel, G., 2000. Leading the Revolution. Harvard Business School Press, Boston.

Hauser, J., Tellis, G.J., Griffin, A., 2006. Research on innovation: A review and agenda for Marketing Science. Marketing Science 25 (6), 687–717.

Hitt, M.A., Johnson, R., Moesel, D., 1996. The market for corporate control and firm innovation. Academy of Management Journal 39 (5), 1084–1119.

Holmstrom, B., 1979. Moral hazard and observability. The Bell Journal of Economics 10 (1), 74–91.

Holt, D.T., Rutherford, M.W., Clohessy, G.R., 2007. Corporate entrepreneurship: An empirical look at individual characteristics, context, and process. Journal of Leadership and Organizational Studies 13 (4), 40–54.

Hornsby, J.S., Holt, D.T., Kuratko, D.F., 2008. The dynamic nature of corporate entrepreneurship: Assessing the CEAI. Best Paper Proceedings: National Academy of Management (CD Rom).

Hornsby, J.S., Kuratko, D.F., Montagno, R.V., 1999. Perception of internal factors for corporate entrepreneurship: A comparison of Canadian and U.S. managers. Entrepreneurship Theory and Practice 24 (2), 9–24.

Hornsby, J.S., Kuratko, D.F., Shepherd, D.A., Bott, J.P., 2009. Managers' corporate entrepreneurial actions: Examining perception and position. Journal of Business Venturing 24 (3), 236–247.

Hornsby, J.S., Kuratko, D.F., Zahra, S.A., 2002. Middle managers' perception of the internal environment for corporate entrepreneurship: Assessing a measurement scale. Journal of Business Venturing 17 (3), 253–273.

Ireland, R.D., Covin, J.G., Kuratko, D.F., 2009. Conceptualizing corporate entrepreneurship strategy. Entrepreneurship Theory and Practice 33 (1), 19–46.

Ireland, R.D., Kuratko, D.F., Morris, M.H., 2006a. A health audit for corporate entrepreneurship: Innovation at all levels: Part I. Journal of Business Strategy 27 (1), 10–17.

Ireland, R.D., Kuratko, D.F., Morris, M.H., 2006b. A health audit for corporate entrepreneurship: Innovation at all levels: Part II. Journal of Business Strategy 27 (2), 21–30.

Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. Journal of Financial Economics 3 (4), 305–360.

Kanter, R.M., 1994. Innovative Reward Systems for the Changing Workplace. McGraw-Hill Publishers, New York.

Khandwalla, P.N., 1976/1977. Some top management styles, their context and performance. Organization and Administrative Sciences 7(4), 21–51.

Khazanchi, S., Lewis, M.W., Boyer, K.K., 2007. Innovation-supportive culture: The impact of organizational values on process innovation. Journal of Operations Management 25 (4), 871–884.

Klein, K.J., Sorra, J.S., 1996. The challenge of innovation implementation. Academy of Management Review 21 (4), 1055–1080.

Knight, F.H., 1921. Risk, Uncertainty and Profit. Houghton Mifflin Company, Chicago.

Kotha, S., Orne, D., 1989. Generic manufacturing strategies: A conceptual synthesis. Strategic Management Journal 10 (3), 211–231.

Krajewski, L.J., Ritzman, L.P., Malhotra, M.K., 2010. Operations Management: Processes and Supply Chains, 9th Ed. Prentice Hall, Upper Saddle River, NJ.

Kuratko, D.F., 2009. The entrepreneurial imperative of the 21st century. Business Horizon 52 (5), 421–428.

Kuratko, D.F., Goldsby, M.G., 2004. Corporate entrepreneurs or rogue middle managers? A framework for ethical corporate entrepreneurship. Journal of Business Ethics 55 (1), 13–30.

Kuratko, D.F., Hornsby, J.S., Bishop, J.W., 2005. An examination of managers' entrepreneurial actions and job satisfaction. International Entrepreneurship and Management Journal 1 (3), 275–291.

Kuratko, D.F., Hornsby, J.S., Naffziger, D.W., Montagno, R.V., 1993. Implementing entrepreneurial thinking in established organizations. SAM Advanced Management Journal 58 (1), 28–33.

Kuratko, D.F., Ireland, R.D., Hornsby, J.S., 2001. Improving firm performance through entrepreneurial actions: Acordia's corporate entrepreneurship strategy. Academy of Management Executive 15 (4), 60–71.

Kuratko, D.F., Montagno, R.V., Hornsby, J.S., 1990. Developing an entrepreneurial assessment instrument for an effective corporate entrepreneurial environment. Strategic Management Journal 11, 49–58.
Lang, J.R., Calantone, R.J., Gudmundson, D., 1997. Small firm information seeking as a response to environmental threats and opportunities. Journal of Small Business Management 35 (1), 11–23.
Lewis, M.A., 2003. Cause, consequence and control: Towards a theoretical and practical model of operational risk. Journal of Operations Management 21 (2), 205–224.
Lyon, D.W., Lumpkin, G.T., Dess, G.G., 2000. Enhancing entrepreneurial orientation research: Operationalizing and measuring a key strategic decision making process. Journal of Management 26 (5), 1055–1085.
MacMillan, I.C., George, R., 1985. Corporate venturing: Challenges for senior managers. Journal of Business Strategy 5 (3), 34–43.
Marginson, D.E., 2002. Management control systems and their effects on strategy formulation at middle management levels: Evidence for a UK organization. Strategic Management Journal 23 (11), 1019–1031.
Miller, D., Friesen, P.H., 1982. Innovation in conservative and entrepreneurial firms: Two models of strategic momentum. Strategic Management Journal 3 (1), 1–25.
Miller, D.J., Fern, M.J., Cardinal, L.B., 2007. The use of knowledge for technological innovation within diversified firms. Academy of Management Journal 50 (2), 307–326.
Morris, M.H., Allen, J., Schindehutte, M., Avila, R., 2006. Balanced management control systems as a mechanism for achieving corporate entrepreneurship. Journal of Managerial Issues 18 (4), 468–493.
Morris, M.H., Jones, F.F., 1995. Human resource management practices and corporate entrepreneurship: An empirical assessment from the USA. International Journal of Human Resource Management 4 (4), 873–896.
Morris, M.H., Kuratko, D.F., Covin, J.G., 2008. Corporate Entrepreneurship and Innovation. Cengage/Southwestern Publishing, Mason, OH.
Narasimhan, R., Talluri, S., 2009. Perspectives on risk management in supply chains. Journal of Operations Management 27 (2), 114–118.
Naveh, E., 2007. Formality and discretion in successful R&D projects. Journal of Operations Management 25 (1), 110–125.
Paiva, E.L., Roth, A.V., Fensterseifer, J.E., 2008. Organizational knowledge and the manufacturing strategy process: A resource-based view analysis. Journal of Operations Management 26 (1), 115–132.
Peng, D.X., Schroeder, R.G., Shah, R., 2008. Linking routines to operations capabilities: A new perspective. Journal of Operations Management 26 (6), 730–748.
Perez-Freije, J., Enkel, E., 2007. Creative tension in the innovation process: How to support the right capabilities. European Management Journal 25 (1), 11–24.
Pinchot, G., 2000. Intrapreneuring. Warner Books, New York.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method bias in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology 88 (5), 879–903.
Poskela, J., Martinsuo, M., 2009. Management control and strategic renewal in the front end of innovation. Journal of Product Innovation Management 26 (5), 671–684.
Rutherford, M.W., Holt, D.T., 2007. Corporate entrepreneurship: An empirical look at the innovativeness dimension and its antecedents. Journal of Organizational Change Management 20 (3), 429–446.
Sathe, V., 1989. Fostering entrepreneurship in large diversified firm. Organizational Dynamics 18 (1), 20–32.
Schuler, R.S., 2006. Fostering and facilitating entrepreneurship in organizations: Implications for organization structure and human resource management practices. Human Resource Management 25 (4), 607–629.
Scott, W.R., 1998. Organizations: Rational, Natural, and Open Systems. Prentice-Hall, Upper Saddle River, NJ.
Shepherd, D.A., McMullen, J.S., Jennings, P.D., 2007. The formation of opportunity beliefs: Overcoming ignorance and doubt. Strategic Entrepreneurship Journal 1 (1), 75–95.
Shostack, G.L., 1987. Service positioning through structural change. Journal of Marketing 51 (1), 34–43.
Simmons, R., 1995. Control in an age of empowerment. Harvard Business Review 63 (2), 80–88.
Skinner, W., 1969. Manufacturing – Missing link in corporate strategy. Harvard Business Review 47 (3), 136–145.
Slevin, D.P., Covin, J.G., 1997. Strategy formation patterns, performance, and the significance of context. Journal of Management 23 (2), 189–209.
Stopford, J.M., Baden-Fuller, C.W.F., 1994. Creating corporate entrepreneurship. Strategic Management Journal 15 (7), 521–536.
Sykes, H.B., 1986. The anatomy of a corporate venturing program. Journal of Business Venturing 1 (3), 275–293.
Sykes, H.B., Block, Z., 1989. Corporate venturing obstacles: Sources and solutions. Journal of Business Venturing 4 (3), 159–167.
Thompson, J.D., 1967. Organizations in Action. McGraw-Hill, New York.
Thornhill, S., Amit, R., 2001. A dynamic perspective of internal fit in corporate venturing. Journal of Business Venturing 16 (1), 25–50.
Vesper, K.H., 1984. Three Faces of Corporate Entrepreneurship: A Pilot Study, in Frontiers of Entrepreneurship Research. Babson College, Wellesley, pp. 294–320.
Weiss, D., Maher, M.W., 2009. Operational hedging against adverse circumstances. Journal of Operations Management 27 (5), 362–373.
Zahra, S.A., 1991. Predictors and financial outcomes of corporate entrepreneurship: An exploratory study. Journal of Business Venturing 6 (4), 259–286.
Zahra, S.A., Covin, J.G., 1995. Contextual influences on the corporate entrepreneurship-performance relationship: A longitudinal analysis. Journal of Business Venturing 10 (1), 43–58.
Zwikael, O., Sadeh, A., 2007. Planning effort as an effective risk management tool. Journal of Operations Management 25 (4), 755–767.