Journal of Organizational Behavior
J. Organiz. Behav. **25**, 147–173 (2004)
Published online in Wiley InterScience (www.interscience.wiley.com). **DOI**: 10.1002/job.236

The routinization of innovation research: a constructively critical review of the state-of-the-science

NEIL ANDERSON*, CARSTEN K. W. DE DREU AND BERNARD A. NIJSTAD

Department of Work and Organizational Psychology, University of Amsterdam, Amsterdam, The Netherlands

Summary In this review we argue that facilitators of innovation at the individual, group, and organizational levels have been reliably identified, and that validated process models of innovation have been developed. However, a content analysis of selected research published between 1997 and 2002 suggests a routinization of innovation research, with a heavy focus on replication–extension, cross-sectional designs, and a single level of analysis. We discuss five innovative pathways for future work: Study innovation as an independent variable, across cultures, within a multi-level framework, and use meta-analysis and triangulation. To illustrate we propose a 'distress-related innovation' model of the relations between negatively connotated variables and innovation at the individual, group, and organizational levels of analysis. Copyright © 2004 John Wiley & Sons, Ltd.

> Imaginative writers, the reader will have noticed, dropped out of this [Soviet] history when it moved from the 1920's into the period of Stalinism. Of course industrious typewriters continued to manufacture novels, plays and poems, but they no longer revealed authors in search of the authentic self and true community, as the works of Olesha and Babel had, not to speak of the pre-revolutionary masters. From 1930 to 1953 Stalin's engineers of human souls typed out their works to formula. Their product has its fascinations, like mass-market fiction and popular drama in the West, but hardly for understanding the psychologies of high culture. They help one understand mass psychology in its relation with the authorities.
>
> (Joravsky, *Russian psychology: A critical history*, 1989, pp. 463–464)

Introduction

Research interest among organizational scientists into innovation in the workplace has shown no sign of abating over recent years. Indeed, quite the opposite. The range of empirical studies into innovation

*Correspondence to: Neil Anderson, Department of Work and Organizational Psychology, University of Amsterdam, Roetersstraat 15, 1018 WB Amsterdam, The Netherlands. E-mail: N.R.Anderson@uva.nl

 Accepted 13 June 2003

processes and idea implementation has continued to grow, develop, and advance over the last few decades in response to the changing nature of work organizations and the increasing emphasis placed upon employee creativity and work group innovation (Amabile, 1983; Van de Ven, Angle, & Poole, 1989; West, 2002). Yet, how innovative has the innovation research itself recently become? Might it even now be bordering on 'works to formula' as Joravsky so eloquently puts it? Has it become a latter-day reflection of Joravsky's depiction of Soviet psychology in the Stalinist era; the 'authorities' being replaced by market capitalism, the 'works to formula' being replication–extension empirical journal articles, and our desire to understand the 'psychologies of high culture' or 'the authentic self' being replaced by routinized studies into facilitator and inhibitor variables of innovation? Without doubt major advances have been made in several aspects of the research base, but our analogy with Soviet psychology some 50–80 years ago is an intentionally provocative one. Surely, if any area of research in organization behavior should display innovative theories, models, themes of research, and field- and laboratory-based studies, it should be the field of innovation and creativity at work?

In this paper we pose a series of questions and challenges to the state-of-the-science of innovation research. Our tone is intentionally critical, our comments are intentionally pointed, our questions are intentionally uncomfortable, but our intentions are well founded: to provoke a timely and far-reaching review of the knowledge base in this important area based upon epistemological reflexivity amongst colleagues active in innovation research. In short, we argue for a 'time out,' for a state-of-the-science review in which the advances made in innovation research are critically appraised, our methodological orientations are constructively reviewed, and directions for future research are carefully charted and justified in order to avoid the danger of innovation research moving away from cutting-edge theory building and empirical investigations—a danger we term the '*routinization of innovation research*.' Initially, however, it is necessary to establish precisely what is meant by the term 'innovation,' to differentiate workplace innovation from individual creativity, and thus to clarify our interpretation and usage of this construct in the present paper before we embark upon a critical summary of recent and desirable future developments.

Innovation defined: distinctions between innovation and creativity

Organizational scientists and innovation researchers have made a crucially important distinction between workplace innovation and the more secular term of creativity. West and Farr (1990), in their now generally accepted definition of this field, define workplace innovation as:

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

Their definition is particularly valuable in several regards. First, there must be an inherent application component, as West and Farr (1990) describe it, for any set of actions to be classed as an innovation. This clearly distinguishes innovation from creativity in that workplace innovation involves the '*intentional introduction and application*' of new and improved ways of doing things (see also West, 1997; Anderson & King, 1993; for extended discussions of this distinction). Creativity, on the other hand, can also refer to idea generation alone. Thus, workplace innovation includes both ideation (idea generation) and implementation whereby both sets of processes are clearly implicated in the research enterprise and, indeed, may cause tensions between the two phases (i.e., the 'ideation–implementation' dilemma; King, 1992). Second, this definition emphasizes that innovation must confer intended benefit at one or more levels of analysis: the job role, work group or wider organization. Again, this is not necessarily the case for creativity. Third, an innovation must be new to the 'relevant unit of adoption,' an aspect

that has been termed *relative* as opposed to *absolute novelty* in the innovation literature (Anderson & King, 1993; King & Anderson, 2002). That is, an innovation may be common practice in other organizations but it would still be classed as such if it is new to the unit under research (i.e., relative novelty). Indeed, absolute novelty is almost impossible to justify as a criterion since most innovations will be a mixture of emergent processes, adopted and adapted procedures which are in common usage elsewhere, and ideas which become sharpened over time by realistic limitations imposed by the organization (e.g., profitability, practicality of use), and so innovation researchers have almost exclusively focused upon cases and processes of relative novelty in organizations (West, 2002).

We use West and Farr's general definition here to delineate what we refer to as the field of innovation research and empirical studies into innovation processes in work organizations. While the terms creativity and innovation do have conceptual overlaps, our use of this definition also allows us to clearly differentiate between the two. Here, we are concerned exclusively with workplace innovation and, in line with West and Farr's definition, for instance, therefore exclude studies of individual and group creativity from our subsequent analyses and review commentary.

Innovation Research: A State-of-the-Science Overview

Innovation research in retrospective: key antecedent variables

Innovation research has flourished over the last 30 years as organizations have moved inexorably away from previously dominant bureaucratic forms of structure and Taylorian job specialization toward more flexible, lean, and flat structures (e.g., Howard, 1995; King & Anderson, 2002). Innovative behaviors by employees, which might formerly have been seen as inappropriate, disrespectful or even subversive, have become increasingly sought by organizations attempting to compete in a fast-moving and changeable, globalized business environment. It can be argued that this premium placed on innovation knowledge, skills, abilities and other factors (KSAOs) has been a significant driving force behind the now substantial research efforts by organizational scientists over these years. So, how far has the body of innovation research come, what are its strengths and weaknesses, and what future directions would appear to offer most potential to extend our understanding of the causes, consequences, and *modus operandi* of innovation processes in work organizations?

Innovation research has undoubtedly progressed and advanced quite significantly over more recent years. It has shed light upon a number of factors at three levels of analysis—the individual, work group, and the organization more widely—which have consistently been found to be supportive or inhibitive of innovative outcomes (for major reviews, see, chronologically: Zaltman, Duncan, & Holbeck, 1973; Amabile, 1988; Van de Ven et al., 1989; King, 1990; West, 1990; Anderson & King, 1993; West, 2001, 2002; King & Anderson, 2002). Considerably more research has been conducted at the individual and organizational levels of analysis, than at the level of the workgroup or ad hoc team and, as we argue later in this paper, this has been a regrettable shortfall in the coverage of innovation research especially given the increasingly widespread use of teamwork in organizations. Although here is not the place for an exhaustive review of all of the variables found at each of the three levels of analysis to be facilitative of innovation (see, for instance, other papers in this issue of the journal), the research base is now sufficiently robust to allow a summary of these factors to be presented.

Table 1 presents an overview of the main factors which have been consistently found across several primary source studies to be facilitators of innovation at differing levels of analysis. As can be seen, a substantial body of research has now accumulated on a wide range of factors at the individual, group,

Table 1. Innovation research findings in overview: facilitators of innovation at three levels of analysis

Level of analysis	Characteristic	Dimension	Key studies/evidence[a]
Individual	Personality	Tolerance of ambiguity	Barron and Harrington (1981); Patterson (1999)
		Self-confidence	Barron and Harrington (1981)
		Openness to experience	West (1987); Patterson (1999); George and Zhou (2001)
		Unconventionality	West and Wallace (1991); Frese et al. (1999)
		Originality	West and Wallace (1991); Patterson (1999)
		Rule governed (negative relation)	Simonton (1991); Frese et al. (1999)
		Authoritarianism (negative relation)	Simonton (1991)
		Independence	West (1987); Patterson (1999)
		Proactivity	Seibert et al. (2001)
	Motivation	Intrinsic (versus extrinsic)	West (1987); Frese et al. (1999)
		Determination to succeed	Amabile (1983)
		Personal initiative	Frese and Zapf (1994)
	Cognitive ability	Above average general intellect ('g')	Barron and Harrington (1981); Patterson (1999)
		Task-specific knowledge	West (1987); Wallach (1985); Taggar (2002)
		Divergent thinking style	Kirton (1976, 1989)
		Ideational fluency	Barron and Harrington (1981)
	Job characteristics	Autonomy	Axtell et al. (2000)
		Span of control	Axtell et al. (2000)
		Job demands	Janssen (2000)
		Job dissatisfaction	Zhou and George (2001)
		Support for innovation	Eisenberger et al. (1990); Axtell et al. (2000)
		Mentor guidance	Simonton (1991); Walberg, Rasher, and Parkerson (1980); Csikszentmihalyi (1996); Zhou (1998)
		Appropriate training	Basadur, Graen, and Green (1982); Basadur, Graen and Scandura (1986)
	Mood states	Negative moods	George and Zhou (2002)
Work group			
	Team structure	Minority influence	Nemeth and Wachtler (1983); De Dreu and West (2001)
		Cohesiveness[b]	Payne (1990)
		Longevity[b]	Katz (1982); West and Anderson (1996)
	Team climate	Participation	West and Anderson (1996); De Dreu and West (2001)
		Vision	West and Anderson (1996); De Dreu and West (2001)
		Norms for innovation	West and Anderson (1996); De Dreu and West (2001)
		Conflict	De Dreu and de Vries (1997)
		Constructive controversy	Tjosvold (1988)
	Team member characteristics	Heterogeneity of members	Nemeth and Wachtler (1983); Paulus (2000)
		Education level	Wallach (1985)

	Team processes	Reflexivity	West, Patterson, and Dawson (1999)
		Minority dissent	De Dreu and West (2001); Taggar (2002)
		Integration skills	Stevens and Campion (1994); Taggar (2002)
		Decision-making style	King, Anderson, and West (1992)
	Leadership style[c]	Democratic style	Tierney et al. (1999)
		Participative style	Nystrom (1979); Manz, Bastien, Hostager, and Shapiro (1989); Tierney et al. (1999)
		Openness to idea proposals	Nystrom (1990)
		Leader–member exchange (LMX)	Tierney et al. (1999)
		Expected evaluation	Shalley and Perry-Smith (2001)
Organizational	Structure	Specialization	Damanpour (1991)
		Centralization (negative relation)	Zaltman et al. (1973); Damanpour (1991)
		Formalization (negative relation)	Damanpour (1991); West, Smith, Feng, and Lawthom (1998)
		Complexity	Damanpour (1991); Kimberly (1981)
		Stratification (negative relation)	Kanter (1983)
		Matrix principles	Staw (1990)
	Strategy	'Prospector' type	Miles and Snow (1978); Meyer (1982)
		Organicity	Nicholson, Rees, and Brooks-Rooney (1990)
	Size	Number of employees[b]	Rogers (1983)
		Market share (negative relation)	Rogers (1983)
	Resources	Annual turnover	Mohr (1969)
		Slack resources	Kanter (1983, 1990); Damanpour (1991)
	Culture	Support for experimentation	Damanpour (1991); Nystrom (1990); King et al. (1992); West and Anderson (1992)
		Tolerance of idea failure	Madjar et al. (2002)
		Risk-taking norms	King et al. (1992); West and Anderson (1992)

[a]Studies cited are illustrative of each trend of findings, not an exhaustive listing of all primary source studies to have reported effect sizes of note.
[b]For several characteristics at different levels of analysis curvilinear effects have been proposed or, in a few instances, found. Both n-shaped and u-shaped curvilinear effects have been reported in a relatively small number of more complex study designs.
[c]Clearly, some dimensions will display interaction effects both within level (e.g., tolerance for ambiguity and openness to experience) and between levels (e.g., job autonomy and work group structure). Thus, teasing out such effects requires careful study design and appropriate data-analytical strategies (also, to therefore avoid statistical artifacts caused by measuring essentially the same construct or variable twice at different levels of analysis).

and organizational levels of analysis found to be associated with innovation in the workplace. The body of research is thus now sufficiently mature for scholars and practitioners to be able to list in schedule form the antecedent factors most likely to be facilitative of innovation, assuming that maximization of innovation potential is a sensible goal (several authors caution against this for obvious reasons; e.g., Amabile, 1983; West & Anderson, 1992; Van de Ven et al., 1989). This alone can be argued to be a crucially important contribution of the innovation research, which, if one examines the dates of publication of many of the studies in this area, has largely been the case only over the last two decades or so.

Another striking feature of Table 1 is the central contribution that organizational psychologists have made to this body of knowledge (see also West, 2002), and especially to the robustness of the empirical research in this area (Nijstad & De Dreu, 2002). While some of the more popularist management research continues to use atheoretical case studies of in situ innovation processes as they unfold over time, research designs employed by organizational psychologists have been more sophisticated and have undoubtedly strengthened the reliance that can be placed upon their key findings (see also Damanpour, 1990, 1991; West, 2001). The cautious, multivariate, and sometimes longitudinal stance of organizational psychologists active in innovation research starkly contrasts against the mass of more popular texts in the management sciences which have extolled the virtues of unfettered innovation support and have exhibited an unashamed 'pro-innovation bias' (Kanter, 1983; Peters & Waterman, 1982).

Innovation research in retrospective: processes and levels of analysis

Two other important areas of contribution that innovation research has made warrant commenting upon. First, important advances have been made in our understanding of *innovation processes* in organizations. Several general models of the innovation process have been proposed at differing levels of analysis (most notably, Damanpour & Gopalakrishnan, 2001; Rogers, 1983; Schroeder et al., 1989; Van de Ven et al., 1999; West, 1990, 2002; Zaltman et al., 1973) and have received some validation from longitudinal observation studies (e.g., King, 1992; Van de Ven et al., 1999). This research confirms unequivocally that innovation processes in organizations are iterative, non-linear (that is, the sequence of events cannot easily be portrayed as a neat, step-by-step unfolding series of phases), disjunctive, cyclical, and often stressful to those involved either as initiators or being affected by their implementation.

In keeping with the theme of this special issue, it does indeed seem to be the case that innovation processes have both positive and negative psychological consequences for those involved, an issue to which we return later in this paper. Thus, understanding the nature of the etiology of innovation processes is of vital importance for applied psychologists, and the contribution of research in this area has been to sharpen our perception that innovation processes are far from the simple, linear, stage models such as those propounded in popular management texts (see King & Anderson, 2002, for a detailed discussion). Rather, dealing with the psychological consequences of innovation means first to embrace its inherent complexities in organizational life; innovation is by definition a form of social restructuring—it should not surprise us that its concomitant psychological effects are similarly the restructuring of cognitions, perceptions, expectations, and behavioral repertoires for the individual. Whether the findings of organizational scientists in this regard have had as much impact on practice as perhaps they should have is a moot point, but it is undoubtedly true that their model building and validation efforts can be cited as a major area of novel contribution over recent years.

Second, as hinted at above, organizational psychologists have made strides forward in shifting the *level of analysis* in innovation research from being purely at the macro-organization level toward individual and work-group-level processes and effects. It would seem to be highly unlikely that

management scientists more generally would ever have narrowed down their focus to such micro- and meso-analytical issues (e.g., Kanter, 1982; Baer & Frese, 2003). In fact, such has been the impact of applied psychologists in their attention to work role and work group innovation that these levels of analysis have now become 'home territory' for their research efforts. Particularly at the group level of analysis, organizational psychologists have made significant advances to the research literature which was previously quite underdeveloped and somewhat truncated (e.g., King & Anderson, 2002; West, 2001, 2002; West & Anderson, 1996). These contributions have built up over more recent years but the body of findings is now quite substantial, allowing valuable practical recommendations and prescriptions for team-building and innovation processes to be put forward (West, 1997). As organizations have become more reliant upon group-based structures, ad hoc project teams, and multidisciplinary design and development teams, these advances in our understanding of team-level innovation processes are particularly salient.

To summarize, innovation research has expanded considerably, its focus has become increasingly multi-level, and our understanding of key aspects of the innovation process has undoubtedly developed to more than keep pace with sweeping changes in the nature of work organizations and task demands on individuals and groups. To this end, at least, innovation researchers appear to have been replete with creativity in their efforts to generate scientific research findings of societal, organizational, and psychological value. But before we dismissively jettison Jarovsky's (1989) iconoclastic quote in a fit of delusory, self-congratulatory peak over the state-of-the-scientific research base in innovation at work, we need to take heed of several warning signs and challenging trends evident from recent developments in innovation studies.

In the subsequent sections of this paper we sound a discordant note of caution, partly based upon a content analysis and coding of innovation research in recent years. It shows that Jarovsky's summation of Soviet psychology over 50 years ago could become equally applicable to innovation research unless the field becomes more reflective and innovative. Ironically, our analysis suggests that innovation research is becoming less radically innovative, its methods increasingly routinized and cross-sectional, and its approach now less likely to uncover the positive and negative consequences of innovation than some years ago. We pull no punches in the following sections of this paper, having in this section identified several major contributions of past innovation research to our general understanding of change processes in organizations. However, we do so in a genuine attempt to provoke constructive controversy and critical reflection over the directions, methods, and issues that need to be addressed by innovation research in the foreseeable future.

A Snapshot of Foci and Methods in Current Innovation Research

What are the prevailing trends, directions, and themes for innovation research presently? Which research methods are in popular usage amongst innovation researchers and how have study designs typically operationalized the concept of workplace innovation for investigation? Recent targeted reviews of the innovation literature have quite understandably not been able to include such 'current trends' questions (e.g., Anderson & King, 1993; West, 2002). We therefore decided to carry out a comprehensive, content analytical summary of published innovation research over the last 5-year period in order to shed light upon these issues. In so doing our intention was to provide an initial 'snapshot' of the current state-of-the-science of innovation research in these regards and to present an overview of current themes based upon this content analysis. The last 5 years of publications was chosen as the period for analysis on the grounds that it would provide a snapshot of contemporary trends and

research approaches, but, simultaneously, that a 5-year period is sufficient to cover publication time-lags and to give a representative sample of published papers over recent years for this snapshot. It was not our intention, and indeed would be well beyond the scope of this review paper, to undertake an exhaustive, multi-decade content analysis of all innovation studies published in all journals, regardless of citation impact as an indicator of journal quality. We therefore decided to carry out a detailed content analysis of all innovation papers published over the most recent 5 years (1997–2002) in the top-rated scientific journals in management sciences.

We used the impact analysis of Zickar and Highhouse (2001) to identify the top-rated journals in management sciences and industrial-organizational psychology that have regularly published studies into workplace innovation. The Zickar and Highhouse survey covered a total of 23 journals, from which they produced a top-10 ranking list based upon citation impact indices and ratings by over 200 active researchers. We used this list of top-10 journals on the grounds that they represent the most prestigious scientific outlets in the field, that they all have a history of publishing articles directly relevant to innovation research (as opposed to more secular psychological or psychometric topic areas), and that, combined, they therefore represent the 'top tier' of scientific medium in which innovation research reviews and studies would appear. The journals were: *Journal of Applied Psychology* (*JAP*), *Personnel Psychology* (*PP*), *Academy of Management Journal* (*AMJ*), *Academy of Management Review* (*AMR*), *Organizational Behavior and Human Decision Processes* (*OBHDP*), *Administrative Science Quarterly* (*ASQ*), *Journal of Management* (*JOM*), *Journal of Organizational Behavior* (*JOB*), *Organizational Research Methods* (*ORM*), and *Journal of Vocational Behavior (JVB*). Because we were interested in empirical studies, *AMR* was excluded from the list as it publishes narrative review articles only. *ORM*, as a purely methodologically oriented journal, was replaced by the *Journal of Occupational and Organizational Psychology* (*JOOP*) as the authors were aware of several important innovation studies being published in the latter over recent years and because its British/European origin counterbalances the preponderance of US-based journals in the Zickar and Highhouse listing.

Search procedure and criteria

A comprehensive computer-based and manual search of these nine journals between the years of 1997 and 2002 inclusive was undertaken. For the computer-based search we entered the keywords 'innovation, innovative, innovativeness, creative, and creativity' in order to locate all relevant published papers within the journals just listed. A researcher independent from the authors undertook this search and also the multidimensional coding of all studies located (see below). PsycInfo and manual searches resulted initially in the identification of 28 published articles. We applied the following three criteria for the inclusion of studies. First, studies must represent an empirical investigation into innovation in the workplace at the individual, work group, or organizational level of analysis in accordance with West and Farr's (1990) definition, as noted above. Second, studies must report quantified data attesting to relationships between innovation and other specified variables, as opposed primarily to case studies reporting the adoption of technical innovations by companies across industrial sectors. Third, and finally, studies could either be field study designs or laboratory experiments, treat innovation as either the independent or dependent variable (see below), or examine within-level or between-levels of analysis as long as they met the previous two criteria.

Applying these criteria led to the exclusion of several publications identified in the search. These publications involved review articles (e.g. Drazin, Glynn, & Kazanjian, 1999), studies into creativity outside the world of work (e.g., Paulus & Yang, 2000), review commentaries (e.g., Paulus, 2002), the impact of group diversity on work team performance (e.g., Polzer, Milton, & Swann, 2002), grounded theory approaches to new technology as innovation implementation (e.g., Edmonson, Bohmer, &

Pisano, 2001), theoretical model-building contributions without empirical data (e.g., Arndt & Bigelow, 2000; Greve & Taylor, 2000), or reports on the development of psychometric scales related to innovation or team climate strength (e.g., Anderson & West, 1998; Gonzalez-Roma, Peiro, & Tordera, 2002). A total of 15 studies were included for multidimensional coding. Studies included are marked with an asterisk in the list of references.

A researcher other than the authors initially coded all studies, and all studies were subsequently coded by the first author in order to establish inter-coder reliability. Disagreements were solved through discussion until the researchers agreed upon a consensus coding. Across all dimensions (prior to consensus discussions) the overall agreement between coders, estimated as a correlation coefficient, was 0.94. Studies were coded against 10 main dimensions: source of the research question(s), setting, methodology, data collection method(s), level of analysis, innovation measurement, interaction effects, negative predictors, innovation conceptualization, and country of study origin. *Source of the research question(s)* as a category was derived from Sackett and Larsen (1990), who proposed three sub-categories: (a) questions derived from theory, (b) questions derived from real-world problems, and (c) questions derived from existing studies, so-called 'coupling' studies or 'replication–extension' studies (Anderson, 1998). Clearly, studies in the final category represent the least innovative designs as they add incrementally to an existing, often well-established, theme of research findings in an area. Second, *setting* was coded dichotomously as either laboratory experiment or field study. The third category, *methodology*, was coded as cross-sectional, longitudinal (studies using two or more measurement points with an interval between each), or quantitative case study. In the latter sub-category at least some quantitative data needed to have been reported even if the overarching methodological approach was that of a qualitative case study. Fourth, *method* was coded trichotomously as questionnaire survey, experimental design, or intervention study.

We subdivided the next category of *level of analysis* into six possible codings: individual, group, organizational, as the three possibilities for studies examining a single level of analysis; and multilevel, which was further subdivided into individual–group (I-G), group–organizational (G-O), and individual–organizational (I-O) for studies which spanned levels of analysis in their design. Sixth, we coded *innovation measurement* for the measure(s) used by researchers to evaluate innovation (self-report, supervisor report, peer report, behavioral frequency counts, or SME—subject matter expert—judges). Seventh, following Nijstad and De Dreu (2002), *interaction effects* were coded dichotomously (yes–no) to signify whether or not studies had tested for such effects between predictor variables in their analysis. *Negative predictors* were examined through an open-ended category whereby the researchers noted down any negatively connotated variables measured in studies. These were later summarized and a frequency distribution calculated. We coded *innovation conceptualization* in terms of whether studies had treated innovation as the dependent variable (DV), the independent variable (IV), or both, where a multi-stage design may, for instance, have regressed variables onto a measure of innovation which was in turn regressed onto a second-order variable such as employee mental health. Finally, country of study origin was noted by both researchers; again this resulted in a simple frequency count across all studies coded. This 10-dimension coding framework was therefore designed to examine in some detail the conceptual, operationalization, cross-cultural, methodological, and analytical components of innovation studies over this 5-year period.

Content analysis: summary findings

Table 2 summarizes the results from this multidimensional content analysis. Several interesting and noteworthy findings emerge. Aside from the observation that there have been far fewer published studies into innovation than we expected, perhaps the most striking finding is that, of the 15 studies coded,

Table 2. Content analysis of innovation studies: 1997–2002

			N	Per cent
Source of research question	Extension/replication		12	80
	Theory-driven		2	13.33
	Real world-driven		1	6.67
Setting	Laboratory		3	20
	Field		12	80
Methodology	Cross-sectional		12	80
	Longitudinal		3	20
	Case study		0	0
Method	Questionnaire survey		12	80
	Experiment		3	20
	Intervention		0	0
Level of analysis	Individual		11	73.33
	Group		2	13.33
	Organization		0	0
	Multi-level (see footnote) of which:		2	13.33
		I/O	0	
		G/O	0	
		I/G	1	6.67
		I/G/O	1	6.67
Innovation measurement[a]	Self-report		6	40
	Supervisor report		9	60
	Peers report		1	6.67
	Behavior count		2	13.33
	Judges (experiment)		2	13.33
Interaction effects	Yes		10	66.67
	No		5	33.33
Negative predictors	None		9	60
	Job dissatisfaction		1	6.67
	Negative mood		2	13.33
	Unsupportive co-workers		1	6.67
	Task conflict		1	6.67
	Home and work strain		1	6.67
Innovation conceptualization	Dependent variable		14	93.33
	Independent variable		0	0
	Both		1	6.67
Country of origin	Bulgaria		1	6.67
	Canada		1	6.67
	The Netherlands		3	20
	United Kingdom		2	13.33
	United States		8	53.33

A total of 15 empirical studies were coded as follows: *JAP*, 4 studies; *JOOP*, 3 studies; *AMJ*, 3 studies; *JOB*, 2 studies; *PP*, 2 studies; *OBHDP*, 1 study.

[a]Percentages exceed 100 per cent because multiple measures were taken in some studies.

Multi-level studies were subdivided into individual/group, group/organizational, individual/organizational, and individual/group/organizational as indicated by levels of variables measured in primary source studies.

'Negative predictors' refers to variables which are negatively connotated, being found as predictors of innovation (e.g., work stress, negative mood states), rather than negative relationships with outcome measures.

'Country of origin' refers to the country of origin of study authors.

the vast majority, 12 (80 per cent) represented replication–extensions of existing lines of enquiry and research. Only 13 per cent of the studies coded could reasonably be categorized as theory-driven by Sackett and Larsen's (1990) category definitions, which equated to only two of the studies identified over the last 5 years. This is a disconcerting finding, as it relates not to 'lower-level' publications in practitioner texts or company reports but to nine of the top-rated journals in the management sciences

and organizational psychology. It appears that innovation research more recently has become predominantly replication–extension in orientation. Only one study (Frese, Teng, & Wijnen, 1999) was derived from real-world problems, in this case the operation of an employee suggestion scheme in a Dutch organization.

Other key findings are illustrated in this table. Unsurprisingly, field studies continue to outnumber lab-based experiments in innovation research (80 per cent and 20 per cent, respectively), with the concomitant methods of data collection being questionnaire surveys (80 per cent) as opposed to experimental measures (20 per cent). Surprisingly, we located not a single published intervention study over this period. Despite regular calls by innovation researchers for the need for longitudinal designs, only 20 per cent of studies between 1997 and 2002 used multiple time point measures, as opposed to 80 per cent using a single time point cross-sectional or correlational design. The majority of studies examined within-level individual innovation (73 per cent) with only two published studies investigating group-level effects (13 per cent), but encouragingly two studies (13 per cent) examined cross-level effects at either the I-G, G-O, or I-O levels of analysis. Innovation was variously measured across studies, but the most popular methods were by self-report (40 per cent) and supervisor report (60 per cent). Surprisingly few studies made use of independent judges to rate innovativeness (only 13 per cent) or observational behavior counts (13 per cent), raising pertinent concerns over common method variance and inherent biases in supervisor ratings of subordinate innovativeness which are well rehearsed in the innovation literature (e.g., West & Anderson, 1996). With regard to interaction effects, we found that 67 per cent of all studies coded analyzed interaction effects between variables, although we believe this to be a function of the preponderance of individual-level studies.

Of particular interest for this special issue, we found that six of the 15 studies (i.e. 40 per cent) coded did incorporate some form of measurement of negative predictors of innovation. These constructs included job dissatisfaction, negative mood states, unsupportive co-workers, task conflict, and home and work strain. Conversely, we found that not a single study published in the last 5 years had conceptualized innovation as the independent variable, a particularly relevant finding in relation to the remit for the present special issue of *JOB*. In contrast, an overwhelming 93 per cent conceptualized innovation somewhat routinely as the dependent variable, with only one study being a multi-stage design where innovation was treated as a 'mid-model' variable between predictors and a further outcome measure (in this case career progression; see Seibert, Kraimer, & Crant, 2001). Finally, our coding of country of study origin resulted, perhaps unexpectedly, in a preponderance of studies from the U.S.A. (53 per cent), a few from Europe (Netherlands 20 per cent, U.K. 13 per cent), and one study each from Bulgaria and Canada. As we come on to discuss below, the cross-national generalizability of these findings is therefore an unresolved question.

Summary discussion

Summarizing these findings, it seems that the archetypal innovation study published in the premier journals over the last 5 years was a field-based, cross-sectional, replication–extension of previous findings into individual work role innovation in the U.S.A. Although some evidence of innovation in attending to interaction effects and, more encouragingly, in the use of multi-level designs is apparent, these studies are still the exception rather than the norm. Of real concern is the ongoing use of self-report measures of innovativeness despite calls for researchers to move toward independent ratings in order to avoid percept–percept bias. Moreover, a comparison with these findings against the wider field of organizational psychology historically raises even more uncomfortable issues. Sackett and Larsen (1990) coded all studies in three top journals (*JAP*, *PP*, and *OBHDP*) in three separate years: 1977,

1982, and 1987. Of the 577 papers identified, 13 per cent were theory-driven, a paltry 3 per cent were derived from real-world problems, and the remaining 84 per cent were coded as replication–extension studies. These proportions are notably similar to the current findings: 13 per cent of studies were theory-driven, 7 per cent stimulated by real-world problems, and the remaining 80 per cent were replication–extensions. It seems that recent innovation research may have become no more innovative, or at least as replicative, in its study designs as the wider field was some 15–20 years ago.

More encouraging is our finding that negative predictor constructs have been included by researchers over recent years as predictors of innovation outcomes in work organizations. However, the list of constructs included thus far is some way from being comprehensive, and it is interesting to note from Table 2 that, without exception, all of these constructs relate to the individual rather than the group or organizational levels of analysis. Our finding that research over the last 5 years has almost without exception treated innovation as the single outcome variable warrants comment briefly (we return to this later in this paper). Conceptualizing innovation as both a dependent and an independent variable offers a novel set of possibilities for future research into the effects of innovation processes upon organizational members. It not only recognizes that innovation may cause other, more salient effects psychologically, in terms of job performance, and job satisfaction outcomes, but it properly encapsulates the longitudinal and cyclical relations between these variables in practice (e.g., West, 2001; West & Anderson, 1996). It does appear, however, that the vast majority of studies over the last 5 years have failed to incorporate this inherent cyclicality into either their design or conceptualization of innovation. Finally, we cannot ignore the cross-national dispersion of study origins reported in Table 2. Over half of all published studies in this snapshot period originated from the U.S.A. While this is perhaps not surprising in comparison to publication rates across the organization sciences and organizational psychology generally, it does raise the spector that innovation research is heavily biased toward a North American, Anglo-Saxon perspective. Are these findings internationally generalizable to other countries and continents? This, of course, is a rhetorical question; at present we simply do not know. The obvious need for further research into cultural differences in order to examine this issue of international generalizability is considered in more detail below.

Our intention was not to undertake an exhaustive quantitative analysis of all innovation studies published to date (indeed, this would be unrealistic), but to gain a snapshot view of trends, advances, and methodological developments in innovation research over recent years. In a narrative review such as this paper presents, these findings also provide some valuable insights and indications of potentially fruitful pathways for future research. However, no such content analysis could ever stimulate or generate a fully rounded set of themes for future research directions to address. Rather, the following section both builds on our content analysis findings but also identifies other important themes and directions held out by the researchers themselves, who are all active in innovation research, to be the most important directions for innovation studies in the foreseeable future. We identify five such themes, which we term 'innovative pathways' for future research.

Five Innovative Pathways for Future Research

So, in more overview and projective terms, where should innovation research go from here? Additional guidance may be derived from the work of psychologist William McGuire (1997), who was concerned with the fact that much of our field was focusing on hypothesis-testing issues rather than hypothesis-generating issues. He proposed several categories of a total of 49 creative heuristics that have often been used to generate hypotheses in psychological research. These creative heuristics may help

moving the field of innovation research beyond replication–extension studies, and from four categories we will highlight some that may be particularly useful and applicable to innovation research.

One obvious heuristic, which requires no formal training in psychology or research methods, is to *recognize and account for the oddity of occurrences*, and deviations from the general trend. The strong focus in innovation research on replication–extension studies suggests that we are preoccupied with searching for regularities to the neglect of odd events and exceptions to the rule. Thus, researchers could invest more in understanding why innovation occurred despite the fact that the situation was not very conducive to innovation, or why innovation did not occur in spite of the fact that the situation appeared very conducive to innovation. Such investment is likely to generate new antecedent and moderator variables of innovation at work.

In the second category of creative heuristics, two stand out as particularly useful. *The first—reversing the plausible direction of causality*—will be discussed in more detail as we propose to consider innovation as an independent rather than dependent variable. The second—*conjecturing interaction variables that qualify a relation*—echoes the concern that research on team-level innovation tends to focus on main effects only and ignores complex interaction effects. We will return to this when we make a case for increased use of laboratory experiments and triangulation in innovation research, and discuss the advantages of building multi-level theory and multi-level designs.

In the third category, McGuire (1997) advocates the use of complex conceptual analysis. A creative heuristic within this category is to *identify counterforces obscuring an obvious relation*, or the use of meta-theories, such as the evolutionary functionalism paradigm, as thought provokers. Particularly useful to innovation research are several heuristics in the fourth category, concerned with reinterpretations of past research, such as *discovery by integrating multiple past studies*. We return to this when we make a plea for the use of meta-analysis in the field of innovation research.

In the remainder of this section, we will discuss in more detail several avenues for future research on innovation, inspired by the creative heuristics framework just described and the findings of our content analysis presented earlier in this paper. The five 'innovative pathways' that will be discussed relate to content areas for innovation research (pathways 1, 2, and 3) and methodological aspects of innovation research (pathways 4 and 5). Since the latter have not been commented upon in any of the recent reviews of the innovation literature, we believe it valuable to raise these two themes as discrete issues for consideration in this paper. The five pathways we identify are: (1) innovation as an independent variable; (2) cross-national generalizability and cultural differences; (3) the development of multi-level theories and designs; (4) the use of meta-analysis; and (5) the triangulation of research methods in innovation studies.

Innovative pathway 1: innovation as an independent variable

As illustrated in our content analysis of published papers, innovation studies have almost exclusively treated innovation as the dependent variable upon which other 'predictor' variables have been regressed (see also Damanpour, 1991). This is a legitimate but rather restricted conceptualization of the nomological network of interrelationships between innovation processes and other outcomes. As we noted earlier in this paper, innovation processes have been argued to result in the restructuring of individual cognitions, individual perceptions of psychological well-being (e.g., Bunce & West, 1994); proactivity and future propensity to innovate in job roles (West, 1987); work group processes and climate (West & Anderson, 1996); perceptions of cohesiveness and participation in work teams (West & Anderson, 1992); perceptions of leadership style and the management of innovation processes (Anderson & King, 1991); and cultural values and articulated norms in an organization (King, Anderson, & West, 1992).

This research hints at the likely expansive range of impacts that innovation will have upon performance, psychological processes, and outcomes at the individual, group, and organizational levels of analysis. However, none of these studies explicitly set out to investigate innovation as an independent variable, nor to examine its causal, linear impacts upon various outcomes at different levels of analysis. This is a significant gap in our understanding of the longer-term impacts of innovation processes. It rather leaves the reader with the inaccurate impression that innovations are the final end-product of previous processes which end abruptly at some predetermined point (see also Amabile, 1983; Van de Ven et al., 1989).

An alternative conceptualization of innovation processes is that they are cyclical, longitudinal, iterative, and recursive in nature. Indeed, existing innovation research can be fundamentally criticized for its largely inaccurate portrayal of innovation in organizations as being static, snapshot, linear processes that display a discrete end-point of the innovation or innovativeness as measured by the researchers themselves. Despite others raising similar criticisms in the past (e.g., Agrell & Gustafson, 1996; Hosking & Anderson, 1992; Nicholson, 1990; Van de Ven et al., 1989), the march of applied studies treating innovation solely as an outcome variable has shown no sign of abating, even in the last 5 years. Of course, cross-sectional designs can be particularly criticized for presenting snapshot views of processes that are quintessentially longitudinal and iterative in nature, and so the need for longitudinal studies cannot be overstated (King & Anderson, 2002; Baer & Frese, 2003). Moreover, for innovation research to continue to develop in the future it will be necessary for researchers to reconceptualize the process as one in which innovation may be the cause of multiple, spin-off outcome effects at different levels of analysis. That is, to begin to treat innovation as the independent rather than dependent variable in their study designs.

Innovative pathway 2: cross-national generalizability and cultural differences

Given our content analysis finding that the majority of recently published studies originated from the U.S.A., and that past research in innovation has similarly used mostly North American samples, could our current understanding of the innovation process be biased by cultural artifacts and innovation management strategies present only in North America? Might what is perceived to be (and rated as) innovative behavior in the U.S. cultural context be perceived as unacceptably challenging actions, say, in a European context or even as subversive behavior, say, in an Asian organizational context? For the issue of innovation in the workplace these are particularly vexed questions as, by definition, innovation unavoidably involves challenging the status quo at some level of analysis and at some point in the process (Nicholson, 1990; Van de Ven et al., 1999). Yet, cross-cultural differences and the international generalizability of findings from innovation research carried out predominantly in the U.S.A. have received scant attention by researchers active in this field. This is a pointed gap in our understanding of innovation processes across different cultural contexts, and one (with acknowledgements to the anonymous reviewers and action editor for this paper) that we raise as an important pathway for future research.

An exception to this dearth of research into cross-cultural aspects of innovation is the work of Shane and his colleagues (Shane, Venkataraman, & MacMillan, 1994; Shane, Venkataraman, & MacMillan, 1995). In a 30-country international study, Shane et al. (1995) examined innovation-championing strategies across North America, Europe, and the rest of the world. They found that culture power distance was significantly related to preferences of gaining support for the innovation from authority figures, whereas in more collectivist cultures preferences related to innovation champions gaining cross-functional support for new and improved ways of doing things. Innovation processes are thus likely to unfold differently across different cultures, or at least those that turn out to be successful in an organization. Pragmatic recommendations for the 'management' of innovation (itself a contradictory term

that has been criticized by some authors: see King & Anderson, 2002, for instance), derived exclusively from research findings originating from a North American cultural context, are therefore of dubious validity in markedly different cultural contexts. Innovation research has certainly lagged behind other areas in the management sciences and organizational psychology in researching issues of international generalizability; our call here is for future research to begin to redress this shortcoming and to critically examine whether established findings from North America do indeed generalize to other cultural contexts.

Whereas the work by Shane and colleagues is among the few that directly deals with innovation across cultures, other lines of research can provide some input into the cross-cultural analysis of workplace innovation, and provide a basis for hypotheses and model building. Take, for instance, work that considers the reactions to, and effectiveness of, minority dissent in decision-making groups. In individualistic cultures, minority dissent within small groups stimulates divergent thinking and creativity (De Dreu & De Vries, 1993; Nemeth & Wachtler, 1983; Van Dyne & Saavedra, 1996) and—provided high levels of reflexivity and participation in decision making—work team innovation (De Dreu, 2002; De Dreu & West, 2001). The idea is that mild levels of conflict, compared to low levels (absence of dissent) or high levels (facing opposition by a majority), stimulates cognitive activity and motivation to understand the 'odd' perspective offered by the minority (Nemeth, 1986). An experimental study by Ng and Van Dyne (2001) examined whether these findings generalize from individualistic cultures, characterized by a desire for autonomy and independent self-construal, to collectivistic cultures, characterized by a desire for harmony and interdependent self-construal (e.g., Triandis, 1989). Results showed that the traditional effects of minority dissent were obtained in groups with high levels of individualism. When dissent occurred in collectivist groups, quality of decision making was better when the dissenter occupied a high- rather than low-status position.

Related to the work by Ng and Van Dyne is work on culture and conformity by Bond and Smith (1996), who showed that individuals in collectivist cultures display stronger tendencies to conform than individuals in individualistic cultures. Higher levels of conformity and obedience may come together with lower levels of creativity and divergent thinking. At the same time, however, it may well be that higher levels of conformity also facilitate implementing ideas and supporting actions that were decided upon by management. Thus, features of collectivist cultures may inhibit the development of creative ideas and divergent perspectives, but facilitate the implementation, support, and application of new ideas into innovative practices, services, and products. Culture dimensions may thus impact innovation at work in rather complex ways and intervene at different phases of the innovation process.

Innovative pathway 3: multi-level theory and multi-level designs

Typically, studies into innovation have been limited to only a single level of analysis in their design frameworks. It is very encouraging to note from our analysis of publications over the last 5 years that this has begun to change. Indeed, in reality innovation processes will usually span at least two levels of analysis, if not more (Van de Ven et al., 1999; Baer & Frese, 2003). This preponderance of single-level studies has critically restricted our understanding of how multi-level innovation processes develop over time.

Almost all larger-scale innovations will possess features which cross the levels of analysis between individuals, work groups, and organizations, and multi-level research is sorely needed to chart these effects and processes. Perhaps of all of criticisms this one is the most perplexing. Recent years have witnessed a resurgence of interest in, and attention to, multi-level theories, studies, and analyses in organizational psychology, yet curiously these theoretical and methodological innovations in the wider field seem largely to have passed innovation and creativity research by (e.g., Klein & Kozlowski,

2000). As Rousseau (2000, p. 574) aptly notes, 'the dynamism of level shifting can mean that the innovations and complexity characteristic of a multilevel field can be missed if one assumes a single vantage point.' One notable, but very recent exception to this is the Baer and Frese (2003) study into organizational climates for personal initiative, enacted innovations, and resultant organizational performance. Here the authors used multi-level theory and measures to demonstrate significant relations between summated individual perceptions of innovation climate, the enactment of process innovations, and, ultimately, to organizational performance (change in return on capital and goal achievement). We concur fully with Baer and Frese that such multi-level designs are needed to uncover such consequent effects across different levels of analysis, and we would also suggest that such designs provide a powerful, innovative pathway for future innovation research to progress our understanding of innovation as a quintessentially multi-level phenomenon.

How best might we as researchers proceed toward multi-level innovation research? Klein and Kozlowski's (2000) excellent edited volume presents a number of potential directions for theorizing, methodological considerations, and analytical procedures that we hope will be embraced by innovation researchers in the future. Certainly, our finding that 87 per cent of studies published in this area in recent years represented single-level-of-analysis efforts needs to change. If it does not the inherently multi-level effects of innovation in organizations will remain beyond our understanding and innovation studies will become myopically and doggedly stuck at one of the three levels we identified earlier in this paper.

The multi-level nature of innovation is first and foremost important because different variables will influence innovative behavior at different levels (see Table 1). At the individual level, individual role innovation requires that the person is both able (e.g., has certain cognitive abilities and personality characteristics) and willing (e.g., is motivated, experiences job dissatisfaction) to be innovative. The specific job characteristics (autonomy, job demands) further determine whether the person will engage in innovative behavior, probably in interaction with personal characteristics: Some people leave the organization if they are dissatisfied with their work, while others try to change their situation. At the team level, team composition (heterogeneity) is of foremost importance, because the resources (knowledge, skills, abilities) to be innovative mainly reside with the team members. However, team processes will determine the extent to which the innovative potential of the team is fully realized (see also De Dreu & West, 2001; Nijstad & Paulus, 2003; West, 2002). Team processes, in turn, depend on team structure, climate, leadership, and the like, but also on variables in the wider organizational context. Finally, innovation at the organizational level is arguably the most complex level of analysis. Here, the full myriad of factors will play a role, from individual characteristics (e.g., the open-mindedness of the CEO) to organizational characteristics, such as market share, structure, and organizational culture.

The multi-level nature of innovations also has implications for (1) the way innovativeness should be operationalized and (2) the way data should be analyzed. Regarding operationalization, it may be insufficient to ask a team supervisor's overall rating of his or her co-worker's level of innovativeness. A co-worker may be innovative at the individual, team, or organizational level, and different factors will be predictive at each level. Thus, we move into multi-rater instruments and dimensions of innovativeness as perceived by superiors, co-workers, and subordinates. If the team supervisor mainly bases his assessment of co-workers on the innovations a co-worker has introduced to improve team functioning, it would be inadequate to treat this in the same way as individual role innovation, and only look at predictors at the individual level. It would be better to specifically measure innovativeness at both the individual and the team level. Note that supervisors may not always be the most adequate source of information. In a study on innovation in semi-autonomous teams, De Dreu and West (2002, Study 1) asked supervisors whether team innovations were initiated primarily by one individual or by the entire team. In many cases supervisors appeared unable to trace back innovations accurately, and the authors

decided to collapse data into one single measure. When more 'objective' measures of innovativeness are employed, it will be wise to distinguish between innovations at each level of analysis. It may well be that certain factors that positively affect innovations at one level actually inhibit innovations at another (or even that there is a negative correlation between innovativeness at different levels). Innovation research could learn much from the selection and appraisal literatures in this respect where the vexed issue of the 'criterion problem' has been addressed over many years and recently trends toward multi-rater performance measures have become evident (e.g., Salgado & Anderson, 2002).

The level-of-analysis issue also has clear implications for data analysis. Especially when team innovation is considered, one needs data-analytic techniques that take statistical dependency into account. When innovativeness is assessed at the individual level, it is inappropriate to analyze the data with simple multiple regression, because individuals are not statistically independent, but nested within teams (see, for example, Kenny et al., 2002). Instead, one should use multi-level regression (see, for example, Snijders & Bosker, 1999), a technique especially useful when several teams are investigated within one or more organizations. Multi-level regression offers the theoretically relevant possibility to examine cross-level interactions, in that it is allowed that the slope of a predictor variable differs across different teams. For example, there may be a positive relation between team member creativity and individual innovativeness in one team, whereas there is no relation in another team. By testing for cross-level interactions, it is possible to use team characteristics to predict for which team a positive or a null relation exists between these variables and innovation. In this way, the question under which conditions individual potential for innovativeness is realized and under which conditions it is not can be directly and adequately addressed.

In principle, the same applies to the organizational level of analysis. Here, there are three nested levels: individuals are nested within teams (or departments), which are nested within organizations. However, because one study will rarely assess innovativeness in different organizations (or at least not enough organizations to have the required statistical power), it may be better to deal with these issues using meta-analyses.

Innovative pathway 4: the use of meta-analysis

Although one of the main contributions of innovation research has been to identify a variety of factors associated with innovation outcomes at different levels of analysis, this has been done through individual source studies of which there is now a huge number in total (see Table 1). Despite Anderson and King's (1993) call 10 years ago for meta-analyses of these individual study findings to be carried out, only Damanpour's (1991) meta-analysis remains as the single quantitative summation of effect sizes. This is regrettable, as meta-analysis has been widely used in various areas of the social and management sciences, and in organizational psychology especially (e.g., Hunter & Schmidt, 1996; Schmidt & Hunter, 1998; Salgado & Anderson, 2002).

The meta-analytic technique has the important advantage of allowing researchers to partial out measurement error and restrictions due to relatively small sample sizes, and in a field such as innovation where there are numerous, relatively small sample size studies this is fundamentally advantageous. Moreover, the use of small sample size studies may easily lead to biased conclusions when conducting qualitative reviews. As two cases in point, De Dreu and Weingart (2003) found that a predicted positive relationship between task-related conflict in teams and team performance did not hold up when study findings were analyzed meta-analytically, despite narrative reviews suggesting otherwise. Salgado and Anderson (2002) meta-analyzed the criterion-related validity of tests of general mental ability across European Community countries and found impressively high levels of operational validity and validity generalization of findings across countries. Earlier narrative reviews had cast doubt upon the validity of

cognitive tests, especially for use in collectivist cultures. It cannot be excluded that similarly inaccurate conclusions survive in the domain of innovation research as well, given the huge mass of relatively small sample size primary studies upon which present-day findings have been based.

Damanpour (1991) provides a definitive quantitative summary of effect sizes at the organizational level of analysis, yet at the individual and group levels of analysis meta-analytic procedures have seemingly not been applied. This will be an important contribution for the future, as it will also allow the relative contribution of different variables to be quantified and, given sufficient sample sizes, for definitive conclusions to be drawn. This would also negate the need for a plethora of ongoing studies into a variety of factors hypothesized to be antecedents of innovation, and would thus move innovation research to a more composite and summative level of investigation (King & Anderson, 2002). Once we have established these main effect relations, as has been the case in meta-analyses in personnel psychology, the research field is freed up to move onto investigate the impact of more subtle moderator and mediator variables and thus to bootstrap upwards the level of complexity of its posited research models (Schmidt & Hunter, 1998). The case in point of selection research again illustrates this potential benefit. For many years narrative reviews of employment interviews had published dire warnings of interview validity, especially for unstructured interview formats. A series of meta-analyses over the last two decades has not only dispelled this misunderstanding—interviews, even unstructured formats have been found to be as valid as other popular selection methods—but has established beyond reasonable doubt that moderators such as degree of structure, panel or one-to-one interviews, and predictor constructs make the crucial differences in observed operational validity of this selection method. Similarly for innovation research, Table 1 summarizes the plethora of primary studies, many investigating identical or notably similar predictor constructs, which we argue are ripe for quantitative meta-analysis techniques. There is considerable replication and overlap across these primary studies—factors found to be antecedents and facilitators of innovation at all three levels of analysis have been reported over several primary studies in several cases. Our point is that meta-analysis will permit the codification and summary of such common-sense predictor constructs into a more generic typology of moderator variables (e.g., Schmidt & Hunter, 1998). Once these moderators at each level of analysis are identified, the need for this ongoing mass of antecedent factors studies becomes negated; researchers will be freed up to concentrate on superordinate moderator variables. As importantly, once these moderators are established beyond doubt (as in several areas of personnel psychology research), innovation scholars will be able to direct greater efforts to innovation process studies, to cross-cultural investigations, and to multi-level designs.

A final main advantage of meta-analysis to be highlighted here is that it allows the testing of moderator variables at the different levels of analysis. Similar to multi-level regression described above, it is possible to test whether variance in effect sizes across studies can be meaningfully attributed to, for example, the fact that relationships have been tested in different (types of) organizations, or whether the size of the organization, or organizational or national culture explains variance in effect size across studies. As argued above, a single study will rarely have the statistical power to be able to test for these moderator effects at the organizational level. Meta-analysis thus provides the most robust procedure to gain insight into the moderators at the organizational level, and should complement multi-level study designs.

Innovative pathway 5: triangulation of research methods

We are all aware that different research methods have their own strengths and weaknesses: Cross-sectional designs have high external validity but preclude conclusions about causal relations, longitudinal surveys are better in this regard but may suffer from the 'third variable problem,' and experimental

research is excellent for establishing causal relations but compromises on external validity. In innovation research (as in most other areas in organizational behavior), where it is clearly important to have both internal and external validity, it is therefore extremely useful to use a multitude of research methods, including surveys, longitudinal designs, and experiments, to come to sound and robust conclusions. In addition to using multiple research methods, different operationalizations of dependent and independent variables can be combined. For example, problems with self-report measures and common method variance can be dealt with when different measures of innovation are used in the same study, including behavior counts, archival data, self-report, and other-report data (e.g., ratings by supervisors or peers). In short, we argue for triangulation: using a combination of research methods and operationalizations in innovation research.

A case in point is De Cremer and Van Knippenberg's (2002) recent research on the effects of leader behavior on cooperation of co-workers. De Cremer and Van Knippenberg were able to show that procedural fairness and leader charisma interacted to affect cooperation in three different studies and using three different measures of cooperation. Similar effects were obtained in a scenario experiment in which cooperation was measured as hypothetical resource allocation, in a laboratory experiment with real resource allocations, and in a field survey where Organizational Citizenship Behavior was used as a measure of cooperation. Clearly, these findings are much more convincing in concert than they would have been alone. Similarly, conclusions regarding causality and external validity in innovation research would be much more robust when they are found using a variety of methods and operationalizations.

Innovation research, however, has been restricted to mainly cross-sectional surveys, with the evident disadvantage of not being able to establish causal relations. Only three out of the 15 studies listed in Table 2 used laboratory experiments to test hypotheses. The low number of laboratory experiments may reflect a tendency among researchers to shy away from experimentation, it may reflect a tendency for journal editors and reviewers in our field to discourage the submission and revision of papers based on laboratory experiments, or it may reflect a belief among innovation researchers that innovation cannot be studied through laboratory experimentation. Only three studies used a design with more than one measurement in time, probably because longitudinal studies are much harder to conduct than cross-sectional ones. Further, we were unable to locate papers in which studies using different methodologies have been combined. When we look at the measurement of innovation, Table 2 reveals that researchers continue to rely heavily on self-report and supervisor report data, at the expense of more unobtrusive measures of innovation such as archival data and behavioral counts. In only five out of 15 studies, different measures of innovation have been combined, which is somewhat disappointing.

In our view, it will in particular be useful to combine field-based surveys with experimentation. Experiments allow one to better assess the causal links between independent and dependent variables and, at least in some cases, experiments are an efficient and effective substitute for labor-intensive longitudinal research. Experiments also allow one to create levels of variables to a degree that is sometimes impossible to observe in field settings, which may for example be useful if researchers take up the challenge to study innovation as an independent rather than dependent variable. Further, in experiments it is possible to measure variables that are hard to observe in field studies, including immediate emotional reactions and relatively objective measures of innovation (e.g., behavioral counts or expert ratings). We would like to emphasize, however, that we will continue to need field studies, preferably with longitudinal designs, and that field and laboratory studies should complement rather than replace each other. Indeed, we do need to establish that laboratory findings generalize to field settings and see what really happens rather than what might happen. Although laboratory findings often do generalize (e.g., Anderson & Bushman, 1997; also see Mook, 1980), there are differences between the average university student and the average employee in work organizations (e.g., Barr & Hitt, 1986). Thus, only when different methods are combined, and when different operationalizations of innovation

are used, can we paint a more complete picture of the innovation process and achieve high internal as well as external validity.

Distress-Related Innovation: Proposal for a Construct and Integrative Model

To illustrate the innovative pathways outlined above, we conclude this review with a *distress-related innovation* model. Organizational life is full of negatively connotated phenomena like threats to job security, job dissatisfaction, small group conflict, budget deficiencies and shrinking market share, and perceived pressures to restructure organizational processes. At the individual level of analysis, the work of George and Zhou (2001; Zhou & George, 2001) shows that negative mood states and job dissatisfaction can stimulate creativity and innovation. At the group level, research into minority influence (e.g., De Dreu, 2002; De Dreu & West, 2001; Van Dyne & Saavedra, 1996) and conflict in work teams (Lovelace, Shapiro, & Weingart, 2001) shows that when team climate is generally constructive, minority dissent and task-related conflict lead teams to be more innovative. In addition, some recent work suggests that the relationship between task-related conflict in teams and team innovation is curvilinear rather than linear—more innovations were found at moderate than at low or high levels of task conflict (Carnevale & Probst, 1998). Finally, at the organizational level of analysis, there is evidence that budget deficiency and lower 'slack' resources stimulate organizations to be more innovative in marketing and product development (e.g., Kanter, 1983). Also, at the organizational level, Zaltman et al. (1973) suggests that an organization innovates in order to cope with work overload or changing circumstances beyond their immediate control (see also West, 2002). We therefore propose that this multi-level class of phenomena can be combined into the single construct of distress-related innovation.

These results together suggest that threat and conflict, perhaps through stress, can stimulate innovation at the individual, group, and organizational levels of analysis, and perhaps these relations are curvilinear rather than linear. To date, however, these research efforts have been conducted in isolation and no cross-referencing takes place. Furthermore, at least the work by Zhou and George on individual creativity, and the work on team innovation by Anderson and West (Anderson & West, 1998; West & Anderson, 1996), De Dreu (2002; De Dreu & West, 2001), and Lovelace et al. (2001) is primarily multi-level in its design (e.g., threat by fellow team members predicts individual negative moods and innovativeness, or individual creativity following exposure to minority dissent predicts team level innovation). Future work on distress-related innovation at least requires a multi-level theory (outside changes in the organization's environment cause groups and individuals to act for innovations to emerge) for a black-box type of reasoning to be avoided. Figure 1 presents a heuristic framework of the distress–innovation relationship from a multi-level perspective.

The framework depicted in Figure 1 allows one to hypothesize both that distress-related variables act as a trigger for innovation, and that innovation acts as a trigger of distress and team conflict. Further, our framework posits interactions between the three levels of analysis of the individual, team, and organization. Innovation comes hand in hand with (sometimes fundamental) changes in the ways people work, it often creates ambiguity and uncertainty, and it undercuts basic routines people have developed over, sometimes, the course of many years. The distress-related innovation model in Figure 1 allows one to hypothesize that distress at one level of analysis affects innovation at another level. Thus, for instance, it can be that group-level distress (e.g., minority dissent) stimulates novel work processes at the individual level, which in turn reduces short-term profit at the level of the wider

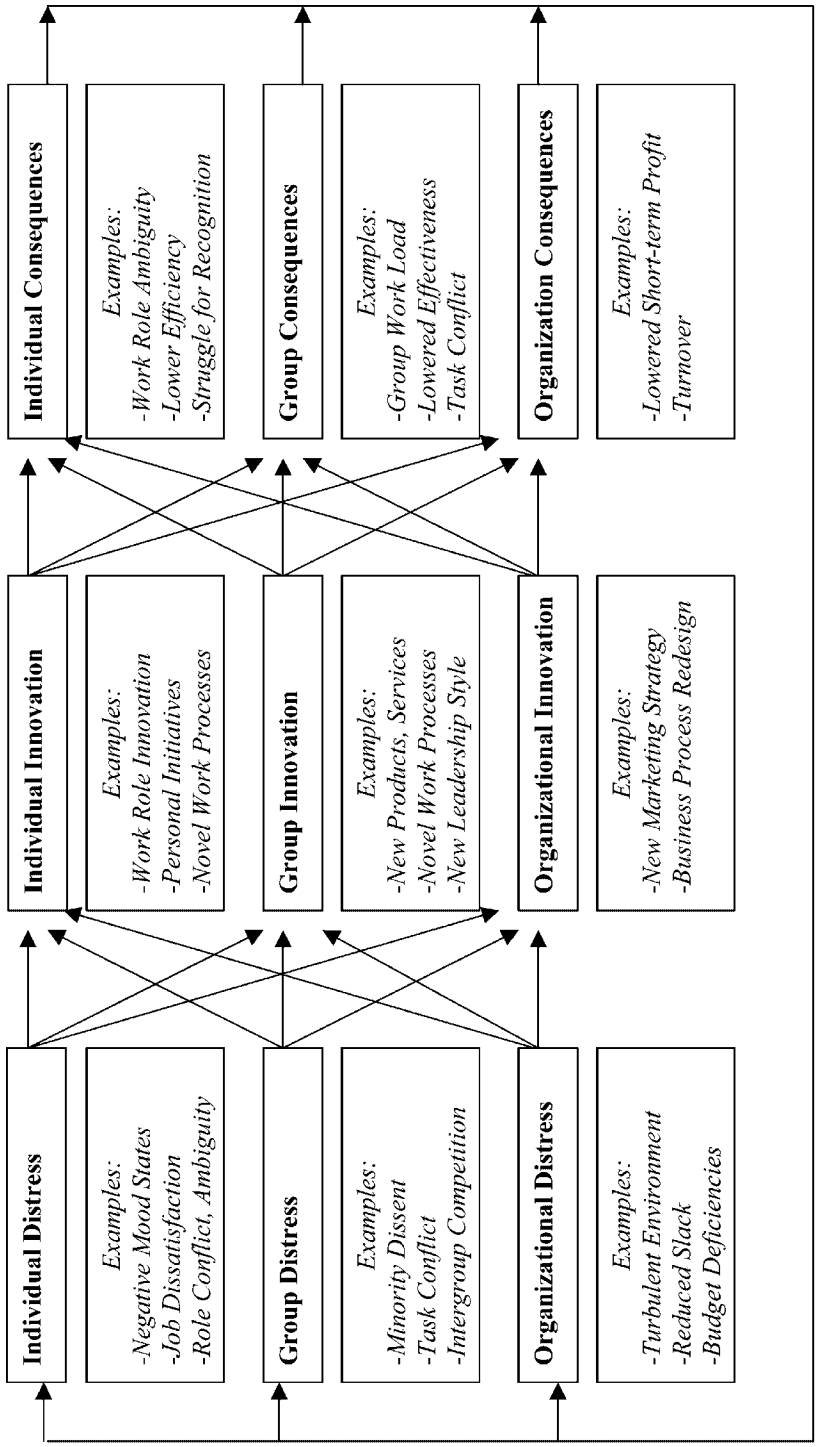

Figure 1. Distress-related innovation at three levels of analysis

organization. Also, the model allows one to hypothesize about possible negative consequences of innovation at various levels of analysis. Thus, for instance, individual-level distress (e.g., negative mood states) may perversely lead to individual-level innovation (e.g., personal initiatives) to attempt to alleviate these feelings, which in turn may lead to other possible negative consequences at the individual level (e.g., work role ambiguity), at the group level (e.g., conflict), and at the organizational level (e.g., turnover). Finally, the model is recursive, in that it recognizes that negative consequences of innovation at one level of analysis result in distress at the same, or another level of analysis. Thus, for instance, negative consequences of innovation at the group level (e.g., lowered short-term effectiveness) may result in individual level distress (e.g., negative mood states), or in organizational level distress (e.g., budget deficiencies).

The relationships depicted in Figure 1 cannot be tested at once with the use of primary studies, especially where it concerns hypotheses at the organizational level of analysis. Here, meta-analyses combining studies from the various levels of analysis will be particularly useful and informative. Meta-analysis can also be used to examine whether relationships between distress and innovation are curvilinear instead of linear. A study of specific predictions about cross-level interaction effects, in particular between individual- and group-level variables, can be undertaken with multi-level regression techniques as we have argued above. For this to become feasible, however, researchers should start to design studies in such a way that both individual-level and group-level constructs are measured reliably. To examine the effects of innovation on distress variables, especially at the individual and group levels, laboratory experiments may come in handy, as they allow careful manipulation (perhaps through false feedback) of the level of innovation an individual or group is confronted with.

Finally, we would note that our distress-related innovation model is congruent with earlier models of the innovation process found to be accurate portrayals of how innovation processes unfold over time in organizations (e.g., King, 1992; Van de Ven et al., 1999). We have simplified the model to consider just a single distress-related provoking variable and a single innovation example and consequent negative outcome at a different level of analysis in each case. In reality, of course, there will be numerous consequences and knock-on effects stemming from distress-related innovation at different levels of analysis. As a general model and heuristic, we propose that this model can be used by fellow researchers to stimulate ideas over possible relations, treatment of innovation as an independent or dependent variable (or both), and the likely predictors and consequences of distress-related innovations in the workplace.

Concluding Thoughts

Obviously, the distress-related innovation model in Figure 1 is but one way to think about innovation at various levels of analysis, and we do not pretend this idea to be the most innovative and in highest need of research. Here, it is more important to note that the ideas and relationships depicted in Figure 1 also reflect our intentions in writing this article. Deliberately, we tried to induce some distress by being critical about the state-of-the-science in the field of innovation research. There are evidently both bright sides and dark sides to the innovation field at its present stage of development. We assumed that creating some distress may provoke innovation in innovation research, and we have done so as an intentional attempt to provoke constructive controversy. To this end, we have made several suggestions in this paper, including treating innovation as the independent variable, widening our foci to include cross-cultural aspects of innovation initiation and implementation, using multilevel designs, conducting meta-analyses, and relying more on multi-method designs in future research. We believe that

following these suggestions will be beneficial for the field of innovation research, and will generate theory development and methodological advance in the field. It is our hope that in a few years' time innovation research will become as innovative as the multi-level phenomena it seeks to depict and explain in the workplace.

Acknowledgements

The authors wish to acknowledge Gerard Hodgkinson, Steve Kozlowski, the action editor, and the two anonymous reviewers for their valuable comments on an earlier version of this paper. Preparation of this article was supported by an Army Research Establishment grant to Neil Anderson. The opinions expressed in this paper are those of the authors alone and are not connected to these grant funding bodies.

Author biographies

Neil Anderson is Professor of Organizational Psychology at the University of Amsterdam, The Netherlands. His research interests include innovation and creativity at work, team climate and performance, selection and assessment, and organizational change. Further details are available at http//users.fmg.uva.nl/nanderson.

Carsten K. W. De Dreu is Professor of Organizational Psychology at the University of Amsterdam. His research is concerned with (1) conflict, negotiation, and group performance, (2) motivated information processing in group decision making, and (3) minority dissent and creative thinking. His work has been published in the major journals in social and organizational psychology, and it has received several international awards.

Bernard A. Nijstad received his PhD from Utrecht University in 2000. He is currently employed as an Assistant Professor at the Department of Work and Organizational Psychology of the University of Amsterdam. His research interests include group creativity and innovation, group decision making, and indecision.

References

Agrell, A., & Gustafson, R. (1996). Innovation and creativity in work groups. In M. A. West (Ed.), *The handbook of work group psychology* (pp. 317–343). Chichester: Wiley.

Amabile, T. M. (1983). *The social psychology of creativity.* New York: Springer-Verlag.

Amabile, T. M. (1988). A model of creativity and innovation in organizations. In B. Staw, & L. L. Cummings (Eds.), *Research in organizational behavior* (Vol. 10, pp. 123–167). Greenwich: JAI Press.

Anderson, C. A., & Bushman, B. J. (1997). External validity of 'trivial' experiments: the case of laboratory aggression. *Review of General Psychology, 1*, 19–41.

Anderson, N. (1998). The people make the paradigm. *Journal of Organizational Behavior, 19*, 323–328.

Anderson, N., & King, N. (1991). Managing innovation in organizations. *Leadership and Organization Development Journal, 12*, 17–21.

Anderson, N., & King, N. (1993). Innovation in organizations. In C. L. Cooper, & I. T. Robertson (Eds.), *International review of industrial and organizational psychology* (Vol. 8, pp. 1–34). Chichester: Wiley.

Anderson, N., & West, M. A. (1998). Measuring climate for work group innovation: development and validation of the team climate inventory. *Journal of Organizational Behaviour, 19*, 235–258.

Arndt, M., & Bigelow, B. (2000). Presenting structural innovation in an institutional environment: hospitals' use of impression management. *Administrative Science Quarterly, 45*, 494–522.

*Axtell, C. M., Holman, D. J., Unsworth, K. L., Wall, T. D., Waterson, P. E., & Harrington, E. (2000). Shopfloor innovation: facilitating the suggestion and implementation of ideas. *Journal of Occupational and Organizational Psychology, 73*, 265–285.

Baer, M., & Frese, M. (2003). Innovation is not enough: climates for initiative and psychological safety, process innovations, and firm performance. *Journal of Organizational Behaviour, 24*, 45–68.

Barr, S. H., & Hitt, M. A. (1986). A comparison of selection decision models in manager versus student samples. *Personnel Psychology, 39*, 599–617.

Barron, F., & Harrington, D. W. (1981). Creativity, intelligence and personality. *Annual Review of Psychology, 32*, 439–476.

Basadur, M., Graen, G. B., & Green, G. (1982). Training in creative problem solving: effects on ideation and problem finding and solving in an industrial research organization. *Organizational Behavior and Human Performance, 30*, 41–70.

Basadur, M., Graen, G. B., & Scandura, T. A. (1986). Training affects on attitudes toward divergent thinking amongst manufacturing engineers. *Journal of Applied Psychology, 71*, 612–617.

Bond, R., & Smith, P. B. (1996). Culture and conformity: a meta-analysis of studies using Asch's (1952b, 1956) line judgment task. *Psychological Bulletin, 119*, 111–137.

Bouwen, R., Steyaert, C., & De Visch, J. (1992). Organizational innovation. In D. M. Hosking, & N. Anderson (Eds.), *Organizational change and innovation: Psychological perspectives and practices in Europe*. London: Routledge.

Bunce, D., & West, M. A. (1994). Changing work environments: innovative coping responses to occupational stress. *Work and Stress, 8*, 319–331.

Carnevale, P. J., & Probst, T. M. (1998). Social values and social conflict in creative problem solving and categorization. *Journal of Personality and Social Psychology, 74*, 1300–1309.

Csikszentmihalyi, M. (1996). *Creativity: Flow and the psychology of discovery and invention.* New York: HarperCollins.

Damanpour, F. (1990). Innovation effectiveness, adoption and organizational performance. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies* (pp. 125–142). Chichester: Wiley.

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

Damanpour, F., & Gopalakrishnan, S. (2001). The dynamics of the adoption of product and process innovation in organizations. *Journal of Management Studies, 38*(1), 45–65.

De Cremer, D., & Van Knippenberg, D. (2002). How do leaders promote cooperation? The effects of charisma and procedural fairness. *Journal of Applied Psychology, 87*, 858–866.

De Dreu, C. K. W. (2002). Team innovation and team effectiveness: the importance of minority dissent and team reflexivity. *European Journal of Work and Organizational Psychology, 11*, 285–298.

De Dreu, C. K. W., & De Vries, N. K. (1993). Numerical support, information processing and attitude change. *European Journal of Social Psychology, 23*, 647–662.

De Dreu, C. K. W., & De Vries, N. K. (1997). Minority dissent in organizations. In C. K. W. De Dreu, & E. Van de Vliert (Eds.), *Using conflict in organizations* (pp. 72–86). London: Sage.

De Dreu, C. K. W., & Weingart, L. R. (2003). Task versus relationship conflict and team effectiveness: a meta-analysis. *Journal of Applied Psychology, 88*, 741–749.

*De Dreu, C. K. W., & West, M. A. (2001). Minority dissent and team innovation: the importance of participation in decision making. *Journal of Applied Psychology, 86*, 1191–1201.

Drazin, R., Glynn, M. A., & Kazanjian, R. K. (1999). Multilevel theorizing about creativity in organizations: a sensemaking perspective. *Academy of Management Journal, 24*, 286–307.

Edmonson, A. C., Bohmer, R. M., & Pisano, G. P. (2001). Disrupted routines: team learning and new technology implementation in hospitals. *Administrative Science Quarterly, 46*, 685–716.

Frese, M., & Zapf, D. (1994). Action as the core of work psychology: a German approach. In H. C. Triandis, M. D. Dunette, & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (Vol. 4, pp. 271–340). Palo Alto, CA: Consulting Psychologists Press.

*Frese, M., Teng, E., & Wijnen, C. J. D. (1999). Helping to improve suggestion systems: predictors of making suggestions in companies. *Journal of Organizational Behavior, 20*, 1139–1155.
*George, J. M., & Zhou, J. (2001). When openness to experience and conscientiousness are related to creative behavior: an interactional approach. *Journal of Applied Psychology, 86*, 513–524.
*George, J. M., & Zhou, J. (2002). Understanding when bad moods foster creativity and good ones don't: the role of context and clarity of feelings. *Journal of Applied Psychology, 87*, 687–697.
Gonzalez-Roma, V., Peiro, J. M., & Tordera, N. (2002). An examination of the antecedents and moderator influences of climate strength. *Journal of Applied Psychology, 87*, 465–473.
Greve, H. R., & Taylor, A. (2000). Innovations as catalysts for organizational change: shifts in cognition and search. *Administrative Science Quarterly, 45*, 54–80.
Hosking, D. M., & Anderson, N. (1992). Organizing change and innovation: challenges for European work and organizational psychology. In D. M. Hosking, & N. Anderson (Eds.), *Organizational change and innovation: Psychological perspectives and practices in Europe* (pp. 1–17) London: Routledge.
Howard, A. (Ed.). (1995). *The changing nature of work*. San Francisco: Jossey-Bass.
Hunter, J. E., & Schmidt, F. L. (1996). Cumulative research knowledge and social policy formulation: the critical role of meta-analysis. *Psychology, Public Policy, and Law, 2*, 324–347.
*Janssen, O. (2000). Job demands, perceptions of effort–award fairness and innovative work behaviour. *Journal of Occupational and Organizational Psychology, 73*, 287–302.
Joravsky, D. (1989). *Russian psychology: A critical history.* Oxford: Blackwell.
Kanter, R. M. (1982). The middle manager as innovator. *Harvard Business Review, 4*, 95.
Kanter, R. M. (1983). *The change masters.* New York: Simon & Schuster.
Katz, R. (1982). The effects of group longevity on project communication and performance. *Administrative Science Quarterly, 27*, 81–104.
Kenny, D. A., Mannetti, L., Pierro, A., Livi, S., & Kashy, D. A. (2002). The statistical analysis of data from small groups. *Journal of Personality and Social Psychology, 83*, 126–137.
Kimberly, J. R. (1981). Managerial innovation. In P. C. Nystrom, & W. H. Starbuck (Eds.), *Handbook of organizational design* (pp. 84–104). Oxford: Oxford University Press.
King, N. (1990). Innovation at work: the research literature. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies* (pp. 3–13). Chichester: Wiley.
King, N. (1992). Modeling the innovation process: an empirical comparison of approaches. *Journal of Occupational and Organizational Psychology, 65*, 89–100.
King, N., & Anderson, N. (2002). *Managing innovation and change: A critical guide for organizations*. London: Thompson.
King, N., Anderson, N., & West, M. A. (1992). Organizational innovation: a case study of perceptions and processes. *Work and Stress, 5*, 331–339.
Kirton, M. (1976). Adaptors and innovators: a description and measure. *Journal of Applied Psychology, 61*, 622–629.
Kirton, M. (1989). *Adaptors and innovators: Styles of creativity and problem-solving.* London: Routledge.
Klein, K. L., & Kozlowski, S. W. J. (Eds.). (2000). *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions*. San Francisco: Jossey-Bass.
Lovelace, K., Shapiro, D. L., & Weingart, L. R. (2001). Maximizing cross-functional new product teams' innovativeness and constraint adherence: a conflict communications perspective. *Academy of Management Journal, 44*, 779–783.
*Madjar, N., Oldham, G. R., & Pratt, M. G. (2002). There's no place like home? The contributions of work and nonwork creativity support to employees' creative performance. *Academy of Management Journal, 45*, 757–767.
Manz, C. C., Bastien, D. T., Hostager, T. J., & Shapiro, G. L. (1989). Leadership and innovation: a longitudinal process view. In A. Van de Ven, H. L. Angle, & M. Poole (Eds.), *Research on the management of innovation: The Minnesota studies* (pp. 1–23). New York: Harper & Row.
McGuire, W. J. (1997). Creative hypothesis generating in psychology: some useful heuristics. *Annual Review of Psychology, 48*, 1–30.
Meyer, A. D. (1982). Adapting to environmental jolts. *Administrative Science Quarterly, 27*, 515–582.
Miles, R. E., & Snow, C. C. (1978). *Organizational strategy, structure and process.* New York: McGraw-Hill.
Mohr, L. B. (1969). Determinants of innovation in organizations. *American Political Science Review, 63*, 111–126.
Mook, D. G. (1980). In defense of external invalidity. *American Psychologist, 38*, 379–387.
Nemeth, C. J. (1986). Differential contributions of majority and minority influence. *Psychological Review, 93*, 23–32.

Nemeth, C. J., & Wachtler, J. (1983). Creative problem-solving as a result of majority vs. minority influence. *European Journal of Social Psychology, 13*, 45–55.
Ng, K. Y., & Van Dyne, L. (2001). Individualism–Collectivism as a boundary condition for the effectiveness of minority influence in decision making. *Organizational Behavior and Human Decision Processes, 84*, 198–225.
Nicholson, N. (1990). Organizational innovation in context: culture, interpretation, and application. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies*. Chichester: Wiley.
Nicholson, N., Rees, A., & Brooks-Rooney, A. (1990). Strategy, innovation and performance. *Journal of Management Studies, 27*, 511–534.
Nijstad, B. A., & De Dreu, C. K. W. (2002). Creativity and group innovation. *Applied Psychology: An International Review, 51*, 401–407.
Nijstad, B. A., & Paulus, P. B. (2003). Group creativity: common themes and future directions. In P. B. Paulus, & B. A. Nijstad (Eds.), *Group Creativity*: *Innovation through collaboration* (pp. 326–339). New York: Oxford University Press.
Nystrom, H. (1979). *Creativity and Innovation.* Chichester: Wiley.
Nystrom, H. (1990). Organizational innovation. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies*. Chichester: Wiley.
Patterson, F. (1999). *Innovation potential predictor.* Oxford: Oxford Psychologists Press.
Paulus, P. B. (2000). Groups, teams and creativity: the creative potential of idea-generating groups. *Applied Psychology: An International Review, 49*, 237–262.
Paulus, P. B. (2002). Different ponds for different fish: a contrasting perspective on team innovation. *Applied Psychology: An International Review, 51*, 394–399.
Paulus, P. B., & Yang, H. C. (2000). Idea generation in groups: a basis for creativity in organizations. *Organizational Behavior and Human Decision Processes, 82*, 76–87.
Payne, R. L. (1990). Madness in our method: a comment in Jackofsky and Slocum's paper 'A longitudinal study of climates'. *Journal of Organizational Behaviour, 11*, 77–80.
Peters, T. J., & Waterman, R. H. (1982). *In search of excellence: Lessons from America's best run companies*. New York: Harper & Row.
Polzer, J. T., Milton, L. P., & Swann, W. B. (2002). Capitalizing on diversity: interpersonal congruence in small group work. *Administrative Science Quarterly, 47*, 296–324.
Rogers, E. (1983). *Diffusion of innovations* (3rd ed.). New York: Free Press.
Rousseau, D. M. (2000). Multilevel competencies and missing linkages. In K. L. Klein, & S. W. J. Kozlowski (Eds.), *Multilevel theory, research, and methods in organizations: Foundations, extensions, and new directions*. San Francisco: Jossey-Bass.
Sackett, P. R., & Larson, J. R. (1990). Research strategies and tactics in industrial and organizational psychology. In M. D. Dunnette, & L. M. Hough (Eds.), *Handbook of industrial and organizational psychology* (2nd ed., Vol. 1, pp. 419–489). Palo Alto, CA: Consulting Psychologists Press.
Salgado, J. F., & Anderson, N. (2002). Cognitive and GMA testing in the European Community: issues and evidence. *Human Performance, 15*, 75–96.
Schmidt, F. L., & Hunter, J. E. (1998). The validity and utility of selection methods in personnel psychology: practical and theoretical implications of 85 years of research findings. *Psychological Bulletin, 124*, 262–274.
Schroeder, R. G., Van de Ven, A., Scudder, G. D., & Polley, D. (1989). The development of innovation ideas. In A. Van de Ven, H. L. Angle, & M. Poole (Eds.), *Research on the management of innovation: The Minnesota studies*. New York: Harper & Row.
*Seibert, S. E., Kraimer, M. L., & Crant, J. M. (2001). What do proactive people do? A longitudinal model linking proactive personality and career success. *Personnel Psychology, 54*, 845–874.
*Shalley, C. E., & Perry-Smith, J. E. (2001). Effects of social-psychological factors on creative performance: the role of informational and controlling expected evaluation and modeling experience. *Organizational Behavior and Human Decision Processes, 84*, 1–22.
Shane, S., Venkataraman, S., & MacMillan, I. (1995). Cultural differences in innovation championing strategies. *Journal of Management, 21*, 931–946.
Simonton, D. K. (1991). Latent-variable models of posthumous reputation: a quest for Galton's G. *Journal of Personality and Social Psychology, 60*, 607–619.
Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. London: Sage.
Staw, B. M. (1990). An evolutionary approach to creativity and innovation. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies*. Chichester: Wiley.

Stevens, M. J., & Campion, M. A. (1994). The knowledge, skill, and ability requirements for teamwork: implications for human resource management. *Journal of Management, 20*, 503–530.
*Taggar, S. (2002). Individual creativity and group ability to utilize individual creative resources: a multilevel model. *Academy of Management Journal, 45*, 315–330.
*Tierney, P., Farmer, S. M., & Graen, G. B. (1999). An examination of leadership and employee creativity: the relevance of traits and relationships. *Personnel Psychology, 52*, 591–620.
Triandis, H. C. (1989). Self and social behavior in differing social contexts. *Psychological Review, 96*, 269–289.
Tjosvold, D. (1998). The cooperative and competitive goal approach to conflict: accomplishments and challenges. *Applied Psychology: An International Review, 47*, 285–313.
Van de Ven, A., Andrew, H., Polley, D. E., Garud, R., & Venkataraman, S. (1999). *The innovation journey.* New York: Oxford University Press.
Van de Ven, A., Angle, H. L., & Poole, M. (Eds.). (1989). *Research on the management of innovation: The Minnesota studies*. New York: Harper & Row.
Van Dyne, L., & Saavedra, R. (1996). A naturalistic minority influence experiment: effects of divergent thinking, conflict and originality in work-groups. *British Journal of Social Psychology, 35*, 151–167.
Walberg, H. J., Rasher, S. P., & Parkerson, J. (1980). Childhood and eminence. *Journal of Creative Behavior, 13*, 225–231.
Wallach, M. A. (1985). Creativity testing and giftedness. In F. D. Horowitz, & M. O'Brien (Eds.), *The gifted and talented: Developmental perspectives*. Washington DC: American Psychological Association.
West, M. A. (1987). Role innovation in the world of work. *British Journal of Social Psychology, 26*, 305–315.
West, M. A. (1990). The social psychology of innovation in groups. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies*. Chichester: Wiley.
West, M. A. (1997). *Developing creativity in organizations.* Leicester: BPS Books.
West, M. A. (2001). The human team: basic motivations and innovations. In N. Anderson, D. S. Ones, H. K. Sinangil, & C. Viswesvaran (Eds.), *Handbook of industrial, work and organizational psychology* (Vol. 2, pp. 270–288). London/New York: Sage.
West, M. A. (2002). Sparkling fountains or stagnant ponds: an integrative model of creativity and innovation implementation within groups. *Applied Psychology: An International Review, 51*, 355–386.
West, M. A., & Anderson, N. (1992). Innovation, cultural values and the management of change in British hospitals. *Work and Stress, 6*, 293–310.
West, M. A., & Anderson, N. (1996). Innovation in top management teams. *Journal of Applied psychology, 81*, 680–693.
West, M. A., & Farr, J. L. (1990). Innovation at work. In M. A. West, & J. L. Farr (Eds.), *Innovation and creativity at work: Psychological and organizational strategies*. Chichester: Wiley.
West, M. A., Patterson, M. G., & Dawson, J. F. (1999). A path to profit? Teamwork at the top. *Centrepiece, 4*, 6–11.
*West, M. A., Smith, H., Feng, W. L., & Lawthom, R. (1998). Research excellence and departmental climate in British universities. *Journal of Occupational and Organizational Psychology, 71*, 261–281.
West, M. A., & Wallace, M. (1991). Innovation in health care teams. *European Journal of Social Psychology, 21*, 301–315.
Zaltman, G., Duncan, R., & Holbeck, J. (1973). *Innovations and organizations*. New York: Wiley.
Zhou, J. (1998). Feedback valence, feedback style, task autonomy, and achievement orientation: interactive effects on creative performance. *Journal of Applied Psychology, 83*, 261–276.
*Zhou, J., & George, J. M. (2001). When job dissatisfaction leads to creativity: encouraging the expression of voice. *Academy of Management Journal, 44*, 682–696.
Zickar, M. J., & Highhouse, S. (2001). Measuring prestige of journals in industrial-organizational psychology. *Industrial-Organizational Psychologist, 38*(4), 29–36.

*Indicates study included in the content analysis.

