

TOWARD AN INTEGRATIVE MODEL OF INNOVATION:
A CRITIQUE AND SYNTHESIS OF RESEARCH ACROSS LEVELS

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ABSTRACT

Despite a voluminous literature and widespread belief in the inherent value of innovation, our understanding of the innovation construct remains rudimentary. Extant research on innovation spans across a variety of disciplines and levels of analysis. Yet, the divergence in core assumptions and methodologies across disciplines, coupled with few systematic efforts to integrate findings, have seriously hampered the cross-fertilization of research ideas in the field of innovation. The motivation for this work stems from the fragmentary nature of innovation research and the need for a more holistic, ecumenical outlook on innovation. We believe that this paper takes a step toward overcoming disciplinary myopia and a further step toward synthesizing the diverse innovation literature.

In this paper, we provide a synopsis of the innovation literature, with an emphasis on how innovation may potentially be reframed to develop a more comprehensive understanding of the construct. To this end, the paper is structured as follows. First, we outline various semantic definitions of innovation and their lexical variants. We then briefly discuss three confluent, but distinct terms (creativity, invention and organizational change) often mistakenly perceived to be synonymous with innovation. Next, we delineate the levels of analysis associated with innovation research and describe exemplary research emerging from these domains. Finally, we identify a number of promising research directions and propose an integrative cross-level model of innovation to energize future innovation research.

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Despite a voluminous literature and widespread belief in the inherent value of innovation (e.g., Kimberly, 1981), our understanding of the innovation construct remains rudimentary. Extant research on innovation spans across disciplines and levels of analysis. Yet, the divergence in core assumptions and methodologies across disciplines, coupled with few systematic efforts to integrate findings, have seriously hampered the cross-fertilization of research ideas (e.g., Gopalakrishnan & Damanpour, 1997). The motivation for this work stems from the fragmentary nature of innovation research and the need for a more holistic, ecumenical outlook on innovation. We believe that this paper takes a step toward overcoming disciplinary myopia and a further step toward synthesizing the diverse innovation literature.

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I. Semantic Definitions of Innovation

There is a wide range of definitions that attempt to convey the latent meaning of

innovation. An illustrative sample of such definitions follows:

“...the successful implementation of creative ideas within an organization.” (Amabile, 1988, p. 126).

“...the development and implementation of new ideas by people who over time engage in transactions with others within an institutional context.” (Van de Ven, 1986, p. 591).

“...a process through which economic or social value is extracted from knowledge through the generation, development, and implementation of ideas to produce new or improved products, processes, and services.” (The Conference Board of Canada, 2002, p. 2).

“...any idea, practice, or material artifact perceived to be new by the relevant unit of adoption.” (Zaltman, Duncan, & Holbek, 1973, p. 10).

“...adoption of an internally generated or purchased device, system, policy, program, process, product, or service that is new to the adopting organization.” (Damanpour, 1991, p. 566).

“...the adoption of an idea or behavior that is new to the organization...the innovation can either be a new product, a new service, a new technology, or a new administrative practice.” (Hage, 1999, p. 599).

“...the intentional introduction and application within a role, group or organization of ideas, processes, products and procedures, new to the relevant unit of adoption, designed to significantly benefit the individual, group, organization or wider society.” (West & Farr, 1990, p. 9).

Some of the thematic undercurrents lining these definitions include: 1. novelty, 2. tangible applied outcomes, 3. different forms of innovation, 4. expected benefit, 5. dynamism, and 6. subjective perception. Suffice it to say that innovation is a process involving the implementation of a creative idea in any shape or form that is perceived to add value. However, the primary reason each of the semantic definitions listed above hinge on different thematic assumptions is that they have been formulated by innovation researchers who focus on different levels of analysis and whose disciplinary optics are different. For example, the Conference Board of Canada’s definition is predicated on a

macro-level perspective of innovation. This definition incorporates national- and industry- level concepts such as knowledge, social and economic value and is broader in scope allowing a loose interpretation of the term “new”. Conversely, Damanpour and Hage both furnish definitions of innovation targeted at the organization-level. These definitions suggest that newness is to be judged in relation to the adopting organization. Lastly, Van de Ven and Amabile propose definitions that encompass group- and individual-level conceptions of innovation, respectively. While Amabile highlights the importance of “creative ideas”, Van de Ven acknowledges the role of social dynamics in shaping the process of innovation. Taken together then, many of these definitions appear to be better suited to one specific level of analysis.

Contrary to these level-specific definitions, West and Farr paint a more integrative portrait of innovation. They advance a definition that spans across levels of analysis while at the same time incorporating many of the underlying assumptions. Specifically, West and Farr’s definition suggests: 1. newness should be gauged in reference to the “adopting unit”, at whichever level (individual, group, organization) this may be, 2. innovation entails both the “introduction” and “application” of novel ideas resulting in tangible applied outcomes, 3. innovation is embodied in the form of “processes, products, and procedures”, and 4. innovation is directed toward positive change, whether this be in the form of benefiting “the individual, group, organization, or wider society”. By the same token, however, one may argue that West and Farr’s definition does not adequately convey that innovation should be construed as a dynamic process as well as an outcome (Damanpour, 2002). Similarly, despite acknowledging the role of varying contexts and levels of analysis in determining the character of innovation, West and Farr’s definition

fails to explicitly recognize the influence of subjective perception on the innovation process.

In summary, the sample definitions listed above help in distilling the latent meaning of innovation; however, even the most detailed and inclusive definition seems deficient in capturing the true depth and breadth of the innovation construct. In view of this lack of agreement regarding the precise meaning of innovation, the innovation construct has been confounded with three similar yet distinct concepts.

II. Lexical Variants of Innovation

In the research literature, a number of terms have been used interchangeably with “innovation”, including “creativity”, “organizational change”, and “invention” (Damanpour, 2002). Each of these concepts can be differentiated from innovation primarily in terms of the form or scope of change they embody. Confounding these terms with innovation is not only misleading, but renders the concept of innovation more amorphous and elusive to define – in essence, less scientific.

“Creativity” is the term perhaps most frequently employed as a synonym of innovation. Amabile (1988) defines creativity as “the production of novel and useful ideas by an individual or small group of individuals working together.” (p. 126).

Although Woodman, Sayer, and Griffin (1993) also define creativity at the organizational level as: “the creation of a valuable, useful product, service, idea, procedure, process by individuals working together in a complex social system.” (p. 293), generally, creativity is viewed as a micro-, particularly individual-level phenomenon. West and Farr (1990), for example, refer to creativity as “a cognitive process in which events occur within the person.” (p. 11). As indicated in these definitions, in contrast to innovation, creativity is

deemed to reflect absolute novelty as opposed to novelty relative to a specified constituency, and focuses on the ideational or generative stage of innovation. Unlike innovation, creativity does not encompass a strong social or implementation component or necessarily imply an expected benefit. Thus, creativity may be viewed as a sub-process and point of departure for innovation; it is a necessary but not sufficient condition for innovation to occur (Amabile et al., 1996).

“Organizational change” can also be differentiated from innovation. Organizational change involves the introduction of behaviors in an organization that are different from those currently in use (Daft & Becker, 1978; Damanpour, 2002). Commonly associated with organizational change is a set of procedures which fall under the umbrella of organizational development. Insofar as organizational development interventions exemplify a specific type of innovation – “administrative innovation” (Damanpour, 1991; Damanpour and Evan, 1984; Gopalakrishnan & Damanpour, 1997; Kimberly & Evanisko, 1981; Knight, 1967) and are precursors to change, organizational change may be construed as an outcome or consequence of innovation. In other words, just as creativity is a subset of innovation, innovation may be envisioned as a subset of organizational change.

Lastly, “invention” may be conceptualized as an outcome of creativity and a subset of innovation. While both creativity and invention center on the generation stage of innovation, Damanpour (2002) suggests that invention is the practical manifestation of creativity. Thus, invention embodies the end product resulting from creativity. Invention differs from innovation, however, by virtue of its exclusive focus on the generation, and not adoption stage of innovation. Specifically, as stated by Roberts (1988, p. 12):

“Innovation is composed of two parts: (1) generation of an idea or invention, and (2) the conversion of that invention into a business or other useful applications”. Therefore, only a commercially successful invention will evolve into an innovation.

In summary, creativity is unsystematic, generally centers on the individual level of analysis, and is anchored in the generation stage of innovation only. Invention is a technological outcome of creativity, and likewise, focuses on the generation stage. Organizational change is an outcome of the adoption of innovation. As a simplified heuristic then, one may conceive the relations between these concepts as follows: creativity breeds invention; invention forms the basis of innovation; and innovation, in turn, cultivates organizational change.

III. Levels of Analysis in Innovation Research

As the preceding discussion suggests, research on innovation has been multidisciplinary in nature spanning various levels of analysis. However, much of the work in any one discipline is directly tied to one corresponding level of analysis. Economists and political scientists adopt a macro-outlook on innovation and address issues such as national and regional systems of innovation, as well as innovation diffusion processes that drive innovation within and across industries. Management scientists and sociologists channel their energies into the organization level, investigating the role of factors such as organizational structure, strategy, and culture on innovation adoption and implementation, and by extension, the effects of innovation on organizational performance. Lastly, psychologists and organizational behaviorists tend to focus on innovation at the individual and group levels, examining issues such as the antecedents of individual creativity, and the impact of group-level communication and

leadership on innovation. In what follows, we will identify central factors linked to innovation at each level of analysis. To provide a sense of theory development, we will also outline one or two illustrative conceptual models at each level. Finally, we will examine cross-level research conducted to date, with particular emphasis on specific cross-level models that have been proposed. The aim of this section is to locate primary themes and research findings in the innovation literature and highlight the added value of cross-level innovation research.

A. Individual and Group Level Research

Amabile (1983) proposed a seminal model of individual and small-group creativity which identified three required components for creativity to occur – intrinsic task motivation, skills in the task domain, and skills in creative thinking. In her model, Amabile (1983) linked each of these core components to specific stages in the creative process, including: task presentation, preparation, idea generation, idea validation, and outcome assessment. Amabile (1983) postulated that creativity is a multiplicative function of the three central components of creativity – thus, absent any one of these components, the level of creativity that emerges will be negligible. Although recognizing the contribution of each of these components, Amabile has devoted much of her field research to testing her central prediction relating to motivation, namely that “...the intrinsically motivated state is conducive to creativity, whereas the extrinsically motivated state is detrimental...” (Amabile, 1983, p. 91). On balance, Amabile’s findings have supported her motivation hypothesis, though some extrinsic factors such as “pressure” and “recognition” have surfaced as facilitators, not inhibitors, of creativity (Amabile, 1988; King, 1990). Overall, Amabile’s social psychological model of

creativity is helpful in articulating key individual attributes that stimulate creativity and mapping, in general terms, how they may influence micro-level innovation. However, for a social psychological model, it fails to take account of the social influences and interactions that underlie innovation (King, 1990).

Scott and Bruce's (1994) path model of individual innovation in the workplace addresses some of the primary limitations of Amabile's model by exploring the effects of contextual factors on individual innovative behavior. They examine the extent to which leadership, team-member exchange, and individual problem solving style directly and indirectly influence individual innovative behavior through perceptions of the climate for innovation. Results revealed that leader-member exchange (LMX) was the best predictor of innovative behavior with its effect partially mediated by the climate dimensions. A direct positive relationship between leader role expectations and innovative behavior and a direct negative relationship between systematic problem-solving and innovative behavior were also found to be significant. Interestingly, although results pertaining to leader-member exchange were quite encouraging, Scott and Bruce suggest future research should "search for additional direct antecedents to innovative behavior rather than antecedents whose effects are mediated by innovative climate perceptions" (p. 602).

Extending this earlier work (i.e., Scott and Bruce, 1994), Scott and Bruce (1998) and Tierney, Farmer, and Graen (1999) studied the effects of LMX and other factors on individual innovative behavior. Further examining the relations between LMX, problem solving, and innovation, Scott and Bruce (1998) found that LMX accounts for incremental variance beyond problem-solving style in explaining innovative behavior. They suggested these results were consistent with the notion that LMX fosters innovative

behavior through the creation of facilitating task conditions, development of subordinate skill and self-efficacy, and the reduction of anxiety associated with negative evaluation of innovative ideas. Likewise, couching their major propositions in an LMX framework, Tierney, Farmer, and Graen (1999) found not only that employee cognitive style, employee intrinsic motivation, and overall quality of leader-member exchange were positively related to employee creative performance, but that the interaction of employee and leader intrinsic motivation positively influenced employee creativity.

Taken together, findings from these two studies supplement earlier research indicating that characteristics such as power, commitment, and support of innovation managers (e.g., Cooper & Kleinschmidt, 1994; Jervis, 1975) as well as those of the top management team such as receptivity to change and team heterogeneity (Cooper & Kleinschmidt, 1994; Hage & Dewar, 1973; Kickul & Gundry, 2001; Schoenecker, Daellenbach & McCarthy, 1995; Zmud, 1984) influence innovation at the individual and group level. Furthermore, given the nature of LMX, results from these studies buttress research linking employee discretion, positive affect, and feedback/recognition to individual innovation (see King, 1990). More importantly, however, these studies underline the joint effect of contextual and individual difference variables on innovation, and more focally, the critical and unique contribution made by one's immediate supervisor in cultivating an individual's creative capability.

Along similar lines to research on LMX, Kickul and Gundry (2001) examined the joint effect of CEO creativity and top management team functional diversity on the adoption of innovations in internal and external relationships, and products and services. Results from a sample of e-commerce firms indicated that opportunity assessment (i.e.,

the extent to which members on the top management team actively share, contemplate, and formulate new ideas and opportunities) mediated the interactive influence of CEO creativity and top management team diversity on innovation adoption. Their findings not only re-affirm the pivotal role of the leader-member relationship in driving innovation, but underscore the importance of factors such as group communication/information-sharing and managerial attention to innovation opportunities in facilitating the innovation process. Further group level research has reinforced the importance of group and inter-group communication on innovation (e.g., Ancona & Caldwell, 1992; Monge, Cozzens, & Contractor, 1992). More focally, the importance of boundary roles in transmitting requisite knowledge and information needed to spur group innovation has been featured in a number of studies (e.g., Albrecht & Ropp, 1984; Corwin, 1972; Tushman, 1977; Tushman & Katz, 1980).

In line with Amabile's (1983) proposition that a certain level of factual knowledge must exist to stimulate creativity and Cohen and Levinthal's (1990) more recent concept of "absorptive capacity", the role of gatekeepers has been stressed in the innovation literature. As a result of their in-depth knowledge base, gatekeepers serve as both effective translators and filters of external information and are pivotal in safeguarding unit members from information overload (Conway, 1997; Tushman, 1977). Gatekeepers do not simply serve as one-way information conduits however (i.e., decoding and disseminating information from external sources to colleagues in the R & D unit) – they also facilitate external communication across boundaries (Tushman & Katz, 1980). Related to this research on boundary spanning and the pressing need to stay

abreast of trends in the external environment is the notion that managerial attention and motivation to innovate are key drivers in the innovation process (Van de Ven, 1986).

Emphasizing the importance of attentional and motivational factors in role innovation, Farr and Ford (1990) propose a four-component model of role innovation based on expectancy theory. Farr and Ford posit that factors affecting: the perceived need for change, the perceived efficacy for implementing change, the perceived payoff from change, and one's ability to generate new and useful ideas will jointly influence role innovation. Echoing the observations of other innovation scholars (e.g., Zaltman, Duncan, & Holbek, 1973), Farr and Ford contend that fundamental to perceiving a need for change is detection of a problem or performance gap in one's work. Thus, not unlike Van de Ven (1986), Farr and Ford (1990) suggest vigilance to situational stimuli in one's surroundings and the capacity to recognize problems are key catalysts of innovation. Having reviewed the innovation literature pertaining to leadership, leader-member exchange, group communication (boundary roles), and individual attention / motivation to innovate, we will now proceed with an overview of central themes in the innovation literature at the organizational level.

B. Organization Level Research

A plethora of research has investigated innovation at the organization level. In addition to examining various antecedents of innovation, research has provided valuable insight into how the innovation process evolves as well as the relationship between innovation and organizational performance. There are a number of sequential, or stage, models of innovation (Wolfe, 1994) which presuppose that success factors vary for each distinct stage (e.g., Daft, 1982; Gerwin, 1988; Kanter, 1988a; Pierce & Delbecq, 1977;

Rowe & Boise, 1974). Arguably the best known stage model and accompanying contingency theory of innovation was espoused by Zaltman, Duncan, and Holbek (1973). Zaltman et al. propose that the innovation process may be defined in terms of two principal stages: initiation and implementation. The initiation stage is comprised of three substages: knowledge-awareness, attitude formation, and decision. The implementation stage, on the other hand, contains two substages: initial implementation and sustained implementation.

Using this blueprint, Zaltman et al. constructed the ambidextrous model of organizational innovation. In the ambidextrous model, they propose that features of an organic structure such as high complexity, low formalization and centralization will aid initiation of innovation due to the extensive gathering and processing of information required at this stage, whereas features of a mechanistic structure such as low complexity and high formalization and centralization will facilitate implementation of innovation because of this structure's capacity to mollify role conflict and ambiguity. Although the weight of empirical evidence has not tipped in favor of the ambidextrous model (Damanpour, 1991, 1992), empirical support for the validity of the 5-substages stipulated by Zaltman et al. has been more promising (Ettlie, 1980).

An alternative perspective to sequential, stage models of the innovation process is the "interactive process perspective" (Slappendel, 1996). Perhaps best exemplifying this perspective, Schroeder, Van de Ven, Scudder, and Polley (1989) propose a more dynamic process model of innovation anchored in six key observations. These observations are as follows: 1. innovation is *stimulated by shocks*, either internal or external to the organization; 2. an initial idea tends to *proliferate into several ideas*; 3. *unpredictable*

setbacks and surprises occur and provide the basis for learning; 4. as an innovation evolves, *old and new ideas/practices will exist concurrently* and need to be integrated, and 5. *restructuring of the organization often occurs* to better handle the innovation process, and 6. *hands-on top management involvement occurs throughout the innovation process*, though particularly during the early stages.

Much of the research evidence substantiating Schroeder et al's model is inductive in nature and reliant on case study data. Departing from this mould, however, King (1992) conducted an empirically based comparative analysis of the reliability and accuracy of the Zaltman et al. and Schroeder et al. process models. Inter-rater reliability coefficients for the Schroeder et al. model exceeded those of the Zaltman et al. model; conversely, the accuracy scores for the individual stages propounded by Zaltman et al. were higher than those for the six observations articulated by Schroeder et al. It was also noted that the stages in the Zaltman et al model tended to overlap and did not always unfold in sequence. Overall, King concluded that both models received some support yet the more flexible and fluid Schroeder et al. model offered a more accurate depiction of the backtracking and overlap of stages that typify the innovation process. In light of these findings, King advocates research following the interactive process perspective. While researchers have yet to fully explore this model, they have begun to divert more attention into the context surrounding innovation adoption and implementation. One form this has taken is research exploring work climate.

In general terms, work climate may be defined as a relatively enduring quality of an organization's internal environment that results from the behavior and policies of organization members, especially those in top management (Pritchard & Karacik, 1973).

Consistent with earlier research reporting that innovation is a joint function of motivation to innovate, resource availability, and obstacles (Mohr, 1969), a number of studies (e.g., Abbey & Dickson, 1983; Radnor & Robinson, 2000; Ross, 1974; Wilson, Ramamurthy, Nystrom, 1999) have linked measures of general work climate to innovation adoption and implementation. Extending this research relating to work climate, Amabile, Conti, Coon, Lazenby, and Herron (1996) have constructed a measure labeled the KEYS, specifically designed to assess “climate for creativity”, which focuses on creativity, and thus, the *initiation* of innovation. Furthermore, Klein and Sorra (1996) have specified a construct entitled *climate for implementation*. While this climate for implementation construct will require further refinement, certainly this effort coupled with refinements of climate measures focusing on creativity, are to be encouraged. One of the principal barriers impeding the advancement of innovation climate research is the lack of consistent and systematic measurement in this domain.

A number of structural variables (see Damanpour, 1991) have been investigated in relation to innovation. To date, research in this area has revealed that one broad cluster of structural variables – structural complexity – comprised of specialization, functional differentiation, and professionalism, appears to be a more robust predictor of innovation than a second distinguishable cluster – bureaucratic control (for meta-analysis, see Damanpour, 1996; for sample primary studies: Aiken & Hage, 1971; Bigoness & Perreault, 1981; Cohn & Turyn, 1980; Daft, 1982; Hull & Hage, 1982; Kim, 1980; Sapolsky, 1967). Indeed, in a recent review of the organizational innovation literature, Hage (1999) reinforces the importance of structural complexity to innovation but suggests this factor has been underspecified, and thus, its net effect on innovation

underestimated in the literature. He proposes that technical knowledge resources (see Damanpour, 1991), job complexity (e.g., Zammuto & O'Connor, 1992), and presence of a research department (e.g., Cohen & Levinthal, 1990) should be combined with the indicators of structural complexity to form a broader construct labeled “complex division of labor” (Hage, 1999, pp. 604-605). In addition to arguments advanced by Damanpour (1991) for specific indicators of structural complexity, Hage points out that one critical element complex division of labor injects into the innovation equation is the explicit recognition of the importance of in-house knowledge and learning capability in driving innovation.

Given recent research demonstrating the fundamental role knowledge and learning play in innovation (e.g., Cohen & Levinthal, 1990; Glynn, 1996; Gopalakrishnan & Bierly, 2001; Huber, 1998; Noteboom, 1999) and the fact that, apart from the advantages of a research department in improving absorptive capacity (Cohen & Levinthal, 1990), dimensions of complexity have not been incorporated in discussions of the learning organization, research probing the relations between complexity, organizational learning, knowledge management, and innovation is in high demand.

Turning to the performance side of the innovation equation, several authors have noted that a pronounced “pro-innovation bias” pervades the research literature on innovation (e.g., Abrahamson, 1991; Anderson & King, 1993; Kimberly, 1981). This implicit assumption that innovation is a desirable end in itself (and necessarily improves organizational performance) has served to deflect research from the possible negative effects of the innovation process, as well as the impact of innovation on employees (Anderson & King, 1993). Indeed, given the threat innovation poses to the status quo, it

can often incite conflict within an organization (Anderson & King, 1993), directly affecting both employee and organizational performance. As shown in James, Clark, & Cropanzano's (1999) model of group, institutional and organizational creativity, innovation in the workplace may not only precipitate negative behaviors (via conflict in the workplace), but these negative behaviors may be enacted in creative ways. Individuals and groups may develop creative means of stealing from their employer or averting unpleasant work duties, and organizations can engage in creative methods of circumventing industry/government regulations or extracting trade secrets from competitors.

While an unfortunate consequence of researchers' pro-innovation bias has been a marked neglect of outcomes associated with innovation (Anderson & King, 1993), a few studies have explored the relationship between innovation and organizational performance, each providing valuable contributions to the innovation literature. Research by Damanpour and colleagues has perhaps been the most prominent in linking various patterns of innovation to organizational performance. Damanpour (1984, 1989, 1990) found that in public libraries, both technical and administrative innovations boost organizational performance. Consistent with the proposition that a sense of balance is required in an organization's socio-technical system, these findings indicated that administrative and technical innovations tend to have a higher correlation in high performance than low performance organizations, with the degree of lag between adoption of innovation types inversely related to organizational performance. Analogous to these findings, Damanpour & Gopalakrishnan (2001) later revealed that synchronous adoption of product and process innovations maximizes organizational performance in

the banking industry due to the integrative nature of product and process innovations and their growing interdependence over time. Lastly, also using a sample drawn from the banking industry, but employing a multi-dimensional measure of innovation adoption that included indicators of innovation rate, speed, and consistency of adoptions, Subramanian and Nilakanta (1996) examined the effects of technical and administrative innovation on two organizational performance measures: 1. organizational efficiency and 2. organizational effectiveness. Contrary to an earlier study by Becker and Stafford (1967) comparing administrative and technical innovations, both of these innovations were positively related to organizational efficiency. In terms of organizational effectiveness, results signaled that only the timing of technical innovations predicted organizational performance; administrative innovations were not significantly related to organizational effectiveness. On the whole, this research by Subramanian and Nilakanta supports the impact of innovation on organizational efficiency and the value of gaining first mover advantages in the banking industry. While some authors have offered brief rationales for how innovation may improve performance (e.g., Damanpour, 1984), more theory development is needed outlining in which contexts innovation will and will not impact performance. Research along the lines of Abrahamson (1991) directly challenging the pro-innovation bias will be valuable in this regard. For a snapshot of how innovation is conceived and tested at the macro-level, we now turn to a discussion of relevant models and representative research advanced at the industry-societal level.

C. Industry-Societal Level Research

Research at the macro-level of analysis has mostly focused on the development of diffusion models. Recently, however, there has been a trend toward the construction of

innovation policy frameworks, most notably, national and regional systems of innovation. A number of factors explain variance in innovation diffusion (e.g., Norton & Bass, 1987; Teece, 1980; Warner, 1974; Wejnert, 2002). In her synthesis of diffusion models, Wejnert (2002) identifies three primary components related to the diffusion of innovation: 1. characteristics of the innovation itself; 2. characteristics of the innovators / actors, and 3. characteristics of the environmental context. Although some efforts have been made to explore the joint effects of environmental context and characteristics of the innovator on the adoption and diffusion of innovations (e.g., Barras, 1986; Butler, 1988; Daft, 1982; Damanpour & Gopalakrishnan, 1998; Kanter, 1988b, Lawless & Anderson, 1996; Utterback & Abernathy, 1975), Wejnert stresses the need for more research investigating the role of cross-component interactions driving innovation diffusion.

Despite the limitations of innovation research at the macro-level, in a recent review of the innovation and competitiveness literature, Clark and Guy (1998) propose a policy framework of innovation which outlines some of the central factors associated with innovation at the macro-level. They identify policy levers that encompass three categories: 1. policies designed to stimulate the supply of technologies, 2. policies concerned with stimulating or satisfying the demand for technologies, and 3. policies primarily concerned with improving information flows by developing networks or national infrastructure. While research suggests that, depending on a firm's corporate strategy, demand-pull factors may be more prominent triggers of organizational innovation than the supply of technology in one's industry (e.g., Ettlie, 1983; Marcus, 1988; Miller & Friesen, 1982; Utterback, 1971; Zmud, 1984), at the national and multinational level, certainly principles of both supply (e.g., defined chiefly in terms of

innovation generation) and demand (e.g., defined chiefly in terms of innovation adoption) function jointly in determining a nation or region's aggregate level of innovation.

Consistent with this paradigm, in terms of supply-side innovation drivers directly linked to industry, Lengnick-Hall (1992) suggests four primary mechanisms or routes to innovation that may be pursued by organizations. These include formal R & D units, intrapreneuring/internal ventures, external joint ventures, and acquisitions/mergers. According to Lengnick-Hall, in order for a firm's innovation efforts to be successful and forge a distinct competitive advantage, not only must the proposed innovation reflect market realities and be properly timed in terms of its market launch, but an organization's strategic configuration must be difficult to emulate, and the firm must have requisite capabilities to exploit and sustain innovation. Indeed, although innovation appropriability (i.e., protection of intellectual property) may assist in gaining an immediate advantage over one's competition, one of the primary means by which innovations forge longer-term, sustainable competitive advantage is through their capacity to marshal absorptive capacity (see Abernathy & Clark, 1984 for similar concept labeled "transilience") and foster organizational learning (Cohen & Levin, 1989; Cohen & Levinthal, 1989, 1990). Insofar as the manner in which knowledge resources are galvanized and managed in an organization is reflected in its strategic configuration, it appears an organization's approach to knowledge management will play a central role in determining its innovation effectiveness.

As indicated by Clark and Guy (1998), and Lengnick-Hall (1992), joint ventures and mergers/acquisitions are popular approaches for leveraging cross-firm knowledge and resource synergies, and bolstering innovation. Perhaps ironically, however, one of the

main sources of organizational competitive advantage - the distinctiveness of an organization's structural configuration - may impede the success of collaborative ventures aimed at innovation. Lengnick-Hall (1992) notes that strategic and cultural differences between collaborating organizations are two of the primary barriers to the success of joint ventures and mergers/acquisitions. Furthermore, despite the potential for these approaches to infuse new knowledge into an organization and revitalize its strategy, mergers/acquisitions bear considerable managerial transaction costs, thereby often resulting in a diminished managerial commitment to innovation (Hitt, Hoskisson, & Ireland, 1990). Likewise, mergers/acquisitions tend to shift managerial attention from an emphasis on strategic control (long-range performance goals) to financial control (short-term financial targets), thereby often reducing the amount of innovation that occurs (Hitt, Hoskisson, Johnson, & Moesel, 1996). Nevertheless, if organizations are wary of these pitfalls and are diligent in selecting and managing relationships at all stages of the collaborative process, these strategic arrangements may effectively impart those capabilities needed to exploit and sustain innovation, and in turn, maintain a demonstrable competitive advantage (Lengnick-Hall, 1992).

D. Cross-Level Research

As evidenced in this section, each level of analysis has added useful insights regarding specific factors underlying the innovation process. Each perspective, however, also has clear limitations. Innovation research conducted at the organizational and industry/societal level often relies on impersonal analyses of social, structural, political, economic, and/or historical forces affecting innovation and organizational functioning, and treats individuals as behavioral and dispositional "black boxes". On the other hand,

individual and group level research acknowledges the crucial influence of human agency, but often overlooks the role of organizational and environmental context in shaping innovation. In light of these shortcomings, House, Rousseau and Thomas-Hunt (1995) assert that researchers must steer away from single-level conceptualizations and explore common properties and relationships of variables across levels of analysis, or risk continuing to generate oversimplified, incomplete, and in some cases, highly inconsistent portraits of how organizational phenomena occur.

One of the most comprehensive models of innovation to formally recognize linkages across levels of analysis (and not simply aggregate, independent effects across levels) was the model of creativity and innovation in organizations introduced by Amabile (1988). In an extension of her earlier work, Amabile integrates her model of individual creativity (Amabile, 1983) into a preliminary model of organizational innovation. She posits that the individual and group level components of creativity (intrinsic task motivation, skills in the task domain, and skills in creative thinking) each influence components integral to innovation at the organization level (motivation to innovate, resources in the task domain, and skills in innovation management, respectively), which, in turn, tie in to different stages of the organizational innovation process (setting the agenda, setting the stage, producing the ideas, testing and implementing the ideas, outcome assessment). Moreover, she envisions relations between organization-level and individual/group-level components as bidirectional, such that each of the organization-level components of innovation facilitates or constrains the development of each of the individual components of creativity.

Building on Amabile's work, both Woodman, Sawyer, and Griffin (1993) and Ford (1996) have proposed more elaborate cross-level models linking creativity to organizational innovation. Emphasizing the role of organizational climate/culture factors, Woodman et al.'s theory of organizational creativity models innovation as being a multiplicative function of individual, group, and organizational factors, and emphasizes the role of person – context interactions in explaining organizational creativity. Unlike Amabile, however, Woodman et al.'s model acknowledges the influence of the external environment on the innovation process. Specifically, Woodman et al. propose that the level of information exchange with the external environment will moderate the effects of factors across levels of analysis on innovation. Extrapolating on the models proffered by Amabile and Woodman et al., Ford's (1996) "theory of individual creative action in multiple social domains" recognizes that motivation, domain-related skills, and creative ability interact with organizational-level domains to produce creative actions. Ford's model, however, also postulates that sense-making processes operate across levels of analysis and the tension between competing habitual and creative responses plays a central role in determining innovation. In terms of sense-making, decision-makers may ask themselves a number of crucial questions which straddle individual, group, institutional, and market domains (e.g., "I wonder if the rest of my team will find this interesting? Will the company allocate funds for a basic research project? Will this product conform to federal safety requirements? Will it sell?") and exemplify the many factors across levels of analysis that determine whether creative endeavors will be actively pursued.

Recent cross-level models proposed by Ocascio (1995), Mone, McKinley, and Barker (1998), and Coopey, Keegan, and Emler (1998) accentuate the role of attention and sense-making in the innovation process. Related to demand-pull conceptions of the innovation process and the notion that a perceived performance gap frequently triggers innovative change (e.g., Zaltman, Duncan, & Holbek, 1973), Ocascio (1995) presents a cross-level theory that attempts to reconcile paradoxical assertions specified in theories of failure-induced change and threat-rigidity. Specifically, based on the premise that decision-making and information-processing takes place in the context of groups and across levels of analysis, Ocascio's cross-level theory postulates that attentional resources and responses to economic adversity will be in large part shaped by organization-level culture and cognitions, as well as processes constituted at the level of the organizational field. Complementing this thesis that shared meaning and sense making are instrumental in governing innovation, Mone, McKinley, and Barker (1998) advance a model specifying a number of cross-level moderators of the organization decline – innovation relationship. In addition to recognizing organizational and environmental moderators, decision-maker attributions regarding the stability and controllability of organizational decline are deemed to temper the relationship between organizational decline and innovation. Taken together, these cross-level models illustrate the added value of formulating theories of innovation and change that draw on a number of research disciplines and methodological paradigms. By blending micro-, macro-, and meso-perspectives, cross-level models that explore relationships between levels of analysis will embed innovation phenomena within their proper context while at the time enabling explanation of the fundamental behavioral processes driving innovation.

IV. Pathways for Future Research: Research Directions and a Preliminary Integrative Model

Based on this review, a number of issues across levels of analysis seem to warrant further inquiry. At the individual levels of analysis, more research is needed addressing the impact of leader-member exchange, and individual sense making / attention on innovation. One particularly fruitful avenue for research involves further disentangling by which means LMX exerts its effect on innovation. Given LMX is a contextual variable influenced by the quality of supervision, and it appears to play a pivotal role in innovation, process research in this domain will be particularly instructive for practicing managers. To further enrich this research, exploring interactions between individual-level variables and the interface between these variables and group, organizational, and environmental variables (e.g., climate factors) will help situate this research within its appropriate social context.

Future innovation research should place particular emphasis on examining group-level dynamics. Group-level innovation research should delve into issues such as gate keeping and group member attitudes toward innovation as well as explore the effects of group cohesion and group decision-making variables (e.g., risky shift) on innovation. Research investigating resistance to change may shed light on how innovation is perceived from group members' perspective. An interesting question here is whether resistance to change may serve a functional purpose (e.g., pre-empting adoption of an ineffectual innovation). Given the inherent complexity of group level dynamics, coupled with the disproportionate amount of univariate group innovation research conducted to

date, a multivariate approach to this research is strongly recommended (e.g., King & Anderson, 1990).

Turning to the organizational level, a number of promising research paths are evident. Perhaps most noticeably, more research is needed linking different types, patterns, and antecedents of innovation to different measures of organizational innovation and organizational performance. Only recently has innovation research directed its attention to outcomes of innovation. Research on innovation climate is also in its infancy and requires more assiduous study. Partly due to poor measurement practices (e.g., overuse of “grab-bag” measures), research on innovation climate has not yielded the caliber of findings originally anticipated. More systematic refinement of innovation climate measures along the lines of Amabile et al. (1996) and Klein and Sorra (1996) should provide a starting point for improving the quality of research in this domain. Given the appreciable impact climate may exert on innovation variables at all levels of analysis, climate research should remain a priority. In terms of structural factors, Hage’s “complex division of labor” construct mandates further specification, particularly in terms of its intersection with knowledge and climate. One pressing question here is whether an organization’s complex division of labor enhances innovation simply through its supply of in-house knowledge, or via the organizational climate generated by a complex division of labor. Lastly, efforts patterned after King (1992) to empirically validate and refine process models of innovation, whether sequential or dynamic, should also be deemed a high priority.

With respect to macro-level research, as a general theme, more work is needed synthesizing knowledge generation and knowledge diffusion/absorption streams of

innovation research (e.g., Fiol, 1996). There seems to be some debate surrounding how best to approach this issue however. While Fiol (1996) and others (e.g., Tushman and Nelson, 1990) point out the value of building cross-level research models to bridge innovation subject matter (e.g., factors affecting the generation and diffusion of innovations), Damanpour (2002) endorses a “divide and conquer approach”. Damanpour suggests we should step back to conduct separate analyses on innovation generating and innovation adopting organizations (to isolate their differences), and then use this information to formulate integrative theories of innovation. In addition to aiming to merge generation and diffusion research streams, research at the macro-level should continue to study the effects of different forms of inter-organizational collaboration (e.g., joint ventures, mergers/acquisitions) on levels of firm innovation and patterns of innovation diffusion. An interesting question here relates to whether firms with different strategic configurations (strategies, structures, and cultures) can manage partnerships effectively, and if so, whether these differences can, in fact, result in more successful, innovative alliances. Lastly, as per Wejnert (2002), characteristics of innovators should be examined in conjunction with environmental factors (e.g., societal culture and political conditions) in tracing levels and patterns of innovation diffusion. Consistent with this latter theme, much can be gleaned from policy research examining the effects of formalized innovation strategies on the national landscape of innovation. To this end, policy research blending empirical rigor with an appreciation for theory and extant knowledge of diffusion will provide important clues regarding how demand- and supply-side factors affect innovation generation and diffusion.

Whether viewed in terms of various semantic definitions or lexical variants of innovation, or the nomological network surrounding the innovation construct, a few common threads emerge from surveying the literature on innovation. Across all sources and levels of analysis, innovation is conceived as both a process and outcome associated with generating and converting knowledge into a novel and tangible output. Underlying this conception of innovation is a fundamental assumption that innovation requires study not only of how knowledge is generated and absorbed but how this knowledge is perceived and nurtured by key decision-makers and organization members throughout the innovation process. In this vein, regardless of level of analysis, there is recognition that innovation is far from a lifeless, bloodless construct, but instead is very much a dynamic, social, and subjectively driven phenomenon. While, traditionally, research at the macro-level may have been accused of treating organizational phenomena as behavioral “black boxes” (e.g., House, Rousseau, & Thomas-Hunt, 1995), this appears to be becoming less the case with innovation research. Research at all levels of analysis has begun delving into concepts such as joint ventures, absorptive capacity, gate keeping, climate for innovation, and leader-member exchange – all of which relate to developing effective channels of knowledge transfer by means of establishing constructive partnerships with others. Given this common denominator spanning levels of analysis, more work is needed not only on tracking patterns of knowledge transfer, but in assessing the structure, quality, and tenor of collaborative relationships impinging on the innovation process. Within this framework, more research should examine innovation from organizational members’ perspective (and not just leaders, managers), as well as the impact of affective variables on innovation dynamics. Research on the attentional, motivational, and sense-

making activities related to innovation may provide useful points of departure for this research.

In light of these thematic commonalities suffusing researchers' conceptualizations of innovation, and the potential for cross-level models of innovation to integrate research across disciplines, one of the major inferences drawn from this review is that more cross-level theory development and empirical testing of innovation phenomena is badly needed. As highlighted by the meso-paradigm, cross-level theories have the capacity to shed new light on innovation phenomena by exploring issues that have traditionally fallen on the periphery of the study of innovation such as interactions and linkages among variables at different levels of analysis. Furthermore, this approach will encourage more systematic application and integration of a broad range of research perspectives and methodologies, and as a result, will pave the way for a more synergistic and cumulative body of research. Guided by these objectives and grounded in the cross-disciplinary innovation research we have reviewed, we propose a 4-tier working model of innovation (see Figure 1 - page 41).

As shown in Figure 1, we regard innovation as a dynamic, multi-level process aimed at transforming creative energy into a novel tangible outcome that contributes social and economic value and forms the foundation for social and organizational change. Viewed from this optic, and consistent with Damanpour (2002), we envision the innovation process as being comprised of different sequential manifestations of innovation, ranging from individual creativity (i.e., "the production of novel and useful ideas..." Amabile, 1988), to invention (i.e., "the product, technology, or process stemming from the creative process..."; Damanpour, 2002), to innovation (i.e., the process of commercializing or implementing an invention / rendering an invention

successful), to social / technological change (i.e., broad-scale diffusion and stimulation of further change).

Moreover, in accordance with Amabile's (1988) major premise regarding the individual / small group and organization levels, three fundamental components of innovation combine to influence innovation. We extend Amabile's work, however, by suggesting that the variables underlying Motivation to Innovate, Resources in the Task Domain, and Innovation Skills (Creativity/Innovation Management Skills) jointly and multiplicatively determine innovative output not only at the individual / small group and organizational levels but also at the societal level. We also believe it is important to specify the variables underlying the three components of innovation at each of the four tiers, and not simply at two omnibus levels (combined individual and small group level, and organizational level). Turning to another central proposition of the model illustrated in Figure 1, innovative output at each level of analysis can be systematically linked to each of the sequential manifestations of innovation. Specifically, it is hypothesized that innovative output at the individual, group, organizational, and societal levels cultivate creativity, invention, "innovation" (as alluded to earlier, the assimilation / commercialization phase of the process), and social / technological change, respectively. Thus, variables at the organizational level, for instance, exert a more pronounced effect on the assimilation / commercialization segment of the innovation process than variables at the individual innovation level. In this vein, with each successive level of analysis and sequential manifestation of innovation, the diagram reflects a progression from factors that drive the generation of innovation to those facilitating the adoption of innovation. Linking the levels of analysis to the sequential manifestations of innovation serves to

demystify terminology surrounding innovation and captures the importance of time / chronological considerations in the evolution of innovation. Overall, this working model provides an overview of key antecedents of innovation and how they contribute to the innovation process. It also offers a preliminary roadmap that will assist in formulating cross-level research propositions.

While the proposed model will require further specification and refinement, we hope that, in line with our model, future research will begin to broaden its scope and explore innovation across levels of analysis and disciplines. Adopting this more synergistic approach will foster greater cross-fertilization of ideas, and a more convergent and progressive innovation literature. Overcoming the disciplinary parochialism that has pervaded innovation research will be no small task, but in order to paint a richer, more complete portrait of the innovation construct and the dynamics surrounding its development, manifestation, and sustainability, a more integrative research paradigm must be actively pursued.

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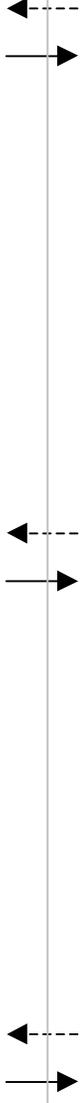
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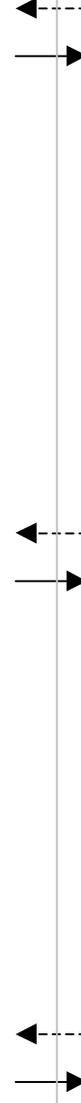


Motivation to Innovate X Resources in Task Domain X Innovation Skills

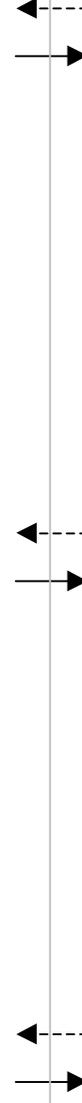
Intrinsic Task Motivation	Broad Work Experience Job Knowledge / Expertise Cognitive Aptitude	Creative Cognitive Style (divergent thinking, ideational fluency, flexibility, curiosity) Risk Orientation
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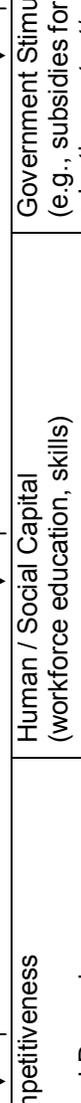
Perceived Climate for Creativity (encouragement, autonomy, resources, pressure, impediments; Amabile, 1996) Leader-Member Exchange Group Norms	Team-Member Exchange / OCB Group Functional / Demographic Diversity Group Size Resource Slack	Participative Management Power, Commitment, Support of Innovation Champion and / or Group Leader Boundary Roles / Gatekeepers
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Org. Vision / Strategy Climate for Implementation (skill, incentives for innov. use, removing obstacles to use; Klein & Sorra, 1996) Innovation Attribute / Management-Decision Variables (e.g., Compatibility, Relative Advantage, Complexity)	Absorptive Capacity Complex Divison of Labour (Structural Complexity + Job Complexity, Research Dept., and Tech. Knowledge) Managerial Professionalism/ Cosmopolitanism	Managing Conflict / Resistance to Change Synchronous Adoption of Different Innovation Types (Administrative – Technical; Product – Process).
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Global Competitiveness Technological Dynamism Demographic Dynamism Government Policy	Human / Social Capital (workforce education, skills) Labour Productivity Information Infrastructure (e.g., internet connectivity) R & D Infrastructure	Government Stimuli (e.g., subsidies for R & D and adoption, patent/copyright laws, focus on “niche” markets) Collaborative Initiatives (industry joint ventures, industry – university partnerships, science parks)
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Individual Innovation

Group Innovation

Org. Innovation

Societal Innovation