

Managerial Cognition in R&D Processes Within Indian hi-tech firms: A Conceptual Framework

Niharika Garud*, Lakshmanan Prasad**

Abstract

New products are a source of firms' competitive advantage. Research on R&D investments, processes and performance has majorly been at the level of analysis of organizations. In this research, we theorize and build theoretical arguments on managerial cognition in R&D projects and impact on performance within firms at an individual level entrepreneurial decision-making and resource utilization processes. We bridge behavioral-decision with cognitive perspective in building propositions on R&D processes. We examine corporate R&D managers, under resource constraints and high uncertainty, apply cognitive processes to take decisions and how it affects performance. We argue that cognitive processes are moderated by political skills of R&D manager and how it affects performance. This research also builds our understanding of managerial cognition under uncertainty within large organizations.

Key words: management of innovation, R&D, emerging economies, resource constraints

* Doctoral Candidate, Organizational Behavior & Human Resources Indian Institute of Management Bangalore, India E: niharikag08@iimb.ernet.in P: +91-942-570-9875 Address: C/O FPM Office, IIM Bangalore Campus, Bannerghatta Road, Bangalore 560076 INDIA

** Professor, Organizational Behavior & Human Resources Indian Institute of Management Bangalore, India E: prasad@iimb.ernet.in P: +91-80-26993158 Address: C-208, Academic Blocks, IIM Bangalore Campus, Bannerghatta Road, Bangalore 560076 INDIA

NOTE: Both authors have contributed equally

INTRODUCTION

Innovation and R&D are important factors for growth and profitability of organizations and play an important role in economic development of nations. Innovation positively impacts firm level competitiveness, national standards of living and a nation's ability to eradicate poverty (Dutz, 2007). Therefore, researchers, practitioners and organizations are actively interested in identifying determinants of successful innovation and R&D outcomes. The research on innovation and R&D in organizations began with Schumpeter (Schumpeter, 1947) proposing that larger monopolistic organizations are responsible for most technology innovations that reach the market (Cohen & Levinthal, 1990). With the emergence of the behavioral and managerial cognition perspective over the last forty years, scholars began to study innovation and R&D challenges at the micro level of the scientist, the innovator and the product champion (Burgelman, 1983). Recent research has found the roles of innovator, product champion and manager to overlap and affect the outcomes and process of R&D and innovation, irrespective of their formally assigned roles.

Decisions to invest and decisions to disintegrate or persist with an idea can influence investments in R&D over time as well as long run outcomes. These decisions in R&D projects are taken in an uncertain environment and hence, are risky, with potential payoffs only realized in the long run. Furthermore, they are based on temporal tradeoffs between firms' short term profitability and long term gains (Deutsch, 2007). According to resource dependence theory, irrespective of potential benefits to the firm in the longer run, not all stakeholders of the firm will be interested in making R&D investments. R&D managers need to operate and realize novel ideas in organizational settings while operating with similar issues that entrepreneurs face - limited resources and other constraints during the new product development. Hence, an unconventional entrepreneurial approach to manage risky R&D decisions will play crucial role in supporting managers to deviate to the path of new product development and innovation in firms.

The managers of R&D projects choose specific ideas from a number of proposals of new products operating in the same R&D setting. Hence, managers use their own domain specific knowledge bound by cognitive biases and firm dynamics to assess the R&D project in terms of both short term and

long-term benefits. This process requires managers and hence, their firm, to identify relevant resources that aid such projects from already constrained internal and external environments. Identifying the cognitive issues of experienced managers, working in similar uncertainty as in entrepreneurial settings, provides us insights on how managerial style (effectual, causal and bricolage) facilitates R&D performance and in turn, informs us on how managers should deal with R&D and innovation. In this research, we examine managers of R&D projects through the lens of cognition processes (taken from entrepreneurship literature) within the boundaries of a firm.

IMPACT OF MANAGERIAL COGNITION ON R&D PERFORMANCE

Investments in R&D and innovation processes in large organizations pose a challenge in terms of valuations made by conventional management practices (Klein & Sorra, 1996). For instance, the goal of the R&D process may change with the development process and the targets and solutions might not be clear. So if a new product is being developed, it becomes difficult to accurately identify potential market and demand functions. The typical managerial issues that arise around the development and conceiving of the idea for a new product that is yet to be developed include: How do we design the process flow for this product? How do we identify, value and seek resources for its development? How do we convince the top management to provide support and to shelter the development processes? These are some common issues arising in R&D intensive areas on a regular basis (von Zedtwitz, Gassmann, & Boutellier, 2004). The managers in R&D are therefore forced to be more entrepreneurial as compared to the managers in routine operations (Busenitz & Barney, 1997; Lyon, Lumpkin, & Dess, 2000).

Some of the most common conflicts faced by R&D managers in an organization are to rationalize the process of creation and predict the creation at the same time (Davenport & Short, 1990). Data such as demand functions, market estimation and goal specification are often required to be presented to stakeholders including top management in large organizations for investment purposes. This justification is the key to acquire resources and to get the internal legitimacy to the process of creation, which might be crucial for subsequent stages of development (Deeds, Decarolis, & Coombs, 2000). We,

therefore, argue that entrepreneurial cognition of managers positively affects their innovative behavior and performance in R&D (including output and efficiency). We propose that R&D managers, in resource constrained corporate settings, who learn from their entrepreneurial expertise, who employ effectuation and bricolage and use their political skills, are better decision-makers in product innovation when viewed through the lens of organizational performance standards.

ENTREPRENEURIAL COGNITION IN DECISION-MAKING

Organizations in general deal with both exploration and exploitation constantly as in ambidextrous organizations (O'Reilly, 2004). For example, exploration of a particular opportunity or an idea might require more entrepreneurial thinking and actions whereas exploitation will require goal orientation and setting targets (Sarasvathy, 2001). Exploration and exploitation processes are integral to uncertainty and the R&D context and lead to an emergent strategy (Mintzberg & Waters, 1985). In recounting of R&D success, the organizations depict the successful output as a direct result of the choices and decisions that they made. Similarly, exploration and exploitation might be viewed as a result of an intended set of decisions in a corporate context where decision makers are answerable to internal polity and external stakeholders. Hence, individual behavior becomes crucial when managers get involved in decision-making processes of the organization that are bound by a set of resources, stakeholders, and social structures. However, there can be different ways in which individuals intrinsically think, gather data, process information, make certain choices and act upon them in any social settings (Salancik & Pfeffer, 1978). Thus, the difference in choices and actions is where entrepreneurial actions in corporate settings begin.

LINKAGES BETWEEN MANAGERIAL COGNITION AND R&D PERFORMANCE

Investments, intensity and outcomes in R&D have been globally used to measure innovation management inputs (Adams, Bessant, & Phelps, 2006). Several scholars have linked R&D intensity (ratio of investments or expendi-

ture or number of people employed along with variety of roles and some expression of R&D output) with innovation performance and firm performance at firm level (e.g. Deeds, 2001; Greve, 2003; Parthasarthy & Hammond, 2002). R&D has been studied at firm, entrepreneurial and individual level. There are several behavioral studies which focus on personality traits of R&D managers and comparative analyses with entrepreneurs, intrapreneurs and general managers (cf. (Scott & Bruce, 1994). Several studies have shown innovative efforts of employees and management as one of the key factors influencing innovative performance of the firm (Bedrock & Watson, 1993; Hoffman, Parejo, Bessant, & Perren, 1998). However, we can see a clear gap between the behavioral, cognitive and micro studies in R&D and their implications on individual as well as team based performances and innovativeness. When financial and other constraints are imposed on R&D in organizations, R&D managers may choose to invest and continue to invest as per the organizations criteria to evaluate such projects. Even then, their evaluation is not always be empirical or based on net present value calculations. They may use their earlier experiences and expertise to analyze the R&D opportunity and synthesize it into a holistic view before making a specific R&D investment. Since their expertise, ability to think holistically and cognition has not been studied before in terms of their impact on performance, this is a clear research gap in the area.

ENTREPRENEURIAL COGNITION IN CORPORATE SETTINGS

The entrepreneurial cognition concepts of effectuation and bricolage have largely been studied in the context of independent entrepreneurs and start-ups in organization research. However, there are only a few articles that study bricolage and effectuation in larger corporate settings (Brettel, Mauer, Engelen, & Küpper, 2011; Senyard, Baker, & Steffens, 2010). R&D and innovation provide an interesting context to examine effectual and bricolage cognitive processes in contrast to traditional approaches of planning and rationality to explore and exploit opportunities in resource constraint environments. Our research examines the application of the entrepreneurial cognition concepts of effectuation and bricolage to R&D and innovation decision-making and its performance in large corporate settings.

Effectuation

Sarasvathy discusses four principles of entrepreneurial cognition displayed by entrepreneurial experts that shows how entrepreneurs think, process information and make key decisions through effectuation (Sarasvathy 2001). When compared to the causal school of thought, effectuation refers to processes that start with “a set of means as given and focuses on selecting between possible effects that can be created with that set of means” while causation builds on prediction and processes that “take a particular effect as given and focuses on selecting between means to create that effect” (Sarasvathy, 2001). The principles of effectuation can be applied to the context of R&D decisions in uncertain environments (Dew et al., 2009). The first principle, known as bird-in-hand or means, broadly highlights what the present status is in terms of “who I am”, “what I know” and “whom I know” (Brettel et al., 2011). The possible courses of effectuator arise driven by available means rather than a goal or target. Secondly, effectuation uses the concept of affordable loss rather than expected returns to be the evaluation criteria for potential investments (Chandler, McKelvie, DeTienne, & Mumford, 2011). This contradicts the process of routine planning, estimation, break-even points in business plans and finally, expected returns from the finished product. The effectuation process therefore uses an upside down approach when compared to conventional strategic planning with competitive analysis (Chandler et al., 2011). The third principle of effectuation emphasizes the importance of self selected stakeholders and strategic alliances/partnerships, where pre-commitments are important to reduce uncertainty and to remove entry barriers and hence, to an extent, have some control on the future events. The willingness to change the course of action and the ability of stakeholders to view such changes as another opportunity plays a very important role in effectual logic and decision-making. However not all stakeholders in large organizations are likely to view unexpected outcomes or events to be windows of opportunities rather than hurdles to the process (Wiltbank, Dew, Read, & Sarasvathy, 2006). Organizing to avoiding such “shocks” in the development process is typically considered to be of utmost importance in corporate settings. Managers in large corporate settings, who are keen to invest in developing new businesses, may find that these four principles of effectuation lead to new opportunities to plan different courses

of actions and may also provide a safer approach of making such investments under uncertainty in large corporate settings.

Bricolage

Levi-Strauss first defined bricolage in 1966 anthropology as making do with current resources, and creating new forms and new order from tools and materials available at hand. Bricolage specifically addresses cognitive patterns displaying resource orientation rather than goal orientation and the term has been adopted in management theory on improvisation and similar processes (Baker, Miner, & Eesley, 2003; Weick, 1993). However, bricolage is conceptually much more than simply being a “resource seeker”; it involves intimate and in-depth knowledge of existing resources, specific domains of application and the context of application. Hence, bricolage may appear quite similar to improvisation activity and improvisation seems to imply that bricolage will occur (Baker et al., 2003). Bricolage also helps organizations and existing set-ups to view resources in a different light for its possible new uses, applications and combinations which were not considered to be relevant or practical earlier. Instead, like means in effectual logic, the bricoleur considers the current set of resources as the potential starting point for a new idea (Senyard et al., 2010).

INNOVATIVE BEHAVIOR AND R&D PERFORMANCE

At the micro level, individual measures in R&D have been typically restricted to a few constructs such as innovative behavior, innovative outcomes and innovator-adaptor measures. Studies show relationships between team diversity and team innovative performance (Kessler and Chakrabarti, 1996) and prior exposures to experience of team members with teams’ innovative outcomes (Bantel and Jackson, 1989) but the individual linkages have not been clearly drawn so far. Since an individual placed in charge of a team primarily does the decision-making in an R&D team, it is logical to study the individual decision-maker and his/her orientation in R&D investments. Earlier studies have shown relationships between propensity of teams to innovate and the teams’ innovative output. But at the individual level, such studies are rare due to measurement issues.

Since R&D decisions and investments are being studied at the individual level, analyzing the outcomes and efficiency measures for the individual decision-maker provides a consistent approach to analyze impact of R&D investments and decisions on individual's own performance. Performance in the context of R&D and innovation has always been measured through proxies and it has been difficult for scholars to agree on a single measure of performance. Hence, we argue that innovative behavior (idea generation, promotion and realization), and innovative outcomes emerge from the individual's self ability to perceive and develop novel ideas along with longer term benefits of enhancement of knowledge, expertise and initiatives for future potential ideas (Brettel et al., 2011). Thus, the performance measure is not dependent on the temporal element in the context of R&D and considers a longer benefit approach as the best approach to study and analyze innovative performance. For this study, innovative behavior, innovative outcomes and efficiency are terms adapted from earlier works (Brettel et al., 2011; Scott & Bruce, 1994). Innovative behavior measures individual's contribution to three stages in R&D and innovation process where idea is generated, promoted and realized in the firm through development and negotiation processes with other stakeholders in the organizational setting. Innovative outcomes are defined in terms of individual's perceived value of the work, future potential of the work, individual expertise and competencies. Individual's efficiency has been defined in the standard way of benchmarking their progress using budgeting, timelines and performance standards set by the firm.

POLITICAL SKILLS OF MANAGERS IN R&D

Since at the individual level, the ability to negotiate and actively explore new resources is important for gaining or even realizing resources at hand, the individual needs to constantly interact with the reporting structure and with entities such as higher management, colleagues, technology experts, marketing executives or even customers. Within the context of large organizations, the individual's capability to negotiate with others, understand them effectively and to use such knowledge to influence others to act in such a way that it enhances ones or the organizational objectives is known as their political skill (Ferris et al., 2005; Mintzberg & Waters, 1985).

Politically skilled individuals at work use social astuteness and capacity to adjust behavior to different and changing situational demands in ways that appears to be sincere so to inspire support and trust. They effectively influence and control the responses of others (Ferris et al., 2007). Political skill also influences the ability of individual to network positively (Ferris et al., 2007) and networking is crucial in effectual logics. The ability to influence others at work (interpersonal influence) is also positively affected by the political skill of the individual (Ferris et al., 2007). We argue that political skill will be crucial in organizations where individuals actively seek resources, network with others for further knowledge, pre-commitments and more resources. And finally, political skill is crucial when the goal orientation is weak and the individual is effectually constructing the path of development for innovation and R&D.

PROPOSITIONS ON ENTREPRENEURIAL COGNITION IN R&D SETTINGS

We develop a set of propositions on the use of bricolage and effectuation in the process of innovation and R&D in large corporate settings.

Individual Innovative Behavior

Research suggests that different levels of innovativeness require different sets of resources in terms of scale and scope (Green, Welsh, & Gordon, 2003). This represents the constant dilemma faced by R&D managers in organizations in justifying investments in major resources without any clear expected potential return. The literature on innovative behavior of individuals at workplaces examines intentional creation, introduction, and application of new ideas within a work role, group, or organization, in order to benefit role performance, the group, or the organization (West & Farr, 1989). Scott & Bruce (1994) argued that individual innovative behavior is complex and consists of three behavioral tasks (idea generation, idea promotion, and idea realization). Hence, in spite of different levels of innovativeness, individuals who actively explore and exploit different bundles of means might be more innovative and successful in creating and completing R&D projects than those who keep a larger goal such as creating disruptive or incremental innovations.

Proposition 1a. In the context of large organizations, means orientation of R&D managers is likely to positively affect innovative behavior of R&D managers.

Proposition 1b. In the context of large organizations, bricolage orientation of R&D managers is likely to positively affect innovative behavior of R&D managers.

Individual Innovative Outcomes

We relate effectual logic of means and bricolage to the innovative outcomes at the individual level. The outcomes of R&D processes have been measured in various ways at the individual level of analysis (Scott & Bruce, 1994). Effectuation through the means principle closely relates to the absorptive capacity of the firm (Cohen & Levinthal, 1990) – its ability to value the resources at hand and to incorporate and implement that knowledge to take effective R&D decisions. Lichtenthaler (2009) argues that as the difficulty in predicting developments in highly innovative environments increases, prior resources become particularly crucial. The concentration on existing resources helps firms to access additional knowledge and resources and to successfully proceed on their development paths. Lichtenthaler (2009) concludes that the cumulative resources and knowledge generation that are based on existing resources and knowledge is particularly important in uncertain environments because institutions constantly face new challenges. As shown earlier, the individual's political skill influences their ability to network positively (Ferris et al., 2007). We argue that political skill will be crucial in organizations where individuals actively seek resources, network with others for further knowledge, pre-commitments and more resources and finally, political skill is crucial when the goal orientation is weak and the individual is effectually constructing the path of developments for innovation and R&D.

Proposition 2a. In the context of large organizations, means orientation of R&D managers, moderated by their political skills, is likely to positively affect R&D managers' individual outcomes.

Proposition 2b. In the context of large organizations, bricolage orientation of R&D managers, moderated by their political skills, is likely to positively affect R&D managers' individual outcomes.

Individual Efficiency

Though seeking several bundles of resources will provide individual decision makers an opportunity to explore and exploit several courses of action, such R&D projects will not be as efficiently implemented as R&D projects with well-defined goals (Brinckmann, Grichnik, & Kapsa, 2010). Similarly, individual decision makers that work on several projects with ill-defined goals will struggle to meet efficiency targets in the R&D context. While attempts to increase efficiency in various ways (such as guiding the process, defining schedules and budgets, reducing errors), are desirable in general, several research studies suggest the opposite for innovative outcomes of R&D processes (Fredrickson & Iaquinto, 1989; Seidel, 2007; Wiltbank et al., 2006). They find that comprehensive planning activities in the R&D context are negatively associated with performance as well as with the organization's ability to notice important changes in environment, and with innovation process outcomes. This is primarily due to the changing goals and ambiguity involved in the R&D process (Seidel, 2007). Hence, R&D managers using means and bricolage will struggle to meet their efficiency targets.

Proposition 3a. In the context of large organizations, means orientation of R&D managers is likely to negatively impact R&D managers' individual efficiency.

Proposition 3b. In the context of large organizations, bricolage orientation of R&D managers is likely to negatively impact R&D managers' individual efficiency.

Affordable Loss

Affordable loss is the advance commitment of what the effectuator or stakeholder is willing to lose in the R&D process and is opposite to the investment orientation with expected outcomes or positive returns at the end of the process (Saravathy, 2008). Affordable loss is akin to decisions in R&D processes that aim to minimize risk and losses. R&D managers may choose different paths to minimize risk, such as strict budgeting, strict schedules and adhering to specifications provided already by organizations or even by customers for developing the idea. This might lead to increase in efficiency of the individuals' performance and their impact on R&D but it will also

bind them into pre-existing notions of the development process for a product, which is not yet in existence. In contrast, the logic of affordable loss gives the freedom to stakeholders to control the situation without making any promises of outcomes and returns.

In the R&D process, where uncertainty is high, reliable predictions and forecasting of the development processes require information, which cannot be assessed easily (for example, customer acceptance of a new product, demand function or sales function for a new market). In fact, such information cannot be gathered reliably even by formal market analysis or other means of getting external data as the potential of a highly innovative idea will remain unclear till actualized. Dew et al. (2009) concludes that the acceptable downside potential or affordable loss is far easier to estimate keeping the current situation in mind while upside data is usually difficult to estimate and is generally not discriminating and reliable enough to make key decisions. Neoclassical investment theory (Campbell, 1992) states that decisions to maximize expected returns (which equally considers upside and downside information) leads to superior operational performance and, as a result, higher process efficiency. Pre-commitments to budgets and schedules for projects avoid overspending on resources and hence, effectuators play to be on the safer side. We therefore propose that effectual logic of affordable loss positively impacts efficiency at individual level for R&D processes.

Proposition 4a. In the context of large organizations, affordable loss orientation of R&D managers is likely to positively impact R&D managers' efficiency in implementing R&D projects.

However, affordable loss along with pre-commitments to schedules and budgets may restrict the behavioral tasks of idea development, promotion and realization. Pre-commitments to budgets and schedules will draw boundaries, thereby blocking out-of-the-box thinking of the effectuator. Ideas may have to be tailored to meet apriori deadlines. Since the reliability of their predictions will be questioned, effectuators will tend to rely on the downside of the outcomes. The urge to get pre-commitments on large resources and make major investments will be low. This in turn will negatively influence innovation in the project. Similar patterns may also follow in the promotion of new ideas and the realization of new ideas – keeping the downside of outcomes as the priority. Hence, we propose that the principle

of affordable loss will negatively influence innovative behavior of the R&D manager. There is no available research (conceptual or empirical) that links affordable loss orientation with the behavioral perspective.

Proposition 4b. In the context of large organizations, affordable loss orientation of R&D manager negatively impacts innovative behavior of R&D manager in implementing R&D projects.

Partnerships and Co-creation

Partnerships or alliances in effectuation refer to the involvement of stakeholders in decision making and innovation processes in order to expand the means available and to co-create new possibilities (Saravathy, 2008). This is crucial to cross-functional integration in organizations and to acquire resources from the environment which might be necessary for organizational survival (Olson, Walker, Ruekerf, & Bonnerd, 2001). Stakeholders such as customers and suppliers may also provide crucial information and new resources to reduce the ambiguity and uncertainty in R&D processes and in turn positively impact R&D output (Griffin, 2002; Petersen, Handfield, & Ragatz, 2003). Read, Song, & Smit (2009) in their meta-analysis of effectuation and venture performance found a positive relationship between self-selected stakeholders and new venture performance.

In the context of uncertainty in R&D and innovation, the conventional market and competitors' analysis (causal approach to making decisions) is inappropriate as there are no sources of reliable information and data about the potential market for the potential product. Partnering with interested stakeholders tends to bring in more clarity rather than haziness to the R&D process, positively impacting the innovative outcome. For example, an interested customer may agree to test the prototype at no cost and give feedback at a stage when formal market testing may not be feasible as the product is not yet complete. This pre-commitment by a customer might also help in better idea realization and even promotion of the product. It has been found that integration of market knowledge into decision-making improves innovation performance (Grinstein, 2008). Hence, we propose that seeking partnerships positively impact innovative behavior of the R&D managers and their performance output.

Proposition 5a. In the context of large organizations, partnership orientation of R&D manager is likely to positively affects innovative behavior of R&D manager.

Proposition 5b. In the context of large organizations, partnership orientation of R&D manager is likely to positively affect innovative outcomes of R&D manager.

DISCUSSIONS

In our conceptual framework, we have theorized on how entrepreneurial cognitions within large organizations lead to performance in the context of uncertainty of R&D and innovation. The propositions developed can be tested in R&D settings in different industry sectors with different technological intensities. Apart from implications for research and practice in innovation and R&D, there are implications for our understanding of managerial cognition in highly uncertain environments. We contribute theoretically to our understanding of the moderating effect of political behavior in the context of organizational decision-making under uncertainty. The theoretical arguments offer insights on how individuals make a difference in R&D processes through their innovativeness and their political skills. This reflects how politics at an individual level can support, facilitate and nourish activities in the uncertain environments within organizations. The research builds on the cognition and behavioral theories in the management and organizational research. It also contributes to the literature of entrepreneurial perspectives from an organizational point of view. In summary, this research will contribute to literature in the areas of R&D, innovation, managerial cognition and the political process within behavioral decision-making in large organizations.

RECOMMENDATIONS FOR FUTURE RESEARCH

The dearth of research work in this field calls for scholars from around the world to study R&D and to contribute to both academia and practice. This field is particularly of interest to both the groups, as it has the ability to bring profitability and competitive advantage for the firms. Through this

research, we see a great potential for overcoming hindrances to study R&D and innovation within established firms using diverse lenses of cognition, behavior and entrepreneurship theories. This will enrich scholarly understanding for R&D and will be crucial to broaden the field. Empirical studies will support and strengthen the theory building in the field. The scholarship in the R&D literature needs both qualitative and quantitative approaches to study R&D to connect to the realities of the field and in order to create value for the practitioners.

Research on the R&D performance is also needed, especially at the individual level as much of the literature on R&D performance has kept the organizational level as their main focus. And connecting performance to the dimensions of decision-making, utilization of resources, and dimensions of product development in the firms will be important. It will also be crucial to study R&D performance and linkages with decisions, resources and product development in the context of entrepreneurship and young firms. Through these research directions, scholarship will be broadened to discuss the issues of performance in practice. It is important to understand measurement of both success and failure of individual leadership and management in R&D in future studies. Hence, the future studies could incorporate objective measurements for performance and effective or disruptive management styles for leaders or managers or even their decision-making teams in terms of their individual financial measures, resource utilization measures and divergent process outcomes. While future studies should verify if our theoretical arguments hold, it would be interesting to test the arguments using standardized measurement scales and experimental designs already existing in the field. It will also be important to study the context of emerging economies and Asian cultures to contribute and enrich understanding of R&D practices around the world. As emerging economies have started playing an important role in the global markets, the scholarly and empirical work in these contexts have been long due. Longitudinal datasets will also play a role in understanding evolution of R&D processes where the transition of performance and expected outcomes from R&D could be monitored. These longitudinal datasets will also allow researchers to understand how R&D has evolved with the firm and how they have influenced competitive advantage, profits and strategy building.

CONCLUSIONS

We theorize and build arguments on R&D processes within established firms using lenses of managerial cognition. We discuss how entrepreneurial cognition impacts R&D keeping in mind the central role of individuals and how individual cognition influences the aspects of R&D process including outcomes and efficiency at the individual level. This research contributes and builds on cognitive and behavioral research in the context of R&D and organizational research.

References

- Adams, R., Bessant, J., & Phelps, R. (2006) "Innovation Management Measurement: A Review". *International Journal of Management Reviews*, 8(8): 21-47.
- Baker, T., Miner, A. S., & Eesley, D. T. (2003) "Improvising firms: Bricolage, account giving and improvisational competencies in the founding process". *Research Policy*, 32(2): 255-276.
- Bantel, K. A., & Jackson, S. E. (1989) "Top management and innovations in banking: Does the composition of the top team make a difference?" *Strategic Management Journal*, 10(S1): 107-124.
- Bedrock, R., & Watson, T. (1993) "Managing innovation for survival and growth: Rotunda PLC — a case in point". Paper presented at *16th National Small Firms Policy and Research Conference*.
- Brettel, M., Mauer, R., Engelen, A., & Kupper, D. (2012) "Corporate effectuation: Entrepreneurial action and its impact on R&D project performance". *Journal of Business Venturing*, 27(2): 167-184.
- Brinckmann, J., Grichnik, D., & Kapsa, D. (2010) "Should entrepreneurs plan or just storm the castle? A meta-analysis on contextual factors impacting business planning-performance relationship in small firms". *Journal of Business Venturing*, 25(1): 24-40.
- Burgelman, R. (1983) "Corporate entrepreneurship and strategic management: Insights from a process study". *Management Science*, 29(12): 1349-1364.
- Busenitz, L. W., & Barney, J. B. (1997) "Differences between entrepreneurs and managers in large organizations: Biases and heuristics in strategic decision-making". *Journal of Business Venturing*, 12(1): 9-30.
- Campbell, C. A. (1992) "A decision theory model for entrepreneurial acts". *Entrepreneurship Theory & Practice*, 17(1): 21.
- Chandler, G. N., McKelvie, A., DeTienne, D., & Mumford, T. (2011) "Causation and effectuation processes: A validation study". *Journal of Business Venturing*, 26(3): 375-390.
- Cohen, W. M., & Levinthal, D. A. (1990) "Absorptive capacity: A new perspective on learning and innovation". *Administrative Science Quarterly*, 35(1).

Davenport, T. H., & Short, J. E. (1990) "The new industrial engineering: Information technology and business process redesign". *Sloan Management Review*, Summer 11-27.

Deeds, D. L. (2001) "The role of R&D intensity, technical development and absorptive capacity in creating entrepreneurial wealth in high technology start-ups". *Journal of Engineering and Technology Management*, 18(1): 29-47.

Deeds, D. L., Decarolis, D., & Coombs, J. (2000) "Dynamic capabilities and new product development in high technology ventures: An empirical analysis of new biotechnology firms". *Journal of Business Venturing*, 15(3): 211-229.

Deutsch, Y. (2007) "The influence of outside directors' stock-option compensation on firms' R&D". *Corporate Governance: An International Review*, 15(5): 816-827.

Dew, N., Read, S., Sarasvathy, S. D., & Wiltbank, R. (2009) "Effectual versus predictive logics in entrepreneurial decision-making: Differences between experts and novices". *Journal of Business Venturing*, 24(4): 287-309.

Dutz, M. A. (2007) *Unleashing India's innovation: Toward sustainable and inclusive growth*. Washington DC: The World Bank.

Ferris, G. R., Treadway, D. C., Kolodinsky, R. W., Hochwarter, W. A., Kacmar, C. J., Douglas, C., & Frink, D. D. (2005) "Development and validation of the political skill inventory". *Journal of Management*, 31(1): 126-152.

Ferris, G. R., Treadway, D. C., Perrewe, P. L., Brouer, R. L., Douglas, C., & Lux, S. (2007) "Political skill in organizations". *Journal of Management*, 33(3): 290-320.

Fredrickson, J. W., & Iaquinto, A. L. (1989) "Inertia and creeping rationality in strategic decision processes". *Academy of Management Journal*, 32(3): 516-542.

Green, S. G., Welsh, M. A., & Gordon, E. D. (2003) "Advocacy, performance, and threshold influences on decisions to terminate new product development". *The Academy of Management Journal*, 46(4): 419-434.

Greve, H. R. (2003) *Organizational learning from performance feedback: A behavioral perspective on innovation and change*. Cambridge: Cambridge University Press.

Griffin, A. (2002) "Product development cycle time for business-to-business products". *Industrial Marketing Management*, 31(4): 291-304.

Grinstein, A. (2008) "The effect of market orientation and its components on innovation consequences: a meta-analysis". *Journal of the Academy of Marketing Science*, 36(2): 691-703.

Hoffman, K., Parejo, M., Bessant, J., & Perren, L. (1998) "Small firms, R&D, technology and innovation in the UK: A literature review". *Technovation*, 18(1): 39-55.

Kessler, E. H., & Chakrabarti, A. K. (1996) "Innovation speed: A conceptual model of context, antecedents, and outcomes". *Academy of Management Review*, 21(4): 1143-1191.

Klein, K. J., & Sorra, J. S. (1996) "The challenge of innovation implementation". *Academy of Management Review*, 21(4): 1055-1080.

Lichtenthaler, U. (2009) "Absorptive capacity, environmental turbulence, and the complementarity of organizational learning processes". *Academy of Management Journal*, 52(4): 822-846.

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.

Mintzberg, H., & Waters, J. A. (1985) "Of strategies, deliberate and emergent". *Strategic Management Journal*, 6(3): 257-272.

Olson, E. M., Walker, O. C., Ruekerf, R. W., & Bonnerd, J. M. (2001) "Patterns of cooperation during new product development among marketing, operations and R&D: Implications for project performance". *Journal of Product Innovation Management*, 18(4): 258-271.

Parthasarthy, R., & Hammond, J. (2002) "Product Innovation Input And Outcome: Moderating Effects Of The Innovation Process". *Journal of Engineering and Technology Management*, 19(1): 75-91.

Petersen, K. J., Handfield, R. B., & Ragatz, G. L. (2003) "A Model Of Supplier Integration Into New Product Development". *Journal of Product Innovation Management*, 20(4): 284-299.

Read, S., Song, M., & Smit, W. (2009) "A Meta-Analytic Review Of Effectuation And Venture Performance". *Journal of Business Venturing*, 24(6): 573-587.

Salancik, G. R., & Pfeffer, J. (1978) "Social information processing approach to job attitudes and task design". *Administrative Science Quarterly*, 23(2): 224-253.

Sarasvathy, S. D. (2001) "Causation and effectuation: towards a theoretical shift from economic inevitability to entrepreneurial contingency". *Academy of Management Review*, 26(2): 243-263.

Sarasvathy, S. D. (2008) *Effectuation: Elements of entrepreneurial expertise*. Northampton, MA, USA: Edward Elgar Publishing, Inc.

Schumpeter, J. (1947) The Creative Response in Economic History, *Journal of Economic History*, November, pp. 149-159

Scott, S. G., & Bruce, R. A. (1994) "Determinants of innovative behavior: A path model of individual innovation in the workplace". *The Academy of Management Journal*, 37(3): 580-607.

Seidel, V. (2007) "Concept shifting and the radical product development process". *Journal of Product Innovation Management*, 24: 522-533.

Senyard, J. M., Baker, T., & Steffens, P. R. (2010) "Entrepreneurial bricolage and firm performance: Moderating effects of firm change and innovativeness", *Annual Meeting of the Academy of Management*. Montreal, Canada.

Weick, K. E., (1993) "The collapse of sensemaking in organizations: The Man Gulch disaster". *Administrative Science Quarterly*, 38: 628-652.

West, M., & Farr, J. (1989) "Innovation at work: Psychological perspectives". *Social Behavior*, 4: 15-30.

Wiltbank, R., Dew, N., Read, S., & Sarasvathy, S. D. (2006) "What to do next? The case for non-predictive strategy". *Strategic Management Journal*, 27(10): 981-998.