How Resource Challenges Can Improve Firm Innovation Performance: Identifying Coping Strategies

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Researchers recently suggested that challenges in the form of adversities and constraints can actually promote individuals, teams and firms. However, it remains unclear how such challenges elicit positive innovation performance. Moreover, we still cannot distinguish between the conditions under which challenges enhance or hinder firm innovation performance. In this paper, we review the literature on coping with a specific and central type of challenge – resource challenge, such as a lack of financial or human resources – and propose an underlying mechanism through which firms can benefit from resource challenges. The paper presents an integrative conceptual framework and looks at the key constructs that explain the effects of resource challenges on firm innovation performance. Further, it proposes two key strategies for coping with resource challenges: simplification-focus and compensation.

Introduction

Founded in 2001, the Massachusetts-based firm A123Systems had as its goal the development of efficient batteries that would become the preferred, next-generation power source on the American market. However, the firm faced multiple resource challenges, not the least of which was the immigrant status of its two founders, who lacked substantial financial resources and initially could only employ a small number of workers. Moreover, upon its founding, the firm entered a global 'death race'. The participants were competing for the ultimate prize: to be the first developer of the most promising next technology. Sooner than anyone expected, however, and before the other competitors, the newcomer A123Systems developed a battery with ten times the lifespan of conventional batteries and twice the power. By 2009, Black & Decker power tools and electric cars manufacturers Chrysler and Volvo used A123Systems' batteries (Herman & Smith, 2010). Did A123Systems achieve this remarkable innovation performance despite the fierce human, financial and time challenges the firm faced? Or did it achieve it *because* of these resource challenges?

A growing, multidisciplinary body of research has recently emerged to support the notion that challenges, in the form of adversities and constraints, may be highly beneficial to individuals, teams and firms. In particular, research suggests that resource challenges may positively influence innovation and innovation-related performance (e.g., Esty & Porter, 2005; Gibbert, Hoegl & Välikangas, 2006; Hoegl, Gibbert & Mazursky, 2008; Filippetti & Archibugi, 2011). Nevertheless, many scholars and practitioners view this premise as unrealistic (e.g., Hyytinen & Toivanen, 2005; Penney & Spector, 2005; Maine, 2008; Gomez & Vargas, 2009; Rider, 2009; Ynalvez & Shrum, 2011). Key to this controversy is the lack of clarification in the literature of what mechanism enables firms to benefit from resource challenges (Caniëls & Rietzschel, 2013). Specifically, the precise conditions under which resource challenges can enhance or hinder firm innovation performance are not clear and we do not know what the effective strategies for coping with resource challenges are.

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To address these theoretical shortcomings, this paper makes three key contributions. First, we bridge the gap in the literature and provide an integrative, conceptual framework for the mechanism underlying the effect of resource challenges on firm innovation performance. We examine the key constructs that explain this effect: the challenges (type and intensity), the firm's coping assets, the coping strategies and the ultimate innovation performance. Second, we suggest two strategies for coping with resource challenges: simplification-focus and compensation. Third, we provide a set of novel propositions that shed light on the conditions under which firms generate better/worse innovation performance under different coping strategies.

This paper reviews the literature on resource challenges and subsequent innovation performance in a firm context. Whereas most prior research on resource challenges focuses on the individual level, this study examines both the individual-level and firm-level behaviours and outcomes. This dual focus, on both individual and firm levels in confronting resource challenges, seems beneficial for the following reasons. First, individual decision makers heavily influence firm performance, an element that is especially relevant vis-à-vis the firm's managers (Kahneman, Lovallo & Sibony, 2011). Second, understanding the actions of individual employees and managers is critical to better understanding firm-level processes (e.g., Levinthal & March, 1993). Third, the fact that firms face difficulties and resource challenges is inevitable, and yet under-studied. Combining the examination of these two levels is important for understanding the entire picture of the ability of firms to successfully overcome resource challenges. Fourth, we find that discussing firm-level confronting resource challenges is most relevant for managers. Whereas some literature discusses causes and effects, as we discuss later, we are unaware of studies attempting to uncover the underlying mechanism turning resource challenges into a potential gain at the firm level. The current study attempts to bridge this gap.

The paper is organized as follows. We first present the key constructs and the conceptual framework, after which we outline our set of propositions. We conclude with a discussion of the paper's contributions to research and practice and with recommendations for future research.

Conceptual Framework

We define a resource challenge as a situation in which a firm experiences a level of resources lower than what the firm would have in the absence of this situation or when available resources do not meet the demand for resources (e.g., Hottenrott & Peters, 2012). The source of a resource challenge is typically an event in the firm's internal or external environment that forces it to confront a new and sometimes unexpected condition. A review of the literature reveals that while other resource challenges exist, the resource challenges most frequently discussed in the literature are financial, time and human resources (Andrews & Smith, 1996; Fisher & White, 2000; Gebhardt, Carpenter & Sherry, 2006). We provide detailed examples below. How firm managers respond to challenges depends, among other factors, on the firm's coping assets. We define coping assets as the skills and capabilities that the firm and its managers possess and that managers can utilize when dealing with resource challenges. Although such assets (e.g., a manager's social background or experience) may be available at the management level, they can also be accessible at the firm level, where they include learning capabilities and supportive work routines. Thus, at firms whose managers decide to actively address challenges and implement relevant coping strategies, the approach to resource challenges may positively affect innovation performance, as the manager exploits the coping assets at the disposal of the firm. This managerial task is strategic in nature. The goal of this task is to improve the firm's position, which is at risk of deteriorating in the face of the resource challenge. Thus, adopting an active approach to resource challenges may be critical to firm survival. To date, however, research has largely overlooked key issues such as possible strategies for coping with resource challenges.

Based on a thorough review of the literature, including sociology, psychology, marketing, management and innovation literatures, we develop our conceptual framework (Figure 1). This integrative framework encompasses firm processes that underlie the effect resource challenges have on a firm's innovation performance. It includes coping strategies firms can utilize to benefit from resource challenges and achieve positive innovation performance. Next, we present each of the constructs that constitute our framework and discuss their inter-relationships.

Key Resource Challenges and Their Intensities

Firms can potentially face a wide variety of challenges. Challenges can stem from challenging regulations (e.g., Porter & van der Linde, 1995; Moorman, Du & Mela, 2005),

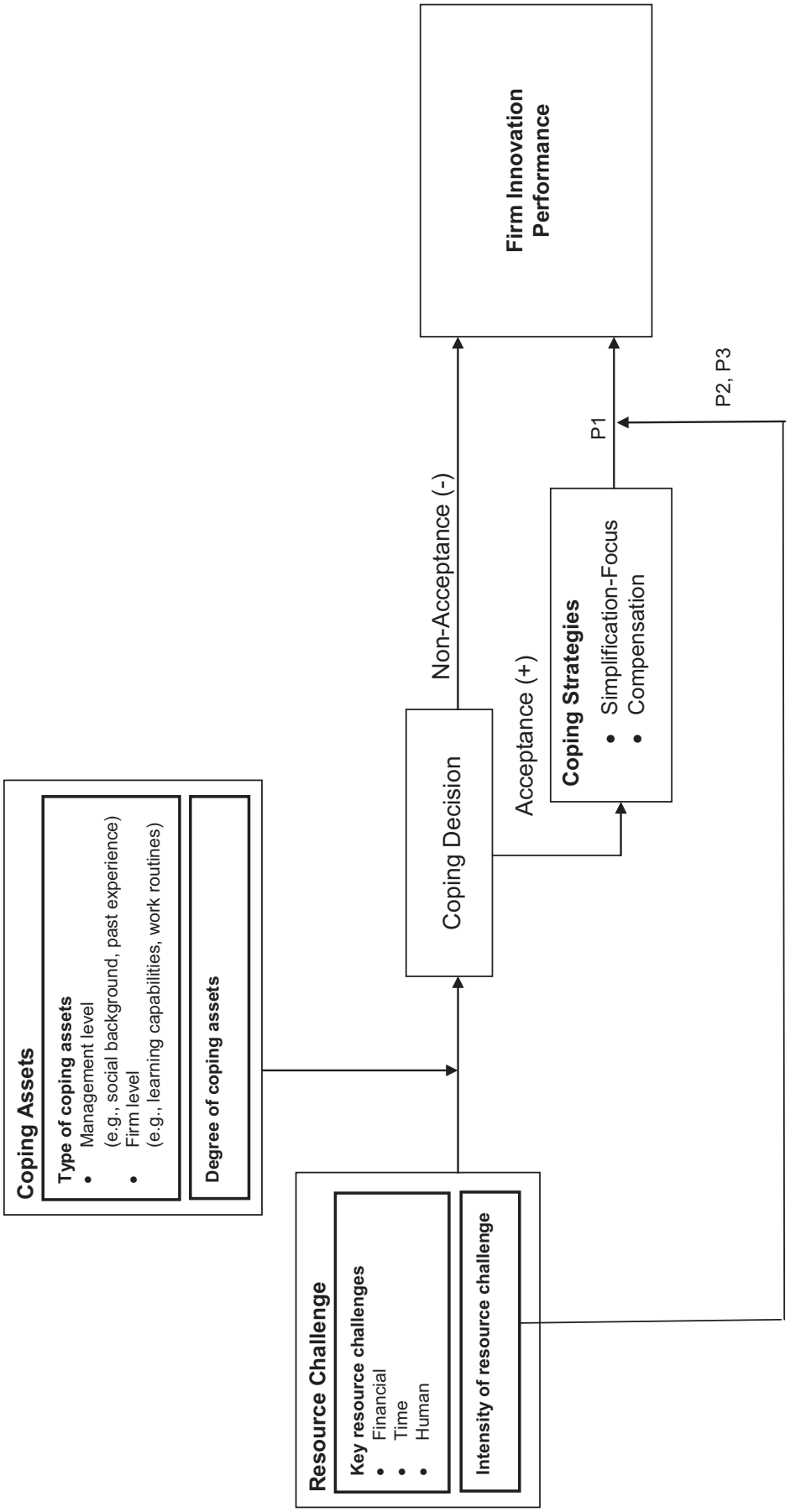

Figure 1. Conceptual Framework

knowledge and information scarcity (e.g., Reinstaller & Hölzl, 2004; Rosenzweig & Mazursky, 2014) or working conditions (e.g., stress; Pauchant & Mitroff, 1990; Dayan & Di Benedetto, 2011). However, the management literature discusses three principal resource challenges far more than other resource challenges. These are financial, time and human resources challenges. Notably, the intensity of each challenge can vary from low to high. In what follows, we discuss these key challenges and their respective intensities.

Financial Challenges

Firms may face a few types of financial challenges. The source of the financial challenge can be external, such as economic recession (Steenkamp & Fang, 2011), or internal, such as failure to meet financial performance target (Gebhardt, Carpenter & Sherry, 2006). We define a financial resource challenge as an event that withholds the firm from investing as much as it would have had the event not occurred. Put differently, a financial resource challenge occurs when funding does not meet resource demands (Kerr & Nanda, 2009; Hottenrott & Peters, 2012). Prior research has examined both the positive and negative effects of financial challenges, often emphasizing the latter (Mone, McKinley & Barker, 1998; Mishina, Pollock & Porac, 2004). These studies suggest that financial challenges tend to be associated with poor innovation performance. For example, Hyytinen and Toivanen (2005) and Yli-Renko and Janakiraman (2008) examine small and medium firms and find that financial challenges drive such firms to allocate limited resources to R&D, an action that negatively affects innovativeness. Katila and Shane (2005) find that financial constraints limit innovation of new firms in manufacturing-intensive markets. Still, the negative effects from financial adversity can also be meaningful among large firms, as Amabile and Conti (1999) reveal. Other research has shown that workers tend to blame their inferior performance on the lack of funding and on the firm for withholding necessary resources (Bandura, 1977; Gomez & Vargas, 2009). Nohria and Gulati (1996) suggest that the lack of financial slack prevents experimentation that is necessary for innovation. Accordingly, Ynalvez and Shrum (2011) find that constrained financial resources are detrimental to the performance and novelty of research endeavours.

Conversely, some scholars highlight the potential benefits associated with financial challenges. For example, Hoegl, Gibbert and Mazursky (2008) argue that financial challenges trigger the individual's motivation and commitment to the firm, thereby enhancing the firm's innovation performance. Similarly, Whited and Wu (2006) find that financially challenged firms earn higher returns than less financially challenged firms, and Srinivasan, Rangaswamy and Lilien (2005) find that some firms turn financial challenges into a performance advantage. Further, Srinivasan, Lilien and Sridhar (2011) find a positive effect of R&D spending during recessions on profits for large versus small firms, and Hottenrott and Peters (2012) show that innovation can be achieved in spite of financial constraints given strong innovative capabilities. Nohria and Gulati (1996) suggest that too much capital slack detracts from a firm's discipline and may cause a firm to pursue a bad innovation project. A study of economic downturns points to an example: following the financial challenge posed by the recession of the early 1990s, Solectron – an electronics manufacturer – decided to reallocate its newly limited resources in favour of product quality and innovation. As a result, the company won the Baldrige Quality Award in 1991, which helped the firm become a market leader (Rigby, 2001).

Time Challenges

Tight deadlines require managers and employees to respond differently to a situation compared with a situation with no time pressure. Numerous management papers addressed time challenges and their effect on performance, and on innovation-related performance in particular (e.g., Andrews & Farris, 1972; Amabile et al., 1996; Andrews & Smith, 1996). For example, Baer and Oldham (2006) observe a difference in creativity between employees experiencing different levels of time challenges, and Andrews and Smith (1996) find a negative association between employees who perceive a time challenge and innovation-related performance compared to those with low levels of perceived time challenge. Accordingly, we define a time resource challenge as an event that expedites the deadline of a specific project or of some project relative to similar projects, overall preventing the firm from allocating the time for a project it would have allocated had it not been for the event. Research has suggested that as long as they are not extreme, time challenges can positively affect individuals and teams. For example, tight deadlines can increase the speed of decision making and responsiveness because they require managers and workers to increase the use of real-time information, carry out several operations simultaneously while simplifying them, and seek advice only from

the best available sources rather than from all available sources (Eisenhardt, 1989). Research has also revealed that innovation and creativity benefit from time challenges (Andrews & Farris, 1972; Amabile, 1983; Sethi, Smith & Park, 2001). For example, Burroughs and Mick (2004) suggest that individuals respond more creatively to a task they must perform quickly than to a task with no timetable challenge. Moreover, Andrews and Farris (1972) show that moderate time pressure positively affects innovation-related performance.

Human Resources Challenges

Occasionally firms downsize by reducing the number of their employees in an attempt to improve the firm's efficiency, productivity or competitiveness (Freeman & Cameron, 1993; Fisher & White, 2000). In many cases, management cannot (or will not) reduce the number and scope of tasks. Accordingly, we define a human resource challenge as an event that leads to a reduction in the number of individuals or team members working on a specific project compared to the size of the team at an earlier stage in the project or in similar projects, overall preventing the firm from allocating the human resources it would have allocated had it not been for the event. The fewer the team members, the bigger the human resource challenge. Prior research has highlighted the benefits of large teams, including the increase in total work hours devoted to the task, better problem solving, better judgement, and high levels of cross-fertilization (Sethi, Smith & Park, 2001). In a similar vein, prior research also demonstrate the negative side of limited human resources. For example, Fisher and White (2000) propose that a human resource challenge negatively affects the organization's learning ability, which in turn can affect the firm's innovation ability. However, evidence of the opposite effect also exists. For example, Amabile and Conti (1999) show that, in the long-run, creativity levels actually increase after human resource downsizing. In accordance, Gibbert, Hoegl and Välikangas (2006) note that IBM realized not only that large product development teams do not expedite projects, but also that teams with too many people may actually delay projects (see also Brooks, 1975). In contrast, under the scenario of a human resources challenge, the benefits stem from the notion that a project team comprising fewer workers is characterized by better communication, higher efficiency and better overall performance than would be possible with a large team (Carmel & Bird, 1997).

Interconnections between Key Resource Challenges

Each one of the key resource challenges mentioned above has its unique contribution to a firm's market position. However, resource challenges may occur simultaneously, correlate with one another, and present cumulative effects because challenges may interconnect. For example, a financial resource constraint may lead to – or be associated with – a limited ability to hire employees, which can create a time challenge. Similarly, a time challenge may increase the difficulty of deploying financial capabilities or train new employees. Thus, different key challenges may be correlated and affect one another, and consequently affect the overall intensity of the challenge, which we discuss next.

Challenge Intensity

Prior research indicated that minor- and medium-intensity challenges may be stimulating and may motivate managers to actively engage with the challenge; however, extreme challenges are viewed as impossible barriers (Gibbert, Hoegl & Välikangas, 2006). Thus, extreme challenges will likely cause firms not to cope with the challenge, as we discuss in detail below. We, therefore, propose that the intensity of a resource challenge reflects the degree of difficulty the challenge imposes on the firm. For example, Keegan and Green (2011) discuss the case of the Indian firm Suzlon Energy. Although Suzlon began as a family textile firm, rising electricity costs motivated the firm to venture into wind energy as an alternative, ultimately to become India's first wind technology company and a global player. Importantly, the resource challenge that Suzlon faced was substantial, but not to the extent that it threatened the firm's existence, i.e., the challenge was not extreme. Similarly, Moreau and Dahl (2005) show that individuals devise innovative solutions when facing a resource challenge. However, extreme challenges with multiple constraints tend to stifle the individual's ability to increase innovativeness.

Thus, the intensity of a resource challenge, which can be low or high, has ramifications in two main areas of firm innovation performance: (i) response to the challenge – whether managers decide to actively cope with the challenge; and (ii) implementation of an optimal coping strategy – if managers decide to cope with the challenge, its intensity may determine the effectiveness of a coping strategy in terms of innovation performance. The initial response to the challenge and the

coping strategy depend on the firm's coping assets, which we discuss next.

Coping Assets

As we mentioned earlier, we define coping assets as the skills and capabilities that the firm and its managers possess and that managers can utilize when dealing with resource challenges. This section explores the nature of coping assets and how managers can utilize them. We divide this discussion into (i) the management level, which involves an individual level point of view, (ii) the firm level and (iii) internal versus external coping assets.

Management-Level Coping Assets

Managers' past experiences and social backgrounds are key to understanding their decisions and actions. Studies in a diverse set of disciplines including sociology, psychology, education and management suggest that one must understand individuals' backgrounds and the challenges they have experienced to fully comprehend the assets they have developed over the years that assist them in coping with new challenges (Bronfenbrenner, 1979; Heilman, 1997; Tiedemann, 2000).

A number of studies suggest that individuals accumulate experiences in confronting and overcoming resource challenges. These can stem from financial challenges, inequality in the workplace or social discrimination. Thus, individuals who are used to facing challenges for prolonged periods of time acquire skills that assist them in coping with new challenges (Browning, Leventhal & Brooks-Gunn, 2005; Seery, Holman & Cohen-Silver, 2010). To improve their position despite adversity, individuals who face adversities develop skills and propensities for the efficient exploitation of opportunities and of available resources. These skills help them cope with existing and recurring situations of adversity and resource challenges (Kanter, 1977; Ibarra, 1992; Thanacoody et al., 2006). The literature attributes such skills and propensities to individuals who belong to specific social groups that face adversity.

One such group of individuals who face adversity in the form of integration and communication challenges is immigrants (Portes, 1995). For example, Granovetter (1995) discusses Chinese immigrants to the US, who formed business associations based on their ethnic origins. The social isolation and financial challenges these immigrants faced, facilitated and promoted the successful operation of their business associations, which raised capital and offered different types of assistance to support their members' entrepreneurial endeavours. This unique situation gave the Chinese immigrants advantages over the local population in establishing new business ventures. A famous case of a successful immigrant despite adversity is that of Samuel Goldwyn, a self-made man. Goldwyn emigrated from Russia to America in 1898, and struggled to become a successful and innovative film producer. The media attributes his success to the difficulties and resource challenges he experienced as an immigrant (Johnston, 1937; Harmetz, 1992; Elber, 2001). Accordingly, research on minority employees has shown that people who are used to working under time challenges and/or social adversities are more adept at utilizing the resources available to them efficiently and creatively (e.g., Amabile, 1983; Ibarra, 1992).

Other than social background, personal experience is also expected to have a role in an individual manager's ability to cope with challenges. Accordingly, when recruiting new personnel, NASA prefers candidates with a wide range of experiences, including both successes *and* failures, to candidates with unblemished histories of success (Dweck, 2006). Apart from the probably intertwined elements of experience and social background, individual managers may possess characteristics affecting their ability to cope with resource challenges (e.g., Pearlin & Schooler, 1978; Billing & Moos, 1981; Tedeschi & Calhoun, 1996). For example, personality traits such as mastery, self-efficacy, learning-goal orientation and growth mindset are positively associated with coping with challenges (Fleishman, 1984; Gist, 1987; Boyd & Vozikis, 1994; Dweck, Mangels & Good, 2004; Dweck, 2006). Additionally, traits of resilience and hardiness increase an individual's ability to face and overcome challenges (Maddi & Khoshaba, 1994; London, 1997), and extraversion and openness to experience are correlated with drawing strength from challenges (Tedeschi & Calhoun, 1996).

Managers who possess certain characteristics are more likely to make a conscious decision to cope with a challenge and to deploy the appropriate strategy to turn a resource challenge into a positive innovation-related performance.

Firm-Level Coping Assets

The firm's work routines and its learning capabilities are central to firm-level coping assets. Managers can cultivate effective coping assets by intentionally shaping specific learning capabilities, collaborations, work routines, norms and cultures (Hofstede, 1985; Powell, Koput & Smith-Doerr, 1996; Moorman & Miner, 1998; Yadav, Prabhu & Chandy, 2007). For example, Välikangas and Gibbert (2005)

suggest that firms that actively challenge their own innovation activity are more likely to cultivate innovation. Similarly, Dougherty and Takacs (2004) suggest that new product development (NPD) teams that operate within structured contexts are able to sustain product innovations. For example, Välikangas and Gibbert (2005) discuss managers of the Siemens Corporation, who strictly structure all R&D efforts. Such rigid discipline enables Siemens to maintain the productivity of its multiple R&D centres. Hoegl and Gibbert (2007) suggest that when teams trained in dealing with limited resources operate under resource challenges, they adjust their activity accordingly and achieve high innovation performance; conversely, when resources are bountiful, development teams tend towards low innovation performance.

Learning capabilities are highly relevant to coping with challenges because they underlie the ability of firms and teams to adapt to new situations (Argyris & Schön, 1978; Sinkula, Baker & Noordewier, 1997). Firms with superior learning capabilities possess the greatest ability to adapt and hence the greatest ability to overcome challenges (Nonaka & Takeuchi, 1995). For example, Moorman and Miner (1998) suggest that firms' learning processes and capabilities advance improvisation, which, in turn, help firms cope with challenging situations.

Finally, other firm characteristics, such as firm size and structure, may also markedly affect coping assets. For example, prior research suggests that the less formal or hierarchical a firm, the better able it may be to cope with challenges, as such a lack of formal structure confers greater flexibility and adaptability (e.g., Nelson, 1991; Moorman, 1995; Chandy & Tellis, 1998; Moorman, Du & Mela, 2005; Ettlie & Elsenbach, 2006; Hewitt-Dundas, 2006).

Internal vs. External Coping Assets

Most management-level and firm-level coping assets are internal to the firm. Still, in some cases, employing these assets may require the utilization of elements external to the firm. For example, managers who maintain rich and extensive social and professional networks use their internal assets by employing entities external to the firm, such as managers and employees in other firms and collaborating firms (e.g., Powell, Koput & Smith-Doerr, 1996), but also policy makers or financial institutions. Similarly, firm-level assets may also involve utilizing elements auxiliary to the firm. For example, a firm that cultivates strategic alliances can deploy these alliances to optimally utilize its own internal coping assets (Powell, Koput & Smith-Doerr, 1996), and a firm with learning abilities that implements improvisation (Moorman & Miner, 1998) can improvise using connections with, or equipment of, suppliers, customers or allies outside the firm (e.g., Gomes-Casseres, Hagedoorn & Jaffe, 2006).

Coping Decision

When confronted with a resource challenge, managers face a coping decision (Gebhardt, Carpenter & Sherry, 2006). We posit that managers can either accept or not accept the opportunity to cope with the challenge. Non-acceptance can take the form of (i) ignoring the resource challenge, (ii) explicitly rejecting the challenge or (iii) deferring the coping decision to a later time. The possible outcomes of a manager's non-acceptance include the firm's outright termination of a project or even market exit (Moorman, Du & Mela, 2005). Another potential result is that the firm executes the project poorly, or retreats and thus gives way to stronger firms (Srinivasan, Lilien & Sridhar, 2011). For example, Hyytinen and Toivanen (2005) find that firms with limited resources are likely to reduce R&D investments following financial challenges, which, in turn, limits innovativeness. In contrast, acceptance means that managers explicitly address the situation and consciously decide to cope with it through specific actions, taking into account the intensity of the challenge and the firm's coping assets. Such actions may focus on the challenged resources. Porter and van der Linde (1995) list cases in which environmental regulation constrains firms from utilizing their usual polluting resources. Still, management choices enable these firms to increase their innovation by using limited resources in a productive manner. Other actions may apply not to the reduced resources, but to strategies designed to deal with the resource challenged. For example, firms can adopt or increase their market-oriented culture in an attempt to deal with the challenge (Gebhardt, Carpenter & Sherry, 2006).

Taking specific actions is an immediate, apparent result of consciously deciding to cope with a challenge. Psychology-related research on challenges has suggested that accepting a challenge has yet two other, less immediate potential benefits (e.g., Duhachek, 2005; Gelbrich, 2010; Hamilton & Hassan, 2010). First, managers who decide to tackle a challenge increase their confidence in dealing with similar challenges in the future, and they create a practical toolkit for dealing with future, similar situations. Cognitive studies suggest that coping with challenges enables

Table 1. Coping Decision as a Function of Intensity of the Resource Challenge and Degree of Coping Assets

		Intensity of resource challenge	
		Low	**High**
Degree of coping assets	Low	(3) Acceptance	(4) Non acceptance
	High	(1) Acceptance	(2) Acceptance

individuals to perceive themselves as more capable. As a result, such individuals are better able, in turn, to cope with new challenges (Tedeschi & Calhoun, 1996). Second, coping enables a positive interpretation of the situation, and this interpretation leads to growth and to a re-evaluation of new possibilities (Cadell, Regehr & Hemsworth, 2003; Linley & Joseph, 2004).

We suggest that the decision of whether or not to accept the opportunity to cope with a resource challenge depends on the interaction of two dimensions: (i) the intensity of the resource challenge and (ii) the degree of coping assets of the firm. We propose the following 2×2 matrix (Table 1).

Since the intensity of the resource challenge is situational and the coping assets (management and firm levels) tend to be relatively stable over time, we contend that the foremost determinant of whether management decides to cope with the challenge is the degree of coping assets. That is, as long as the resource challenges are not extreme, managers and firms with considerable coping assets can deal with and benefit from a high-intensity resource challenge. Thus, reflecting conditions (1) and (2) in Table 1, we expect that firms with a high degree of coping assets will tend to accept resource challenges.

When the firm's degree of coping assets is low, however, the intensity of the challenge plays a greater role. For example, NPD teams need financial, time and human resources to conduct activities such as experimenting, surveying customers and testing prototypes. When a team faces a severe resource challenge of funding, time or workers, coping with such a situation is exceptionally difficult (Damanpour, 1991). Under such circumstances, a low degree of coping assets may push managers to defer coping with the challenge, to execute it poorly or to simply give up the project entirely. Prior research indicates that managers who are not used to facing challenges are less likely to effectively deal with new ones (Kanter, 1977; Shostack, 1988; Sulonen, 2004; Välikangas & Gibbert, 2005). Thus, innovation performance is expected to be poor. Conversely, if a challenge is of low intensity, then even a low degree of coping assets may serve as a moderator and enable managers to utilize assets and perform well. For example, Mishina, Pollock and Porac (2004) argue that a low intensity financial challenge may enhance the firm's entrepreneurial spirit regardless of the firm's coping assets. In summary, we expect that firms with a low degree of coping assets will accept low intensity resource challenges but will not accept high intensity resource challenges. This contention is reflected in conditions (3) and (4) in Table 1.

Coping Strategies

An examination of prior research on resource challenges reveals that a clear definition of the mechanism underlying the potentially positive outcomes in the presence of resource challenges is lacking. Here we attempt to identify and elucidate this mechanism. The literature proposes two identifiable strategies that managers who decide to accept a resource challenge are likely to pursue. We term these two strategies simplification-focus coping strategy and a compensation coping strategy. We review the related literature next.

Simplification-Focus Strategy

Simplification occurs when managers eliminate unnecessary or less valuable parts of the work process and can be perceived as analogous to revamping a value-chain (e.g., Thompson, Strickland & Gamble, 2010) or re-engineering a business process (e.g., Hammer, 1990). The elimination of less important elements of the work process promotes focus by easing the comparison of alternatives and deconstructing complex procedures

(Eisenhardt, 1989; Goldenberg, Mazursky & Solomon, 1999a). But a simplification-focus strategy involves either simplification followed by focus or just focus. Dougherty and Takacs (2004) propose that focusing makes a task associated with innovation easier to handle. They argue that such a strategy enables one to abandon a broad pattern of thinking in favour of focusing attention on specific and more central areas. Termed 'thinking inside the box' by Finke, Ward and Smith (1992), this strategy often saves time and facilitates completion of an innovation-related task. It is especially valuable during adverse situations that involve financial challenges, such as a recession (Rigby, 2001). Thus, simplification is not always a part of the strategy, as managers sometimes proceed directly to the focusing action: concentrating on the key components of the work process. Overall, a simplification-focus approach seems to be the most widely acknowledged in the literature dealing with resource challenges. We discuss this strategy in detail in the Propositions section.

Compensation Strategy

A compensation coping strategy involves closing the gap caused by the resource challenge by utilizing other, existing resources that compensate for the challenged resources. For example, firms with limited R&D or marketing resources can outsource ideation to their customers (Bayus, 2013). Such firms can also establish technological and marketing alliances (Hagedoorn, 1993) or utilize external networks to compensate for lack of financial assets (Gibbert, Hoegl & Välikangas, 2006). Despite the seeming effectiveness of a compensation coping strategy, the management literature does not frequently discuss it.

Unlike a simplification-focus strategy, where managers eliminate parts of the work process and focus on the remaining ones, in compensation managers do the opposite. Rather than eliminate elements of the process, they add to it by utilizing their other, available resources. We define these other, available resources as those in the firm's environment, and therefore, by using them, the firm accrues limited or no extra costs. An optimal utilization of these resources compensates for the adversity the resource challenge causes (Starr & MacMillan, 1990). Managers exploit compensation because the challenge pushes them to optimally utilize the firm's materials, knowledge, people and other processes that are already available (e.g., Eisenhardt, 1989). One type of compensation addressed at length in the literature is the utilization of professional social networks and social capital (e.g., Johannisson & Olaison, 2007; Malmström, 2014). Examples of how challenges lead groups to optimally utilize their social networks in a business arena include minorities in firms and entrepreneurial immigrants (Ibarra, 1992, 1995; Granovetter, 1995; Portes, 1995; Sassen, 1995; Portes & Rumbaut, 2001).

Some firms adopt a compensation strategy early on by using a bootstrapping approach where the venture is based on limited internal capital and often utilizes external substitutions such as inter-firm co-operation, currying personal favours and piggy-back riding (Shan, Walker & Kogut, 1994; Gibbert, Hoegl & Välikangas, 2006). Another bootstrapping approach includes avoiding external financing and relying solely on income from (early) sales, using this income not only to sustain the firm but also to achieve growth through innovation. Using such an approach compensates for external financing by becoming operational early on in the business life cycle, avoiding unnecessary costs and exploiting fast-cash generating opportunities even when these are not in perfect line with the firm's vision (Bhide 1992). Other bootstrapping approaches include using external connections and social credit to compensate for limited time or other resources (Starr & MacMillan, 1990; Malmström, 2014), and using owners' funds and encouraging customers to pay more quickly to compensate for financial constraints (Vanacker et al., 2011).

Another form of compensation strategy is bricolage. Bricolage refers to solving problems and taking advantage of opportunities by combining existing resources (Baker & Nelson, 2005). Similarly to bootstrapping, studies attribute bricolage to entrepreneurs, who access resources available to them to bypass environmental and resource constraints (Baker & Nelson, 2005; Fisher 2012).

Yet another type of compensation strategy discussed in the literature involves inter-firm co-operation and alliances. To generate innovation outcomes under conditions of resource constraints and challenges, such modes of co-operation typically take the form of technological or marketing collaborations (Hagedoorn, 1993; Zidorn & Wagner, 2013). In this manner, firms can compensate for missing technological knowledge resulting from resource constraints, by partnering with another firm for R&D, and enjoying the knowledge flows associated with such an alliance (Gomes-Casseres, Hagedoorn & Jaffe, 2006). Firms can also collaborate with research institutions such as universities and hospitals (Powell, Koput & Smith-Doerr, 1996). Moreover, firms can specifically compensate for financial constraints by sharing the costs of

R&D with their collaborators (Hagedoorn, 1993). We discuss compensation strategy in further detail in the Propositions section.

Firm Innovation Performance

The most frequently discussed firm outputs in the context of resource challenges are creativity, efficiency, productivity, business performance and innovation (e.g., Mone, McKinley & Barker, 1998; Dougherty & Takacs, 2004; Moreau & Dahl, 2005; Hoegl & Gibbert, 2007; Hoegl, Gibbert & Mazursky, 2008). In this paper, we focus on a key firm outcome: innovation performance. Prior research discusses various dimensions of innovation performance, such as the success of new products, level of innovation, number of new products, number of patents and quality of patents (e.g., Trajtenberg, 1990; Sorescu, Chandy & Prabhu, 2003; Grinstein, 2008; Baker et al., 2014; Rosenzweig & Mazursky, 2014).

Propositions

Our propositions shed light on the conditions under which firms exhibit better or worse innovation performance following a specific coping strategy. We specifically discuss the direct link between a coping strategy and innovation performance. Although both coping strategies have significant advantages, we contend that the innovation-related merits of a compensation coping strategy are greater than those of the simplification-focus strategy, the latter of which has some limitations. First, the simplification-focus strategy entails the exclusion of processes or materials – an act that may hinder innovation performance when tackling a resource challenge (Hoegl, Gibbert & Mazursky, 2008). Second, actions taken within the framework of the simplification-focus strategy focus only on components that are already part of the work process. As such, this strategy limits the ability to exploit the challenge for benefits that only exist outside the boundaries of the closed system. This solution to the resource challenge does not promote any long-term learning, a notion supported by research on firm learning, especially exploitation and exploration (March, 1991; Levinthal & March, 1993). Moreover, a simplification-focus strategy is exploitative in nature. While focusing on or simplifying a problem may help save money, time and other resources, thereby generating positive outcomes, the exploitative learning nature of this strategy limits the firm's ability to foster radical innovations, significantly improve its innovation performance or promote long-term, profound learning (Sinkula, Baker & Noordewier, 1997; Baker & Sinkula, 1999).

In contrast, a coping strategy based on compensation is likely to have more meaningful learning consequences, and thus with benefits that are more likely to be long-term than those of simplification-focus. First, compared to a simplification-focus strategy, a compensation strategy requires managers to exercise a more complex management approach by borrowing ideas and resources from outside the closed system, outside the scope of the current work process. Thus, its impact may extend beyond the boundaries of the challenge. While this search for ideas and resources outside the system is costly and demanding, it may generate a good solution to the challenge and directly contribute to innovation performance (Starr & MacMillan, 1990; Ward, 1994; Mahoney, 1995; Bouty, 2000).

Moreover, an approach based on compensation has been shown to be more creative than that based on simplification-focus (e.g., Goldenberg, Mazursky & Solomon, 1999a, 1999b). Because a compensation strategy involves resources in addition to those already in the work process, it is likely to facilitate innovativeness. Indeed, the exploratory nature of compensation-based coping exposes the firm to information and practices outside its current experience and scope of work. This greatly increases the firm's potential to realize innovative breakthroughs (Rowley, Behrens & Krackhardt, 2000). Finally, a resource challenge can also trigger a reassessment of already-existing assets (Tedeschi & Calhoun, 1996), which may have long-term effects. In summary, a compensation strategy provides a richer toolbox for current and future encounters with challenges, and therefore it is superior to a simplification-focus strategy.

The above discussion suggests that whereas a simplification-focus strategy is likely to have a moderately positive effect on firm innovation performance, a compensation strategy is likely to be more valuable in the long run and have a positive impact that will extend beyond the scope of the specific resource challenge. In other words, it can lead to greater innovation performance because it utilizes additional resources and entails new and meaningful learning opportunities. Moreover, because a dominant compensation strategy involves collaboration with entities outside the firm, and because such collaborations induce learning opportunities, a compensation coping strategy is superior to a simplification-focus strategy in enhancing innovation performance. Formally stated:

Proposition 1. *A compensation coping strategy enhances firm innovation performance more than a simplification-focus coping strategy.*

The difference in the contribution to innovation performance between the compensation and simplification-focus strategies suggests that each strategy may be effective under resource challenges that vary by intensity. Because compensation enhances learning to a greater extent than simplification-focus, it may be preferable for coping with relatively high-intensity resource challenges. A high-intensity challenge entails more learning opportunities precisely because it stimulates intense thought about how to meet a challenge. Often inherent to these contexts is the need for deep learning, which positively affects innovation (Baker & Sinkula, 1999). Conversely, as we argued above, the contribution of simplification-focus to the firm is much more limited. Further, because a simplification-focus strategy is less likely to lead to deep learning within the firm, it may only be suitable for coping with low-intensity challenges. Formally stated:

> **Proposition 2.** *A simplification-focus coping strategy enhances a firm's innovation performance under low-intensity resource challenges more than under high-intensity resource challenges.*

> **Proposition 3.** *A compensation coping strategy enhances a firm's innovation performance under both low- and high-intensity resource challenges.*

Conclusions and Future Research

Innovation performance and the nature of its connection to resource challenges is of primary interest. After all, one of the earliest notions of the effect of resource challenges is in the context of innovation (Toynbee, 1934). Researchers have recently suggested that challenges in the form of adversities and limited resources may actually benefit innovation performance. Still, many scholars and practitioners dismiss such a possibility as fable. This paper reviews the literature on resource challenges and identifies mechanisms that may underlie the potentially positive effect resource challenges have on innovation performance.

The example of A123Systems presented in the introduction demonstrates how firms can achieve high levels of innovation performance *despite* human, time and financial challenges (Herman & Smith, 2010). Then again, perhaps A123Systems' achievement was *because* of these challenges? Instead of driving the company's founders to abandon their project, the resource challenges seem to have propelled them forward. Based on our suggested conceptual framework and mechanism, we can explain this counterintuitive evidence. First, the founders possessed high levels of coping assets that enabled them to effectively handle the on-going adversities. In this specific case, their background as immigrants was invaluable. Second, the firm's work routines and cohesion were additional valuable coping assets. Finally, to create its breakthrough innovation, the company followed a compensation strategy in its product development: it overcame the current industry size and efficiency limitations by restructuring the materials and adding trace amounts of metals to the batteries' formula. Now A123Systems' batteries require cheaper elements than they used to. Moreover, the batteries can charge and discharge quickly, which enables them to generate exceptional bursts of power (Herman & Smith, 2010; MIT Technology Review, 2012).

Contributions

This study makes the following contributions. First, we identify in the literature key resource challenges and key coping assets. We contribute to the literature by specifying coping assets at the manager and firm levels, and by suggesting dependence between coping assets and the coping decision. Second, we explain the underlying mechanism that transforms a resource challenge into positive innovation performance. The notion that resource challenges can benefit innovation performance is somewhat counter-intuitive and controversial. Therefore, it is important to establish the theoretical grounds for its feasibility. Third, we identify two coping strategies, both of which can assist managers and firms in benefiting from situations of limited resources. We provide insights regarding the differences between the two coping strategies and the benefits firms can derive by utilizing them. In what follows, we offer conclusions, implications and future research directions.

Coping Strategies and Their Implications

We identify two coping strategies: simplification-focus and compensation. Whereas other approaches to coping with resource constraints are possible, we find that approaches typically discussed in the literature, such as bootstrapping and bricolage that we mentioned above, fit within our two proposed strategies. Studies discuss patterns of simplification-focus more often than they discuss patterns of compensation (e.g., Finke, Ward & Smith, 1992; Dougherty & Takacs, 2004; Hoegl, Gibbert & Mazursky, 2008). This more frequent discussion may indicate that the simplification-focus strategy is more widely used. However, we suggest the compensation

strategy is more likely to lead to long-term innovation performance via opportunities for profound learning at both the manager and firm levels.

Coping Strategies and Learning

A key explanation for the difference between the two strategies involves the firm's ability to learn from the challenge. Researchers view firm learning as a key success factor for firms, especially pertaining to innovation performance (e.g., Baker & Sinkula, 1999; Rowley, Behrens & Krackhardt, 2000). It therefore plays a critical role under resource challenges. For example, Lampel, Shamsie and Shapira (2009) show that although it is often difficult for firms to prepare for challenges, their ability to learn from and adapt to the challenge are paramount to a firm's recovery and future success (e.g., Christianson et al., 2009; Lee & Makhija, 2009).

This is an important message for managers who face resource challenges. Future research could further extend this notion and examine the contexts within which the two strategies play more, or less, positive roles. For example, it is possible that because a simplification-focus strategy eliminates parts of a process, that it can be as beneficial as a compensation strategy under short-term resource challenges. One could also argue that executing either of the coping strategies presents its own particular challenges to managers.

Coping Strategies and Costs

Do simplification and compensation strategies differ in costs? It seems reasonable to suppose that a compensation strategy may cost more to implement than a simplification strategy. A compensation strategy requires utilizing elements outside the process. Even if such elements already exist, and require little or no direct financial costs, utilizing them may require co-ordination costs, technological adjustments, work routine adjustments, and so forth. Some struggling firms may not be able to use this superior strategy due to its demanding costs. Such firms may therefore opt to use a compensation strategy that is based on social networking, as the latter may be less costly. Still, even utilizing one's network has it costs, usually in the form of social costs (expectation of reciprocation down the line) – for example, a firm that follows a bootstrapping approach, and utilizes external available resources with limited or no extra costs to the firm. Still, using external connections and social credit to compensate for limited time or financial resources (Starr & MacMillan, 1990; Malmström, 2014) is likely to create social debt. Conversely, a simplification-focus strategy that eliminates parts of the process is likely to cost less than a compensation strategy. Therefore, a firm that opts to refrain from social or other debt may prefer the simplification-focus strategy.

Coping Strategies: Is There a Dominant One?

In addition to its limited costliness compared with a compensation strategy, a simplification-focus strategy is also likely to bear short-term benefits, whereas a compensation strategy may only bear long-term benefits. Do these characteristics turn a simplification-focus strategy to a dominant strategy? If both strategies are feasible, should managers under low-intensity resource constraints favour a simplification-focus strategy? We argue that this is not necessarily the case. Whereas short-term financial performance could be a key issue for some firms, other firms may prefer to focus on long-term performance and strive to achieve long-term enhanced innovation. Scholars have noted before that managers should balance between, and even prioritize, long-term strategic benefits over short-term financial objectives. The primary reason for such prioritizing would be that long-term strategic benefits lead to long-term financial performance (Kaplan & Norton, 1996; Gamble, Peteraf & Thompson, 2015). That is, for example, if a firm is not in immediate danger of bankruptcy, managers may want to favour the more costly compensation strategy, if they envisage potential long-term benefits that outweigh the short-term benefits of a simplification-focus strategy. Therefore, the question of a dominant strategy remains dependent upon firm contingencies.

Coping Strategies as Mutually Exclusive

To what extent are the simplification-focus coping strategy and the compensation coping strategy mutually exclusive? The two coping strategies are based on opposing behaviours. Whereas a simplification-focus strategy eliminates elements of the process, a compensation strategy integrates into the process elements and processes outside the focal process. Still, a single firm may implement both coping strategies in two different periods, in response to two different resource challenges, or in response to a single resource challenge that affects two business units. One can also envisage a case in which managers eliminate non-valuable work process actions through simplification-focus and add valuable actions through compensation. Therefore, despite

opposing behaviours, it is possible that the implementation of these two approaches overlaps.

The Added Value of a Compensation Strategy

A compensation strategy has a number of key benefits. In essence, this strategy entails optimally utilizing available resources. Because it disrupts traditional and entrenched activities and processes, a compensation strategy is likely to positively affect processes beyond those we discuss here. Another benefit has to do with serendipitous connections. Johnson (2010) suggests serendipitous connections between people, knowledge and ideas are associated with new ideas and the emergence of radical innovations. A compensation strategy means a greater potential for serendipitous connections than a simplification-focus strategy because compensation utilizes networks. Inherent to networks is the high potential for serendipitous connections, and therefore, much more than for a simplification-focus strategy, a compensation strategy is likely to have a long-term effect on firm innovation performance.

Additionally, as we previously suggested, professional social networks provide an important resource that both managers and workers can utilize. Social networks, a good source for useful advice and suggestions, also facilitate cross-fertilization. Another potential resource is one's experience with resource challenges, which, as we explained earlier, is invaluable. Moreover, seniority in the firm, which implies long-term experience with work processes within the firm, can benefit the transfer of resources from other firm activities to the activity most affected by the challenge. Despite the difference between these resources – networks and experience – they both draw on the same type of resource, namely, social capital. The potential benefits stated above make social capital an exceptionally valuable resource that firms possess and can utilize.

Coping Assets and Their Cultivation

Coping assets are central to our understanding of a firm's ability to effectively deal with resource challenges. A high degree of coping assets is a toolbox that managers can use when facing resource challenges. Managers can develop and cultivate capabilities such as improvisation, flexibility and learning that will enable the firm to effectively handle changing circumstances, especially those related to resource challenges (Moorman & Miner, 1998; Grewal & Tansuhaj, 2001; Wang & Bansal, 2005). In addition, managers can allocate efforts to establish the necessary work routines, processes and learning capabilities to assist their firms in better coping with resource challenges. For example, firms faced with resource challenges can recruit workers with experience in confronting such challenges because of their invaluable acquired ability to efficiently utilize available resources. Importantly, firms who recruit such workers effectively influence coping assets and future choice of a coping strategy, raising issues of endogeneity, which we discuss later.

Type of Resource Challenges

We highlighted three typical firm resource challenges: financial, time and human resource challenges. Nevertheless, when discussing the potential impact of each on firm innovation performance, we examine the role of these challenges in general rather than addressing the unique impact of each. Future research can identify the specific effects each resource challenge may have on firms. For example, is a financial challenge more difficult to handle than a human resource challenge? Do the different challenges interact differently with the two coping strategies?

Apart from the resource challenges we study here, there are other potential types of challenges. For example, in a business environment where information and knowledge are key success factors, future work should focus on studying challenges such as information scarcity, technology unavailability, and so forth. These resources have thus far received limited research attention (e.g., Bawden, Holtham & Courtney, 1999; Reinstaller & Hölzl, 2004; Rosenzweig & Mazursky, 2014). Additionally, resource challenges can take the simple form of a shortage in raw materials. That is, even when no financial challenges exist, the amounts or types of raw materials available may pose considerable challenges to firms. A scarcity of material resources can be the result of political conflicts or recessions (Glick & Taylor 2005; O'Rourke, 2005), among other possible reasons. Such challenges may influence firm attributes like its production ability or its ability to supply its customers with the goods at the level of quality they expect. An evaluation of which coping assets and strategies are the most useful in such cases would be worthwhile.

Researchers from multiple disciplines have a rich history of work addressing the responses to challenges in general and to resource challenges in particular. Some of these studies were published some time ago (e.g., Toynbee, 1934; Wilkins, 1969; Gene, 1975), which presents an ideal opportunity for

future research appraising the larger thesis of coping with challenges over time.

Firm Performance

We focus on firm innovation performance. Is the process portrayed, however, similar for different types of firm performance? Future research can study the interaction of coping strategies with different types of resource challenges, and the effect of coping assets on aspects such as firm productivity, efficiency and profitability. Is one coping asset more effective than another in dealing with resource challenges? Moreover, the effects of resource challenges on innovation performance are likely to differ across national and corporate cultures and the extent to which complexity and turbulence characterize the industry. Such aspects can be addressed in future research.

Our distinction between the two coping strategies and their associations with exploitative and explorative learning processes is particularly valuable in the context of innovation. The strong link between simplification-focus and exploitative learning (Sinkula, Baker & Noordewier, 1997; Rowley, Behrens & Krackhardt, 2000) indicates that a simplification-focus strategy is likely to lead to incremental innovation. Conversely, the strong link between a compensation strategy and explorative learning (Sinkula, Baker & Noordewier, 1997; Rowley, Behrens & Krackhardt, 2000) indicates that a compensation strategy is likely to lead to radical innovation. Importantly, both coping strategies yield positive innovation performance; the type of innovation, however, is a key dimension that may distinguish between the two strategies.

Positive Effect Thresholds of Resource Challenges

We expect resource challenges to have a positive impact on firm innovation, as long as they are not extreme (Chandler, 1996; Ettlie & Elsenbach, 2006; Rosenzweig & Mazursky, 2008). Nevertheless, the thresholds between a potentially positive resource challenge and an extreme resource challenge remain unstudied. That is, at what level of intensity are resource challenges beneficial, and at what level do they become extreme, thus leading to poor performance? Such thresholds may vary across the type of resource, the existing coping assets, and other variables such as firm size, type of industry, and so forth.

Endogeneity

Firms can use their past experience, learning abilities and gains from past performance to cultivate coping assets. Moreover, such experience, learning abilities and past performance are likely to affect not only the coping decision but also the choice of coping strategies if the firm accepts the challenge. This loop of causality may lead to endogeneity concerns. Therefore, any future empirical work should address endogeneity issues both conceptually and empirically.

Future Empirical Work

Future studies can empirically test the propositions we present here. A quantitative approach that includes measuring different types of resource challenges, coping assets and coping strategies – albeit difficult to execute – would make a considerable contribution and we therefore find it worthwhile. Further, this framework should also be examined in terms of different units of analysis (e.g., firms vs. managers), industry contexts (e.g., manufacturing vs. services), national or corporate culture contexts (e.g., hierarchical vs. non-hierarchical, masculine vs. feminine, individualistic vs. collectivistic), and firm settings (e.g., firms of different sizes).

For example, at the firm level, future research can use a 'natural experiment' such as the 2008 global economic crisis to study the impact on innovation performance of firms using the simplification-focus and compensation strategies for coping with financial constraints. Such a natural experiment would need to control for firm size and for different industries and measure financial resources before and after the emergence of the crisis as an independent variable approximating the intensity of the challenge. The number of new products or the level of innovativeness of new products would measure innovation performance, whereas the number of collaborations, type of collaborators, and adding vs. subtracting parts and materials from the process can be used as mediators for innovation performance. A different natural experiment can use regulatory actions as generating resource constraints (e.g., Porter & van der Linde, 1995). For example, Moorman, Du and Mela (2005) used the Nutrition Labeling and Education Act as a stimulus of constraining regulation and examined the performance of food firms before and after the implementation of the Act. At the management level, following a similar procedure to that of Moreau and Dahl (2005), scholars can manipulate coping assets and strategies in lab experiments or control them in field experiments, to test their impact on innovation performance. In addition, collaboration with an organization, using qualitative research methods, may serve as a case study

on the implementation of different coping strategies and their direct effect on innovation performance.

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