LEADERSHIP AND INNOVATION IN RESEARCH AND DEVELOPMENT TEAMS

LEIF DENTI
Leadership and Innovation in R&D Teams

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UNIVERSITY OF GOTHENBURG
DEPT OF PSYCHOLOGY

2013
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Leif Denti
Internet: http://hdl.handle.net/2077/33160
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Department of Psychology
University of Gothenburg
ISSN: 1101-718X
ISRN: GU/PSYK/AVH--283—SE

Cover design: Magnus Grettve
Printed in Sweden by Ineko AB, 2013

Gothenburg, SWEDEN, 2013
Nothing endures but change

Heraclitus
Abstract

This thesis focuses on the members of industrial research and development (R&D) teams and their leaders. The field of individual innovation is fragmented and lacks research that coherently integrates psychological factors that explain why antecedent variables affect individual innovation. Leadership, the major issue in this thesis, has been shown conclusively to influence employee innovation, but research is especially needed on (1) the psychological factors that explain the relationship between leadership and individual innovation, and (2) the contextual factors that affect leaders’ abilities to influence innovation in R&D teams. The aim of this thesis is therefore to identify and empirically test psychological and contextual factors that may explain how and when leaders influence innovation in R&D teams.

This thesis consists of four studies. Study I systematically reviews 30 years of research on leaders’ influence on innovation in order to identify the factors that mediate or moderate the relationship. The sample consists of 30 empirical studies in which leadership is the independent variable and innovation is the dependent variable. Study II and Study III are correlational studies based on Study I. In these studies, leadership is conceptualized using leader–member exchange theory (LMX). Individual innovation is measured by innovation outcomes (e.g., new patents, products, scientific publications, and other publications) and by leaders’ ratings of team members’ innovative work behavior.

The main findings indicate that individual personal initiative—the propensity to take a proactive stance to one’s work and to be persistent in overcoming challenges and setbacks—predicts individual innovation. A mediating effect is identified in which LMX is associated with innovation through the personal initiative of team members. Study II shows that organizational support—an organization’s active encouragement of innovation through the provision of resources and empowerment—moderates the relationship between LMX and individual personal initiative and thus strengthens the relationship when organizational support is high. Study III shows that creative self-efficacy—the belief in one’s ability to be creative—mediates the relationship between leadership and personal initiative. Moreover, Study III finds that the culturally bound value of conservation is negatively related to individual innovation. Highly conservative individuals value the status quo and are inclined to conform to established ways of doing things. Last, Study IV, which is an interview study, concludes that when R&D project leaders actively facilitate the development of new ideas and provide guidance and expertise, they may stimulate idea generation and increase the possibility of successfully completing innovation projects. Project leaders who limit team members’ work autonomy and neglect basic project management hinder the generation and implementation of innovative ideas.

The thesis concludes that leaders in R&D influence the innovativeness of their teams and employees. Various contextual and psychological factors at the individual, team, and organizational levels may facilitate or hinder the efforts of leaders to influence innovation outcomes.

Keywords: LMX, leadership, innovation, creativity, personal initiative, creative self-efficacy, intrinsic motivation, mediator, moderator, R&D
Populärvetenskaplig svensk sammanfattning


Syftet med avhandlingen är att identifiera och empiriskt testa (1) psykologiska faktorer som förklarar sambandet mellan ledarskap och innovation i forsknings- och utvecklingsmiljöer, samt (2) kontextuella faktorer som stärker eller försvagar sambandet mellan ledarskap och innovation.


Vidare kan organisationen i sig stödja innovation i större eller mindre utsträckning. Stödjande organisationer uppmuntrar innovation, till exempel genom att kommunicera att innovation är önskvärt och därigenom gynna en öppen dialog kring nya idéer. Stödet består även av i vilken grad organisationen tillhandahåller resurser öronmärkta för innovation såsom tid, pengar, information och tillgång till expertis. Stödjande organisationer ger också utökad frihet och mandat till utvecklingsgrupper. Avhandlingen visar att sambandet mellan ledarskap och personligt initiativtagande är starkare när graden av organisatoriskt stöd är starkt.

Studie II genomfördes i fem svenska industri företag där 163 gruppmedlemmar från 43 forsknings- och utvecklingsgrupper deltog tillsammans med deras ledare och avdelningschefer. Resultaten visade att individers benägenhet att ta initiativ förklarade sambandet mellan LMX och innovativt beteende samt innovativa utfall. Graden av organisatoriskt stöd påverkade styrkan i relationen mellan LMX och personlig initiativförmåga. Detta samband var starkast då organisatoriskt stöd var högt. Vidare var LMX positivt relaterat till individers interna motivation, men individers grad av motivation var i sin tur inte relaterat till deras innovation.

Studie III genomfördes i ett svenskt industri företag med forsknings- och utvecklingsgrupper från Sverige, Frankrike, USA och Indien. Totalt medverkade 266 gruppmedlemmar från 65 grupper, deras ledare och avdelningschefer. Även i denna studie förklarade individers benägenhet att ta initiativ sambandet mellan LMX och individuell innovation. Vidare förklarade individers kreativa självuppfattning sambandet mellan LMX och benägenhet att ta initiativ. Individer med hög kreativ själv-
uppfattning (creative self-efficacy) har en stark tro på sin egen förmåga att ta fram nya, värdefulla idéer. Ett tredje resultat från denna studie var att individers grad av traditionell lägning motverkade innovationer. Traditionell lägning (conservation) är en väsentlig aspekt av Schwartz värdeteori och varierar mellan länder. Individer med traditionell lägning är mer benägna att agera i enlighet med formella roller, normer, och för bevarandet av status quo. Individer med mindre grad av traditionell lägning är inriktade mot att söka förändring, personlig frihet och intellektuell utmaning. I Sverige har betydligt färre personer en traditionell lägning i jämförelse med andra länder.


I avhandlingen dras två huvudsakliga slutsatser. För det första verkar ledare ha ett inflytande på innovationsförmågan hos sina gruppmedlemmar. Till exempel kan de uppmuntra diskussion och idégenerering samt ge gruppmedlemmar känslan av att kunna ge ett kreativt bidrag. En högkvalitativ arbetsrelation med ömsesidig respekt och tillit, där både ledare och medarbetare bidrar till att uppnå gemensamma målsättningar, underlättar innovationer. Speciellt viktigt är att ledaren uppmuntrar nya initiativ. För det andra belyser avhandlingen vikten av att från ledningshåll aktivt stödja innovationer. Ledningsgrupper bör uppmuntra innovationer i kommunikation och handling, ge tillräckligt med frihet till utvecklingsgrupper och tillhandahålla resurser i form av tid, utrustning, information och expertkunskap.
Preface

This dissertation is based on the following four studies which will be referred to by their Roman numerals:


Acknowledgements

The last four years when researching this thesis have been the best of my life. During the journey I have encountered so many warm, intelligent and helpful people. This thesis is essentially a product of many people’s efforts and contributions. There are so many to thank. I feel a deep gratitude to you all.

First and foremost, I would like to give my very warmest and special thanks to my supervisor, Professor Sven Hemlin. You are a true scholar, an academic maven and a role model; curious, knowledgeable, and charismatic. I also thank Professor Stefan Tengblad, leader of the research project, for valuable input and discussions. I am especially thankful for the high amount of autonomy I experienced under your supervision. I also would like to thank my co-supervisor Professor Jan Johansson-Hanse for your vast methodological knowledge and sharp analytical sense.

Thank you Professor Mike Mumford for taking me under your wings during my stay at the University of Oklahoma in the fall of 2011. To my colleagues at CASR, thank you for welcoming me warmly and making me feel comfortable. I know it must have been odd dealing with a dapper, socialist, nihilist, Swede. I have made good friends and I hope to visit y’all someday when you are scattered about the world.

To my partners at the companies where the research was conducted, thank you for your collaboration. I thank AB Volvo for being the main partner company of this research project. A special thanks to Jonas Salén, Björn Flood, Peter Janevik, Johan Stenson, Nitin Patel, Martin Moberg, Ingrid Engström, Christer Ovrén, Marita Grundström, Jonas Thorngren, and Karin André. Without your patience and efforts, this thesis would not exist.

I have also many colleagues in Sweden to thank. As a fresh doctoral student I took my first stumbling steps at the Gothenburg Research Institute. I would like to thank all the good people there for welcoming me. A fresh doctoral student should also be challenged. A special thanks to Professor Dennis Töllborg and Karl Ydén for keeping me on my toes.

At the department of psychology, I would like to thank my colleagues who have always been there to help and support me. I have had many interesting conversations with you guys. Your knowledge into the human psyche is truly inspiring.
Thank you VINNOVA (The Swedish Governmental Agency for Innovation Systems) for funding the project.

Thank you AB Netsurvey and Mårten Westberg for excellent collaboration with study II.

Thank you Lisa Olsson, my “academic big sister”, for your support and good advice.

Thank you Carl-Christian Trönnberg for your advice and interesting conversations.

Thank you Isak Barbopoulos for your help with surveying participants in study III.

Thank you Nakima Ackerhans-Schreiber for your help with interviewing participants in study IV.

Thank you Magnus Jansson for reviewing the thematic categories in study IV.

Thank you Marcia Lynn-Halvorssen for your language editing and valuable questions.

Thank you Magnus Grettve for your splendid design of the cover of my thesis.

Last, but definitely not least, I thank my family for always supporting me: my parents, and my brother and sister. Thank you my dear friends for all your help. Writing a doctoral thesis requires some solid work. Thank you Anna for your deep love and understanding.

A sunny day in June
LEIF DENTI
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Introduction

Under pressure from international competition, with the demand for more complex and differentiated products and services, developing innovation capability has become a key goal of organizations. Shorter product life cycles, with frequent replacements and improvements, add to the pressure for innovation as production processes are shortened to meet deadlines (Tidd & Bessant, 2009). More and more researchers are studying the factors that promote innovation and its antecedent, creativity. Such factors have been identified at the level of the organization (see Damanpour & Aravind, 2012), the team (see Hülsheger, Anderson, & Salgado, 2009), and the individual employee (see Hammond, Neff, Farr, Schwall, & Zhao, 2011). However, the research on innovation among individuals is fragmented. There is little integration in the research of the psychological and contextual factors that explain why antecedent variables affect innovation at the individual level (Hammond et al., 2011; Shalley, Zhou, & Oldham, 2004; Yuan & Woodman, 2010).

This thesis focuses on individuals’ innovative activities in research and development (R&D) teams in organizations. The thesis takes an interactionist perspective on individual innovation. In this perspective, both psychological factors (such as an individual’s intrinsic motivation) and contextual factors (such as the degree of innovation support in an organization) influence innovative outcomes (Hemlin, Allwood, & Martin, 2004; 2008; Woodman, Sawyer, & Griffin, 1993). Leadership,
the major topic of this thesis, has been shown conclusively to influence employees’ innovation work (Rosing, Frese, & Bausch, 2011). However, research is especially needed on leadership in R&D (Elkins & Keller, 2003) and on the psychological factors that explain the relationship between leadership and innovation (Byrne, Mumford, Barrett, & Vessey, 2009; Mumford, Scott, Gaddis, & Strange, 2002; Shalley & Gilson, 2004).

This thesis proposes and integrates several factors that help explain how leaders influence innovation in R&D teams. The thesis investigates how leadership relates to innovation, examining the psychological factors that mediate the relationship between leadership and individual innovation. The thesis also investigates when leadership is related to innovation in its examination of the contextual factors that facilitate or hinder leaders’ efforts to promote innovation. Such moderators strengthen or weaken the relationship between leadership and innovation.
A closer look at innovation

What is innovation?

At its core, innovation is a form of change (Tidd & Bessant, 2009). This change can refer to an organization’s offerings such as goods or services (often called product innovation), or the way these offerings are created and delivered (often called process innovation). Innovation also occurs in the introduction of change to the organizational structure and its routines, policies, and methods. The changes resulting from innovation can have different degrees of novelty. Incremental innovations typically involve small changes (e.g., improvements) to an organization’s offerings (or processes) that build on existing knowledge and capabilities. In contrast, radical innovations are fundamental changes to an organization’s offerings that often prod the organization to take a new technological trajectory (Benner & Tushman, 2003).

Tidd and Bessant (2009) described four phases of a general innovation process. First, organizations must scan their environments to identify opportunities for innovation. For example, these opportunities may be new or changed customer needs, new technologies that stem from research activities, or pressures to conform to new legislation. This first phase, while vital, is often neglected by large organizations that would rather spend their resources on developing existing technology and catering to existing customers. As Christensen pointed out in his aptly named book, The Innovator’s Dilemma (1997), organizations that focus solely on refining their current offerings (through incremental innovation) may find themselves at a dead end when
markets change or new markets emerge with very different needs and expectations. In those cases, smaller organizations that focus solely on offerings that cater to new markets may best the old competitors (Isaksen & Tidd, 2006).

The second and third phases of the innovation process involve selection of the options that are most likely to produce a competitive edge and to the resourcing of those options. Here, resourcing refers to the acquisition of knowledge resources through R&D efforts, to their purchase, or to their collaborative development with others (often called “open innovation”; see Chesbrough, 2003).

The fourth phase is the implementation of the innovation, which often begins with an idea that develops through different stages toward a tangible outcome. As discussed above, outcomes can be a new goods or services (for sale to customers) or new processes or methods for the organization.

**Innovation and the fate of organizations**

Innovation is assumed to be an integral factor that contributes to organizational results such as long-term growth and profit (see Schumpeter, 1934). Many firms that are regarded as highly innovative are also market leaders. Examples include Apple, Google, Proctor & Gamble, The 3M Company, and Bosch (Isaksen & Tidd, 2006).

One should keep in mind that innovation is not easy. The process of developing innovations is inherently uncertain and involves considerable risk. For instance, ideas fail, new technologies emerge, and markets change (Tidd & Bessant, 2009). Furthermore, innovation projects experience delays because of their novelty, complexity, and unpredictability (Reiter-Palmon & Ilies, 2004). Ideas are the raw material for innovation in organizations. Initial ideas, however, rarely lead to tangible outcomes that create value for organizations.

For example, Stevens and Burley (1997), in their literature survey of new product development in many different markets, reached a striking conclusion. They found that of 300 ideas for new offerings (e.g., goods or services) proposed to management, only about 125 of them actually resulted in new projects. Of these 125 projects, nine developed into larger projects, four resulted in major development efforts, and two resulted in new products. Of the new products launched, only one was profitable. They also found that approximately 90 to 95 percent of all U.S. patents lack any market relevance, and only 1 percent are profitable. Other estimates indicate that approximately 30 to 95 percent of the ideas for new offerings are unsuccessful (Tidd, Bessant, & Pavitt, 2001).

Given these odds, Getz and Robinson (2003, p. 132) suggest “companies might well be better off putting their money in the lottery!” However, companies rarely have the option of not innovating, especially in today’s turbulent and fast-paced business
environment. Christensen (1997) and others (e.g., Tidd & Bessant, 2009) remind us that unless companies renew their offerings on a continual basis, their chances for survival are severely reduced. There are numerous examples of firms that failed to innovate in time. IBM received plenty of warning in the 1990s that technology had shifted from large mainframe computers into more decentralized networked computing. However, IBM reacted too late to this shift in technology and nearly missed the opportunity as a result. Another example is Polaroid Company that failed to recognize the developing digital imaging technology, and ultimately went into bankruptcy (Isaksen & Tidd, 2006). Hasselblad, which failed similarly, was ultimately acquired by two venture capital firms.

According to Tidd and Bessant (2009), innovation, which results in a number of strategic advantages, allows organizations to stay ahead of their competition. For example, the complexity of an offering (e.g., microchips that competitors have difficulties copying) and the possibilities for legal protection (e.g., for new drugs) increase these advantages. Another advantage that innovation can provide relates to the more efficient processes that can shorten production time. For example, Japanese car manufacturers, by fine-tuning their various processes, were able to offer better quality, flexibility, and choice while maintaining the same sales price for their cars. Finally, innovation creates strategic advantages related to timing, such as first-mover advantages, which allow a company to be the first in a new market.

Company profits reveal clearly that innovation matters. For example, the median profit margin for the 25 top innovative firms in the world\(^1\) in 1995-2005 was 3.4 percent. The median profit margin for firms listed in the S&P Global Index in the same time period was 0.4 percent (Hauptly, 2008).

**The elusive concepts of innovation and creativity**

The concepts of innovation and creativity are highly intertwined and are often used interchangeably in the literature (Basadur, 2004; Csikszentmihalyi, 1999). This is partly because innovation and creativity have been defined similarly. OECD (2005, p. 46) defined innovation as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations,” while Woodman et al. (1993, p. 293) defined creativity as “the creation of a valuable, useful new product, service, idea, procedure or process.” The two definitions are similar because both relate to outcomes. Moreover, the concepts of innovation and creativity are intertwined because creativity precedes innovation in a multi-stage

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\(^1\) *Per* Business Week.
process with the goal of new outcomes. Creativity is required at various stages of the process of turning ideas into outcomes, but it is only part of the innovation process. In this view, creativity is often defined as idea generation, or ideation. For instance, according to Amabile et al. (1996, p. 1155), creativity is “the production of novel and useful ideas.” Innovation is the subsequent realization and implementation of ideas into outcomes (Anderson, De Dreu, & Nijstad, 2004; Mumford & Gustafson, 1988; Shalley & Gilson, 2004).

Thus, creativity can be thought of as a necessary but insufficient condition for the creation of novel and original outcomes. Creativity must be present in order to achieve these outcomes, but creativity by itself is not enough. Rather, creative ideas must be realized and implemented. Another aspect is that innovation, as an implementation-focused process, aims to benefit the organization, although this is not necessarily the goal of creativity (Anderson et al., 2004).

This thesis follows the OECD’s (2005) definition of innovation. It views creativity as the generation of novel and useful ideas (Amabile et al., 1996). Innovation is the effort to turn those ideas into realities.

**Measuring innovation**

Innovation has traditionally been conceptualized and measured in the technology-based domains such as manufacturing (Martin, 2012). In these domains, attention focuses on new products and patents, and, to a lesser extent, on R&D funding and the number of R&D researchers (Archibugi & Pianta, 1996). Other measures of innovation are the numbers of invention disclosures and research reports (e.g., Scott & Bruce, 1994), the number and effectiveness of implemented innovations (e.g., Rank, Nelson, Allen, & Xu, 2009), and the number of scientific publications (e.g., Keller, 2012). Figures such as annual R&D expenditure as a percentage of gross revenue (e.g., Jung, Wu, & Chow, 2008) and the ratio of new product sales to total sales (e.g., Gumusluoğlu & Ilsev, 2009) have also been used to measure innovation. See Table 1 for an overview of these innovation measures.

**Dark innovation.** However, there is a danger in conceptualizing and measuring innovation using only broad measures such as patents and products (Martin, 2012). Many activities that could be characterized as innovative are missed if such measures are used (although some researchers, such as Archibugi and Pianta (1996), argue that a large share of firms’ inventions are patented). Martin (2012) labels these activities as “dark innovation” because they are overlooked by the searchlight of “conventional” innovation measures. Some dark innovation examples are activities (1) that are incremental accomplishments too small to be correctly measured using typical innovation indicators, (2) that involve little formal R&D, and (3) that are rarely
patented. A challenge for the future conceptualization and measurement of innovation is how such dark innovations should be identified and measured.

**Innovative work behavior.** This thesis confronts the dark innovation challenge in its attempt to measure and validate one crucial aspect of dark innovation, namely the specific behaviors of R&D team members. An implicit assumption of this method for measuring innovation is that a higher frequency of a specific type of behavior promotes innovative outcomes in organizations.

A number of conceptualizations and scales have been suggested as ways to measure those behaviors (e.g., De Jong, 2008; Janssen, 2000; Krause, 2004; Scott & Bruce, 1994). For example, De Jong (2008) and De Jong & Den Hartog (2010) described four types of innovative work behaviors that they theoretically identified and empirically validated: i) opportunity exploration, ii) idea generation, iii) championing, that is, rallying support for one’s ideas, and iv) implementation. Behavioral scales can be used in the context of the individual (e.g., Atwater & Carmeli, 2009), the team (e.g., Hurley & Hult, 1998), the supervisor or leader (e.g., Scott & Bruce, 1994), peer reports (e.g., Amabile, Schatzel, Moneta, & Kramer, 2004), and expert or external assessments (e.g., Jung et al., 2008; Sosik, Avolio, & Kahai, 1997). Furthermore, innovative work behavior scales have been positively related to innovation measures such as invention disclosures (Scott & Bruce, 1994) and the number and effectiveness of implemented innovations (Rank et al., 2009).

Innovative work behavior may be a promising construct for measuring dark innovations in organizations. The behavioral measure is statistically related to the more conventional innovation measures (e.g., products and patents) and additionally may cover aspects of organizational innovation related to more informal and incremental activities. Yet considerable challenges remain before we can conclusively accept behavioral data as proxies for innovation. First, behavioral reports depend on human judgments, and are thus more open to biases than measures of tangible innovation outcomes. Second, the collection of independent (i.e., leadership assessments) and dependent variables (i.e., self-rated innovation scales) from the same individuals invites statistical and methodological biases such as the common method bias. This bias refers to the situation when the covariance between variables is “attributable to the measurement method rather than to the constructs the measures represent” (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003, p. 879). As a consequence, the bias may inflate relationships between variables. Third, it is still a challenge to show conclusively that a high prevalence of innovative work behaviors at organizations is related to innovation outcomes.

Theoretically, since both types of innovation measures account for the same phenomenon, we should expect that the two measures would be related. For instance,
innovative work behavior most likely precedes tangible outcomes of innovation such as new products or product improvements. Furthermore, it is important to consider measurement levels (individual, team, or organization) when evaluating correlations between subjective measures and quantitative measures. For instance, assessments of individual innovative behavior should yield the highest correlations with outcome measures at the individual level. We should expect lower correlations if assessments of individual innovative behavior are correlated with outcome measures at the team level.

Table 1 and 2 provide an overview of commonly used innovation measures, both outcome measures (Table 1) and subjective innovation measures (Table 2). Corroborating correlations with other measures of innovation are shown in the columns “convergent validity”.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Example study</th>
<th>Convergent validity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of invention disclosures</td>
<td>Scott &amp; Bruce (1994)</td>
<td>Significant correlation with leader-rated individual innovation behavior ($r = .33^*$)</td>
</tr>
<tr>
<td>Number and effectiveness of implemented innovations (leader rated)</td>
<td>Rank et al. (2009)</td>
<td>Significant correlation with leader-rated individual innovation behavior ($r = .44^*$)</td>
</tr>
<tr>
<td>Number of patents, last 5 years</td>
<td>Keller (2012)</td>
<td>Significant correlation with number of publications ($r = .35^*$)</td>
</tr>
<tr>
<td>Number of publications, last 5 years (both external and internal to the company)</td>
<td>Keller (2012)</td>
<td>Significant correlation with number of patents ($r = .35^*$)</td>
</tr>
<tr>
<td><strong>Team level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of process innovations</td>
<td>West, Borril, Dawson, Brodbeck, Shapiro, &amp; Haward (2003)</td>
<td>Other measures were not collected</td>
</tr>
<tr>
<td><strong>Organization level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of patents</td>
<td>Jung et al. (2008)</td>
<td>Significant correlation with expert ratings of 50 organizations ($r = .50^*$)</td>
</tr>
<tr>
<td>Number of patent citations</td>
<td>Makri &amp; Scandura (2010)</td>
<td>No correlation with number of patents</td>
</tr>
<tr>
<td>Ratio of annual R&amp;D spending to annual sales</td>
<td>Jung et al. (2008)</td>
<td>No correlation with patents or expert ratings, but similar pattern of correlations with independent variables</td>
</tr>
<tr>
<td>Ratio of sales of new products to total sales</td>
<td>Czarnitzki &amp; Kraft (2004)</td>
<td>Other measures were not collected</td>
</tr>
<tr>
<td>1. Ratio of sales of new products to total sales, 2. ratio of sales of new products to R&amp;D expenditures</td>
<td>Gumusluoğlu &amp; Ilsev (2009)</td>
<td>Other measures were not collected</td>
</tr>
<tr>
<td>Number of 1. product/market innovations (i.e., new products and new markets entered) and 2. organizational innovations (e.g., new planning/control systems) adopted by an organization over a two-year period</td>
<td>Elenkov &amp; Manev (2009)</td>
<td>The sub-dimensions of the product/market innovations and organizational innovations loaded on separate factors; they correlated significantly ($r = .42^*$)</td>
</tr>
<tr>
<td>Number of 1. new products, 2. new markets entered, 3. total R&amp;D spending, 4. employees in R&amp;D</td>
<td>García-Morales, Matías-Reche, &amp; Hurtado-Torres, 2008</td>
<td>Significant correlation with CEO subjective ratings of organizational innovation ($r = .88^*$)</td>
</tr>
</tbody>
</table>

* p-value not reported.

' Correlation is significant at the 0.05 level (two-tailed)

** Correlation is significant at the 0.01 level (two-tailed)
### TABLE 2
Subjective rating scales in innovation research at the individual, team, and organizational levels

<table>
<thead>
<tr>
<th>Measure</th>
<th>Example study</th>
<th>Convergent validity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovative work behavior (leader-rated)</td>
<td>Scott &amp; Bruce (1994)</td>
<td>Significant correlation with number of invention disclosures ($r = .33^*$)</td>
</tr>
<tr>
<td></td>
<td>De Jong &amp; Den Hartog (2010)</td>
<td>Significant correlation with employee-rated innovation scale ($r = .35^*$)</td>
</tr>
<tr>
<td>Innovative output (leader-rated)</td>
<td>Axtell, Holman, Unsworth, Wall, &amp; Waterson (2000)</td>
<td>Significant correlations with employees’ self-ratings on the same measure (Sub dimension ‘suggestions’: $r = .062^<em>$; sub dimension ‘implementations’: $r = .42^</em>$)</td>
</tr>
<tr>
<td><strong>Team level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team innovativeness (self-rated)</td>
<td>Hurley &amp; Hult (1998)</td>
<td>No correlation with number of ideas adopted by the organization.</td>
</tr>
<tr>
<td></td>
<td>Burpitt &amp; Bigoness (1997)</td>
<td>Other measures were not collected</td>
</tr>
<tr>
<td></td>
<td>Somech (2006)</td>
<td>Other measures were not collected</td>
</tr>
<tr>
<td><strong>Organizational level</strong></td>
<td></td>
<td></td>
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<tr>
<td>Exploratory/exploitative innovation of business unit (leader-rated)</td>
<td>Jansen, Van Den Bosch, &amp; Volberda (2006)</td>
<td>Exploitative innovation was significantly correlated with measures of financial performance ($r = .18^*$)</td>
</tr>
<tr>
<td>Organizational innovation (leader-rated)</td>
<td>Chen, Tjosvold, &amp; Liu (2006)</td>
<td>Other measures were not collected</td>
</tr>
<tr>
<td>Organizational innovation (CEO-rated)</td>
<td>García-Morales et al. (2008)</td>
<td>Significant correlation ($r = .88^*$) with quantitative measures (Number of 1. new products, 2. new markets entered, 3. total R&amp;D spending, 4. employees in R&amp;D)</td>
</tr>
<tr>
<td>Innovation as an entrepreneurial activity (CEO-rated)</td>
<td>Ling, Simsek, Lubatkin, &amp; Veiga (2008)</td>
<td>Significant correlation with the sales growth of an organization ($r = .27^*$)</td>
</tr>
<tr>
<td><strong>Innovation as an entrepreneurial activity (CEO-rated)</strong></td>
<td>Zahra (1996)</td>
<td>Significant correlations with firms 1. R&amp;D spending as a percentage of sales, 2. No. of new products, 3. Revenue from new businesses ($r$ not disclosed)</td>
</tr>
</tbody>
</table>

* p-value not reported.

1. *Correlation is significant at the 0.05 level (two-tailed)

2. **Correlation is significant at the 0.01 level (two-tailed)
Determinants of innovation

More than three decades of innovation research (1980–2013) present a fairly comprehensive picture of the antecedent factors that facilitate organizationally based innovation at the individual, team, and organizational levels (Anderson et al., 2004). However, the processes that result in innovation are complex because they occur at various and nested levels of human organizing. In addition, the commercial side of innovation demands more precise information about organizational innovativeness (Kanter, 1996; Paulus & Yang, 2000; Shalley & Perry-Smith, 2000; Sternberg, 1999; Williams & Young, 1999). This thesis acknowledges that many authors (e.g., Carlsson, 1997; Edqvist, 1997), particularly in the area of economics, view innovations as mainly the result of inter-organizational processes. This thesis does not examine this field of innovation research—i.e., innovation systems—because the focus is intra-organizational factors and processes.

This thesis takes an interactionist perspective on human organizing in that it acknowledges that innovative outcomes are the results of psychological and contextual factors (Ford, 1996; Woodman et al., 1993). The theoretical framework for this thesis is Creative Knowledge Environments (CKE) that Hemlin, Allwood, and Martin (2004; 2008) developed. They defined Creative Knowledge Environments as follows:
...those environments, contexts and surroundings, the characteristics of which are such that they exert a positive influence on human beings engaged in creative work aiming to produce new knowledge or innovations, whether they work individually or in teams, within a single organization or in collaboration with others. (Hemlin et al., 2004, p. 1)

CKE operate at several levels. Individuals are on work teams (at the micro level) within an organization or an organizational department (at the meso level). The organization/department is in a sector (university, industry), in a region, and in a nation (the macro level). At the macro level, market characteristics, laws, and regulations as well as regional, national, and cultural characteristics have influence. These levels can be described as mutually influential. For example, individuals, who are often members of teams, are influenced by factors such as team climate and leadership. In turn, teams, which are in departments or areas in the organization, are influenced by the organizational culture, resource availability, and various structural factors. This thesis focuses primarily on the micro level by investigating the relationship between team leadership and innovation.

CKE is similar to other noteworthy conceptualizations of creativity and innovation in organizations—Woodman et al.’s (1993) early interactionist theory of organizational creativity, and Ford’s (1996) multi-level theory of creative action in social domains. Several reviews and meta-analyses on individual innovation are central to this thesis. In a recent review of innovation research, Anderson et al. (2004) identified several key factors that facilitate innovation at three levels: the individual, team, and organizational levels. Other literature reviews and meta-analyses have described various factors related to individual level innovation (Hammond et al., 2011), leadership as a predictor of innovation (Mumford et al., 2002; Rosing et al., 2011), team and organizational climate (Hülsheger et al., 2009; Hunter, Bedell, & Mumford, 2007), and organizational factors that influence innovation (Damanpour, 1991; Damanpour & Aravind, 2012). Table 3 synthesizes and condenses this literature with reference to Anderson et al. (2004) and Hemlin et al. (2008).
<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Factor</th>
<th>Studies (empirical/meta-analytic)</th>
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</thead>
<tbody>
<tr>
<td><strong>Individual level</strong></td>
<td></td>
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</tr>
<tr>
<td>Personality</td>
<td>Openness to experience, conscientiousness (N), autonomy, proactivity,</td>
<td>Barron &amp; Harrington (1981); George &amp; Zhou (2001); Keller</td>
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<tr>
<td></td>
<td>locus of control, need for achievement</td>
<td>(2012); Seibert, Kraimer, &amp; Crant (2001)</td>
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<tr>
<td>Motivation</td>
<td>Intrinsic motivation, extrinsic motivation (N), self-efficacy, creative</td>
<td>Frese, Teng, &amp; Wijnen (1999); Hammond et al. (2011); Prabhu,</td>
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<tr>
<td></td>
<td>self-efficacy</td>
<td>Sutton, &amp; Sauser (2008); Tierney &amp; Farmer (2011)</td>
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<tr>
<td>Cognitive ability</td>
<td>Knowledge and expertise, divergent thinking in combination with</td>
<td>Basadur, Graen, &amp; Scandura (1986); Feist &amp; Gorman (1998)</td>
</tr>
<tr>
<td>and style</td>
<td>convergent thinking</td>
<td></td>
</tr>
<tr>
<td>Task characteristics</td>
<td>Complexity, autonomy, challenge, stimulation, pressure (curvilinear)</td>
<td>Amabile et al. (1996); Hammond et al. (2011); Hunter et al.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2007)</td>
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<tr>
<td><strong>Team level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>Job relevant diversity, background diversity (N), cohesion (curvilinear),</td>
<td>Hülsheger et al. (2009); Keller (2001); West &amp; Anderson (</td>
</tr>
<tr>
<td></td>
<td>size (N), goal inter-dependence</td>
<td>(1996)</td>
</tr>
<tr>
<td>Climate</td>
<td>Internal and external communication, openness, emotional safety,</td>
<td>Amabile et al. (1996); Anderson &amp; West (1998); Bain, Mann,</td>
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<tr>
<td></td>
<td>interpersonal relationships, participation, idea support, risk-taking,</td>
<td>&amp; Pirola-Merlo (2001); Ekvall (1996); Hunter et al. (2007);</td>
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<tr>
<td></td>
<td>task orientation, conflict (N)</td>
<td>Tierney, Farmer, &amp; Graen (1999)</td>
</tr>
<tr>
<td>Leadership/leader</td>
<td>Participation, support, vision, goal setting, expertise, problem</td>
<td>Hülsheger et al. (2009); Mumford et al. (2002); Pearce &amp;</td>
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<tr>
<td>traits</td>
<td>solving skills</td>
<td>Ensley (2004); Tierney et al. (1999); Rosing et al. (2011)</td>
</tr>
<tr>
<td><strong>Organizational level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structure</td>
<td>Specialization, functional differentiation, internal/external</td>
<td>Damanpour (1991); Damanpour &amp; Aravind (2012); Ekvall (1996)</td>
</tr>
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<td></td>
<td>communication, formalization (N), centralization (N)</td>
<td></td>
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<tr>
<td>Culture</td>
<td>Espoused/enacted support for innovation, experimentation, risk-taking,</td>
<td>Amabile et al. (1996); Ekvall (1996); Ekvall &amp; Ryhammar (</td>
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<tr>
<td></td>
<td>openness, trust, empowerment</td>
<td>(1999); Mann (2005); West &amp; Anderson (1996)</td>
</tr>
<tr>
<td>Resources</td>
<td>Time, money, facilities, information, knowledge and expertise</td>
<td>Amabile et al. (1996); Damanpour (1991); Mann (2005)</td>
</tr>
</tbody>
</table>

Adapted from Anderson et al. (2004, p. 150) and Hemlin et al. (2008, p. 201).

Note: Factors thought to have a negative or curvilinear relationship with innovation are marked "(N)" and "(curvilinear)" respectively.
Determinants of innovation at the organizational level

Organizational structure. Burns and Stalker (1961), in their seminal work, described the difference between mechanistic and organic organizational structures. Mechanistic organizations typically rely on a high degree of formalization (using rules and procedures) and centralization (concentration of decision-making at upper management levels). Furthermore, mechanistic organizations tend to have a lower degree of complexity (differentiation of functions) compared to organic organizations. Organic organizations, on the other hand, have more areas of expertise and thus a broader knowledge base (specialization), as well as a greater tendency for employees to engage in cross-functional collaboration. Organic organizations also tend to engage in more internal and external communication. Internal communication within the organization spreads knowledge and ideas. External communication outside the organization promotes scanning the environment for opportunities, forming cooperative alliances with other organizations, and absorbing knowledge (also known as absorptive capacity). Managers at organic organizations, who are typically more favorably inclined toward change, are more likely to challenge the status quo (Burns & Stalker, 1961; Damanpour, 1991).

Damanpour (1991) tested the relationships between innovation and organizational characteristics (formalization, centralization, specialization, internal and external communication, and attitudes toward change) in a meta-analysis. Damanpour and Aravind (2012) re-tested these characteristics using a sample of studies published between 1991 and 2009. These two meta-analyses resulted in a similar pattern of correlations between the organizational characteristics and innovation, which suggests robustness of the relationships. Four characteristics that demonstrated good effect sizes in both meta-analyses were the following: specialization, complexity, external communication, and the degree of available technical knowledge resources. In addition, three characteristics that had positive effects in the 1991 meta-analysis also had positive correlations in a majority of the characteristics in the 2012 sample: professionalism (the degree of education and experience of organizational members), internal communication, and managerial attitude towards change. In summary, innovation appear to occur more naturally in decentralized, organic, and flexible contexts than in mechanistic and rigid organizational contexts (Jung et al., 2008; Kanter, 1996; Mumford et al., 2002; Thompson, 1965).

Organizational culture. The culture of an organization, specifically its degree of organizational support, also influences innovation (Amabile et al., 1996; Anderson & West, 1998; Hemlin et al., 2008; Pirola-Merlo, Bain, & Mann, 2005; Woodman et al., 1993). A number of studies have shown that support for innovation is positively
related to team innovation (e.g., Agrell & Gustafson, 1994; Anderson & West, 1998; Hülsheger et al., 2009; Pirola-Merlo, 2000). When teams and individuals are supported, they feel they can test new ideas and methods aimed at achieving their goals or completing their tasks (Pirola-Merlo et al., 2005).

Pirola-Merlo (2000) suggested dividing organizational support into three forms. The first form is organizational encouragement of innovation, that is, the extent to which individuals perceive various types of support such as idea encouragement, trust, emotional safety, and acceptance of risk-taking. The second form is access to needed resources such as time, materials, expertise, and information. The third form is empowerment, that is, the extent to which individuals feel autonomous as they undertake tasks. Such organizational support may lead to actual advances in innovation (Bain et al., 2001; Ekvall & Ryhammar, 1999).

In a questionnaire study among hospital management groups, West and Anderson (1996) found that organizational support for innovation was the strongest predictive factor of innovation, (i.e., the implementation of organizational changes). In particular, autonomy, or the freedom to pursue ideas, has consistently been linked to innovation (e.g., Ekvall, 1996; Hunter et al., 2007). Granting autonomy, which is a signal of trust, can empower teams and individuals who, as a result, experience a sense of ownership and control (Amabile, 1998; Mann, 2005; Pirola-Merlo, 2000).

**Resources.** From an organizational perspective, innovation is often resource-intensive (Damanpour & Aravind, 2012; Mumford et al., 2002; Woodman et al., 1993). These resources may be the money, time, and facilities for new projects that develop research ideas (Pirola-Merlo, 2000) or, increasingly important, the access to relevant information and knowledge (Tidd & Bessant, 2009).

**Determinants of innovation at the team level**

**Team composition.** Primarily, there are two types of diversity in teams: job-relevant diversity and background diversity. Job-relevant diversity refers to employees’ different competences and functions, education, tenure, skills, and knowledge. Background diversity mainly refers to employees’ age, gender, and ethnicity. The literature proposes that job-relevant diversity encourages team innovation because of the different perspectives and approaches that stimulate the communication of diverse information (e.g., Paulus & Yang, 2000; Reiter-Palmon, de Vreede, & de Vreede, 2013; West & Anderson, 1996). Hülsheger et al.’s (2009) meta-analysis related job-relevant diversity positively to team innovation but related background diversity negatively to team innovation. They explained that diverse backgrounds might impede communication, thereby increasing the risk of conflict and misunderstanding. In a longitudinal study of four manufacturers, Keller (2001) found that job-relevant
diversity indirectly influenced the performance of 93 cross-functional R&D teams as far as their product technical quality and scheduling.

**Team size.** Some scholars have suggested that team size (i.e., the number of team members) is positively related to innovation. More team members increase the likelihood that the team has sufficient competences (e.g., Stewart, 2006). Hülsheger et al. (2009) also found this positive relationship in their meta-analysis. However, at the individual level, they found a slightly negative relationship between team size and innovation. These findings suggest that team size is important when a team works on a complex innovation task that requires many and various competences, but a larger team size may encourage social loafing and free riding.

**Team climate.** Several factors pertaining to team climate have been linked to innovation. Team climate is the psychological atmosphere in the team and its organizational environment (Hemlin et al., 2008). Team creativity is facilitated when team member relationships (including the relationships with their supervisors) are positive and supportive. In this climate, ideas are encouraged, and risk-taking is approved (Hunter et al., 2007), members work together and communicate closely (Hülsheger et al., 2009), conflict is low (Ekvall, 1996), and joy is present (Hemlin, 2009).

An important team climate factor is the nature of its information exchange (Mumford et al., 2002). Internal communication refers to the information-sharing interactions within the team. External communication refers to the information-sharing interactions outside the team. These interactions are thought to increase the likelihood of new knowledge and perspectives entering the team (Perry-Smith & Shalley, 2003). It is especially important how a team uses these communication channels in innovation ventures where objectives are complex and ambiguous (Keller, 2001; Reiter-Palmon & Ilies, 2004). Hülsheger et al. (2009) related both internal and external communication positively to team innovation.

**Task orientation.** When team members agree that task outcomes should be as excellent as possible, the team has a high degree of task orientation. In such teams, members think about which processes and strategies can achieve their objectives. Typically, various ideas to improve the quality of decisions about processes and strategies are explored (Hemlin, 2008; Hülsheger et al., 2009). Often task orientation is a sub-construct in various team climate scales. An example is the Team Climate Inventory (TCI) that Anderson and West (1998) related to team innovation in R&D (see also Pirola-Merlo et al., 2005). A closely linked concept is goal interdependence, which is the extent to which team members share the same goals. In the meta-analysis by Hülsheger et al. (2009), goal interdependence was positively related to team innovation.
Vision. A team’s vision is a clear expression of the purpose and importance of its goals (West & Anderson, 1996). A vision helps team members channel their efforts into solving problems and completing tasks. Hülsheger et al. (2009) found that a leader’s support of the team vision through good communication and task-oriented focus was one of the strongest predictors of team innovation. Other studies have also established relationships between leader support for team vision and team innovation (e.g., Pieterse, van Knippenberg, Schippers, & Stam, 2010).

Determinants of innovation at the individual level

Personality. In a multi-faceted review of artists’ and scientists’ personalities, Feist and Gorman (1998) described the creative personality. Individuals with such personalities, they claim, are open, flexible, and self-confident. Such individuals also have high self-efficacy and a strong need for autonomy. Self-efficacy refers to people’s perception of their effectiveness in a specific area. Autonomy refers to people’s freedom to pursue their goals and to develop their ideas. Moreover, innovative behavior has been associated with other personality traits: high proactivity (Seibert et al., 2001), high achievement orientation (Barron & Harrington, 1981), openness to experience (Hammond et al., 2011), and internal locus of control (Keller, 2012). Individuals with an internal locus of control think they control their future, whereas individuals with an external locus of control think the future is outside their control (Judge, Locke, & Durham, 1997). Finally, George and Zhou (2001) showed that the personality trait conscientiousness is negatively related to creativity in the workplace.

Cognitive ability and style. Much of the work in R&D requires knowledge and expertise (Amabile et al., 1996; Hemlin, 2009; Woodman et al., 1993). However, expertise alone does not necessarily lead to innovative excellence. Feist and Gorman (1998) claimed that the way in which creative people approach a problem determines the outcome. Highly productive scientists have an open and explorative mindset at the beginning of the process. This mindset becomes considerably more incisive, focused, critical, and evaluative toward the end of the process. Divergent thinking, i.e., the ability to combine knowledge elements from diverse sources, is best combined with convergent thinking, that is, the ability to focus on and select the best solution to a specific problem, to produce creative and innovative outcomes (Woodman et al., 1993). In a longitudinal study of 644 scientists in the R&D departments of five organizations, the degree to which participants engaged in divergent thinking predicted the amount of patents and publications they produced (Keller, 2012).

Intrinsic motivation. Some scholars claim that the personality traits that favor creative outcomes depend on a key mediator: individual intrinsic motivation (Amabile, 1983; Mumford et al., 2002). According to Amabile (1983; 1998) intrinsic motivation
is a motivational state resulting from a reaction to the intrinsic challenge of a task (i.e.,
the work itself), rather than to extrinsic factors such as rewards. This motivational state
is arguably one of the most important individual factors related to creativity (Amabile,
1983; Woodman et al., 1993). For example, Prabhu et al. (2008) found that intrinsic
motivation mediated the personality traits of openness to experience and self-efficacy
to individual creativity.

**Creative self-efficacy.** In their development of Bandura’s (1977) theory of self-
efficacy, Tierney and Farmer (2002) defined creative self-efficacy as the self-belief in
one’s abilities to be creative. A number of studies have related creative self-efficacy to
individual creativity (e.g., Gong, Huang, & Fahr, 2009; Tierney & Farmer, 2011) and
to team creativity (Shin & Zhou, 2007; Somech, 2006; Sosik et al., 1997). High levels
of self-efficacy may increase intrinsic motivation (Ford, 1996) and mobilize in-
dividuals’ cognitive resources in pursuit of their ideas (Thomas & Velthouse, 1990).

**Task characteristics.** Various scholars have suggested that task characteristics
influence employees’ creativity and innovative behavior. Hammond et al. (2011)
related task characteristics, such as job complexity, work autonomy, and expectations
of creativity, to individual innovation. Krause (2004) showed that when project leaders
allow team members to use their own discretion, idea generation and idea im-
plementation increase. Creativity in tackling challenging and complex tasks is
enhanced when people are allowed more freedom because of their intrinsic motivation
(Amabile, 1988; Oldham & Cummings, 1996). Moreover, such tasks spur employees
to focus their attention, try new alternatives, and find creative solutions (Shalley &
Gilson, 2004).

**Summarizing determinants of innovation**

Organizations that want to maximize their employee’s innovation capabilities
should first assess their organizational structure. Overly formalized and bureaucratic
organizational structures seem to impede innovation. In contrast, organizational
structures in which decision-making and influence over processes are decentralized and
in which project teams have considerable autonomy seem to facilitate innovation
(Damanpour & Aravind, 2012; Jung et al., 2008; Thompson, 1965). Upper
management should encourage, expect, and reward creative ideas (Mumford &
Gustafsson, 1988), promote open and critical discussion without fear of negative
reprisals, and accept that failure is sometimes inevitable (Mann, 2005; Pirola-Merlo,
2000). Project teams should have a diversity of competences (Reiter-Palmon & Illies,
2004) as well as people with creative personalities and proactive traits (Feist &
Gorman, 1998; Seibert et al., 2001). Team members should be assigned tasks that are
challenging and stimulating (Amabile, 1998; Oldham & Cummings, 1996; Shalley &
Gilson, 2004), and shared (Anderson & West, 1998). Last, team members should be presented with a clearly stated vision (Pieterse et al., 2010).

However, a fundamental question must be asked: Who is responsible for implementing these recommendations and creating environments that encourage individual innovation? It is evident that ultimately this responsibility rests with the conductors of the symphony called organizational innovation — the leaders.
The role of leaders in R&D

Innovation management typically focuses on sustaining and nurturing innovation through managing the processes, strategies, structures, and external linkages related to innovation (Tidd et al., 2001). This thesis takes a narrower scope in that it deals with the role of R&D team leaders where most innovative activities of the organization take place. Despite the vast body of innovation and creativity research, relatively little attention has been paid to the relationship between innovation and leadership (Byrne et al., 2009), especially in R&D environments (Elkins & Keller, 2003). For example, in their meta-analysis, Hiller, DeChurch, Murase, and Doty (2011) do not discuss innovation as an outcome of leadership. In their summary of 1161 empirical studies, the aim was determine “whether, when, and how leadership affects outcomes” (p. 1137).

The reason may be that in complex systems such as organizations, the influence of leaders on innovation is only one of several influences (Kaiser, Hogan, & Craig, 2008). For example, because progress in innovation work is often non-linear, significant space exists for unpredictable dynamics (Marion & Uhl-Bien, 2001). In some instances, this unpredictability is the result of external forces and chance (Kaiser et al., 2008). In this perspective, innovation is a complex process that cannot be adequately and systematically managed (Tidd & Bessant, 2009). Another reason may be the “romantic conception of the creative act” (Mumford et al., 2002, p. 706). According to this notion, individuals conceive of creative ideas that their supervisor obstructs
rather than facilitates. However, conclusions from research into intra-organizational innovation point in the opposite direction. Leaders are increasingly considered essential for the facilitation of innovation. They can create the necessary conditions that allow innovation and creativity to flourish (Kaiser et al., 2008; Mumford et al., 2002; Shalley & Gilson, 2004).

As a general framework, this thesis conceptualizes the leadership role as integral to organizational innovation. Leaders have a dual role in managing innovation among individuals and teams. First, leaders can create the favorable environments and the multiple opportunities that lead to innovation (Shalley & Gilson, 2004). For example, they can help create and support a positive team climate (Anderson & West, 1998), facilitate problem-solving and team reflection (Puccio, Mance, & Murdock, 2010; Somech, 2006; Tierney et al., 1999), and assemble diverse teams (Keller, 2001). Moreover, leaders can increase individual intrinsic motivation (Deci & Ryan, 1987) and establish and maintain high quality work relationships with team members (Scott & Bruce, 1994). In this role, leaders promote innovation as a bottom-up process. They are the facilitators who create the conditions that allow team members to produce innovative outcomes.

Second, leaders embody the organization’s desire to be innovative. For example, they manage and allocate resources such as time, facilities, money, and knowledge (Drazin, Glynn, & Kazanjian, 1999), set individual and team goals (Shalley & Gilson, 2004), coordinate expectations about innovation outcomes (Yuan & Woodman, 2010), monitor progress (Mumford & Connelly, 1991), oversee the reward system (Mumford & Gustafson, 1988), and grant autonomy to individuals and teams (Hemlin, 2006; Hülsheger et al., 2009). In this role, leaders promote innovation as a top-down process. They are the managers who coordinate the organization’s innovation strategies and goals.

**Theories of leadership**

How does the literature define leadership? The concept is multifaceted with no single definition, but a reasonable and influential definition states that leadership is a process whereby one individual exerts influence over a group (Yukl, 2002). Leadership in organizations is typically studied at the individual level, for example, in research or project teams where there is a formal leader and various team members. This thesis focuses on the formal leaders of such teams.

Authors, researchers, and practitioners have long theorized about leadership. Human trait theories have focused on the characteristics of successful leaders. One popular theory was (and is) the so-called great man theory that maintains that outstanding leaders are simply born to be great. Other leadership theories—
contingency theories—focus on situational characteristics rather than personal characteristics. According to these theories, successful leaders adapt to their circumstances.

Today, much of the contemporary leadership literature on innovation refers to the transformational/transactional theory of leadership (Bass, 1985). Transformational leadership is a style theory of leadership (Oke, Munshi, & Walumba, 2009) in which transformational leaders exert influence by “broadening and elevating followers’ goals and providing them with confidence to perform beyond the expectations specified in the implicit or explicit exchange agreement” (Dvir, Eden, Avolio, & Shamir, 2002, p. 735). In contrast, transactional leaders exert influence by means of the contractual exchange of rewards and corrective actions (Avolio, Bass, & Jung, 1999). Researchers have related transformational leadership to innovation in the study of individuals and teams (e.g., Eisenbeiss, van Knippenberg, & Boerner, 2008; Jung, 2001; Rank et al., 2009) and of organizations (e.g., Aragón-Correra, García-Morales, & Cordón-Pozo, 2007; Gumusluoglu & Ilsev, 2009; Jansen, Vera, & Crossan, 2009).

There are other studies that link leadership to innovation. Some studies have operationalized leadership as leader behaviors that are positively related to individual and team innovation, for example, behaviors that aim at clarifying problem construction and improving self-efficacy (Redmond, Mumford, & Teach, 1993), stimulating open discussion and debate (Somech, 2006), and providing support and encouragement (Krause, 2004; Rosing et al., 2011).

Leadership consists of three elements: the leader, the team (or group) members, and the leader–member work relationship (Graen & Uhl-Bien, 1995). While much research on the leader’s role in innovation has focused on leadership style and behavior, the perspective of this thesis is that leadership is a relational concept. This means the focus is on the leader-employee relationship rather than on the leader in isolation. Thus, leadership is viewed more inclusively in this thesis because it addresses those who are led (i.e., employees or team members) as well as those who lead.

This thesis conceptualizes the leader-member work relationship using leader-member exchange (LMX) theory (Graen & Cashman, 1975; Graen & Uhl-Bien, 1995). In this theory, the work relationship is the primary means leaders use to exert their influence. LMX may be especially important to investigate in R&D settings because of its team member focus. Without team members’ ideas and efforts, there are no innovative achievements. In R&D settings, in particular, leaders may have to take greater recognition of these ideas and efforts than they would in less knowledge-intensive settings (Olsson, 2012). As Feist and Gorman (1998) discussed, engineers and scientists (who are often employed in R&D settings) require a high degree of autonomy. They have their own visions and ideas, and can manage their own tasks.
(Hemlin, 2006). Thus, leadership in which followers have an active role in negotiating the leader-follower work relationship may be especially pertinent in R&D settings.

A closer look at LMX theory

LMX theory, theoretically rooted in role theory and social exchange theory, differs from other leadership theories because it focuses on the unique work relationship between supervisor and employee or, as in this thesis, between team leader and team member (see Gerstner & Day, 1997). LMX theory views leadership as a tacit agreement about what is expected from each participant in the leader–member dyad. Low quality LMX relationships are based primarily on the employment contract where the leader-follower interaction is formal and impersonal. In high quality LMX relationships, team members and leaders exert themselves beyond the formal terms and conditions of their work contracts. Their interactions are based on mutual trust, respect, liking, and influence (Greguras & Ford, 2006).

In the development of work relationships, leaders and team members gradually enter into reciprocal exchanges of greater value (Graen & Cashman, 1975). LMX relationships establish quickly—in about two to four weeks—and appear to be stable thereafter (Liden, Wayne, & Stilwell, 1993; Nahrgang, Morgeson, & Illies, 2009). In the early stages of the relationship, a leader assesses the motivation, behavior, and performance of a team member in order to determine how much discretion, autonomy, and influence in decision-making to allow that team member (Graen & Cashman, 1975; Scott & Bruce, 1994).

Gerstner and Day (1997) demonstrated that the quality of LMX is predictive of outcomes at the individual, team, and organizational levels. For example, researchers have studied the following outcomes: work performance (Burton, Sablynski, & Sekiguchi, 2008; Wang, Law, Hackett, Wang, & Chen, 2005), organizational commitment behavior (Burton et al., 2008; Sherony & Green, 2002), employee job satisfaction and well-being (Hooper & Martin, 2008), and creative performance (Olsson, Hemlin, & Pousette, 2012).

Researchers have also suggested that the quality of the LMX relationship relates to individual innovation. The heightened sense of advocacy and trust in high quality LMX relationships influences team member creativity (Mumford & Gustafson, 1988), partly because leaders are likely to evaluate ideas more favorably (Zhou & Woodman, 2003). Leaders in high quality LMX relationships may also increase team members’ freedom in the implementation of creative ideas (Hemlin et al., 2008; Liden & Maslyn, 1998). Yuan and Woodman (2010) found that higher performance expectations and increased team member recognition in the organization might also stimulate innovation. However, empirical studies of LMX and of individual
innovation are few (e.g., Basu & Green, 1997; Scott & Bruce, 1994; Yuan & Woodman, 2010). Given the few studies, more research is needed. Olsson (2012, p. 62) argued, “scholars of leadership research should incorporate leaders, followers, and relational as well as contextual variables in order for the field to advance.” This thesis is intended to help fill this gap in the leadership research.

How R&D leaders influence individual innovation

Innovation, from an individual perspective, has both cognitive and motivational aspects (Ford, 1996; Woodman et al., 1993). For instance, to generate ideas, individuals need to reorganize and combine knowledge, which is a cognitive process (Soriano de Alencar, 2012). Innovative work is also typically riddled with setbacks and problems (Reiter-Palmon & Ilies, 2004). People’s intrinsic motivation will partly determine how much effort they invest in trying to overcome these difficulties (Puccio & Cabra, 2012). Leaders can influence both these cognitive and motivational aspects (Mumford et al., 2002; Rosing et al., 2011).

**Creative problem-solving.** The problems of innovative work are exceptional because they are often new to the person who encounters them, ill-defined because they are ambiguous and difficult to understand, and complex because they may have several different solutions (Mumford, Peterson, & Robledo, 2013; Reiter-Palmon & Ilies, 2004). The problem-solver must therefore begin by structuring (or making sense of) a problem and by identifying the goals, conflicts, procedures, restrictions, and data required to understand and solve it (Mumford, Mobley, Uhlman, Reiter-Palmon, & Doares, 1991). In some cases, problem construction is a relatively straightforward and quick process, after which the problem-solver can collect data and generate ideas. In other cases, however, the problems are so difficult that successful problem construction is essential for finding innovative solutions. Several studies have shown that when people spend more time constructing a problem, they generate better and more original solutions (e.g. Redmond et al., 1993). Leaders can assist in this process by offering their expertise. In fact, leaders’ expertise (i.e., their domain-related knowledge and experience) is a strong predictor of innovation in R&D (Mumford et al., 2002).

**Support.** Although leader support is not a clearly defined concept (Rosing et al., 2011), it is thought that leaders who recognize the team members’ good work, support them emotionally, involve them in important decisions, and monitor their progress fairly are instrumental in promoting innovative work. Less supportive leaders give employees ambiguous task assignments, fail to resolve important problems, and fail to monitor progress adequately (Amabile et al., 2004). Leaders typically support those team members with whom they have high quality work relationships (Liden & Maslyn, 1998). Leader support may also be important when the workload is high.
Janssen (2000) demonstrated that job demands were positively related to team members’ innovative work behaviors only when team members perceived that leaders fairly rewarded their work. Janssen took a social exchange perspective on fairness that maintains that, much like LMX theory, exchanges consist of interpersonal trust and mutual obligation.

**Guidance and intellectual development.** Using their technical expertise, leaders can guide team members in selecting those ideas that are most likely to meet an objective or solve a problem. Leaders can help their team members construct and understand a problem (Mumford, Connelly, & Gaddis, 2003). Leaders with high expertise may also contribute knowledge and ideas useful in solving novel problems (Hemlin & Olsson, 2011). Furthermore, R&D leaders may stimulate their team members’ intellectual development in a way that leads to an accumulation of knowledge and expertise (Bass, 1999; Rosing et al., 2011).

**Other leadership behaviors.** Other leader behaviors and leadership styles are less frequently examined in relation to innovation (Rosing et al., 2011). Krause, Gebert, and Kearney (2007) found that participative leadership is related to innovation at the individual level. Somech (2006) reached the same conclusion at the team level. Participative leaders share decision-making with their team members. Other studies have found that leaders should not monitor the innovative work by their employees too closely. George and Zhou (2001) showed that close monitoring was negatively related with employee creativity. Oldham and Cummings (1996) found that non-controlling leadership was positively related to industrial workers’ individual creativity as assessed by supervisors (but not with patents, which are more related to innovation).
Summary of the empirical studies

General aim of this thesis

Research on innovation in R&D is fragmented because researchers have not yet agreed on the factors that influence innovation, or on how these factors interact (Hemlin et al., 2008). Thus, several scholars call for more inquiry (e.g., Anderson et al., 2004; Avolio, 2007; Graen & Uhl-Bien, 1995; Hackman & Wageman, 2007; Hammond et al., 2011; Hemlin et al., 2008; Hunter et al., 2007; Mumford et al., 2002; Shalley & Gilson, 2004). In particular, we know little about the contextual factors that influence leaders’ abilities to promote innovation in organizations (Rosing et al., 2011) or about the psychological mechanisms that mediate leadership to individual innovation (Byrne et al., 2009).

This thesis responds to that call with its investigation into the factors that mediate and moderate the relationship between leadership and innovation.

Theoretical framework and central constructs

The theoretical framework Creative Knowledge Environments (CKE) posits that individuals who conduct creative work (such as in R&D) are nested in several different organizational levels of influence (Hemlin et al., 2008). This thesis contributes to the CKE framework and to the general body of knowledge of leadership and individual innovation in two ways, labeled here as (1) and (2).
This thesis proposes and tests three psychological constructs (personal initiative, intrinsic motivation, and creative self-efficacy) as mediating variables because of their potential to advance our understanding of how leadership relates to individual innovation. The three constructs are facets of a general motivational construct.

Personal initiative is conceptually similar to intrinsic motivation. However, whereas intrinsic motivation is a psychological state (Amabile, 1983), personal initiative is a behavioral construct. Personal initiative is “a behavior syndrome resulting in an individual’s taking an active and self-starting approach to work and going beyond what is formally required in a given job” (Frese, Fay, Hilburger, Leng, & Tag, 1997, p. 140). In this thesis, intrinsic motivation and personal initiative are proposed and tested as predictors of individual innovation in conjunction with leadership. None of the theoretical frameworks by Ford (1996), Woodman et al. (1993), or Hemlin et al. (2004; 2008) proposes the concept of personal initiative as a predictor of individual innovativeness.

There are, however, good reasons to complement these three theoretical frameworks with personal initiative. In innovation, the emphasis is on the implementation of ideas. Personal initiative is a particularly relevant concept in an R&D context because of its behavioral- and action-oriented focus (Rank, Pase, & Frese, 2004). Individuals with high personal initiative are proactive and set goals beyond the terms of their formal work contracts. For example, the concept has been related to individual creativity (Binnewies, Ohly, & Sonnentag, 2007) and to problem-solving (Daniels, Wimalasiri, Cheyne, & Story, 2011). This thesis proposes that personal initiative mediates the relationship between LMX and individual innovation. For example, the increased trust and mutual contribution associated with high quality LMX relationships may encourage team members to take the initiative at work when they think leaders listen to their ideas and support their innovation efforts.

Creative self-efficacy differs from the two other constructs in that it is self-belief in one’s ability to produce creative outcomes (Tierney & Farmer, 2002). It is proposed in this thesis that creative self-efficacy mediates the relationship between leadership and personal initiative. It is likely that high quality LMX relationships increase team members’ creative self-efficacy because of increased leader support, positive feedback on ideas, provision of useful resources (Chong & Ma, 2010; Tierney & Farmer, 2002), and expectations of creativity (Yuan & Woodman, 2010). Individuals with strong creative self-efficacy should be inclined to take the initiative in promoting and realizing their ideas (Tierney & Farmer, 2011).

This thesis proposes and tests the influence of moderating variables in the relationship between leadership and the psychological constructs of intrinsic motivation and personal initiative. Several researchers have called for more study in...
this area as leaders are influenced by organizational factors (Byrne et al., 2009; Mumford et al., 2002; Shalley & Gilson, 2004). The construct of organizational support is especially relevant in the R&D setting since meta-analyses have shown that support is one of the strongest factors that predict individual innovation (Hülsheger et al., 2009; Hunter et al., 2007). Bain et al. (2001), who studied R&D teams, confirm these findings.

This thesis follows Mann’s (2005) description of organizational support. According to Mann, organizational support has the following characteristics: (A) Organizational encouragement of innovation, which encompasses both the espoused value of innovation (i.e., the stated value of innovation) and the enacted value (i.e., the actual support for innovation); (B) Resource availability, which includes access to facilities, materials, time, expert knowledge, and useful information; and (C) Empowerment, which refers to employee autonomy (i.e., the freedom to pursue unique ideas and insights independently) and supervisory encouragement.

This thesis proposes that the presence or absence of organizational support affects the ability of the leader to manage and promote innovation among team members. According to LMX theory, leaders and members continually engage in exchanges aimed at achieving better work relationships (Liden & Maslyn, 1998). When leaders are in an environment in which innovation is encouraged (i.e., an environment in which sufficient resources are available and work group autonomy is permitted), the likelihood that they will provide such resources and grant such autonomy increases (Graen, Cashman, Ginsburgh, & Schiemann, 1977).

**How mediating and moderating variables work**

It is important to differentiate between mediation and moderation. Both mediating and moderating variables are “third variables” that explain some aspect of the relationship between an independent variable, or the predictor, and a dependent variable, or the criterion. In this thesis, the predictor variable is leadership, and the criterion variable is innovation.

Baron and Kenny (1986, p. 1176) defined a mediating variable as a variable that “accounts for the relation between the predictor and the criterion.” Thus, a mediating variable explains the mechanisms in the relationship between two other variables. They defined a moderating variable as “a qualitative (e.g., sex, race, class) or quantitative (e.g., level of reward) variable that affects the direction and/or strength of the relation between an independent or predictor variable and a dependent or criterion variable” (p. 1174). Thus, a moderating variable explains the contingencies or circumstances when a relationship between two other variables is either strong or weak.
Overview and specific aims of the four studies

Study I is a review of the leadership and innovation literature. This study identifies and analyzes the factors that researchers claim mediate or moderate the relationship between leadership and innovation. Study I also identifies the non-conclusive factors and proposes new factors. Details of all four studies, with their findings, follow this overview of Studies II, III, and IV.

Study II empirically tests a model in which LMX is hypothesized as positively related to individual innovation. Specifically, this study integrates and tests several streams of research on how mediating and moderating factors affect leaders’ influence on individual innovative work behavior as well as on innovation outcomes. The study hypothesizes that the relationship between LMX and team members’ innovation is mediated by their intrinsic motivation and personal initiative. The study also hypothesizes that organizational support moderates the relationship between LMX and team members’ intrinsic motivation and personal initiative. The model was tested at five Swedish companies known for their innovation.

Study III is a cross-cultural study that tests a model in innovative Swedish, French, U.S., and Indian industrial R&D teams. The study hypothesizes that LMX is positively related to individual innovation and is mediated by individuals’ personal initiative. The study also hypothesizes that creative self-efficacy mediates LMX relative to personal initiative. Additionally, the study hypothesizes that the culturally bound personal value of conservation is negatively related to innovation.

Study IV is an interview study that uses the Critical Incident Technique (Flanagan, 1954) to identify leader behaviors that either facilitate or impede individual innovation and to identify the consequences of these behaviors. The study was conducted at the R&D departments of two innovative Swedish industrial companies. See Table 4 for an overview of the four studies.
TABLE 4
Overview of the four studies in the thesis

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<td>Survey. Four sites (Sweden, France, the USA, India) of R&amp;D departments at an industrial organization</td>
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Study I

Study I reviews the last 30 years of the research literature that describes the factors that moderate or mediate the relationship between team leadership and team or individual innovation.

Materials and methods. Online databases were used to search for empirical articles with the keywords leadership, innovation, and/or creativity. As a result of the article search, 99 peer-reviewed articles satisfied the following two criteria: i) empirically based; and ii) leadership treated as a predictor variable and innovation as a criterion variable.
The articles also had to meet several quality criteria (e.g., published in a journal with a journal impact factor\(^2 >1.0\)). In addition, we searched the Google Scholar database for influential articles that were frequently cited but were published in journals with a lower journal impact factor. The articles were coded according to the following categories: i) study sample, ii) level of analysis, iii) type of criterion variable\(^3\) (i.e., creativity or innovation) and how it was measured (i.e., by subjective or objective measures), iv) predictor variables (i.e., how leadership was measured), v) mediating and moderating variables, and vi) results. The final sample consisted of 30 articles.

**Results.** At the individual level, leaders may stimulate their employees' creative self-efficacy (i.e., their perception of their creative ability) that results in innovative behavior (Gong et al., 2009; Redmond et al., 1993). Creative self-efficacy therefore mediates the relationship between leadership and individual innovation. Moreover, Study I identifies two factors that moderate this relationship. The first factor is organization-based self-esteem (OBSE), defined as an individual’s self-perceived value as an organizational member (Pierce, Gardner, Cummings, & Dunham, 1989). Employees with low OBSE doubt their ideas or efforts benefit the organization. OBSE moderates the relationship between leadership and individual innovativeness because the relationship is stronger for employees with low OBSE (Rank et al., 2009).

The second factor is the individual's self-presentation orientation that also moderates the relationship between leadership and individual innovation. This concept refers to the extent to which an individual engages in certain behaviors, such as impression management, in order to meet the social context expectations in the organization (Gangestad & Snyder, 2000). High self-monitors (i.e., individuals with a high self-presentation orientation) tend to control and alter their behavior so as to present an image congruent with others’ expectations. Low self-monitors do not engage in such image construction (Day, Schleicher, Unckless, & Hiller, 2002). Rank et al. (2009) found that self-presentation moderates the relationship between transformational leadership and individual innovativeness, and that the relationship is stronger for employees with a low self-presentation orientation. These authors concluded that low self-monitors perform best when they work for an organization that agrees with their beliefs and when they can do things their own way. Such individuals also perform best under transformational leaders who take into account their individual strengths and needs.

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\(^2\) The journal impact factor (IF) of a journal reflects the average number of times each article in the journal has been cited in the preceding two years. Thus, when a journal has an IF of 1 or more, each article in the journal has, on average, been cited one or more times in the preceding two years (Garfield, 2006).

\(^3\) The literature search and coding procedure were used in another article on factors that mediate and moderate the relationship between leadership and creativity (Denti & Hemlin, 2013). Study I includes only those articles coded with innovation as the dependent variable.
At the team level, leaders who introduce norms that promote debate, open communication, and divergent thinking may stimulate team innovativeness. Somech (2006) conceptualized the communicative process by which team members collectively reflect on the team’s goals, strategies, and processes as “team reflection”. She found that leaders facilitate team reflection, which in turn influences team innovation. Thus, team reflection is a mediator. Furthermore, Somech found that team heterogeneity moderates leaders’ efforts when innovation is the goal. When team heterogeneity is low, a more direct style of leadership is needed to stimulate discussion and divergent thinking. A more participative leadership style is beneficial when team heterogeneity is high. Moreover, task characteristics may be a moderating factor. Oldham and Cummings (1996) showed that when task complexity is high and supervision is non-controlling and supportive, more patents are produced than in dissimilar situations.

At the organizational level, the relationship between leadership and innovation is strongest in organizations with supportive cultures that encourage innovation in their communications and, most importantly, provide sufficient resources and autonomy to teams that have innovation goals (Howell & Avolio, 1993; Jung et al., 2008). Moreover, organizations that are structurally decentralized, in which formalization is low, may provide a more favorable environment for innovation because of the increased autonomy and the inter-functional and inter-departmental collaboration (Jung et al., 2008; Miller, Dröge, & Toulouse, 1988). In such environments, it is more likely that employees can depart from established practices without negative consequences (Dougherty & Hardy, 1996).

Furthermore, Study I identifies two factors where the findings were too ambiguous to draw conclusions as to whether they are mediators or moderators in the relationship between leadership and innovation. Those two factors are psychological empowerment at the individual level and team climate at the team level.

New moderating and mediating factors. Study I proposes several new moderators and mediators between leadership and innovation. At the individual level, the individual’s number of external work contacts and degree of personal initiative may mediate the relationship between leadership and innovation. At the team level, the team developmental stage may moderate the relationship. The research suggests that teams respond to leaders’ influence differently at each developmental stage (Wheelan, 2005).

Conclusions. Study I concludes that leaders influence the innovation capabilities of their teams and their members. Organizations that want to lay a foundation for innovation should implement an innovation policy that rewards creative contributions and encourages risk-taking and innovation. In this way, organizations can create an environment that stimulates individuals’ willingness to undertake creative endeavors.
Teams engaged in innovation work should be granted sufficient autonomy for creative problem-solving and should be assembled with team member heterogeneity in mind. Finally, leaders should promote team norms that emphasize open discussion, emotional safety, mutual respect, and joy through stimulating team reflection and shared decision-making.

Study II

Study II models the relationship between leadership, conceptualized as the leader–member exchange theory (LMX), and team member innovation. The study addresses several factors that moderate and mediate this relationship.

Hypotheses. We hypothesized, first, that LMX is positively related to innovation, and, second, that team members’ intrinsic motivation and personal initiative both mediate this relationship. Amabile (1983) and others propose that intrinsic motivation is an antecedent to employee creativity and intrinsic motivation has been shown to mediate the relationship between leadership and creativity (e.g., Shin & Zhou, 2003). Personal initiative may mediate the relationship between leadership and individual innovation because leaders in high quality LMX relationships are assumed to sanction and encourage initiative at work, for example by granting freedom and discretion (Frohman, 1999; Rank et al., 2004). According to Frese et al. (1997), individuals with high personal initiative are proactive and persistent in overcoming challenges and setbacks. This behavioral orientation may be especially valuable in R&D contexts where unpredictable and novel problems often arise and where progress is seldom linear (Marion & Uhl-Bien, 2001).

Third, we hypothesized that organizational support for innovation positively predicts team members’ intrinsic motivation and personal initiative, and that organizational support interacts with LMX, strengthening the LMX relationships with intrinsic motivation and personal initiative, when organizational support is high.

Materials and method. We surveyed 43 R&D-intensive teams at five innovative Swedish industrial companies. The sample consisted of 166 team members (chiefly, scientists and engineers), 43 leaders, and 10 department managers. In each team, five team members completed a survey about their work relationships with their team leader, their degree of intrinsic motivation and personal initiative, and their perception of organizational support for innovation.

We used two strategies to measure innovation. First, we created an index of innovation outcomes by averaging the total number of i) patent applications, ii) new products, iii) scientific publications, and iv) other publications (e.g., white papers and in-house reports). It was required that a team member had contributed to these outcomes since joining the team under its current leader. We asked team members to
report their individual scores on the indicators. Each team leader and each department manager reported the total scores for the team as a whole.

Next, we used a rating scale developed by Scott and Bruce (1994) to measure team members’ innovative work behaviors. We asked team leaders to rate their team members. Using the same scale, we asked department managers to rate the teams under their supervision. The two innovation measures indicated significant medium to high inter-rater correlations. This strengthened the convergent validity of the measures.

In testing our hypothesized model, we used the index of innovation outcomes provided by team members as well as the team leaders’ ratings of innovative work behaviors (our level of inquiry was the individual level). The control variables were the participants’ education level, time as a team member, gender, and age. We used path analysis to analyze the results. In path analysis, a researcher specifies a single model that permits the simultaneous analysis of an entire set of hypotheses.

Results. Figure 1 presents the results of Study II. Using both measures of innovation, personal initiative was positively related to individual innovation, while, contrary to our hypotheses, LMX and intrinsic motivation were not directly related to team member innovation. LMX positively predicted intrinsic motivation and personal initiative.

In assessing the hypothesized mediation effects, personal initiative mediated the relationship between LMX and team member innovation, but the mediator effect was not evident for intrinsic motivation, contrary to the hypothesis. LMX was therefore indirectly related to team member innovation, mediated by personal initiative.

There was a moderator effect when the relationship between LMX and personal initiative was stronger when organizational support for innovation is higher. Contrary to our hypothesis, this moderation effect was not evident for organizational support and intrinsic motivation (i.e., the relationship between LMX and intrinsic motivation was not moderated by organizational support for innovation).
FIGURE 1a

Results for the hypothesized paths between leadership, and innovation outcomes mediated by intrinsic motivation and initiative and moderated by organizational support

Two sets of parameter estimates are presented. The first set (Model 1) uses employee innovation outcomes as the dependent variable. The second set (Model 2) is in parentheses and uses team leaders’ ratings of innovative work behavior as the dependent variable. Standardized beta coefficients are given for the structural paths. All exogenous variables were allowed to correlate. \( R^2 \) is presented for the endogenous variables.

*This is the interaction term of organizational support (OSIQ) and LMX.

\( p < .05 \)

\( p < .01 \)
**Conclusions.** The main conclusion of Study II is that the team members play the lead roles in producing innovation outcomes in the five Swedish industrial companies. However, the team leaders may also play a crucial role. Through a high quality work relationship, leaders may stimulate team members to take greater initiative. Study II also concludes that organizations should support innovation by promoting pro-innovation policies and by providing their teams with sufficient autonomy and resources. This support may make it easier for leaders to create opportunities for team members to be proactive and take the initiative at work.

**Study III**

Study III is similar to Study II in that it models the relationship between leader-member exchange and team member innovation. The study addresses two factors that mediate the relationship in an organization that has a presence in four countries: Sweden, France, the USA, and India.

**Hypotheses.** We hypothesized that LMX is positively related to team member innovation. As in Study II, we hypothesized that team members’ personal initiative mediates this relationship. We also hypothesized that team members’ creative self-efficacy mediates the relationship between LMX and their personal initiative. Researchers have associated creative self-efficacy with leaders’ supportive behaviors (e.g., Chong & Ma, 2010; Tierney & Farmer, 2002). According to LMX theory, such behaviors exist in high quality LMX relationships (Basu & Green, 1997; Liden & Maslyn, 1998). Thus, when the quality of the LMX relationship is higher, employees’ creative self-efficacy should strengthen. Yet creative self-efficacy is primarily a self-belief in one’s capabilities for producing creative outcomes. In order to turn these beliefs into tangible outcomes, these beliefs much be acted upon. Thus, creative self-efficacy is likely to be positively related to personal initiative, which is a related concept but one that is more clearly oriented toward action.

In responding to the call from many scholars (e.g., Anderson et al., 2004; Rank et al., 2004; Shalley et al., 2004) we investigated the construct of conservation, a personal value orientation that we argue is a relevant construct in the change processes needed for innovation in a cross-cultural setting (Shin & Zhou, 2003). We hypothesized that individuals’ level of conservation is negatively related to innovation. Conservation is one of two overarching value dimensions in Schwartz’s (1992) value theory. This theory, which posits ten fundamental human values, states that conservation as a value mainly consists of three combined elements: tradition, conformity, and security. Individuals with high conservation are inclined to act in accordance with their assigned roles, to conform to established ways of doing things, and to maintain the status quo. Individuals with low conservation are more inclined to seek freedom and to require
personal work autonomy. These inclinations are proposed to have associations with individuals’ innovative outcomes and behaviors (Anderson et al., 2004).

**Materials and method.** The survey sample in Study III consisted of 269 team members in 60 R&D teams from an innovative organization in the automotive industry. The teams were situated in four countries: Sweden (n = 55), the USA (n = 76), France (n = 38) and India (n = 100). The team leaders (n = 60) and their section managers (n = 22) also completed the survey. Team members responded to measures of LMX, creative self-efficacy, personal initiative, and conservation. To ascertain construct validity and cross-cultural equivalence, these measures were subject to confirmatory factor analyses (CFA).

As in Study II, we used two strategies to measure team member innovation. First, we constructed an index of measures of innovation outcomes by averaging the numbers of (1) new patent applications, 2) scientific publications, 3) new product improvements (i.e. new components), and 4) other publications (e.g., technical reports, white papers) that team members had worked on or authored since joining the team under their current leader. Team leaders and department managers also reported on these measures for each team they supervised. Moreover, team leaders rated their team members on a rating scale that measured innovative work behavior (see Scott & Bruce, 1994). Using the same scale, the department managers rated the teams under their supervision. The two innovation measures provided by these three viewpoints yielded medium to high inter-rater correlations, indicating good convergent validity.

In further analyses, we used the index of innovation outcomes provided by team members, and team leaders’ ratings of innovative work behaviors (our level of inquiry was at the individual level). Moreover, we used the following control variables: job complexity, affectivity, time as a team member, education level, and age. We used path analysis to test the hypothesized relationships.

We tested our hypotheses using two models where the criterion variable was either the innovation index or the team leaders’ ratings of innovative work behavior. As an additional test for model validity, we compared our hypothesized model with nine alternative plausible models. In these models we specified theoretically viable combinations of antecedent, mediating, and proximal variables in relationship to the innovation variable. None of the alternative models provided a better fit to the data than the hypothesized model.

**Results.** Figure 2 presents the parameter estimates for the hypothesized model when team members’ innovation index is the criterion variable. Figure 3 presents the path estimates for the hypothesized model when leaders’ ratings of team member innovative work behavior is the criterion variable. LMX was directly and positively related to team members’ innovative work behavior but not to their innovation
outcomes. However, we found that personal initiative mediated LMX to these outcomes. Moreover, as hypothesized, creative self-efficacy mediated LMX to personal initiative. Finally, the culturally bound value of conservation was negatively related to individual innovation.

**Conclusions.** Study III concludes that high quality LMX may be conducive to team members’ innovative work behaviors, but that it is plausible that innovative outcomes are more determined by individual factors than leaders’ influence. The process of transforming new ideas into new technology and products is inherently unpredictable and complex (Kaiser et al., 2008; Mumford et al., 2002). The ability to be proactive and goal-oriented in overcoming obstacles and in making efforts that exceed the requirements of the formal work contracts may be crucial in these ventures. Initiatives aimed at innovation at all levels of an organization should be recognized and supported if organizations are to survive in the ever-increasing competition from global competitors.
FIGURE 2
Results for the hypothesized paths between leadership, creative self-efficacy, personal initiative, conservation, and employee innovation outcomes (innovation index)

* Standardized beta coefficients are given for the structural paths. R² is given for the endogenous variables.
'. Significant at the 0.05 level (two-tailed).
". Significant at the 0.01 level (two-tailed).
Results for the hypothesized paths between leadership, creative self-efficacy, personal initiative, conservation, and employee innovative work behavior (IWB)

* Standardized beta coefficients are given for the structural paths. $R^2$ is given for the endogenous variables.

*, Significant at the 0.05 level (two-tailed).

**, Significant at the 0.01 level (two-tailed).
Study IV

Study IV identifies R&D project leader behaviors that either stimulate or hinder team members’ abilities to produce innovative outcomes and the consequences of these behaviors.

Participants and procedures. The thesis author and an assistant interviewed 72 participants in the R&D departments of two innovative organizations in the automotive industry using the Critical Incident Technique (CIT) developed by Flanagan (1954). This interview method is preferable to other interview methods because it prompts participants to describe their experiences using specific, recent incidents as points of reference rather than generalized experiences or opinions (Butterfield, Borgen, Amundson, & Maglio, 2005; Flanagan, 1954).

We asked each participant to recall “a recent incident where your project leader did something that stimulated you or your team, increasing your ability for innovation.” Innovative ability, which we defined using the OECD (2005) definition, was described to the participants as follows: “Ability for innovation means the ability to implement new ideas. Innovation differs from creativity in that creativity can be seen as generating new ideas, while innovation is the implementation of new ideas.” When the participants said that they had recalled a recent incident we asked the following questions: i) Can you describe the situation? ii) What did the leader do that stimulated/hindered your ability for innovation? iii) What were the consequences?

We asked the participants to describe two instances in which their leader stimulated their innovative abilities and two instances in which their leader hindered their innovative abilities. Thus, each participant was prompted to describe as many as four incidents (two stimulating, two hindering). The 129 stimulating incidents and 102 hindering incidents were analyzed using thematic analysis (Braun & Clarke, 2006) where three categories were predefined: situation, leader behavior, and consequences.

Results. Most critical incidents occur during day-to-day management of projects. Project coordination, which is the largest category for both the stimulating and hindering situations, consists of assigning and directing tasks, calling meetings, outlining the project goals, managing resources and information, providing feedback, and making decisions. The critical incidents also occur in problem situations (for the team or for the team member), or when participants want to implement their ideas.

The most frequent leader behavior that stimulates team members’ innovation is their active facilitation of new ideas. At idea-generating meetings and workshops, leaders encourage team members with feedback on new ideas. In this manner, leaders stimulated a free and open dialogue where information and perspectives can be easily exchanged. The leaders who hindered team members’ innovation neglect new ideas. The most frequent leader behavior that hinders team members’ innovation is the lack
of autonomy. Members’ autonomy is restricted, for example, when leaders give them overly detailed instructions and too closely supervise their work.

Stimulating leader behaviors resulted in better solutions, more ideas, and increased team member motivation. Hindering leader behaviors resulted in poorer solutions, fewer ideas, member demotivation, and decreased teamwork efficiency.

**Conclusions.** Study IV concludes that R&D project leaders need good general project management skills (as conceptualized by Yukl, 2002). Such skills are hygienic factors with regard to innovation outcomes. For example, leaders’ competent management of project information flow does not necessarily stimulate innovation, but if a leader lacks this skill, innovation suffers. To stimulate innovation, leaders can support team members’ ideas, give them work autonomy, and offer their expertise.

Study IV also identifies various dilemmas in project management associated with the inherent uncertainty of the R&D work. Dealing with uncertainty and risks requires will and courage on the part of leaders (Dewett, 2007). Leaders require support for their scheduling and resource allocation decisions, especially in times when projects fail. Therefore, upper management should support experimentation and encourage risk-taking (see Hemlin, 2006).
Discussion

This thesis examines R&D team leaders’ influence on team members’ innovation. The thesis focuses on the how of this influence (i.e., the psychological mechanisms that mediate leadership and innovation) and on the when of this influence (i.e., the contextual factors that facilitate or hinder leaders’ efforts to promote innovation in their teams).

The influence of leaders on team members’ innovation

Based on the four studies, I conclude that leaders can positively influence team members’ innovation. Study I, which reviews current research on team leaders’ influence on innovation, reveals that leaders can exert such influence by stimulating discussion and reflection in teams, by countering narrow and conformist thinking, and by facilitating innovative ideas (Somech, 2006). Moreover, leaders can stimulate their team members’ beliefs in their own creativity, which results in innovation outcomes (Gong et al., 2009; Redmond et al., 1993).

Study II and Study III show that the relationship between leadership, conceptualized as leader-member exchange (LMX) theory, and individual innovation is mediated by the creative self-efficacy and personal initiative of team members. Study IV shows that leaders stimulate team members’ innovation by actively encouraging their new ideas and by providing them with autonomy and direction. These findings suggest that when leaders and team members work together in high quality work
relationships, leaders can provide more opportunities and more work independence for team members. Such relationships may encourage team members to take greater initiative as they work with innovative projects. At the same time, leaders should develop their project management skills. The lack of such skills hinders innovation in R&D projects.

Moderators of leaders’ influence on team members’ innovation

I conclude that certain factors at the individual, team, and organizational levels may either facilitate or hinder leaders’ efforts to promote team members’ innovation. Study I concludes that the leader-member relationship is strongest in more informal organizations that are decentralized because such organizations give teams and their members more freedom to work creatively (Jung et al., 2008; Kanter, 1996). Furthermore, leaders work best in situations that explicitly support innovation, such as when the organization encourages open discussion and risk-taking, grants sufficient autonomy to teams and their members, and provides them with adequate resources, such as facilities and materials, information, and expertise (e.g., Hunter et al., 2007; Mann, 2005).

The role of organizational support for innovation. Study II shows that organizational support moderates the relationship between LMX and team members’ personal initiative. This relationship is stronger when organizational support is high. LMX theory states that leaders and team members engage in an ongoing process of mutual exchange in the interest of a higher quality work relationship (Liden & Maslyn, 1998). When organizational support is high, leaders can reward and encourage team members’ initiatives because they have more options for meeting team members’ demands. In contrast, leaders in less supportive organizational contexts may have little discretion as far as the support they can provide their team members. Thus, Study II suggests the degree of active innovation support provided by an organization indirectly affects innovation in the organization’s teams. In such conditions, leaders can more easily support team members’ innovation.

Study I identifies two moderating factors at the individual level. Leaders seem to have limited influence on individuals with a high propensity for self-monitoring. As these individuals are more concerned with fitting in than making changes, they may be disinclined to persist with their ideas and suggestions if they meet resistance (Rank et al., 2009). Moreover, individuals who perceive themselves as highly valued organizational members may be less inclined to respond to stimulation from leaders (Rank et al., 2009).
Findings like these pertaining to moderating variables at the individual level remind us that, while leadership may be important, innovation work in industrial development teams is chiefly carried out by skilled engineers and scientists.

**The central role of individuals in innovation**

The results of Study II and Study III suggest that LMX is indirectly related to innovative behavior and innovation outcomes through the personal initiative of team members involved in high-technology innovation. Feist and Gorman (1998) concluded that scientists are strongly driven and have a powerful need for achievement and independence. The scientists and engineers surveyed and interviewed in this thesis are likely to be highly and intrinsically motivated because of their education and the inherent complexity and challenge of their tasks (see Amabile, 1983). According to this view, leaders may have an indirect role in influencing innovation. Their influence may be a hygienic factor for these highly skilled individuals. As long as the leader-member work relationship is not detrimental, a reasonably satisfactory relationship will ensure that team members have sufficient work support. If this is true, it also means that a high quality LMX relationship will not necessarily lead to more and better innovation outcomes. This view is consistent with Tierney et al.’s (1999) research in which they found a difference between less innovative and more innovative employees. Leaders had little influence on the latter group.

Study III takes a cross-cultural view of individual characteristics. The value of conservation was negatively related to individual innovation as measured by innovation outcomes, as well as by innovative work behaviors. These results suggest that individuals who act in accordance with their social roles, accept prescribed norms and maintain stability are likely to be perceived as being less innovative and less involved in activities that lead to innovative outcomes. Rather, it can be argued that individuals who emphasize intellectual freedom, exercise personal discretion, and challenge the status quo exhibit the behaviors that result in innovations.

In conclusion, the transformation of new ideas into new technology and products is inherently unpredictable and complex (Kaiser et al., 2008; Mumford et al., 2002). The ability to be proactive and goal-oriented in overcoming obstacles and making efforts that exceed what is required (per formal work contracts) may be crucial in these ventures.

**Dilemmas in leading innovative project work**

Study IV concludes with four dilemmas that leaders of project work face. Projects usually must satisfy certain requirements from constituents (e.g., customers from
within or outside the firm) in order to be regarded as successful. Sometimes the requirements are so detailed that the project team has to work round some of them in order to satisfy the functional requirements of a product in a new way. The first dilemma is whether to meet these requirements or to think more radically. The second dilemma relates to the scheduling of projects. Testing new ideas takes time, especially if the ideas are novel. Given the unpredictability and non-linearity of R&D work, time schedules are often too rigid. Yet in order to produce innovative outcomes, new ideas require time for conceptions, testing and even failure. The third dilemma concerns the leader’s decision-making vis-à-vis the often-changing requirements of constituents and technology. Some project leaders may react too quickly when they change goals and objectives of a project, while others may react too slowly. The fourth dilemma concerns the autonomy project leaders allow their teams. Allowing team members too much freedom risks losing control of projects. This is a problem for leaders who have the final responsibility for team projects towards constituents.

Implications for theory

The findings in this thesis contribute to the theoretical framework Creative Knowledge Environments (Hemlin et al., 2004; 2008) in several ways. First, the finding that personal initiative—not intrinsic motivation—predicts individual innovation gives us a better understanding of how motivational factors predict individual innovation. Personal initiative may be a pertinent construct in R&D because it focuses on implementation behaviors, whereas intrinsic motivation is a psychological state. As discussed previously, it is likely that R&D engineers and scientists have high intrinsic motivation. Moreover, personal initiative, combined with creative self-efficacy, mediates the relationship between LMX and individual innovation. The concept of personal initiative and the proposed mechanisms in this thesis should thus be incorporated into the theoretical frameworks that deal with the factors that promote innovation in organizations.

Second, the theoretical framework Creative Knowledge Environments posits that factors at the higher levels in an organization influence factors at the lower levels. This thesis shows that the organizational support, which moderates the relationship between leadership and team members’ personal initiative, is such a factor. If organizational support is strong, the relationship between LMX and personal initiative strengthens. Thus, the presence of organizational support may affect the ability of leaders to promote innovation among their team members.

Third, further theoretical development should distinguish between innovative work behaviors and outcomes of innovation. Study III found that LMX was directly related to team members’ innovative work behavior, while only indirectly related to
innovation outcomes such as the numbers of new products or product improvements, patent applications and publications (peer-reviewed or not). One explanation of this finding may be that innovative work behavior and indicators of innovation outcomes measure different aspects of innovative work. The first difference is that innovation measures focus on the tangible outcomes of this work, while assessments of innovative behavior measure the individual’s propensity to generate, champion, and implement ideas. Innovative behavior is thus a broader measure of individual innovation, because innovation outcomes can include accomplishments that are not measured by commonly used measures such as patents (Martin, 2012). The second difference is that innovative work behavior likely precedes outcomes in a process where new ideas (e.g., related to technological challenges) are generated and championed, and where steps are taken to implement them (Basadur, 2004). This thesis has shown that innovative work behaviors and commonly used indicators of innovation are positively related. Innovative work behaviors may thus be a promising construct to measure dark innovation, that is, those aspects of innovation that are informal and incremental (Martin, 2012).

Additional conclusions and implications for organizations

The dilemma for project leaders between granting work autonomy and giving up project control is also found in the larger context of innovation management. Innovation in organizations is fraught with risks. Ideas and projects may fail, and advances seldom occur as intended (Getz & Robinson, 2003; Isaksen & Tidd, 2006; Mumford et al., 2002). To manage these risks, organizations may be tempted to increase control over their innovation projects, for example, by closely monitoring project process parameters, setting stringent time constraints, ending projects prematurely, or employing project “gates” (i.e., specific timeframes for progress stages). However, there is a paradox. When increased control limits teams’ autonomy, teams tend to fall back on tried-and-tested ways of solving problems rather than testing new solutions. Yet innovation processes must be managed because of time limits and project specifications (Tidd & Bessant, 2009). The goal is to strike the right balance between tight control and laissez-faire control when managing innovation.

An innovation policy. Organizations can adopt an innovation policy that explicitly supports and encourages new initiatives. Risk-taking is inherent in innovation. Organizations that support and, more importantly, implement values such as experimentation create a hotbed for innovation (Mann, 2005; Mumford et al., 2002). An organizational culture that encourages innovation and individual creativity signals trust. In turn, this culture may influence people’s willingness to undertake creative endeavors (Mumford & Gustafson, 1988; Shalley & Gilson, 2004). Hence,
increased autonomy and trust may inspire people who work in R&D to contribute more willingly to their organizations’ innovation goals.

**Implications for human resources managers.** The findings in this thesis have practical implications for recruitment policies and team composition in R&D environments. R&D teams should have highly skilled and motivated members with different competences. Identifying and employing such people poses a recruitment challenge for human resource managers. R&D teams also require capable leaders who have domain-related expertise that they use in a participative and non-controlling manner. Such leaders are wise, adaptable, and sensitive to the cognitive and motivational needs of their team members.

**Limitations of this thesis**

The conclusions drawn in this thesis should be viewed in light of its limitations. The primary limitation concerns an effect that can be referred to as “the graveyard effect,” which may have influenced the thesis as a whole. In Study I, several quality criteria reduced the number of articles in the first selection by two-thirds. The excluded articles went to a “graveyard.” The findings and implications in this thesis may have been different if those studies remained in the sample. Indirectly, this selection process affected Study II and Study III that tested conclusions from Study I. In defense of the selection process, however, it can be argued that the use of fairly strict quality criteria strengthens the conclusions. Articles with higher impact factors and indexed in the ISI Web of Science (the selection criteria) have been through a more rigorous peer-review process (Aarssen, Tregenza, Budden, Lortie, Koricheva, & Leimu, 2008; Saha, Saint, & Christakis, 2003). This means that lower quality research has been screened out.

The second limitation of the thesis is that Study II and Study III used a cross-sectional design. This design limits the inferences drawn in this thesis regarding the direction of causality. As discussed in these studies, some hypothesized relationships may be reciprocal. For example, highly innovative individuals and project teams may demand certain behaviors from their leaders, such as granting autonomy and increased time for idea generation and problem-solving. Another relationship that may be reciprocal is the relationship between LMX and mediators such as creative self-efficacy and intrinsic motivation. Highly motivated individuals may positively influence the work relationship. On the other hand, the relationships hypothesized in Study II and Study III have a theoretical and empirical basis, which strengthens the causal plausibility of the model. For example, Deci and Ryan (1987) review causal evidence that links leaders’ behaviors to employees’ intrinsic motivation. Along similar lines, Tierney and Farmer (2011) show that leaders influence their employees’ creative self-efficacy
over time. In Study III we checked for these potential problems when testing for alternative models. In these tests, the hypothesized model was the best representation of the data. Still, the path models proposed in Study II and Study III should be considered only an ‘as if’ model of causality (Kline, 2005).

Third, the theory of LMX was tested in relationship to innovation using only the individual team members’ perspectives. As LMX is theoretically conceptualized as a dyadic phenomenon, ideally both sides should have a shared understanding of the nature of the relationship. However, Study II failed to show that leaders’ and members’ LMX ratings were correlated. This is a well-known problem in LMX theory (see Schriesheim, Castro, Zhou, & Yammarino, 2001).

Fourth, because of the nested nature of the data in this thesis (individuals nested in groups, departments, and countries), multi-level statistical methods could have been useful for the analyses. Future researchers should consider using multi-level structural equations modeling whenever individual, dyad or group level effects are hypothesized. These methods allow the researcher to specify mediating and moderating mechanisms, while at the same time consider the multi-leveled nature of organizations.

Fifth, the thesis does not discriminate between radical and incremental innovation. Radical innovation refers to the creation of new and valuable products, while incremental innovation concerns the improvement and refinement of existing products (Tidd & Bessant, 2009). In Study II and Study III, the innovation measures were composites of radical and incremental innovation. In Study IV, the participants were not asked to differentiate between the two types of innovation. The processes in each form of innovation likely differ, adding a layer of complexity to the conclusions of this thesis.

**Recommendations for future research**

This thesis introduces a promising construct—personal initiative—to the field of innovation research. However, more research is needed, especially longitudinal research, before we can infer that the relationships are causal. Research is also needed into the individual construct of intrinsic motivation, which was not related to team member innovation despite a sound theoretical basis and positive relationships with the related concept of individual creativity identified in other studies (e.g., Shin & Zhou, 2003). However, in innovation work, which concerns activities that go beyond idea generation, such as idea development, idea championing, securing resources, and taking steps to realize ideas (Tidd & Bessant, 2009), taking personal initiative, and working proactively may be more important than just being intrinsically motivated.

Furthermore, in Study III’s sample (participants from four countries), unlike Study II’s sample (Swedish participants), the leader–member work relationship was
directly related to team member innovative work behavior. LMX was indirectly related to team member innovation outcomes mediated through the personal initiative of team members in both Study II and Study III. These findings call for further research in five areas which are described next.

(1) More research is needed on the role of leaders in innovation ventures in high technology R&D contexts where scientists and engineers are highly autonomous (Feist & Gorman, 1998) and intrinsically motivated (Amabile, 1983). We need to integrate contextual and psychological factors that facilitate or hinder leaders’ efforts to influence innovation processes and build on the interactionist frameworks proposed by Hemlin et al. (2004), Woodman et al. (1993), and Ford (1996).

(2) Although some work has been done (e.g., Czarnitzki & Kraft, 2004), we need more research that establishes cross-cultural generalizability of processes related to leaders’ influence on innovation (Anderson et al., 2004; Shalley et al., 2004; Yuan & Woodman, 2010). This seems vital in an age where firms are increasingly global.

(3) Researchers could differentiate between measurements of innovation and clarify which variables predict each. As Study III shows, the two measures of innovation (leaders’ subjective ratings of innovative work behavior, and quantitative measures of innovation outcomes) are associated differently with their predictors. For instance, this distinction could become a moderator in the relationships between predictors and innovation in future meta-analyses.

(4) Study III shows that people’s degree of conservation is negatively related to their innovative work behavior and innovation outcomes. Although many individual factors have been scrutinized as predictors of individual innovation (e.g., personality, cognitive ability, motivation, and domain specific skills and expertise), the concept of individual values is missing in reviews and meta-analyses (e.g., Anderson et al., 2004; Hammond et al., 2011; Hülsheger et al., 2009). Thus, further research is needed on individual values that predict innovation. In addition, we need more research on the psychological mechanisms by which these values are related to individual innovation.

(5) Creative self-efficacy and personal initiative are two constructs that we found positively related to innovation as measured by objective measures. A future area of research is to identify the antecedents of these constructs. For example, an innovative team climate (Anderson & West, 1998) may influence individuals’ perceptions about their creative abilities as well as their willingness to engage in long-term, goal-oriented behaviors aimed towards implementing ideas.

In short, we are only beginning to understand leaders’ complex roles in organizational innovation. Integrative studies are needed that examine leaders, teams, and their members, and the contextual and psychological factors that determine individual innovation (Avolio, 2007; Graen & Ulh-Bien, 1995; Hackman & Wageman, 2007).
References


A leader supports teams and individuals as they turn their creative efforts into innovations (leader as facilitator) and manages the organization’s goals and activities aimed at innovation (leader as manager). This review focuses on when and how leadership relates to innovation (i.e., the factors that moderate or mediate the relationship between leadership and innovation). The sample consists of 30 empirical studies in which leadership is treated as the independent variable and innovation as the dependent variable. In addition to reviewing moderating and mediating factors, we identified two factors where the findings are ambiguous. The review proposes three new factors that may mediate or moderate the relationship between leadership and innovation.

*Corresponding author.

Fifty years ago, Burns and Stalker (1961) published their influential work on management and innovation. Since then, much work has been done on leadership in innovative endeavors which has lead to the conclusion that leaders are an...
essential element in the promotion of organizational innovation (Hemlin, 2006a; Hülsh;ger et al., 2009; Mumford et al., 2002). We have now come to the point where more and more research is being directed into understanding when leadership is effective, i.e., under which circumstances at the individual, team and organisational levels, and how leaders influence innovative outcomes, i.e., the various processes and mechanisms of influence. These are the variables that moderate and mediate the relationship between leadership and innovation. This paper reviews the state of research into these moderator and mediator variables.

We view innovation in organisations as an outcome of individual, team, and organisational efforts joined to produce a new product, process, or service that is potentially attractive to a market. Innovation is then the result of a number of activities performed at different levels of the organisation and in its external world. We find the following definition of innovation useful: “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organization or external relations” (OECD, 2005:46).

Sometimes innovation and creativity are used interchangeably in the literature (Basadur, 2004; Csikszentmihalyi, 1999). However, creativity is commonly viewed as idea generation (ideation) while implementation of ideas is innovation (Amabile et al., 1996; Anderson et al., 2004; Scott and Bruce, 1994). In this paper our focus is on innovation studies, but we also examine research that investigates innovation in terms of creativity when it is clear that innovation was the goal.¹

The dual process of managing innovation

We believe that leadership is an integral part of innovative organisational performance for at least two reasons. First, leaders construct the environments that favour creativity and ultimately innovation (Hemlin et al., 2008; Shalley and Gilson, 2004). Much of the leadership research focuses on the essential leadership actions in this construction of context and opportunities that promote the bottom-up process of innovation. Leaders encourage intrinsic motivation (Avolio et al., 1999), facilitate problem solving (Tierney et al., 1999), foster a positive team climate (Anderson and West, 1998), and establish and maintain high quality work relationships with team members (Olsson et al., 2008; Scott and Bruce, 1994).

Second, in a top-down process, leaders manage the strategic innovation goals and activities of their organizations. Leaders may set these goals and direct these activities by managing time, facilities, money, and knowledge resources (Drazin et al., 1999), by setting and managing individual and team goals, by defining

¹In Denti and Hemlin (forthcoming), we review the mechanisms leaders use to promote creativity not included in this paper.
expectations for creative performance (Shalley and Gilson, 2004), by managing rewards (Mumford and Gustafson, 1988), and by granting autonomy to individuals and teams (Hemlin, 2006b; Hunter et al., 2007).

Thus, the leader orchestrates the dual process (a) of providing support to teams and individuals as they turn their creative efforts into innovations (leader as facilitator), and (b) of managing the organization’s goals and activities aimed at innovation (leader as manager) (see Hemlin, 2006b).

Scope of this study

Although leaders have a significant impact on innovation activities, they don’t work in a vacuum. First, researchers have pointed to the power of the context, with its contingency factors, that may interact with leaders’ efforts to stimulate and manage innovation (Bass and Riggio, 2006; Hunt and Conger, 1999; Mumford et al., 2002; Shalley and Gilson, 2004; Yukl, 1999). The contingency factors tell us when leadership relates to innovation (i.e., the circumstances), thus they moderate the relationship between leadership and innovation outcomes. Second, we need more knowledge about the mechanisms leaders use to influence innovation. These are subsumed under another category of factors that mediate leadership and innovation, and they may tell us how leaders influence innovation (i.e., the leaders’ influence at the individual, team, and organisational levels).

This paper reviews the factors by which leadership relates to innovation at the individual, team, and organisational levels of human behavior. Among others, Mumford et al. (2002), Oke et al. (2009), and Isaksen and Tidd (2006) have addressed these factors in their research. However, there are few systematic reviews of the empirical research that compile our current knowledge on the mediating and moderating factors between leadership and innovation. For example, whereas Elkins and Keller (2003) studied only the effects of leadership on various outcomes in R&D, we take a broader approach. We also extend the work of Ford (1996) and Woodman et al. (1993) by examining more recent research. Also, our approach to drawing inferences about moderating and mediating variables differs from previous reviews in that we focus on those studies where moderation and mediation is investigated. The traditional approach has been to draw inferences about moderation and mediation by examining separate studies that does not test for the inference itself. For example, if one study shows that there is a positive relationship between construct A and B, and another study that there is a relationship between B and C, some may draw the erroneous conclusion that B is mediating between A and C. In this case, the mediator variable has not been proven and the inference is based on speculation. A sound approach is to examine those studies that actually test the A-B-C relationship. We have now come to a
point in time where studies that test a moderating or mediating variable between leadership and innovation have formed a substantive body of knowledge. This calls for a review of these variables which is now done in our review. Finally, since several scholars have called for a better understanding of the relationship between leadership and innovation (e.g., Byrne et al., 2009; Mumford et al., 2002; Shalley and Gilson, 2004), we discuss three mediating and moderating factors on leadership and innovation that has not yet been tested in a rigorous way.

Furthermore, in addition to our recognition of the importance of these moderating and mediating factors, we acknowledge the importance of multiple levels of analysis where organizational processes are likely nested in different levels (Drazin et al., 1999; Ford, 1996; Hemlin et al., 2008). For example, the effect of leaders on employees may depend on the climate of the team and the culture of the organization.

Procedure

Literature search

We conducted our literature search in several steps. During 2010 we searched for journal articles using the online databases PsycINFO, PsycARTICLES, ISI Web of Science, Social Services Abstracts, Sociological Abstracts, IBSS (International Bibliography of the Social Sciences), ASSIA (Applied Social Sciences Index and Abstracts), Business Source Premier, Econlit, and Regional Business News. We used the keywords leadership and innovation in our search. We also used the keyword creativity because it is occasionally used interchangeably with innovation in the literature. We analyzed each article’s abstract in order to identify those articles that (1) were based on empirical studies, and (2) treated leadership as an independent variable, and innovation or creativity as a dependent variable. As we required that each journal article selected must have been peer reviewed, we did not consider unpublished articles and dissertations. At this point in our search we had identified 99 articles.²

Sample inclusion criteria

First, we eliminated articles that were published before 1980 since we wanted to include only studies that (a) used advanced methodologies (adequate for mediator-moderator variable analyses) not in significant use before 1980 and that (b) reflected leaders’ influence on employees with contemporary work attitudes and values. Second, we eliminated articles not indexed in the ISI Web of Science and

²We were unable to locate two articles we identified as of interest.
articles with a journal impact factor >1.0.\textsuperscript{3} We specified this criterion in order to identify high quality journal articles that had gone through a more rigorous peer review process. Although questions have been raised about the IF, (e.g., Boor, 1982), it is generally recognized as a valid indicator of journal quality (Garfield, 2006). When a journal’s IF is high, scholars are more inclined to submit their papers to that journal (Judge et al., 2007). More submissions provide a broader base for the selection of high quality research. Journal IF have been empirically related to higher rejection rates (Aarssen et al., 2008) and external assessments of journal quality (Saha et al., 2003).

However, we also wanted to ensure that we included highly influential articles published in journals with lower impact factors. It has been shown that interdisciplinary research such as innovation studies have been disadvantaged by high impact factor journals, which are more mono-disciplinary focused (Rafols et al., in press). For this purpose, we used the Google Scholar citation database to calculate a median of citations for our sample. This median was 77 citations (range 6 — 1291). We then searched the Google Scholar database, using the same above mentioned keywords, and included articles cited more or equal to 77 times. A total of 4 articles were added this way.

**Coding of dependent variables**

We coded the dependent variables of each article (creativity or innovation) as either (a) innovation-measures or (b) creativity-only measures. The basis for this coding was our definition of innovation. The articles in our review had to measure some aspect of implementation (i.e., the application of ideas such as new products or processes). Thus, according to this criterion, we could include articles in which the research aimed at measuring creativity, but not articles in which the research measured creativity only.

Bibliometric data for the reviewed journals is presented in Table 1. In the sample of 30 studies, the number of article cites ranged from 6 to 1291. On average the articles were cited 166 times, and the median of citations was 88.

**Results**

In our sample of 30 studies, 17 studies measured transformational/transactional leadership, 3 studies measured leader-member exchange (LMX), and 10 studies

\textsuperscript{3}The journal impact factor (IF) of a journal reflects the average number of citations per article in the journal during the two preceding years. Thus when a journal has a IF of 1 or more, each article in the journal has been cited on average one time or more times in the two preceding years (Garfield, 2006).
measured other leadership traits or behaviors. In the measurement of innovation, 12 of the 30 studies in the sample were conducted at the individual level, 4 studies at the team level, and 14 studies at the organizational level. The 15 studies that explicitly tested mediation and moderation variables between leadership and innovation are analyzed next.

### Individual level mediating and moderating factors

**Creative self-efficacy, mediator.** It has been suggested that high levels of self-efficacy may contribute to increased motivation (Ford, 1996), greater eagerness to pursue individual ideas, and more effective use of cognitive resources (Thomas and Velthouse, 1990). Gong et al. (2009) recently tested this mediator and found that creative self-efficacy mediates the relationship between transformational leadership and employee innovative behavior. In an experimental study, Redmond et al. (1993) manipulated participants’ feelings of self-efficacy by asking leaders to...
tell participants whether their scores in a pre-test were well above average or average. The participants who were told they scored above-average exhibited greater confidence in solving the problems subsequently posed as well as greater creativity related to the products produced.

Organizational based self-esteem (OBSE), moderator. OBSE refers to the employee’s self-perceived value as an organizational member (Pierce et al., 1989). Some empirical evidence suggests that employees with low OBSE benefit from transformational leadership since they doubt whether their ideas or efforts are of value to the organization. Rank et al. (2009) found that OBSE moderates the relationship between leadership and individual innovativeness since the relationship is more important to employees with low levels of OBSE.

Self-presentation, moderator. Self-presentation, a core sub-dimension in the self-monitoring construct, refers to the way in which individuals engage in impression-management and modify their behavior in order to reflect the expectations from the social context (Gangestad and Snyder, 2000). High self-monitors tend to control and alter their behavior in order to present an image congruent with others’ expectations. Such activity is less important for low self-monitors (Day et al., 2002). Rank et al. (2009) confirmed their hypothesis that self-presentation moderates the relationship between transformational leadership and individual innovativeness. The relationship was stronger for employees with low self-presentation. Rank et al. concluded that low self-monitors perform best when they are involved with an organization that supports them and allows them to act independently. Therefore they perform best working under transformational leaders who recognize their individual strengths and needs.

Team level mediating and moderating factors

Team reflection, mediator. Team reflection is a communication undertaking where team members collectively consider the team’s goals, strategies, and processes. Somech (2006) found that leaders influenced team reflection that in turn promoted team innovation. In functionally heterogeneous teams, a participative leadership style was necessary to promote team reflection; in homogeneous teams, a more direct style was appropriate. These results point to team reflection as a mediator for leadership and team innovation.

Team heterogeneity, moderator. There are more opportunities for divergent thinking in heterogeneous teams where team members have diverse skill sets, knowledge, and cognitive problem solving styles (Hülsheger et al., 2009; Keller, 2001). Somech (2006) examined how leadership behavior, operationalized as participative and directive, affected functional heterogeneity and innovation outcomes. In participative leadership, for example, there is shared influence in
decision-making and solicitation of new ideas from team members. In directive leadership, for example, there is a framework for decision-making and clear rules for behavior. Somech found that participative leadership has a moderating effect on team innovation only when functional heterogeneity is high; directive leadership has an effect when team heterogeneity is low.

Task characteristics, moderator. It is thought that complex tasks motivate employees to find creative ways to solve problems. With simpler tasks, employee fulfillment comes from solving problems using established knowledge and routines (Shalley and Gilson, 2004). In Oldham and Cummings’ (1996) study, although job complexity was not directly related to the production of patents, an interaction showed that high job complexity combined with high non-controlling and supportive supervision resulted in more patents compared to other combinations. Thus, the challenge of the task may moderate the effects of leadership on innovation.

Organizational level moderating factors

Organizational structure. Factors related to the structure of an organization are believed to influence innovation performance (Thompson, 1965). In their study of 50 Taiwanese firms, Jung et al., (2008) found that when centralization and formalization are low, the influence of transformational leadership on organizational innovation is greater. Organizations with a high degree of centralization typically have decision-making authority concentrated at the upper management level (Damanpour, 1991). High formalization in organizations, where numerous routines and rules regulate the work, is thought to impede organizational innovation (Damanpour, 1991). For example, high centralization and formalization may reduce the autonomy of creative employees and teams (Jung et al., 2008), may hamper inter-functional and inter-departmental collaboration (Miller et al., 1988), and may constrain employees who depart from established practices (Dougherty and Hardy, 1996).

Organizational culture. The normative behavior expectations in an organization form the context in which individuals and teams are embedded. Risk-taking, experimentation, openness, trust, and autonomy are part of the organizational support that provides a foundation for innovation (Hunter et al., 2007; Mumford et al., 2002).

Recently, organizational support was examined in relation to leadership and innovation. Jung et al., (2008) found that organizational support (as defined by Siegel and Kaemmerer, 1978) moderated the CEO’s leadership style and the firm’s innovation. The extent of organizational support for innovation may influence the individual’s willingness to undertake creative endeavors. Such willingness may in part depend on the perception of the consequences of such actions in the environment, as Yuan and Woodman (2010) and Scott and Bruce
(1994) show. However, the findings are mixed regarding the role of organizational support. Gumusluoğlu and Ilsev (2009a) based their scale of organizational support on Scott and Bruce’s (2004) study and could not show that support stemming from within the organization moderated the relationship between project leaders’ transformational leadership and firms’ sales of new products. Instead, support from, and collaboration with external institutions strengthened the relationship between transformational leadership and firm innovation.

**Ambiguous contingency factors**

Under this heading, we present two factors where mixed findings point to the fact that it still is unclear whether they are mechanisms in the relationship between leadership and innovation, i.e., if they act as mediating factors, or if they act as contingency factors and exert influence on leaders’ discretion to lead innovative endeavors, i.e., if they act as moderating factors.

**Psychological empowerment.** Recent findings show that empowerment, the motivational construct consisting of meaning, competence, self-determination, and impact (Spreitzer, 1995), both moderates and mediates the relationship between leadership and innovation. Pieterse et al., (2010) found that, only for individuals with high levels of psychological empowerment, transformational leadership was positively related to innovative behavior and transactional leadership was negatively related to innovative behavior. However, Jung et al. (2003) and Jung et al., (2008) could not show that psychological empowerment at the organizational level moderated transformational leadership and organizational innovation. Furthermore, when creativity is the criterion variable, psychological empowerment has been shown to mediate between transformational leadership (Gumusluoğlu and Ilsev, 2009b) empowering leadership (Zhang and Bartol, 2010), and individual creativity. Thus, it is unclear whether leaders influence team members’ psychological empowerment, as suggested by Gumusluoğlu and Ilsev (2009b), or if the construct is independent of leadership, as argued by Pieterse et al. (2010).

**Team climate.** It is assumed that leaders generally have a significant influence in creating a climate conducive to team innovation by, for instance, acting as role models, supporting ideas, and participating in the work (Isaksen and Tidd, 2006). Consistent with these ideas, team climate appears to be a mediator between leadership and innovation as West et al., (2003) have shown. In their study, team climate, measured by Team Climate Inventory (TCI) (Anderson and West, 1998), partially mediated the effects of leadership influence on team innovation in self-managed teams. However, in a more recent study, Eisenbeiss et al., (2008) found that team climate moderated the positive relationship of transformational leadership and innovation. They concluded that leaders may be an important part of team
innovation, but without shared norms and ambitions of excellence, leaders’ influence is limited. These ambiguous findings point to a more profound problem in conceptualizing innovative climate. It is still unclear whether the leader primarily influences the team climate or is influenced by it.

**New moderators and mediators**

In this section, we propose and discuss three new mediators and moderators between leadership and innovation at the individual and team levels. Some of these factors are known to the extant literature and have been tested as predictors for innovation. However, the factors proposed in this section have not yet been tested as mediators or moderators between leadership and innovation.

**Individual level**

*External work contacts, mediator.* The literature has emphasized the effect of external work contact networks on innovation (e.g., Tidd *et al.*, 2001). This research has found that the number and frequency of such contacts relate to individual innovative work behavior (De Jong and Den Hartog, 2010). De Jong (2007) hypothesized that the number of external contacts moderated the relationship between leadership and innovation, but was unsuccessful in finding evidence to support this relationship. However, Mumford *et al.* (2002) and Woodman *et al.* (1993) state that it is the job of leaders to organize and promote the information flow in groups. LMX theory stipulates that good leaders add their resources to those of their team members (Liden and Maslyn, 1998). Thus, the leader may influence whether and when individuals seek contacts external to the group or organization. These external contacts may stimulate innovative endeavors (Hemlin and Olsson, 2011).

*Personal initiative, mediator.* Personal initiative refers to the extent to which the individual engages in proactive and long-term, goal-oriented behaviors where actions are taken that extend beyond the terms specified in the formal work contract (Frese *et al.*, 1997). An individual’s degree of personal initiative and proactiveness has been linked to innovation (Seibert *et al.*, 2001). According to Frohman (1999), leaders may influence such behavior. Transformational leadership theory posits that transformational leaders motivate team members to make extra-contractual efforts (Bass and Riggio, 2006). Similarly, a high quality LMX relationship may have this effect when a team member is given more responsibility and is placed in a position of greater trust (Liden and Maslyn, 1998).

**Team level**

*Group developmental stages, moderator.* Various researchers have studied the different stages in group development (e.g., Arrow *et al.*, 2004; Tuckman, 1965;
Wheelan, 2005). In these group stages, cohesion, commitment, norm conformity, and goal related behavior may fluctuate (Tuckman, 1965). Leaders certainly influence the progression of these stages. Yet it appears that group members respond to leader influence differently in each developmental stage. In the integrative model of group development (Wheelan, 2005), leader influence depends on the group stage. In the first of four stages in this model, members tend to follow most of the direction provided by their leaders, but in the second stage, as they increasingly challenge this direction, conflict arises around issues such as roles, group organizing, and goals. In the third and fourth stages, when group members are again more open to leaders’ influence, performance tends to be highest (e.g., Wheelan and Tilin, 1999). In this understanding of group development, the group dynamics involved in the different stages may limit leaders’ influence to those processes involving innovation, such as ideation and idea implementation.

Conclusions

The When and the How: Contingency factors and mechanisms related to innovation

This article reviewed 30 peer-reviewed articles 1980–2011 from the Web of Science’s highest rated journals. Our aim was to investigate the contingency factors and mechanisms between leadership and innovation, i.e., the moderating and mediating variables.

Moderating variables. In assessing the contingency factors related to when leaders may influence innovation, we conclude that the relationship between leadership and innovation appears strongest in organizations that have a supportive culture for innovation (Jung et al., 2008) and where organizational structures are de-formalized and de-centralized. In such organizations, both leaders and employees are freer to engage in creative work (Damanpour, 1991; Jung et al., 2008). Furthermore, teams that are heterogeneous and work on complex tasks have the highest capability for innovation. Such teams require supportive and non-controlling leadership that includes them in decision-making. Finally, leaders can promote innovative behavior among employees who have low organizational self-esteem and low self-presentation (Rank et al., 2009).

Mediating variables. In addressing the question of how leaders stimulate innovation (i.e., through the use of mediating variables) we conclude that leaders may stimulate innovation on the individual level by influencing creative self-efficacy (Gong et al., 2009; Redmond et al., 1993). Moreover, leaders may also stimulate innovation by introducing norms that encourage team reflection processes, e.g., by means of debates, open communication, and divergent thinking (Somech, 2006).
Implications for leaders of innovation

(Hemlin et al., 2008) argued that a creative knowledge environment (CKE) should be established and promoted in organizations that wish to develop innovative products and processes. To a great extent, establishing a CKE is a leader responsibility. It is crucial for leaders to identify the specific environmental factors conducive to innovation and creativity. One may think of a CKE as a set of nested layers of environmental factors in an organization where individual and team creative activities are undertaken. In such environments, it is clear that the work design, as well as the social and organizational characteristics at the team and organizational levels, have a crucial influence on the innovation processes. This influence is implemented through adopting supportive cultures, informal structures, and organizational slack.

Our literature research suggests there are a number of steps leaders may take when creating a CKE. First, upper management and their teams should establish an innovation policy that is promoted throughout the organization. It is necessary that the organization through its leaders communicate to employees that innovative behavior will be rewarded (Mumford and Gustafson, 1988). Second, when teams are composed, the potential for team innovation should be a consideration in selecting the team members. One team characteristic that seems to promote innovativeness is team heterogeneity (Reiter-Palmon and Illies, 2004). However, if the team is too heterogeneous, tensions may arise. On the other hand, when heterogeneity is too low, more directive leadership is required to promote team reflection, for example, by encouraging discussion and disagreement. Third, if creativity and innovativeness are to flourish, leaders should promote a team climate of emotional safety, respect, and joy through emotional support and shared decision-making (Ekvall and Arvonen, 1991; Hemlin et al., 2008). Fourth, it is essential that individuals and teams have autonomy and space for idea generation and creative problem solving (Pelzand Andrews, 1966). Fifth, time limits for idea creation and problem solutions should be set, particularly in the implementation phases (Basadur, 2004). Finally, team leaders, who have the expertise, should engage closely in the evaluation of innovative activities (Mumford et al., 2002).

Limitations of the study

First, this paper is limited by its sampling procedures. We chose 1980 as our cut-off year because we wanted to include only research studies using advanced methodologies that were suitable for mediator-moderator analyses. We have no knowledge whether our results might have differed had we also included research studies published prior to 1980. Our findings may have also been affected by our
requirement that the studies had to be of high quality (published in journals with IF >1.0). We omitted a few studies that tested mediator-moderator relationships but were published in lesser-ranked journals. Although we may also have omitted some recent high quality studies because they were published in dissertations or books, we considered this omission to be of less concern since it is likely those studies will be published at some future date in quality journals and will be included in future reviews.

Second, in the reviewed articles, theories and concepts were conceptualized, operationalized, measured and analyzed slightly differently, which then may affect the aggregated conclusions we reached. The risk is our conclusions may be too compartmentalized and/or oversimplified. This is an inherent problem of reviews of research literature.

**Suggestions for future research on leadership and innovation**

In addition to further research on the two ambiguous factors that we found (i.e., psychological empowerment and team climate), we suggest the following three areas for future research on leadership and innovation.

*Stages of the innovation process.* Further research is needed into how the innovation process interacts with leaders’ efforts. This process consists of problem construction or definition (Reiter-Palmon and Illies, 2004), idea generation, evaluation, and promotion (Basadur, 2004), and of the planning, championing, and securing of funds for implementation (Scott and Bruce, 1994; Tushman and Nadler, 1986). The role of leaders is to provide a structure for the innovation process. In the early stages of innovation, leaders may have to take a divergent and explorative approach to problem construction and ideation in which knowledge and ideas are broadly integrated. Similarly, a convergent approach, focused on moving forward may be more suitable in the later stages where implementation is the focus. However, there is little research on how leaders may facilitate these cognitive and emotional processes in individuals and in teams (cf. Isaksen and Tidd, 2006).

*Destructive leadership.* Very few studies in our review deal with how leaders obstruct or impede innovation. For example, leaders who monitor their employees too closely and give little support (Oldham and Cummings, 1996), who do not give them sufficient autonomy (Krause, 2004), who exclude them from the decision process, and who squelch new ideas (Somech, 2006) may stifle creativity and innovativeness. Therefore, research is needed on when and how leadership behaviors are detrimental to innovation (Shaw et al., 2011).

*Leadership for radical and incremental innovation.* More research is also needed on leadership when the goal is to create new and novel products...
(i.e., radical innovation) or when the goal is to expand and refine existing products (incremental innovation) (Tidd et al., 2001). While Jansen et al. (2009) found a negative correlation between transactional leadership and radical innovation, their study showed that transactional leadership is positively related to incremental types of innovation. Thus, leaders who are more transaction-oriented may be more successful in promoting innovation when they work toward achieving the innovation goal by guiding employees towards refinements of existing products and increasing the efficiency of existing practices and processes. The distinction between incremental and radical innovation may thus be an important issue in future research and in theoretical modeling of leadership and innovation (see e.g., Isaksen and Tidd, 2006).

Methodology. If moderating and mediating variables are addressed in studies in which leadership and management of innovation in organizations are examined, it is necessary to apply multi-level modeling and structural equation models. Such models are appropriate for analyzing the complex interrelationships of leadership and innovation.

References

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MODELING THE LINK BETWEEN LEADER-MEMBER EXCHANGE AND INDIVIDUAL INNOVATION IN R&D

Denti, L. (a) and Hemlin, S. (b)

(a) Dept. of Psychology / Gothenburg Research Institute, University of Gothenburg
Email: leif.denti@gu.se
(b) Dept. of Psychology / Gothenburg Research Institute, University of Gothenburg
Abstract
This study models individual characteristics, leadership, and organizational support in relationship to individual innovation in highly complex research and development (R&D) settings. The study reports on a survey of 166 R&D team members, 43 team leaders, and 10 department managers in five Swedish industrial organizations. Individual innovation was measured using four indicators (new patent applications, new products, scientific publications, and other publications) and team leaders’ ratings of innovative work behavior. Individuals’ propensity to take personal initiative predicted individual innovation, while intrinsic motivation and leadership (conceptualized by leader-member exchange theory) did not. A mediating effect was found whereby leader-member exchange was associated with individual innovation through the personal initiative of team members. Organizational support moderated the relationship between leader-member exchange and individual initiative. High organizational support strengthened the relationship.

Keywords: Leadership, innovation, creativity, intrinsic motivation, personal initiative
MODELING THE LINK BETWEEN LEADER-MEMBER EXCHANGE AND INDIVIDUAL INNOVATION IN R&D

Innovation is an integral part of organizational performance. For this reason, management in organizations tries to secure and support innovation. In recent decades, the issue of how to promote innovation has become an intensive research area. Innovative outcomes basically result from the work of individuals. Therefore, without motivated and proactive employees, organizations stagnate, losing their competitive edge. However, empirical research on innovation management in organizations is somewhat fragmented. Therefore we set out to integrate and model the mechanisms that drive innovation in work teams. This study is theoretically rooted in the interactionist perspective (Hemlin, Allwood, & Martin, 2008) that we use to research the integration of organizational innovation support, the leadership of research and development (R&D) project teams, and individual characteristics in an attempt to understand innovation in R&D at the individual level.

This study addresses important antecedents of individual innovation: leaders’ influence (Mumford, Scott, Gaddis, & Strange, 2002), organizational support (Amabile, Conti, Coon, Lazenby, & Herron, 1996; Ekvall & Ryhammar, 1999) and individuals’ intrinsic motivation (Amabile, 1983; Woodman, Sawyer, & Griffin, 1993). We also address the more action-oriented behavioral construct of personal initiative that performance (although not innovation) studies have investigated (Frese, Fay, Hilburger, Leng, & Tag, 1997). By combining these factors in a single model, we examine them as predictors, moderators, and mediators of individual innovation in the industrial R&D setting.

**Individual innovation**

We agree with the following definition of innovation: “The implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (OECD, 2005, p. 46). Thus, individual innovation is the individual’s active involvement in the development of new products, processes, or methods. Furthermore, while the various research and management disciplines sometimes use the concepts of innovation and creativity interchangeably (Csikszentmihalyi, 1999), creativity differs from
innovation in that creativity refers to idea generation or “ideation” (e.g., Amabile et al., 1996), while innovation refers to the implementation of ideas (Anderson, De Dreu, & Nijstad, 2004). Thus, creativity precedes innovation in a multi-stage process where ideas are transformed into innovative outcomes (Basadur, 2004).

**Leader-member exchange and individual innovation**

Leaders play a crucial role in facilitating and supporting innovation among members of their teams (Denti & Hemlin, 2012; Mumford et al., 2002). In this study, we claim that leadership is an interactional and inter-relational phenomenon since leaders influence team members through their work relationships. Leader-member exchange theory (LMX) focuses on this dyadic relationship in which leaders engage in an exchange relationship with team members (Gerstner & Day, 1997; Graen & Uhl-bien, 1995). Only a few researchers have associated the quality of the LMX relationship with employee innovation (e.g., Basu & Green, 1997; Scott & Bruce, 1994; Yuan & Woodman, 2010). Low quality LMX relationships are based predominantly on formal work contracts in which, for instance, team members exchange their labor for money and other benefits. In high quality LMX relationships, by contrast, both leaders and team members contribute more to the exchange than the terms of their work contracts require. Such relationships involve mutual trust, respect, liking, and joint contribution toward work goals (Greguras & Ford, 2006).

LMX theory posits that in the development of work relationships, leaders and team members gradually enter into reciprocal exchanges of greater and greater value (Graen & Cashman, 1975). In the early stages of the relationship, a leader assesses the motivation, behavior, and performance of a team member in order to determine how much discretion, autonomy, and influence in decision-making to allow that team member (Graen & Cashman, 1975; Scott & Bruce, 1994). Researchers have associated discretion, autonomy, and influence, which are more common in high quality LMX relationships, with innovative behavior (e.g., Oldham & Cummings, 1996; Rosing, Frese, & Bausch, 2011). Thus, we propose the following hypothesis:

H1: The quality of the leader-member exchange relationship is positively associated with individual innovation.
The mediating role of employee intrinsic motivation

Intrinsic motivation is a motivational state that is elicited by the characteristics and challenges of a task or problem rather than by incentives such as monetary rewards (Amabile, 1983). Intrinsic motivation is among the most important factors that stimulate individual creativity (Hemlin et al., 2008). Although the linkage is inconclusive, intrinsic motivation as an influential factor has been associated with individual creativity in conjunction with leadership (e.g., Dewett, 2007; Jaussi & Dionne, 2003; Shin & Zhou, 2003; Tierney, Farmer, & Graen, 1999). However, Gumusluoğlu and Ilsev (2009) were unable to show that intrinsic motivation mediated the relationship between transformational leadership and individual creativity.

To our knowledge, intrinsic motivation in conjunction with leadership has not been tested with individual innovation as the outcome. We note, however, that Tierney et al. (1999), in relating intrinsic motivation creativity to leadership, used so-called invention disclosures as one outcome measure. One aim of our study is to test if intrinsic motivation mediates between leadership and individual innovation. Leaders may directly motivate their team members by pioneering a vision, by providing them with support, encouragement, and individual attention, and by observing their intellectual potential (Amabile et al., 1996; Avolio & Bass, 2002). Leaders in high quality LMX relationships may increase team members’ intrinsic motivation by allowing them greater autonomy, by providing them with a sense of belonging, and by recognizing their competences (Atwater & Carmeli, 2009). Furthermore, leaders may stimulate intrinsic motivation in team members by setting goals that are difficult yet still attainable (Locke, 1968; Locke, Latham, & Erez, 1988) and by creating more challenging structures for tasks (Amabile, 1998).

In summary, because leaders influence employees’ intrinsic motivation, leading to outcomes such as creativity, performance, and innovation, it is important to test this assumption empirically to see if intrinsic motivation is a mediating variable between leadership and innovation. Thus, we propose the following three hypotheses:

H2a: The quality of the leader-member exchange relationship is positively related to individual intrinsic motivation.
H2b: The degree of intrinsic motivation is positively related to individual innovation.

H2c: Intrinsic motivation is a mediating variable between the leader-member exchange relationship and individual innovation.

The mediating role of employee personal initiative

Frese et al. (1997, p. 140) define personal initiative as “a behavior syndrome resulting in an individual’s taking an active and self-starting approach to work and going beyond what is formally required in a given job.” Although personal initiative is conceptually similar to intrinsic motivation, intrinsic motivation is a psychological state (Amabile, 1983) whereas personal initiative is a behavioral construct (Frese et al., 1997). Thus, personal initiative is the behavioral expression of an individual’s motivational state. Individuals with high personal initiative are proactive and set goals that go beyond the terms of their formal work contracts. Personal initiative is worth exploring because of its inherent behavioral- and action-oriented focus (Frese et al., 1997). Individuals with high personal initiative may be more inclined to take steps to implement their ideas (Rank, Pace, & Frese, 2004). Although no empirical study has yet established a link between personal initiative and individual innovation, Seibert, Kraimer, and Crant (2001) found that the related concept of personal proactiveness was positively related to innovative work behavior and to career success. Personal initiative has also been related to creativity (Binnewies, Ohly, & Sonnentag, 2007). In this study, we respond to Rank et al.’s (2004) call to examine the role of personal initiative in innovation and to Frohman’s (1999) suggestion that leaders may influence team members’ personal initiative.

We hypothesize that personal initiative is a mediating factor between leadership and innovation. First, leaders may directly stimulate initiative, for instance, by recognizing team members’ contributions, by maximizing top-down and lateral information dissemination, and by postponing negative evaluations until outcomes are proven inadequate (Frohman, 1999). The increased trust resulting from mutual collaboration in a close leader-member relationship may also stimulate team members’ personal initiative. In such relationships, team members perceive that leaders attend to their ideas and support their activities. Second, highly trusted team members with significant autonomy—such as typically found
in high quality LMX relationships (Liden & Maslyn, 1998)—may have more discretion in the implementation of their ideas than team members who are less trusted and lack such autonomy. Thus, we propose the following three hypotheses:

H3a: The quality of the leader-member exchange relationship is positively related to individual personal initiative.
H3b: Personal initiative is positively related to individual innovation.
H3c: Personal initiative is a mediating variable between leader-member exchange and individual innovation.

The moderating role of organizational support

Leaders do not work in a vacuum. They lead team members who work in a context commonly referred to as the organization’s culture, climate, and practices (Hemlin et al., 2008). Organizations that encourage risk-taking and experimentation and that promote trusting relationships are a seedbed for innovation (Hülsheger, Anderson, & Salgado, 2009). Such support may lead to an increase in innovative performance (Ekvall & Ryhammar, 1999; Mann, 2005). In West and Anderson’s (1996) study of hospital management groups, organizational support for innovation was the strongest predictor of overall innovation, defined as organizational change. Bain, Mann, and Pirola-Merlo (2001), who studied project teams in a R&D environment, confirmed these findings.

Pirola-Merlo (2000) defined three forms of organizational support. The first form is encouragement of innovation, which encompasses both the espoused value of innovation (i.e., the stated value of innovation) and the enacted value (i.e., the actual support for innovation). The second form is the provision of resources. Resources include facilities, materials, time, expert knowledge, and useful information. The third form is empowerment, which refers to supervisory encouragement and to employee autonomy (i.e., the freedom to pursue unique ideas and insights independently).

Both employee autonomy (Ekvall, 1996; Hunter, Bedell, & Mumford, 2007) and supervisory encouragement (Rosing et al., 2011) have been linked to innovation. Autonomy is the sense of ownership and control created by signals of organizational trust (Amabile, 1998; Pirola-Merlo, 2000). We hypothesize that when an organization
encourages innovation, provides resources, and empowers individuals, intrinsic motivation and personal initiative increase. Thus, we propose the following two hypotheses:

Hypothesis 4a: The degree of perceived organizational support is positively related to individual intrinsic motivation.

Hypothesis 4b: The degree of perceived organizational support is positively related to individual personal initiative.

When leaders work in an environment in which innovation is openly encouraged (i.e., an environment in which sufficient resources are available and work group autonomy is permitted), the likelihood that they will provide such resources and grant such autonomy increases (Graen, Cashman, Ginsburgh, & Schiemann, 1977). According to LMX theory, leaders and members continually engage in exchanges aimed at achieving higher quality in their work relationships (Liden & Maslyn, 1998). Thus, when organizational support is strong, leaders are better positioned to reward excellence and to form high quality work relationships that result in extra-contractual performance (Liden & Graen, 1980; Liden & Maslyn, 1998). When organizational support is weak, leaders have fewer opportunities and fewer incentives to strengthen their work relationships with team members. Thus, the presence or absence of organizational support affects the ability of the leader to manage and promote innovation among members. Organizational support may therefore act as a moderating variable between leadership and employee intrinsic motivation and personal initiative. Thus, we propose the following hypothesis:

Hypothesis 4c. Organizational support for innovation will moderate the positive relationship between leader-member exchange and intrinsic motivation, as well as personal initiative, with the result that such relationships are stronger when organizational support is high.
METHODS

Sample

We surveyed 43 R&D teams in five industries (e.g., automotive, automation & control, industrial equipment, and paper manufacturing). Team members (chiefly scientists and engineers), team leaders, and department managers responded to the survey. The surveys we sent to 211 team members were designed to measure LMX, organizational support, intrinsic motivation, personal initiative, and indicators of innovation outcomes. The surveys we sent to 43 team leaders were designed to measure LMX, indicators of innovation at the team level, and their ratings on team members’ innovative work behavior. The surveys we sent to 15 department managers were designed to measure indicators of innovation at the team level and their ratings of team innovativeness.

The response rates were as follows: team members, 79 percent (n = 166); team leaders, 100 percent (n = 43); and department managers, 67 percent (n = 10). Thus, the sample consisted of 166 leader-member dyads. The average age of the team members was 42 (SD = 10.7). Their gender distribution was 86 percent men and 14 percent women. As far as education, 11 percent had less than a Bachelor’s degree, 59 percent had a Bachelor’s or Master’s degree, and 30 percent had post-Master’s degrees. The number of team members per team varied from 4 to 50 ($M = 13.8$, $SD = 8.5$). Team members had worked in their teams for an average of 4.1 years ($SD = 9.0$).

Procedure

In early 2010, we sent an invitation letter to 50 organizations in Sweden that worked with innovation. We used the number of new patents issued to organizations by the Swedish patent and registration office in order to create our list of potential survey organizations. The CEOs of the three organizations that responded to our letter delegated the management of the survey participation to others. We made direct contact with the R&D department managers in two other organizations. The teams that we surveyed had to have a clear innovation focus, such as product development or research. We made our electronic surveys on two occasions: Spring and Fall of 2010.
Measures

We phrased the survey items as statements that participants responded to, using a seven-point Likert scale: (e.g., 1 = Strongly disagree, 4 = Neither nor, 7 = Strongly agree). Unless otherwise specified, we calculated the scales using the mean of the items for the measure.

Leadership. We measured leadership using the four-dimensional, 12-item leader-member exchange measure (LMX-MDM) developed by Liden and Maslyn (1998). We asked team members and team leaders to rate each other on these four dimensions ($\alpha = .91$ and $\alpha = .82$, respectively). The four sub-dimensions of the LMX-MDM measure are Contribution, Loyalty, Affect, and Professional Respect. They are explained next.

Contribution: The amount, quality, and direction of mutual, work-related activity aimed at achieving joint goals. A sample item is: “I do work for [team leader’s name] that goes beyond what is specified in my job description.” The LMX-MDM scales for team leaders and team members were identical with the exception of this item. In the team leaders’ version, the item is: “I provide support and resources for [team member’s name] that goes beyond what is specified in my job description.” Loyalty: The amount of mutual support and obligation. A sample item is: “[team leader’s name] would defend me before others in the organization if I made an honest mistake.” Affect: The amount of interpersonal liking. A sample item is: “[team leader’s name] is the kind of person one would like to have as a friend.” Professional Respect: The amount of mutual respect for professional capabilities. A sample item is: “I respect [team leader’s name]’s knowledge of and competence on the job.” Using the electronic survey system, the participants read either the team members’ names or the team leaders’ names (instead of the original wordings: “my subordinate” and “my supervisor”).

The team member measure was subjected to a confirmatory factor analysis (CFA)\(^1\) that specified four latent variables. The model fit indicated moderate but acceptable fit ($\chi^2[48, n = 162] = 106.39, p < 0.001, \chi^2/df = 2.21; \text{RMSEA} = .087; \text{CFI} = .96$). The correlation between team member and team leader LMX measures was .115 ($p > .15$). An interpretation of this correlation may be that the perceived agreement on the exchange

\(^1\) The software used here and in subsequent analyses is AMOS 18.0.0 build 992 (Arbuckle, 2009).
relationship was low. In subsequent analyses, we used the team members’ opinions of the leader-member relationship because this measure was theoretically more justified given the hypotheses in our study.

**Intrinsic motivation.** We asked team members to rate their intrinsic motivation on a five-item measure developed by Tierney et al. (1999). A sample item is: “I enjoy finding solutions to complex problems.” Alpha was .72.

**Personal initiative.** We used the six-item measure developed by Frese et al. (1997) to measure team members’ personal initiative. A sample item is: “Whenever there is a chance to get actively involved, I take it.” Alpha was .85.

**Organizational support.** We used the 21-item Organizational Support for Innovation Questionnaire (OSIQ) developed by Pirola-Merlo (2000) and consisting of three underlying constructs that measure participants’ perceptions of organizational support factors that facilitate innovation. The three constructs—Organizational encouragement of innovation, Access to resources, and Empowerment—are explained next.

**Organizational encouragement of innovation** has sub-dimensions of i) espoused value of innovation, ii) enacted value of innovation, and iii) open discussion. A sample item is. “This organization demonstrates its commitment to innovation by its decisions and policies.” (enacted value of innovation). **Access to resources** has sub-dimensions of access to i) experts, ii) facilities/materials, iii) information, and iv) time. A sample item is: “In this organization there are usually knowledgeable people who can assist with difficult problems.” (access to experts). **Empowerment** has sub-dimensions of i) autonomy and ii) supervisory encouragement. A sample item is: “I am free to determine how I will allocate my time each day.” (autonomy).

The theoretical structure of the OSIQ measure was tested with CFA. Three latent factors were specified that corresponded to the three theoretical constructs of the scale. Model fit indices indicated moderate fit ($\chi^2[154, n = 162] = 296.25, p < 0.001, \chi^2/df = 1.92; \text{RMSEA} = .076; \text{CFI} = .91$). Two items—“In this project the demand for facilities and materials generally exceeds the supply.” and “In this project, a hectic pace is required in order to meet time constraints.”—had low and non-significant regression values for their specified latent variables ($b = .02, p > 0.81$, and $b = -.04, p > 0.61$, respectively). A specification search on the standardized residual matrix (the difference between the
observed covariance matrix and the matrix implied by the specified model) revealed several large, standardized residuals for these two items, indicating poor fit (> 3, values above 2.58 are considered to be large [Byrne, 2010]). In total, because the two items had poor usability in the scale, we excluded them from further analyses. After their exclusion, the model fit was adequate: $\chi^2(121, n = 162) = 229.18, p < 0.001, \chi^2/df = 1.89; \text{RMSEA = .075; CFI = .93.}$ In addition, we excluded two items related to supervisory support from further analyses because of the risk of multi-collinearity of the independent variables when OSIQ is used in conjunction with the leadership measure, which would inflate the interaction effect. The alpha for the organizational support scale was .90 (17 items).

**Innovation.** Other researchers have measured innovation variously. For example, they have used leaders’ ratings of innovative work behavior (e.g., Yuan & Woodman, 2010), as well as indicators of innovation outcomes such as number of new patents (e.g., Jung, Wu, & Chow, 2008), scientific publications (e.g., Tierney et al., 1999), and new products developed (e.g., Garcia-Morales, Matias-Reche, & Hurtado-Torres, 2008). We used two methods to measure team member innovation: i) an index for indicators of innovation outcomes and ii) team leaders’ ratings of team members’ innovative work behavior.

For the index of innovation outcomes, we asked team members to report the number of 1) new patent applications, 2) scientific publications, 3) new products, and 4) other publications (e.g., non-scientific reports, internal reports, folders, and promotional materials) they had applied for, authored, or developed while working with current leader (see Pirola-Merlo & Mann, 2005). In addition, we asked each team leader and each department manager to report the team’s number of new patent applications, scientific publications, new products, and other publications for the same timeframe. To create an index variable, we calculated the mean for the four measures. As this variable was severely skewed (skew = 2.86, $SE = .19$, kurtosis = 10.37, $SE = .38$), we transformed the index into a natural logarithm with a constant (1) added to each measure in order to correct for non-normality (Tabachnick & Fidell, 2006).

In addition we used a six-item rating scale that measures innovative work behavior developed by Scott and Bruce (1994). Using this scale, we asked each team leader to rate each team member ($\alpha = .83$) and each department manager to rate each team’s
innovativeness ($\alpha = .91$). A sample item is: “[Team member’s name] searches out new technologies, processes, techniques, and/or product ideas.”

To assess the validity of our innovation measures, we analyzed the inter-rater correlations. Table 1 shows that the innovation index at the individual level significantly correlated with the ratings of innovative work behavior by team leaders ($r = .194, p < .05$). Because the team leaders and the department managers used the team as the measurement unit, we aggregated the individual measures at the team level. The team members’ aggregated innovation index correlated with the innovation indices provided by the team leaders and department managers ($r = .265, p < .01$ and $r = .335, p < .01$, respectively). The correlation between the team leaders’ and the department managers’ innovation indices was also high and significant ($r = .688, p < .01$). When the team leaders’ ratings of innovative work behavior were aggregated at the team level, they correlated highly with the department managers’ ratings of the teams ($r = .510, p < .01$). Thus, using these three points of reference, we concluded that the dependent variable of innovation was measured adequately and with good convergent validity.

In subsequent analyses, we used the individual level self-reported measure of innovation outcomes (the innovation index) and the individual level leader-rated assessments of innovative work behavior (items 1 and 2 in Table 1).

---

**Table 1 about here**

---

**Covariates.** We controlled for educational level, which may be related to individual innovation because of increased task domain expertise or knowledge (Mumford & Gustafson, 1988; Scott & Bruce, 1994). We also controlled for the length of time an individual has been a member of the team. A longer time period may influence the number of participation opportunities related to new patents, publications, and so forth. The time spent in the group may also reflect work experience and expertise (Oldham & Cummings,
In addition, we controlled for gender and age. See Table 2 that explains how the covariates were coded.

**Methods of analysis**

To test for common method variance, we conducted Harman’s one-factor test. This test is not a remedy for common method variance but rather a statistical indicator of its severity (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Because of the number of items, the dimensions of the multidimensional LMX and OSIQ scales were parceled. The test revealed five factors with an eigenvalue over 1 that explained 63.7 percent of the total variance. The first factor explained 26.6 percent of the variance. Each measure loaded on a corresponding factor. The items of the intrinsic motivation measure loaded on two separate factors. Hence, we concluded that common method variance did not appear to be a severe problem.

In accordance with Scott and Bruce’s (1994) methodology, we tested our hypotheses using path analysis. In path-analysis the researcher specifies a single model that can be used for a simultaneous analysis of the entire set of hypotheses. Path-analysis also allows the researcher to specify mediator and moderator mechanisms in the analysis of the relationship between independent and dependent variables. Before making our analyses, we screened for multivariate outliers using Mahalanobi’s distance. We excluded four cases that were significant at the recommended $p < 0.001$ level (Kline, 2005). To analyze moderation, we first calculated z-scores to center the independent variables in order to calculate the interaction term that was the product of the LMX and OSIQ scales (Sauer & Dick, 1993). The interaction term, included in the path model as an exogenous variable, was used to predict the endogenous variables of intrinsic motivation and personal initiative. Similar to multiple regression analysis, significant parameter estimates of the paths indicate an interaction effect (Baron & Kenny, 1986; Sauer & Dick, 1993). To test mediation, we used a bootstrapping procedure to estimate the standard errors of the indirect paths. This procedure is considered superior for power and control of Type 1 errors to Baron and Kenny’s (1986) traditional causal steps approach (Preacher & Hayes, 2008). For example, the casual steps approach does not provide estimates of the size of the indirect effects or of standard errors so that confidence intervals can be constructed (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Moreover, bootstrapping is recommended when
distributions are non-normal (Shrout & Bolger, 2002). This was the case with the innovation index measure in this study. We used two methods to calculate statistical significance of the indirect paths. First, the critical ratio test indicates statistical significance at the 5 percent alpha level if the critical ratio (the ratio of the path estimate over its standard error) is above 1.96. Second, we calculated 95 percent confidence intervals and p-values for the indirect paths using the bias corrected percentile method. Maximum likelihood was used to estimate indirect paths as advocated by Brown (1997).

RESULTS

Table 2 presents descriptive statistics and inter-correlations for the two innovation measures and all predictors in the model.

Table 2 about here

Figure 1 presents the results of the path analysis. The hypothesized model provided a good fit to the data when the dependent variable of innovation was the innovation index (Model 1) and when the dependent variable of innovation was team leaders’ ratings of innovative work behavior (Model 2). Model 1: $\chi^2(10, n = 162) = 10.82, p > .372, \chi^2/df = 1.08; \text{RMSEA} = .023 \text{ (LO 90 = .000; HI 90 = .090); CFI} = .99.$

Model 2: $\chi^2(10, n = 156) = 10.78, p > .375, \chi^2/df = 1.08; \text{RMSEA} = .022 \text{ (LO 90 = .000; HI 92 = .074); CFI} = .99.$
Of the nine hypothesized paths, five paths were significant at the .05 alpha level. LMX associated positively with intrinsic motivation and personal initiative in both models (Model 1: $b = .22, p < .01$ and $b = .27, p < .01$, respectively. Model 2: $b = .21, p < .01$ and $b = .27, p < .01$, respectively). These results support Hypotheses 2a and 2b. However, only personal initiative was significantly related to individual innovation (Model 1: $b = .22, p < .01$. Model 2: $b = .22, p < .01$). This result supports Hypothesis 3b. Contrary to Hypotheses 1 and 2b, the direct effect of LMX and intrinsic motivation was not significantly related to individual innovation in either model. In Model 1, the covariates gender and the time spent on a team were significantly associated with individual innovation ($b = -.17, p < .05$, and $b = 15, p < .05$, respectively). Men reported more innovations than women. People with longer tenure on teams also reported more innovations. Additionally, organizational support was significantly related to intrinsic motivation in Model 2 ($b = .16, p < .05$), but not in Model 1. Organizational support was not related to personal initiative in either model. This result partially supports Hypothesis 4a but not Hypothesis 4b.

**Mediation analyses.** Model 1 showed a significant indirect effect of LMX on individual innovation with both estimation methods (the critical ratio test: $b = .078, SE = .038, CR = 2.05$, and the bias corrected 95 percent confidence interval method: LO 95 = .021, HI 95 = .173, $p < .01$). In Model 2, the critical ratio of the parameter estimate and its bootstrap calculated standard error showed a tendency to be significant ($b = .056, SE = .031, CR = 1.81$), while the bias corrected confidence interval method was significant (LO 95 = .007, HI 95 = .133, $p < .05$). However, the above-stated effect represented the combined indirect effect of LMX on individual innovation, mediated by both intrinsic motivation and personal initiative. Because intrinsic motivation and individual innovation were not significantly related, we re-ran Models 1 and 2 excluding intrinsic motivation to test if the indirect effect mediated through personal initiative only was still significant. In both models and with both methods (i.e., the critical ratio test with bootstrapped standard errors, and the bias corrected confidence interval method), the indirect effect of LMX on team members’ innovation by personal initiative was significant (Model 1: $b = .068, SE = .034, CR = 2.00, LO 95 = .018, HI 95 = .156, p < .01$. Model 2: $b = .058, SE = .028, CR = 2.07, LO 95 = .016, HI 95 = .128, p < .01$). Thus, Hypothesis 3c was supported while Hypothesis 2c was not.
Moderation analyses. In both Models 1 and 2, the interaction term was significantly associated with team members’ personal initiative (Model 1: $b = .21, p < .01$. Model 2: $b = .20, p < .01$), but not with their intrinsic motivation. Because the direct effect on personal initiative by OSIQ was not significant, we concluded that LMX interacts with OSIQ because higher levels of OSIQ is associated with a stronger relationship between LMX and personal initiative. Intrinsic motivation had positive relationships with OSIQ and LMX, but we found no interaction. Thus, Hypothesis 4c was partially supported.

DISCUSSION

To our knowledge, this is the first study to test the individual level variables of intrinsic motivation and personal initiative as mediators in the hypothesized relationship between LMX and individual innovation. Furthermore, we hypothesized that the degree of support from the organization moderated the relationship between LMX on team members’ intrinsic motivation and personal initiative. Our hypothesis was that the relationship would be strengthened when support was high.

We used two measures for innovation. The first was the combined number of patent applications, products, scientific publications, and other publications that team members were involved with while working in the team under the current leader. The second measure was the team leaders’ subjective ratings of their team members’ innovative work behaviors.

Leader-member exchange in relation to intrinsic motivation and personal initiative

The leader-member work relationship was positively related to team members’ intrinsic motivation and personal initiative. This finding agrees with other studies (e.g., Atwater & Carmeli, 2009; Tierney et al., 1999). Thus, the emphasis on extra-contractual influences, such as trust, respect, and mutual contribution toward work goals (Greguras & Ford, 2006), may influence team members’ intrinsic motivation. Moreover, and importantly, we believe our study is the first empirical study to link LMX to personal initiative.

It has been theorized that in the negotiation of the LMX relationship, leaders reward positive behaviors such as initiative by allowing team members more autonomy, influence,
and discretion in decision-making (Graen & Cashman, 1975; Scott & Bruce, 1994). We found that organizational support moderates the relationship between LMX and team members’ personal initiative. The relationship is stronger under higher levels of organizational support. When team leaders and team members work in a context where innovation is actively encouraged (e.g., where relevant expertise, information, facilities, and materials are provided), team leaders have more flexibility in meeting their members’ innovation needs. In an organization where autonomy is encouraged, team leaders may allow team members greater freedom and more discretion in making decisions and in taking action (Frohman, 1999). Hence, as we hypothesized, where organizational support is strong, team leaders may more easily build high quality work relationships with their team members. Such relationships may positively motivate team members to work innovatively.

The role of personal initiative in innovative ventures

In our measurement of individual innovation using indicators of innovation outcomes and team leaders’ ratings of innovative work behavior, we found that team members’ personal initiative was directly related to their innovation. Contrary to our expectations, we found that team members’ intrinsic motivation was not related to innovation. While intrinsic motivation reflects an employee’s mental state (Amabile, 1983), personal initiative can be seen as the behavioral enactment of intrinsic motivation (Frese et al., 1997). Innovation work is often portrayed as a non-linear and risky process in which ideas often misfire, problems are ill-defined, and advances seldom follow an incremental path (Mumford et al., 2002). Moreover, innovation work involves more activities than idea generation. Such activities include developing ideas, championing ideas, acquiring resources, and taking steps toward implementation (Tidd & Bessant, 2009).

We conclude that personal initiative may be a more pertinent construct for examining individual innovation than intrinsic motivation. Personal initiative focuses on proactive behaviors that seem essential for innovation activities. Intrinsic motivation did not relate to team members’ innovation in our study because the participants, mostly scientists and engineers, were already likely to be strongly motivated owing to the difficult challenges of their tasks (Amabile, 1983) and to the advanced level of their own capabilities (Feist & Gorman, 1998). Indeed, we found that intrinsic motivation had the
highest mean in combination with the lowest standard deviation of the variables that predicted innovation.

**Leader-member exchange and team member innovativeness**

We call particular attention to the fact that we found no direct relationship between LMX and team members’ innovation, either by our use of the innovation index or by our use of team leaders’ ratings of innovative work behavior. This result contrasts with Scott and Bruce’s (1994) and Yuan and Woodman’s (2010) studies in which they found positive, direct relationships in LMX with employee innovation as the outcome. However, we found that LMX was indirectly related to team member innovation through personal initiative (i.e., personal initiative acted as a mediator between LMX and innovation).

Our findings should be interpreted in the context of our sample of team members who were mostly Swedish-based scientists and engineers and Swedish-educated team leaders. Swedish management principles have been contrasted with management principles in other cultural contexts (e.g., Byrkjeflot, 2003; Gerstner & Day, 1994; Holmberg & Åkerblom, 2006). In recent decades, a process of de-centralization has become evident among organizations in Sweden in which middle managers and their teams have exerted significant influence over organizational processes (Tengblad, 2003). In this process, ideas such as egalitarianism, shared decision-making, employee collaboration, and team/individual autonomy are emphasized (Holmberg & Åkerblom, 2006). Moreover, this process may have been accentuated in R&D departments. Therefore this study, which focuses on the characteristics of individuals and the supporting roles of leaders and organizations, may reflect Swedish organizational and managerial principles. Our results are also consistent with those from a recent study on Swedish industry- and university-based research groups in the bio field that found no correlation between team member-rated LMX and the publication of scientific research (Olsson, Hemlin, & Pousette, 2012). Instead, that study found that the team leaders’ ratings predicted this outcome.

Our results may also reflect the individual characteristics of the team members. In a meta-analysis of the personalities of scientists, Feist and Gorman (1998) concluded that among other traits, scientists in general are more independent, driven, and achievement-oriented than non-scientists. In addition, they found that when highly creative scientists
were compared with their less creative peers, this pattern of autonomy and achievement orientation was even more evident.

Given the personal characteristics and geographical setting of our sample, it is possible that the team leaders’ influence may be a hygienic factor. That is, as long as the work relationship is reasonably satisfactory, the innovative work of team members will be adequately supported. However, a higher quality work relationship will not necessarily lead to more innovation. This conclusion agrees with Tierney et al.’s (1999) finding that a difference exists between less and more innovative employees when leaders exert little influence over the latter group. Thus, we conclude that leaders may play a role in the facilitation of innovativeness, for example, by providing adequate resources and autonomy.

Another finding of this study relates to the correlation between team leaders’ and team members’ perceptions of their work relationship. We found this relationship to be non-significant. This result is indicative of a well-known problem in LMX theory. The problem may be caused by the LMX construct itself (see Greguras & Ford, 2006), by the measurement of LMX in this study, or by the characteristics of the sample. According to theory, LMX is a dyadic phenomenon (Schriesheim, Castro, Zhou, & Yammarino, 2001) in which the work relationship is viewed as an interactional, mutual exchange. Since both parts of the dyad should have a shared understanding of the relationship, researchers have strongly encouraged measuring both parts (e.g., Schriesheim et al., 2001). However, research from the past 30 years shows that the covariance of leaders’ and member’s ratings of the LMX relationship ranges only from 10 to 20 percent (Gerstner & Day, 1997).

Our study is an improvement on past measurement of dyadic LMX because team leaders and team members read their counterparts’ names in the survey statements. This procedure increased the clarity of their responses. Furthermore, we expected the leader-member agreement on LMX to be high because, by tradition, Swedish management styles tend to focus strongly on interpersonal relationships (Holmblad & Åkerblom, 2006). However, Olsson et al. (2012) have also found no significant correlation between leaders’ and team members’ LMX-MDM ratings in Swedish industrial and academic research groups. Thus, we question whether Liden and Maslyn’s (1998) conceptualization of LMX measures a dyadic phenomenon.
Implications

This study has implications for the management of innovation. First, human resources managers in R&D, when screening for new hires, should look for industrial engineers/scientists who show initiative and motivational characteristics in addition to typical engineering/scientific skills. Second, team leaders should encourage and support innovation by giving team members the opportunity to use their individual initiative. Third, organizations should support innovation through adoption of policies that complement personal initiative. They should adopt policies that give team members increased autonomy and that allocate sufficient resources to their projects.

Limitations and suggestions for further research

We acknowledge some limitations to our study. First, as we used a cross-sectional research design, our findings and inferences about relationships between variables cannot be interpreted as causal. It is possible that some relationships may be reciprocal. For instance, we hypothesized that team leaders influence the motivation and initiative of their team members. However, it is possible, and even likely, that team members who are already highly motivated affect the leader-member relationship positively. We suggest future studies using longitudinal designs consider these kinds of reciprocal relationships. Second, as there are often highly complex interrelationships between the variables of organizational behavior, the relationships in our hypothesized model should be seen as one of several possible models. For instance, organizational support may mediate, rather than moderate, the relationship between LMX and intrinsic motivation and personal initiative. Because leaders often are the primary tools organizations use to support innovation, they are the creators of such support. Third, as stated above, we found little agreement between team leaders’ and team members’ opinions on their work relationships. We encourage researchers of meta-analyses of LMX theory to address this theoretical issue. Finally, because we obtained our predictor variables and the measure of innovation outcomes from team members only, there is a risk of common source bias. The risk is somewhat abated, however, because we found the same pattern of interrelationships when team members’ innovative work behavior was rated by team leaders.
Conclusions

This study contributes to the vast area of leadership research by introducing a promising construct, personal initiative, as an antecedent of individual innovation. Moreover, our study contributes to innovation management research. As innovative work generally is performed in unpredictable and complex environments (Kaiser, Hogan, & Craig, 2008; Marion & Uhl-Bien, 2001), the ability to overcome obstacles proactively may be a key factor for in-house innovation. The amount of individual initiative may be a moderating factor in the relationship between creativity and innovation. New ideas are more likely to be transformed into innovations when personal initiative is high (Rank et al., 2004). A strength of this study is that we tested the model with two different measures of individual innovation: team leaders’ ratings of innovative work behavior and indicators of innovation outcomes. These measures were further corroborated by three different sets of actors at the organizations. Such corroboration validates our findings and inferences about LMX, intrinsic motivation, personal initiative, and the roles they play in individual innovation.

REFERENCES


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Tables and Figures
## TABLE 1
Correlations between the innovation measures at the individual level and the team level as reported by team members, team leaders, and department managers

<table>
<thead>
<tr>
<th>Level</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>1. Team member innovation index (^1) (n = 166)</td>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2. Leader ratings of IWB (^2) (n = 161)</td>
<td>.19(^*)</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Team member innovation index (aggregated) (n = 166)</td>
<td>.66(^**) .05</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Leader innovation index (n = 166)</td>
<td>.18(^<em>) .20(^</em>) .27(^**)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Department manager innovation index (n = 126)</td>
<td>.23(^*) .05 .34(^<strong>) .69(^</strong>)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Leader ratings of IWB (aggregated) (n = 161)</td>
<td>.03 -.03 .56(^<strong>) -.05 .21(^</strong>) .06</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Department manager ratings of IWB (n = 126)</td>
<td>.03 .22(^*) .03 .44(^<strong>) .51(^</strong>) .31(^**)</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

\(^1\) Logarithmized mean of patent applications, scientific publications, new products or product improvements, and other publications.

\(^2\) Innovative work behavior.

\(^*\) p < .05

\(^**\) p < .01
TABLE 2
Means, standard deviations, and inter-correlations\(^a\) between the study’s variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Team member innovation index</td>
<td>2.81</td>
<td>4.10</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>2. Leader ratings of IWB(^b)</td>
<td>5.25</td>
<td>.83</td>
<td>22(^**)</td>
<td>(.83)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Leader-member exchange quality</td>
<td>5.26</td>
<td>.93</td>
<td>.11</td>
<td>.08</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(.91)</td>
</tr>
<tr>
<td>4. Intrinsic motivation</td>
<td>6.06</td>
<td>.67</td>
<td>22(^**)</td>
<td>.12</td>
<td>.24(^**)</td>
<td>(.71)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Personal initiative</td>
<td>5.39</td>
<td>.73</td>
<td>.31(^**)</td>
<td>.24(^**)</td>
<td>.25(^**)</td>
<td>.46(^**)</td>
<td>(.84)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Organizational support</td>
<td>4.87</td>
<td>.79</td>
<td>.06</td>
<td>.14</td>
<td>.32</td>
<td>.24(^**)</td>
<td>.18(^*)</td>
<td>(.88)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Gender(^c)</td>
<td>-</td>
<td>-</td>
<td>23(^**)</td>
<td>-.08</td>
<td>-.02</td>
<td>-.07</td>
<td>-.13</td>
<td>.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Education(^d)</td>
<td>3.19</td>
<td>1.26</td>
<td>.10</td>
<td>.11</td>
<td>.16(^*)</td>
<td>.04</td>
<td>.18(^*)</td>
<td>-.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Time on team (years)</td>
<td>3.11</td>
<td>2.86</td>
<td>.23(^**)</td>
<td>.07</td>
<td>.06</td>
<td>-.01</td>
<td>.05</td>
<td>-.04</td>
<td>-.12</td>
<td>-.18(^*)</td>
<td></td>
</tr>
<tr>
<td>10. Age (in years)</td>
<td>42.10</td>
<td>10.30</td>
<td>-.08</td>
<td>.09</td>
<td>.02</td>
<td>-.03</td>
<td>-.04</td>
<td>-.01</td>
<td>-.05</td>
<td>-.14</td>
<td>.02</td>
</tr>
</tbody>
</table>

\(^a\) \(n = 162\), for variable 2, \(n = 157\). Cronbach’s coefficient alphas are given on the diagonal, where relevant.

\(^b\) Innovative work behavior.

\(^c\) Gender was coded as follows: 0 = “male”, 1 = “female”.

\(^d\) Education was coded as follows: 1 = “Less than bachelor’s degree”; 2 = “Bachelor’s degree”; 3 = “Master’s degree”; 4 = “Licenciate degree”; 5 = “Doctor’s degree”; 6 = “Associate professor”; 7 = “Professor”.

\(^*\) \(p < .05\)

\(^**\) \(p < .01\)
FIGURE 1a

Results for the hypothesized paths between leadership, and innovation outcomes mediated by intrinsic motivation and initiative and moderated by organizational support

Two sets of parameter estimates are presented. The first set (Model 1) uses the employee innovation index as the dependent variable. The second set (Model 2) is in parentheses and uses team leaders’ ratings of innovative work behavior as the dependent variable. Standardized beta coefficients are given for the structural paths. R² is presented for the endogenous variables. All exogenous variables were allowed to correlate.

* This is the interaction term of OSIQ and LMX.

a Two sets of parameter estimates are presented. The first set (Model 1) uses the employee innovation index as the dependent variable. The second set (Model 2) is in parentheses and uses team leaders’ ratings of innovative work behavior as the dependent variable. Standardized beta coefficients are given for the structural paths. R² is presented for the endogenous variables. All exogenous variables were allowed to correlate.

\( p < .05 \)

\( p < .01 \)
LEADERSHIP AND INDIVIDUAL INNOVATION: A CROSS-CULTURAL STUDY OF MEDIATING PSYCHOLOGICAL MECHANISMS

Denti, L., (a) Hemlin, S., (b) and Mumford, M. D. (c)

(a) Dept. of Psychology / Gothenburg Research Institute, University of Gothenburg
   Email: leif.denti@gu.se
(b) Dept. of Psychology / Gothenburg Research Institute, University of Gothenburg
(c) Dept. of Psychology, The University of Oklahoma
Abstract

This cross-cultural study models psychological mechanisms by which leadership relates to individual innovation. Altogether, 269 R&D team members, 60 team leaders, and 20 department managers in a multi-national automotive company in the USA, Sweden, France and India took our surveys. We measured individual innovation in two ways. First, we collected indicators of innovative outcomes (new or improved products, new patent applications, and scientific and other publications). Second, we measured individual innovative work behavior using team leaders’ assessments. Leadership (conceptualized by leader-member exchange theory) was positively associated with individual innovation. Creative self-efficacy and personal initiative mediated this relationship with innovation outcomes. We also found that the culturally bound value of conservation was negatively related to individual innovation. The article discusses hiring and managing implications for organizations that employ highly skilled engineers/scientists in R&D environments. It concludes with recommendations for future research on the mechanisms that explain the relationship between leadership and individual innovation.

Keywords: Leadership, innovation, cross-cultural, creative self-efficacy, personal initiative, conservation
LEADERSHIP AND INDIVIDUAL INNOVATION: A CROSS-CULTURAL STUDY OF MEDIATING PSYCHOLOGICAL MECHANISMS

Innovation is increasingly recognized as an important contributor to the success of organizations. As a consequence, more and more research is directed toward the factors that promote innovation. Such factors have been identified at the level of the organization (see Damanpour & Aravind, 2012), the team (see Hülsheger, Anderson, & Salgado, 2009) and the individual employee (see Anderson, de Dreu, & Nijstad, 2004). Yet, as a research area, the study of individual innovation is fragmented. There is an absence of research that coherently integrates psychological factors that explain why antecedent variables affect individual innovation (Shalley, Zhou, & Oldham, 2004; Yuan & Woodman, 2010).

This study focuses on the innovation activities of the team members on research and development (R&D) teams in organizations. In the study, we take an interactionist perspective on individual innovation in our acknowledgement that psychological and contextual factors influence individual innovation (see Hemlin, Allwood, & Martin, 2008). Leadership, a key issue in this study, has been shown conclusively to influence employee innovation (Rosing, Frese, & Bausch, 2011). However, more research is needed on the variables that mediate the relationship between leadership and innovation (Denti & Hemlin, 2012a). The purpose of this study is to examine several psychological factors in an effort to describe the mechanisms that explain the relationship between leadership and individual innovation.

In the study we address key antecedents of individual innovation: leadership (Mumford, Scott, Gaddis, & Strange, 2002), individuals’ creative self-efficacy (Tierney & Farmer, 2011), and individuals’ personal initiative in innovation activities (Frese, Fay, Hilburger, Leng, & Tag, 1997). Creative self-efficacy is an individual’s self-perception of personal creative ability (Tierney & Farmer, 2002). Personal initiative is an individual’s propensity to take a proactive approach to work (Frese et al., 1997). Both creative self-efficacy and personal initiative are relevant psychological constructs worth investigating in the study of individual innovation. However, to date, neither has been the subject of much empirical research (Rank, Pace, & Frese, 2004; Shalley et al., 2004). In this study we argue
that individuals’ creative self-efficacy and personal initiative are important variables that explain how R&D team leaders influence team members’ innovation.

This study responds to the call by Anderson et al. (2004), Rank et al. (2004), Shalley et al. (2004), and Yuan and Woodman (2010) to examine the relationship between leadership and innovation in cross-cultural settings. As Anderson et al. (2004) concluded, most of the innovation research uses U.S. settings. Therefore, more cross-cultural research is needed in order to apply the findings more generally. The setting of our study is a multinational automotive company. We surveyed employees at locations in the USA, Sweden, France, and India.

In addition to investigating the mechanisms involved in the relationship between leadership and innovation, we studied the construct conservation, a personal value orientation that refers to an individual’s respect for tradition, conformity, and security (Schwartz, 1992). We argue conservation is a relevant factor in the investigation of the change processes required for innovation in a cross-cultural setting (Rank et al., 2004; Shalley et al., 2004; Shin & Zhou, 2003).

The need for a multi method measurement of innovation

Researchers, psychologists, and practitioners, among others, have conceptualized innovation in many different ways. Often innovation is intertwined and used interchangeably with the concept of creativity (Csikszentmihalyi, 1999). For this study, we rely on the definition of innovation as “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (OECD, 2005, p. 46). Innovation at the individual level is thus an individual’s active involvement in the development of new or improved products, processes, or methods. We also distinguish innovation from creativity in that we view creativity as the production of novel and valuable ideas (e.g., Amabile, Conti, Coon, Lazenby, & Herron, 1996), while innovation is the implementation of creative ideas (Anderson et al., 2004). Creativity is an integral part of innovation but precedes innovation in the multi-stage process in which creative ideas are transformed into tangible outcomes (Basadur, 2004).

Supervisors’ ratings of employees’ innovative work behaviors are a commonly used approach to measure innovation at the individual level (e.g., De Jong & den Hartog, 2010;
Scott & Bruce, 1994; Yuan & Woodman, 2010). At the organizational level, innovation is often measured using various indicators, such as the number of new products (goods or services), product improvements, patents or patent applications, and publications (Martin, 2012). An assumption of this approach is that innovative work behaviors will manifest themselves in tangible outcomes. However, researchers use such indicators at the individual level less frequently. When researchers use them, typically they use only one or two indicators. For example, Rank, Nelson, Allen, and Xu (2009) positively correlated the number and effectiveness of innovations to supervisor-rated innovative work behavior by employees.

In this study we follow Anderson et al. (2004) in that we attempt to measure innovation at the individual level using both subjective ratings of innovative work behaviors as well as indicators of innovation outcomes.

**Leader-member exchange and innovation**

Team leaders play a central role in facilitating and supporting their members’ innovative efforts and outcomes (Mumford et al., 2002; Rosing et al., 2011). In this study we take an interactional perspective on leadership in that we view it as an inter-relational phenomenon. In this perspective, leaders influence employees through work relationships. For theoretical support, we refer to Leader-Member Exchange theory (LMX).

LMX theory views the dyadic relationship between leader and follower as an exchange relationship (Graen & Uhl-Bien, 1995). In LMX theory, leaders enter a tacit agreement with followers about the expectations of each member in the dyadic relationship. A low quality LMX relationship is based chiefly on the formal work contract, where, for example, employees exchange their time and labor for money. By contrast, in a high quality LMX relationship, the parties in the dyad exchange mutual trust, respect, liking, and influence (Greguras & Ford, 2006). The commitment to work is over and above that specified by the terms of their formal work contracts. Higher performance expectations and greater performance recognition prevalent in high quality LMX relationships may stimulate team members’ innovative work behaviors (Yuan & Woodman, 2010). High quality LMX relationships may be conducive to team member creativity because of the heightened sense of advocacy and trust (Mumford & Gustafson, 1988). Various researchers have associated the quality of the LMX relationship with employee innovation (e.g., Basu & Green, 1997;
Scott & Bruce, 1994; Yuan & Woodman, 2010). Leaders in high quality LMX relationships may provide more opportunities for team member autonomy (Liden & Maslyn, 1998), thereby increasing their discretion in the decision-making related to creative ideas (Hemlin, Allwood, & Martin, 2008). Decision latitude, work autonomy, and leader influence, which are more common in high LMX quality relationships, have been associated with innovative behavior (e.g., Oldham & Cummings, 1996; Pelz & Andrews, 1966). Therefore, we hypothesize:

**H1: LMX is positively related to individual innovation.**

**Personal initiative as a mediator between LMX and innovation**

A relevant definition of personal initiative is “a behavior syndrome resulting in an individual’s taking an active and self-starting approach to work and going beyond what is formally required in a given job” (Frese et al., 1997, p. 140). Personal initiative is conceptually similar to intrinsic motivation, but whereas intrinsic motivation is a psychological state (Amabile, 1983), personal initiative is a behavioral construct (Frese et al., 1997). Individuals with high personal initiative, according to Frese et al., are proactive and persistent in working to meet challenges and overcome setbacks. This behavioral orientation may be especially relevant in R&D settings where unpredictable and novel problems often arise and where progress is seldom linear (Marion & Uhl-Bien, 2001).

As far as innovative work, where the emphasis is on the implementation of ideas, personal initiative is a relevant concept for investigation because of its behavioral and action-oriented focus (Frese et al., 1997; Rank et al., 2004). Personal initiative has been related to individual creativity (Binnewies, Ohly, & Sonnentag, 2007). Along similar lines, Daniels, Wimalasiri, Cheyne, and Story (2011) showed that individuals with high personal initiative generate and implement more ideas that solve work-related problems. Seibert, Kraimer, and Crant (2001) found that the related concept of proactiveness was positively related to innovative work behavior, and subsequently to career success. We posit that individuals with high personal initiative are more likely to champion and implement ideas. Therefore, we hypothesize:
H2a: Personal initiative is positively related to innovation.

We hypothesize that personal initiative mediates the relationship between LMX and individual innovation. The increased trust and mutual contribution associated with high quality leader-member work relationships may encourage team members to take personal initiative. In such relationships, they may perceive that leaders will listen to their ideas and support the implementation of them. Moreover, the increased autonomy associated with high quality LMX relationships (Liden & Maslyn, 1998) may give team members more decision-making discretion as they try to develop their ideas. Leaders may also directly stimulate personal initiative by approving and encouraging such behavior, and by postponing negative evaluations until performance is proven unsatisfactory (Frohman, 1999). Therefore, we hypothesize:

H2b: Leader-member exchange is positively related to personal initiative.
H2c: Personal initiative is a mediating variable between leader-member exchange and innovation.

Creative self-efficacy as a mediator between LMX and personal initiative

A number of studies (e.g., Gong, Huang, & Fahr, 2009; Tierney & Farmer, 2011) have found that creative self-efficacy, which is the belief in one's ability to produce creative outcomes (Tierney & Farmer, 2002) is related to creativity more generally. Other studies have associated leaders’ influence and creative self-efficacy with leaders’ supportive behaviors (Chong & Ma, 2010; Tierney & Farmer, 2002). According to LMX theory, such behaviors are evident in high quality LMX relationships (Basu & Green, 1997; Liden & Maslyn, 1998). Thus, in high quality LMX relationships, employees’ creative self-efficacy should strengthen. Furthermore, in high quality LMX relationships, leaders can verbally express their trust in their team members’ creative abilities (Liao, Liu, & Loi, 2010). With the increased trust, autonomy and decision latitude that high quality LMX relationships promote, a virtuous cycle begins in which leaders encourage employees to generate creative products; this encouragement may increase employees’ confidence in their creative abilities (Chong & Ma, 2010; Yuan & Woodman, 2010). Then the increase in
creative performance may increase the quality of the LMX relationship (Bauer & Green, 1996). And so the cycle repeats. Tierney and Farmer (2011) demonstrated that leaders’ high expectations of creativity increase employees’ creative self-efficacy over time. Therefore, we hypothesize:

H3a: Leader-member exchange is positively related to creative self-efficacy.

As described above, creative self-efficacy is primarily a self-belief in one’s capability for producing creative outcomes. To realize such self-belief as tangible outcomes, people must act on them. Creative self-efficacy is thus likely to be positively related to personal initiative, which, although similar, is more oriented towards action. An individual with strong self-belief is more inclined to try to realize an idea than an individual with weaker self-belief (Tierney & Farmer, 2011). There is evidence in the research that leaders can promote followers’ self-efficacy (Redmond, Mumford, & Teach, 1993; Tierney & Farmer, 2011). Therefore, we hypothesize:

H3b: Creative self-efficacy is positively related to personal initiative.
H3c: Creative self-efficacy is a mediating variable between leader-member exchange and personal initiative.

**Conservation and innovation**

Schwartz (1992, p. 1) defined a value as “the criteria people use to select and justify actions and to evaluate people (including the self) and events.” Thus, values play a fundamental role in shaping individuals’ goals and behaviors (Schwartz, 2006). We argue that the value of conservation is negatively related to innovation. Conservation is one of two overarching value dimensions in Schwartz’s (1992) value theory that posits ten fundamental human values. Conservation mainly consists of three values in combination: tradition, conformity, and security. Tradition refers to commitment to the rites, beliefs, and behaviors of a culture or religion. Conformity refers to the inhibition of behaviors that violate social expectations or norms. Security refers to the preservation and maintenance of the harmony, stability, and safety of relationships and of self.
Thus, individuals with high conservation are inclined to act in accordance with their place in society, conform to established ways of doing things, and generally maintain the status quo. Individuals with low conservation are inclined to seek freedom, insist on personal discretion, and challenge the status quo. We posit that innovative behaviors and outcomes are less prevalent for individuals with high conservation since they do not habitually go beyond the formal expectations associated with their roles. Individuals with high conservation are furthermore less likely to search for challenges and to make changes. They are less likely to generate and champion ideas, seek support for ideas, or try to overcome obstacles in the implementation of ideas. Therefore, we hypothesize:

H4. The degree of conservation is negatively related to innovation.

METHODS

Sample and procedures

The sample for this study\(^1\) consisted of 269 team members in 60 R&D teams employed by the same automotive company. We conducted our electronic surveys in late 2011 and early 2012. The number of team members in each team varied from 1 to 13 (\(M = 4.1, \ SD = 2.6\)). The teams were in four countries: Sweden (\(n = 55\)), the USA (\(n = 76\)), France (\(n = 38\)), and India (\(n = 100\)). The team leaders (\(n = 60\)) and the department managers (\(n = 22\)) also participated in the survey. The response rate was as follows: team members: 47 percent; team leaders: 86 percent; department managers: 73 percent.

The team members were chiefly engineers and scientists. Their average age was 37.0 years (\(SD = 10.8\)), and 86 percent were men. As far as education, 10 percent had less than a Bachelor’s degree, 85 percent had a Bachelor’s degree or Master’s degree, and 5 percent had a degree higher than a Master’s degree. On average, team members had worked in their teams for 3.6 years (\(SD = 4.1\)).

Team members responded to measures of LMX, creative self-efficacy, personal initiative, conservation, and indicators of innovation outcomes. Team leaders responded to measures of their team members’ innovative work behavior and indicators of innovation outcomes.

\(^1\) Our sample is smaller than the number of surveys we received (\(N = 336\)) because of missing data in the dependent variables (our innovation measures).
outcomes at the team level. Department managers were asked to rate the teams under their supervision on an innovation scale and to report indicators of innovation outcomes for each team. Using the electronic survey system, participants could see the names of their team leaders, their team members, and their team. Team leaders were asked to rate their team members, and vice versa. The sample consisted of 222 team leader-member dyads.

**Measures**

The survey items were phrased as statements that participants rated on a seven-point Likert scale: (e.g., 1 = Strongly disagree; 4 = Neither/nor; 7 = Strongly agree). Unless otherwise specified, we calculated indices of each measure using the mean of items for the measure.

*Construct validity and construct equivalence of measures.* Since the hypothesized relationships were tested in a model with participants from several countries, we conducted tests for measurement equivalence between countries. As Riordan and Vandenberg (1994) point out, culture, which may influence individuals’ frames of reference, may cause a construct to be interpreted differently. Cultural differences also exist in participants’ response styles when answering questionnaires (Van Vaerenberg & Thomas, 2012). For these reasons it is vital to show that a construct has between-country measurement equivalence (in addition to a good factor structure) before any further analyses are conducted (Cheung & Rensvold, 2000). We followed the strategy for establishing between-country measurement equivalence that Byrne (2010) recommended. In phase one, we used confirmatory factor analysis (CFA) to establish a baseline model according to the measure’s theoretical factor structure with good model fit (Model 1). In those cases where the model fit indices were not within acceptable boundaries, items with the lowest factor loadings were removed until the model fit indices were deemed adequate. In phase two, we constrained factor loadings as equal among the four countries (Model 2). Because the two models are nested, we used the Comparative Fit Index (CFI) to compare the constrained model (Model 2) to the unconstrained baseline model (Model 1). This procedure tested for equal patterns of factor loadings in the four countries.

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2 Byrne (2010) recommended the following boundaries for the model fit measures: CFI > .90, RMSEA < .08, \( \chi^2/df \) between 1-3.
Following Cheung and Rensvold’s (2002) recommendation, we chose a limit value of .01 for the difference in CFI (ΔCFI). If ΔCFI, when comparing Model 2 to Model 1, was greater than .01 (i.e., factor loadings were likely to differ across countries), we systematically identified the items that were likely to differ by constraining individual items and comparing these models to the baseline model (Model 1). These items were then removed until the measure was equivalent among the countries.

**Leadership.** We used the four-dimensional, 12-item leader-member exchange (LMX-MDM) measure (Liden & Maslyn, 1998) to measure team members’ perceptions of their work relationship with their leader. The sub dimensions of LMX-MDM are defined as follows: 1. **Contribution:** The perceived amount of work-related activity aimed at achieving mutual goals. 2. **Loyalty:** The amount of mutual expression of public support for the goals and personal character of the other member of the LMX dyad. 3. **Affect:** The amount of mutual affection. 4. **Professional Respect:** The amount of mutual respect for professional capabilities (Liden & Maslyn, 1998, p. 50). A sample item of the sub dimension contribution is “I do work for [team leader’s name] that goes beyond what is specified in my job description.”

To establish cross-cultural measurement equivalence, we specified a baseline, four-factor model in which all items loaded on their corresponding theoretical factor (Model 1). The model fit for Model 1 was good ($\chi^2[192, n = 322] = 327.8, p < 0.001, \chi^2/df = 1.71; \text{RMSEA} = .047; \text{CFI} = .960$). We then constrained all factor loadings to test for equivalence (Model 2). In comparing Model 2 to Model 1, ΔCFI was .013, which is above the chosen limit value of .01. After removing the item “[leader name] defends my work actions to a superior, even without complete knowledge of the issue in question”, ΔCFI was .09, and the LMX-measure was thus equivalent at the level of factor loadings. The model fit for the 11-item LMX-measure was good ($\chi^2[152, n = 322] = 277.8, p < 0.001, \chi^2/df = 1.83; \text{RMSEA} = .051; \text{CFI} = .961$). Alpha was .93.

**Creative self-efficacy.** We measured team members’ creative self-efficacy on a three-item scale developed by Tierney and Farmer (2002). A sample item is: “I feel that I am good at generating novel ideas.” Because this measure consisted of three items, model fit values cannot be calculated. As a result, we could not test for measurement equivalence. Alpha was .82.
**Personal initiative.** We measured team members' personal initiative using a seven-item scale developed by Frese et al. (1997). A sample item is: “Whenever there is a chance to get actively involved, I take it.” To test for cross-cultural equivalence of factor loadings, we specified a baseline model where all items loaded on a single factor (Model 1). Model 1 had good model fit ($\chi^2[56, n = 327] = 101.0, p < 0.001, \chi^2/df = 1.80; \text{RMSEA} = .050; \text{CFI} = .966$). We then tested for equivalence of the factor loadings by constraining these as equal among the four countries (Model 2). In comparing Model 2 to Model 1, $\Delta\text{CFI} = .03$, which implied that the factor loadings were equivalent among the samples. Alpha was .89.

**Conservation.** We measured team members’ conservation with the ten-item Short Schwartz’s Value Survey (SSVS) developed by Lindeman and Verkasalo (2005). Each item reflects a dimension of Schwartz’s (1992) value theory. To calculate team members’ conservation scores, we used Lindeman and Verkasalo’s weights. Because each item of the SSVS measures one dimension of Schwartz’s value theory, we could not test for model fit or measurement equivalence. Alpha was .83.

**Innovation.** We used two methods to measure team member innovation: (1) team leaders’ subjective ratings of innovative work behavior and (2) an index of indicators of innovation outcomes.

For the ratings of innovative work behavior, we used a six-item, individual innovation scale developed by Scott and Bruce (1994). A sample item is: “[Team member’s name] searches out new technologies, processes, techniques, and/or product ideas.” The measure was subjected to CFA in which all indicators were specified to load on a single latent factor. One item was removed to improve model fit: “[Team member’s name] investigates and secures funds needed to implement new ideas.” After the removal of this item, the model fit was fair ($\chi^2[20, n = 249] = 57.4, p < 0.001, \chi^2/df = 2.87; \text{RMSEA} = .087; \text{CFI} = .962$), and the measure was equivalent at the level of factor loadings ($\Delta\text{CFI} = .001$). Alpha was .93.

For the measurement of individual innovation outcomes, we asked team members to report the number of 1) new patent applications, 2) scientific publications, 3) new product improvements (i.e., new components), and 4) other publications (i.e., reports, white papers, manuals) they had been involved with or authored since joining the team under its current leader. Team members could also report that an indicator was not part of the team’s normal
output (e.g., “this work group does not produce scientific publications”). To create an innovation index variable, we calculated the mean for the four indicators. We excluded non-relevant indicators in the construction of this mean (i.e., when participants noted that a specific indicator was not a valid output for their work). As this measure was severely skewed (skew = 2.29, SE = .13, kurtosis = 5.98, SE = .27), we transformed the mean into a natural logarithm with a constant (1) added to each measure in order to correct for non-normality (Tabachnick & Fidell, 2006).

To assess the validity of the innovation measures, we asked each team leader and each department manager to report the teams’ number of new patent applications, scientific publications, new products or product improvements, and other publications during the same timeframe. Department managers were also asked to rate the innovativeness of the teams they were responsible for using Scott and Bruce’s (1994) measure. With these additional viewpoints, we tested for inter-rater correlations. Table 1 shows that the team member innovation index was positively correlated with team leaders’ subjective ratings of team members’ innovative work behavior ($r = .21, p < .01$). The team member innovation index (aggregated at the team level) also correlated significantly with the indices provided by team leaders and department managers ($r = .27, p < .01$, and $r = .43, p < .01$, respectively). The team leaders’ and department managers’ innovation indices also correlated highly and significantly ($r = .43, p < .01$). Finally, team leaders’ ratings of team members’ innovative work behaviors correlated highly with department managers’ innovativeness ratings of the teams under their supervision ($r = .53, p < .01$). Thus, using three points of reference, objective indices, and subjective assessments, we concluded that we had measured the dependent variable of individual innovation adequately and with good convergent validity. We used the individual level team member innovation index and the individual level measure of innovative work behavior in subsequent analyses (Items 1 and 2 in Table 1).

Table 1 about here
Covariates. We entered five covariates in our analyses that were relevant in previous research: Job complexity has been proposed as an antecedent to creativity (Oldham & Cummings, 1996; Shalley et al., 2004) and to creative self-efficacy (Tierney & Farmer, 2002) because of the intrinsic stimulation derived from work complexity. We used a six-item scale based on Piccolo and Colquitt (2006) three-dimensional measure of task variety, task identity and task significance (Hackman & Oldham, 1974). After removal of three items, the measure was equivalent among the four countries ($\Delta$CFI = .004). Alpha was .71.

Affectivity among research participants has been pointed to as a methodological source of common method variance because positive or negative moods may influence global ratings on self-reported measures (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). Affect can also be regarded as a proxy for other sources of common method variance because, theoretically, it should be unrelated to the other measures (Podsakoff et al., 2003). We measured affect with the 20-item PANAS scale (Watson, Clark, & Tellegen, 1988), which is a list of affective words (e.g., interested, excited, distressed, hostile). Participants were instructed to indicate how they felt “right now, that is, at the present moment.” In our analyses, we used the positive affect dimension but had to remove three items to attain reasonable measurement equivalence between countries ($\Delta$CFI = .011). Alpha was .89.

Time on team. We also controlled for the time a team member had been a member of the team since this may influence the criterion variable (individual innovation). The longer that time, the more likely a team member would be involved in innovation projects. Finally, we controlled for education level and age (measured in years).

Analysis strategy

We used path-analysis\(^3\) to test our hypothesized relationships. With this method, we specified a model that allows for a simultaneous test of our hypotheses. Figure 1 shows how the model was specified. Leader member exchange (LMX) and conservation were exogenous variables (i.e., they were specified to only predict other variables and were not themselves predicted by any variable). This was also the case with the control variables. LMX was specified to predict creative self-efficacy that, in turn, predicted personal initiative. Thus, creative self-efficacy was specified to mediate LMX to personal initiative. Personal initiative was, in turn, specified to predict individual innovation. Thus, personal

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\(^3\) The software used is AMOS 20.0.0 build 817.
initiative was specified to mediate LMX to individual innovation. Conservation was specified to predict individual innovation as well. All exogenous variables were allowed to correlate. Affect, our marker variable for common method variance, was specified to correlate with exogenous variables and predict mediating variables to statistically partial out the potential influence of common method variance (Podsakoff et al., 2003).

Alternative models. We also compared the hypothesized model to nine alternative plausible models. In these nine models, we specified theoretically viable combinations of antecedent, mediating, and proximal variables in relationship to the innovation variable. LMX was substituted as an antecedent variable by conservation and creative self-efficacy. Furthermore, LMX, creative self-efficacy, and personal initiative were tested as proximal variables in relationship to innovation (alone and in combination). Table 2 presents the models, their specifications, and model fit indices. Since the alternative models and the hypothesized model were not nested, we used the AIC index to compare the models (Klein, 2010). None of the alternative models provided a better fit to the data than the hypothesized model.

Mediation. To test mediation, we used a bootstrapping procedure to estimate the standard errors of the indirect paths. The significance of the indirect path is assessed by the critical ratio test (the ratio of the path estimate over its standard error), where a critical ratio > 1.96 signifies a significant relationship at the 5 percent alpha level. Supporters of this procedure prefer it to Baron and Kenny’s (1986) casual steps procedure and to Sobel’s (1982) product of coefficient tests. The bootstrapping procedure is better at controlling for Type 1 errors and has greater statistical power (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002). We used maximum likelihood to calculate the indirect paths (Brown, 1997).
RESULTS

Table 3 presents inter-correlations, descriptive statistics, and alpha reliabilities (where relevant) for the two innovation measures and for the predictor variables.

The results are presented in two figures. Figure 1 presents the parameter estimates for the hypothesized model when team members’ innovation index (indicators of innovation outcomes) is the dependent variable (Model 1). Figure 2 presents the path estimates for the hypothesized model when team member innovative work behavior is the dependent variable (Model 2). Of our eight hypotheses, five were fully supported and three were partially supported. Full support requires that both Model 1 and Model 2 support the hypothesis. LMX was significantly related to individual innovation using leaders’ ratings of employee innovative work behavior ($b = .30, p < .01$). This relationship was not significant when the dependent variable was the innovation index. H1, which postulates that LMX is positively related to individual innovation, was thus partially supported. LMX was also associated positively with creative self-efficacy and with personal initiative (Model 1: $b = \ldots$)

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4 Each model was screened for multivariate outliers using Mahalanobis’s distance. We excluded eight cases in Model 1 and four cases in Model 2 that were significant at the recommended $p < 0.001$ level (Kline, 2005).
These findings fully support H3a that postulates a positive relationship between LMX and creative self-efficacy. These findings also support H2b that postulates a positive relationship between LMX and personal initiative. Similarly, creative self-efficacy was positively related to personal initiative (Model 1: $b = .51$, $p < .01$; Model 2: $b = .51$, $p < .01$), fully supporting H3b. Personal initiative predicted individual innovation when the dependent variable was the innovation index ($b = .15$, $p < .05$) but not when leaders’ ratings of innovative work behavior were used. This finding partially supports H2a that postulates that personal initiative is positively related to individual innovation. Conservation was negatively related to individual innovation in both models (Model 1: $b = -.20$, $p < .01$; Model 2: $b = -.26$, $p < .01$), fully supporting H4.

**Mediation analyses.** H3c postulates that creative self-efficacy is a mediating variable between LMX and personal initiative. This hypothesis was fully supported. For Model 1 and Model 2, the path estimates for the indirect path between leader-member exchange and personal initiative was $b = .160$ and $b = .110$, respectively. The standard errors were $SE = .45$ and $SE = .044$, respectively. Thus, the critical ratios were CR = 3.55 and CR = 2.50. The bias corrected confidence interval was also significant in both models (Model 1: LO 95 = .080, HI 95 = .258, $p < .01$. Model 2: LO 95 = .020, HI 95 = .196, $p > .05$). H2c postulates that personal initiative is a mediating variable between LMX and innovation. This hypothesis was partially supported. The indirect path from LMX to innovation was significant for Model 1 ($b = .057$, $SE = .025$, CR = 2.28; LO 95 = .016, HI 95 = .115, $p < .01$) but not for Model 2 ($b = .005$, $SE = .018$, CR = 0.01; LO 95 = -.028, HI 95 = .044, $p > .05$).

**Comparisons among countries.** To examine the differences among the four countries relative to the two innovation variables, we performed two one-way ANOVA tests. The one-way ANOVA was significant for the innovation index [$F(3, 265) = 25.5$, $p < .001$]. Post hoc tests (Tukey HSD) indicated that Sweden had the highest mean score ($M = 2.77$, $SD = 1.05$) and differed significantly from the other countries. The USA had the second highest mean score ($M = 2.13$, $SD = 1.29$) and differed significantly from Sweden, and from France and India ($M = 1.35$, $SD = 1.18$, and $M = 1.20$, $SD = 1.13$, respectively). France and India, which had the lowest mean scores, were a separate sub-set.
We also found significant differences among the countries as far as team members’ innovative work behaviors \( F(3, 218) = 17.4, p < .001 \). Post hoc tests indicated that Sweden and the USA had the highest mean scores (\( M = 5.28, SD = 1.01 \), and \( M = 5.18, SD = 1.06 \), respectively) and were significantly different from India that had the lowest mean score (\( M = 4.03, SD = 1.23 \)). The mean score of the French sample did not differ from the other countries (\( M = 4.63, SD = 1.27 \)).

**DISCUSSION**

This study is the first to integrate the concepts of leadership, creative self-efficacy, and personal initiative as predictors of individual innovation in R&D settings. In a sample from four countries we tested our hypotheses that leadership (conceptualized by LMX theory) is positively related to individual innovation, and that this relationship is mediated by team members’ creative self-efficacy and personal initiative. We hypothesized that the culturally bound value of conservation is negatively related to individual innovation.

We measured innovation in two ways. First, we used an index composed of indicators of innovation outcomes such as the number of patent applications, new products or product improvements, peer reviewed publications, and other publications such as white papers. Second, we used team leaders’ ratings of team members’ innovative work behaviors. The results of this study suggest that team leaders who have a high quality work relationship with their team members may influence their innovative work behavior. However, certain psychological factors must be present if these behaviors are to produce tangible outcomes. One factor is team members’ creative self-efficacy perceptions; another is their personal initiative.

**Leadership and innovative work behavior**

Our findings show that high quality leader-member relationships are positively related to team members’ innovative work behaviors. These findings agree with other research (e.g., Scott & Bruce, 1994; Yuan & Woodman, 2010) on LMX in relationship to employees’ innovative work behaviors. Our study contributes to this research by showing that the relationship is significant even when the sample is drawn from four countries. However, we also found that LMX is not related to individual innovation when measured by indicators of innovation outcomes, such as the number of new products or product
improvements, patent applications and publications (peer reviewed or other). We found that LMX is indirectly related to innovation as measured by these indicators through the personal initiative of team members. One explanation for these findings may be that innovative work behavior and innovation indicators measure different aspects of innovative work. The first difference is that the indicators focus on the tangible outcomes of this work, while assessments of innovative behavior measure individuals’ propensity to generate, champion, and implement ideas. Innovative behavior is thus a broader measurement of individual innovation because outcomes can include (1) incremental accomplishments that are too small to be satisfactorily measured using typical innovation indicators, (2) accomplishments that are not unequivocally product innovations, and (3) accomplishments that are rarely (or never) patented (Martin, 2012).

The second explanation is that innovative work behavior probably precedes outcomes in a process where new ideas (e.g., related to technological challenges) arise and are championed, and where steps are taken toward implementation (Basadur, 2004). It is plausible that individuals who exhibit innovative behaviors will help form high quality LMX relationships more easily because leaders typically recognize and reward those behaviors. LMX theory maintains that, in developing a work relationship, leaders and employees gradually offer mutually reciprocal exchanges of more and more value (Graen & Cashman, 1975). When leaders reinforce innovative behaviors by providing autonomy, resources, and decision latitude, employees exhibit more of these behaviors. In this view, because a reciprocal process governs the relationship between LMX and innovative work behavior, we should expect positive and significant relationships between the two constructs.

**Leader-member exchange in relationship to creative self-efficacy and personal initiative**

We found that the quality of the work relationship between team leaders and members was positively related to team members’ propensity to take initiative at work. It has been theorized that when leader-member work relationships are formed, leaders reward personal initiative by granting members more freedom and discretion in decision-making (Graen & Cashman, 1975; Liden & Maslyn, 1998; Olsson, 2012). The propensity for taking personal initiative may both be an inherent behavioral orientation, but it may also be
influenced by external factors such as leadership. In a recent study in which they surveyed 45 R&D teams from five Swedish industries, Denti and Hemlin (2012b) showed that the relationship between LMX and personal initiative is strengthened when organizations demonstrate a high degree of support for innovation. This support includes encouraging and valuing innovation, providing resources such as time, money, facilities, and expertise, and granting autonomy to teams and employees. Thus, leaders may more easily influence the personal initiative of their team members if the organization supports innovation.

Moreover, the relationship between LMX and personal initiative was mediated by team members’ creative self-efficacy. This finding is consistent with other research in which leadership was positively related to employee’s self-efficacy (e.g., Tierney et al., 2011). It is likely that expectations of performance and creativity increase as the quality of the leader-member work relationship improves (Yuan & Woodman, 2010). In such relationships, team members show that they can meet the expectations of their leaders (Bauer & Green, 1996).

Conservation and innovation

We also found that an individual’s degree of conservation is negatively related to individual innovation using measures of innovation indicators and measures of innovative work behaviors. These results suggest that individuals who act in accordance with their social position, support traditional norms, and maintain stability and harmony in relationships with others are likely to be perceived as being less innovative and less involved in behaviors and processes that lead to innovative outcomes. Individuals who require intellectual freedom and personal decision latitude, who challenge the status quo, and who exhibit innovative behaviors are more involved in innovations.

This finding opens up a new research area on individual values as antecedents of individual innovation. To date, little research has been published on this issue. Although many individual factors have been scrutinized as predictors of individual innovation (e.g., personality, cognitive ability, motivation, and domain specific skills and expertise), individual values are missing in literature reviews and meta-analyses (e.g., Anderson et al., 2004; Hammond, Neff, Farr, & Schwall, 2011; Hulsheger et al., 2009). Thus, further research is needed on the individual values that may predict innovation. In addition, we
need more research on the psychological mechanisms by which these values are related to individual innovation.

**Implications for organizations**

Our findings have several implications for the management of innovation in organizations. First, department managers in R&D, as well as human resources managers should try to identify scientists and engineers who have, in addition to their scientific education and competences, personal initiative, creative self-efficacy and the characteristics of personal values described in this study. Second, project team leaders should strive to create high quality work relationships characterized by mutual trust, respect, and goals commitment. They should also recognize and encourage personal initiative by providing team members with support and opportunities to generate and implement ideas. Third, upper management in organizations should communicate that innovation outcomes are desired. For example, upper management should adopt an innovation policy that allocates resources for new initiatives and that grants team members sufficient autonomy to pursue their ideas. Trust is created by encouraging innovation. Trusting individuals are more willing to undertake creative endeavors because they see that their initiative is supported (Mumford & Gustafson, 1988; Mumford et al., 2002; Shalley & Gilson, 2004).

**Limitations of this study**

This study has a number of limitations. First, its cross-sectional design means that no inferences about causation can be drawn. Second, some relationships between the independent variables may be reciprocal. As discussed above, there may be reciprocity between LMX and innovative work behavior. Similarly, it is plausible that a high quality LMX relationship is formed in a reciprocal process with individuals who exhibit high degrees of creative self-efficacy and personal initiative. Because the relationships between the psychological variables are highly complex, our hypothesized model should be seen as one of several plausible models. We took steps to check for these potential problems when testing for alternative models. In these tests our hypothesized model was the best representation of the data. A challenge for future studies using longitudinal designs is to examine the reciprocal nature of LMX and, in addition, the psychological variables that mediate leadership in its relationship to outcomes. Third, given the nested nature of our
data (individuals nested in groups, nested in departments, nested in countries), this study might have benefited from the use of multi-level statistical methods. We encourage future researchers to use multi-level structural equation modeling whenever individual, dyad, or team level effects are hypothesized. This method would allow researchers to specify mediating and moderating mechanisms, while at the same time consider the multi-leveled nature of organizations. Fourth, there is always a risk of common source bias when conducting research with self-reported variables that are collected from the same individuals. We tried to alleviate this problem by operationalizing innovation using tangible outcomes and by using team leaders’ ratings of their team members’ innovative work behavior. In addition, we included a marker variable in our analyses to control for common method variance as recommended by Podsakoff et al. (2003).

**Recommendations for future research**

First, although some research has been conducted in this area (e.g., Czarnitzki & Kraft, 2004), more research is needed to establish the cross-cultural generalizability of mechanisms related to leaders’ influence on innovation performance (Anderson et al., 2004). This seems vital now that firms are increasingly global. Researchers should also examine the influence of individual values on individuals’ propensity to act innovatively given that organizations’ R&D departments may be widespread throughout the world. Power distance, uncertainty-avoidance, and individualism-collectivism are examples of such values that have been suggested by Rank et al. (2004) and by Shalley et al. (2004).

Second, because the research field of creativity and innovation remains fragmentary (Hemlin et al., 2008), we need more research into the mechanisms that explain how leadership influences innovation performance. We also need to integrate contextual factors that facilitate or hinder leaders’ efforts to influence innovation processes (Denti & Hemlin, 2012a). We should build on the interactionist frameworks proposed by Hemlin et al. (2004; 2008) and Woodman et al. (1993). These contextual factors moderate the relationship between leadership and innovation.

Third, we found that creative self-efficacy and personal initiative are two constructs that positively relate to individual innovation as measured by indicators of innovation outcomes. A future area of research is to identify the antecedents of these constructs. For example, an innovative team climate (Anderson & West, 1998) may influence individuals’
perceptions of their creative abilities as well as their willingness to take a long-term, goal-oriented approach to idea implementation.

Conclusions

Our study contributes to the literature in its examination of the psychological mechanisms by which LMX is related to innovation. The process of transforming new ideas into new technology and products is inherently unpredictable and complex (Kaiser, Hogan, & Craig, 2008; Mumford et al., 2002). The ability to be proactive and goal-oriented in overcoming obstacles and exceeding what is required by formal work contracts may be crucial in these ventures. Innovation initiatives at all levels of an organization should be recognized and supported if organizations are to survive in the ever-increasing competition from global competitors.

REFERENCES


Tables and Figures
### TABLE 1

Correlations between the innovation measures at the individual level and the team level as reported by team members, team leaders, and department managers

<table>
<thead>
<tr>
<th>Level</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual 1. Team member innovation index (n = 269)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Leader ratings of IWB(^b) (n = 222)</td>
<td>.21**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team 3. Team member innovation index (aggregated) (n = 269)</td>
<td>.66** .34**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4. Leader innovation index (n = 214)</td>
<td>.14* .25** .27**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Department manager innovation index (n = 159)</td>
<td>.28** .16 .43** .43**</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>6. Leader ratings of IWB (aggregated) (n = 247)</td>
<td>.29** .75** .51** .35** .24**</td>
<td></td>
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<td></td>
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<tr>
<td>7. Department manager ratings of IWB (n = 181)</td>
<td>.25** .35** .38** .57** .28** .53**</td>
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<td></td>
</tr>
</tbody>
</table>

\(^a\) Logarithmized mean of patent applications, scientific publications, new products or product improvements, and other publications.

\(^b\) Innovative work behavior.

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).
<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
<th>$\chi^2$</th>
<th>df</th>
<th>CFI</th>
<th>RMSEA</th>
<th>AIC</th>
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<tr>
<td>1</td>
<td>Hypothesized</td>
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<td>7</td>
<td>.99</td>
<td>.059</td>
<td>109.57</td>
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<tr>
<td></td>
<td><em>(14.30)</em></td>
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<td></td>
<td></td>
<td><em>(110.30)</em></td>
</tr>
<tr>
<td>2</td>
<td>Conservation, LMX and CSE predict PI. PI predicts ind. innovation.</td>
<td>23.56</td>
<td>6</td>
<td>.96</td>
<td>.110</td>
<td>121.56</td>
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<td></td>
<td><em>(48.42)</em></td>
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<td></td>
<td></td>
<td></td>
<td><em>(146.42)</em></td>
</tr>
<tr>
<td>3</td>
<td>Conservation and LMX predict CSE and PI. CSE and PI predict ind. innovation.</td>
<td>24.75</td>
<td>8</td>
<td>.96</td>
<td>.088</td>
<td>118.75</td>
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<td></td>
<td><em>(43.87)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>(137.87)</em></td>
</tr>
<tr>
<td>4a</td>
<td>Conservation and CSE predicts LMX and PI. LMX predicts PI. PI predict ind. innovation.</td>
<td>39.42</td>
<td>10</td>
<td>.93</td>
<td>.105</td>
<td>129.42</td>
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<td></td>
<td><em>(63.72)</em></td>
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<td></td>
<td></td>
<td></td>
<td><em>(153.72)</em></td>
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<tr>
<td>4b</td>
<td>In addition to model 4a, LMX predicts ind. innovation.</td>
<td>39.42</td>
<td>9</td>
<td>.93</td>
<td>.112</td>
<td>136.00</td>
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<td></td>
<td><em>(44.30)</em></td>
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<td></td>
<td></td>
<td></td>
<td><em>(136.30)</em></td>
</tr>
<tr>
<td>5</td>
<td>Conservation predicts LMX, CSE and PI. LMX predicts CSE and PI predict ind. innovation.</td>
<td>50.00</td>
<td>12</td>
<td>.91</td>
<td>.109</td>
<td>128.71</td>
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<tr>
<td></td>
<td><em>(65.45)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>(151.45)</em></td>
</tr>
<tr>
<td>6</td>
<td>CSE predicts LMX and PI. LMX predicts PI. Conservation, LMX, and PI predict ind. innovation.</td>
<td>26.74</td>
<td>8</td>
<td>.96</td>
<td>.093</td>
<td>120.74</td>
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<td></td>
<td><em>(27.51)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>(121.51)</em></td>
</tr>
<tr>
<td>7a</td>
<td>PI, conservation and LMX predict CSE. CSE predicts ind. innovation.</td>
<td>22.12</td>
<td>6</td>
<td>.96</td>
<td>.100</td>
<td>120.12</td>
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<td></td>
<td><em>(41.82)</em></td>
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<td></td>
<td></td>
<td></td>
<td><em>(139.82)</em></td>
</tr>
<tr>
<td>7b</td>
<td>In addition to model 7a, PI and conservation predict LMX.</td>
<td>36.63</td>
<td>10</td>
<td>.94</td>
<td>.100</td>
<td>126.63</td>
</tr>
<tr>
<td></td>
<td><em>(55.17)</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><em>(145.17)</em></td>
</tr>
<tr>
<td>8</td>
<td>PI, CSE and conservation predict LMX. LMX predicts ind. innovation.</td>
<td>32.50</td>
<td>7</td>
<td>.94</td>
<td>.117</td>
<td>128.50</td>
</tr>
<tr>
<td></td>
<td><em>(38.75)</em></td>
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<td></td>
<td></td>
<td></td>
<td><em>(134.75)</em></td>
</tr>
<tr>
<td>9</td>
<td>Saturated model$^c$</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>110.0</td>
</tr>
<tr>
<td></td>
<td><em>(110.0)</em></td>
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</tbody>
</table>

$^a$ Two sets of model fit indices are presented. The first set used the innovation index as the dependent variable. The second set is in parentheses and used team leaders’ ratings of work innovative behavior as the dependent variable.

$^b$ LMX = Leader-member exchange, CSE = Creative self-efficacy, PI = Personal initiative.

$^c$ Model fit indices for the saturated model are included for comparison.
### TABLE 3
Means, standard deviations, and inter-correlations\(^a\) between the study’s variables

| Variable                                      | Mean | SD  | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   |
|-----------------------------------------------|------|-----|------|------|------|------|------|------|------|------|------|------|------|
| 1. Team member innovation index               | 12.6 | 18.1| -    |      |      |      |      |      |      |      |      |      |      |
| 2. Team member IWB\(^b\)                      | 4.68 | 1.26| .21* (93) |      |      |      |      |      |      |      |      |      |      |
| 3. Leader-member exchange quality             | 5.45 | 1.10| .12  | .29** (93) |      |      |      |      |      |      |      |      |      |
| 4. Creative self-efficacy                    | 5.67 | .85 | .19* | .10  | .31* (93) |      |      |      |      |      |      |      |
| 5. Personal initiative                       | 5.73 | .76 | .13* | - .02* | .39** | .62** (93) |      |      |      |      |      |      |      |
| 6. Conservation                              | 1.31 | .77 | -.25* | -.31** | .06* | .11  | .12  |     (83) |      |      |      |      |      |
| 7. Job complexity                             | 5.31 | 1.04| .21** | -.01* | .26* | .28* | .36** | -.04* | (.71) |      |      |      |      |
| 8. Affect                                     | 3.33 | .80 | -.07 | -.21** | -.01* | .21** | .29** | .21** | .25** | (.89) |      |      |      |
| 9. Time on team (years)                       | 3.62 | 3.97| .36** | .15** | .04* | .06  | -.07  | -.19** | .11* | -.07 |      |      |      |
| 10. Education\(^c\)                          | 2.35 | .76 | -.07 | -.19** | .07  | -.05 | .02  | -.19** | .00* | .01  | .11  |      |      |
| 11. Age (in years)                            | 36.8 | 10.5| .29** | .19** | .08  | .05 | -.07 | -.19** | .15** | -.27** | .39** | -.15 |      |

\(^a\) \(n = 269\), for variable 2, \(n = 222\). Cronbach’s coefficient alphas are given on the diagonal, where relevant.

\(^b\) Innovative work behavior.

\(^c\) Education was coded as follows: 1 = “Less than bachelor’s degree”; 2 = “Bachelor’s degree”; 3 = “Master’s degree”; 4 = “Licentiate degree”; 5 = “Doctor’s degree”; 6 = “Associate professor”; 7 = “Professor”.

* Correlation is significant at the 0.05 level (two-tailed).

** Correlation is significant at the 0.01 level (two-tailed).
FIGURE 1a.
Results for the hypothesized paths between leadership, creative self-efficacy, personal initiative, and conservation and employee innovation (innovation index)

<table>
<thead>
<tr>
<th>Path</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>T.01</td>
<td></td>
</tr>
<tr>
<td>Time on team</td>
<td>-.03</td>
</tr>
<tr>
<td>Education</td>
<td>-.13*</td>
</tr>
<tr>
<td>Affect</td>
<td>.28**</td>
</tr>
<tr>
<td>Job complexity</td>
<td>.11</td>
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<tr>
<td>LMX</td>
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<tr>
<td>Creative self-efficacy</td>
<td>.31**</td>
</tr>
<tr>
<td>Personal initiative</td>
<td>.23**</td>
</tr>
<tr>
<td>Conservation</td>
<td>.14</td>
</tr>
<tr>
<td>Innovation index</td>
<td>.51**</td>
</tr>
<tr>
<td>Conservation</td>
<td>-.20**</td>
</tr>
<tr>
<td>Conservation</td>
<td>.46</td>
</tr>
<tr>
<td>Innovation index</td>
<td>.15*</td>
</tr>
<tr>
<td>Innovation index</td>
<td>.25</td>
</tr>
</tbody>
</table>

* Standardized beta coefficients are given for the structural paths. $R^2$ is given for the endogenous variables. Model fit: $\chi^2[7, n = 269] = 13.57, p < 0.05; \chi^2/df = 1.94; \text{RMSEA} = .059; \text{CFI} = .985$. *: Significant at the 0.05 level (two-tailed). **: Significant at the 0.01 level (two-tailed).
FIGURE 2
Results for the hypothesized paths between leadership, creative self-efficacy, personal initiative, and conservation and employee innovative work behavior (IWB)

*a Standardized beta coefficients are given for the structural paths. \( R^2 \) is given for the endogenous variables. Model fit: \( \chi^2[7, n = 222] = 14.30, p > 0.05, \chi^2/df = 2.04; \text{RMSEA} = .069; \text{CFI} = .977. 

* Significant at the 0.05 level (two-tailed).

** Significant at the 0.01 level (two-tailed).
WHAT DO INNOVATIVE LEADERS DO? A CRITICAL INCIDENT STUDY OF INNOVATION STIMULATING AND HINDERING LEADER BEHAVIORS IN R&D

Denti, L.

Department of Psychology / Gothenburg Research Institute, University of Gothenburg.

Email: leif.denti@gu.se
Abstract
This study examines project leader behaviors that stimulate and hinder innovation in industrial research and development (R&D) project teams. In addition, the study identifies the situations in which such behaviors occur and the consequences for innovation from such behaviors. A modified version of the critical incident technique was used in interviews with 72 participants employed in R&D departments at two companies in the automotive industry. In total, 231 incidents were collected. The study reveals that when R&D project leaders actively facilitate the development of new ideas and provide guidance and expertise, they may stimulate idea generation and increase the possibility of successfully completing innovation projects. Project leaders who limit team members’ work autonomy and neglect basic project management hinder the generation and implementation of innovative ideas. The study concludes that if project leaders are to stimulate innovation, they require training in general project management skills. The study also identifies four major dilemmas that R&D project leaders face.

Keywords: Leadership, innovation, creativity, R&D
WHAT DO INNOVATIVE LEADERS DO? A CRITICAL INCIDENT STUDY OF INNOVATION STIMULATING AND HINDERING LEADER BEHAVIORS IN R&D

Most results from an organization’s innovation activities involve research and development (R&D). Each R&D project team typically consists of engineers and/or scientists. This study focuses on how project leaders of such teams behave with reference to innovation. While people in R&D are, by and large, self-motivated employees who require a certain degree of work autonomy (Mumford & Licuanan, 2004), scholars increasingly point to project leadership in R&D settings as a critical organizational factor in the generation of innovative ideas, products, and processes (e.g., Anderson, de Dreu, & Nijstad, 2004; Elkins & Keller, 2003; Ford, 1996; Hemlin, 2006; Mumford, Scott, Gaddis, & Strange, 2002; Woodman, Sawyer, & Griffin, 1993). Because there is evidence that R&D team leaders require different managerial skills than team leaders in other contexts (Mumford & Licuanan, 2004), more research is needed on those special skills. However, R&D leadership is surprisingly understudied (Elkins & Keller, 2003; Hemlin & Olsson, 2011). Specifically, we need to identify team leader behaviors in R&D that stimulate or hinder innovation among team members (De Jong & Den Hartog, 2007).

In this paper, innovation is the successful result of collaborative efforts by individuals and teams in companies who are working to create a new and marketable product, service, or organizational process or method (see OECD, 2005). Thus, innovation is the implementation of ideas, while creativity is the generation of ideas. Various scholars (e.g., Anderson et al., 2004) agree with this definition of innovation. Innovative behavior in this paper is behavior intended to facilitate the implementation of ideas for new products, services, or organizational processes and methods.
Leadership and innovative outcomes

Denti and Hemlin (2012a) identified two roles that R&D leaders may play in promoting innovation in their project teams. First, leaders may play a facilitating role when they construct environments that accommodate creativity and ultimately produce innovations. Leaders can create a permissive team climate (Anderson & West, 1998), encourage intrinsic motivation (Avolio, Bass, & Jung, 1999), and facilitate problem solving and team reflection (Puccio, Murdock, & Mance, 2007). Leaders who take this bottom-up, individual centered approach encourage team members to use their own abilities to produce innovative results. Second, leaders may play a managerial role when they manage scheduling, budgets, and knowledge resources (Drazin, Glynn, & Kazanjian, 1999), set individual and team goals (Shalley & Gilson, 2004), monitor progress and allocate rewards (Mumford & Gustafson, 1988), and establish performance expectations (Yuan & Woodman, 2010). Thus, in this top-down, organization centered approach, leaders have the primary responsibility for the achievement of organizational innovation strategies and goals.

Previous studies on leader behaviors with creativity or innovation as outcomes

A few attempts have been made to create taxonomies of creativity- or innovation-stimulating leader behaviors. For example, De Jong and Den Hartog (2007), in an interview study with twelve entrepreneur-managers, identified a broad range of leader behaviors that promote innovation. Amabile, Schatzel, Moneta, and Kramer (2004) used qualitative evidence (diary entries) and quantitative evidence (e.g., leader support ratings) in their research. Like many other researchers, Amabile and colleagues focused on creativity as the outcome (see also Shalley & Gilson, 2004). These researchers found that leaders promote team members’ creativity when they support their actions and decisions, monitor their progress fairly, recognize their good performance, and consult with them about decisions.

Identifying leader behaviors in the innovation context

Amabile et al. (2004) and De Jong and Den Hartog (2007) used Yukl’s (2002) taxonomy of managerial practices (MPS) as frameworks for coding leader behaviors. Successful leader behaviors in a context where innovation is the goal may be congruent with Yukl’s taxonomy. However, although the MPS taxonomy is one of the most
comprehensive leader behavior taxonomies (Arnold, Arad, Rhoades, & Drasgow, 2000), some scholars argue that conceptualizations of effective leader behaviors based on performance predictions in routine contexts may provide flawed explanations of how leaders influence individuals and teams that have innovation as a goal (Mumford & Licuanan, 2004; Rosing, Frese, & Bausch, 2011). The context in which innovative work occurs is very dynamic because progress is often both unpredictable and non-linear (Reiter-Palmon & Ilies, 2004). Problems are numerous, often novel, and typically ill-defined (Mumford, Hester, & Robledo, 2012). Because of this complexity, such problems may be solved in several different ways. Moreover, engineers and scientists who are intrinsically motivated (Tierney, Farmer, & Green, 1999) and highly autonomous (Feist & Gorman, 1998) may not require external motivation.

**Negative leader behaviors in the innovation context**

Research is particularly scarce on leader behaviors that hinder team members’ innovation. Leadership theories commonly emphasize positive leader behaviors that stimulate innovation. However, in Amabile et al.’s (2004) study, the participants frequently mentioned that negative leader behaviors negatively influenced their affective states (e.g., increased anger and frustration). Some researchers have suggested that negative events, information, and feedback have greater effects on outcomes, for example, on motivation and affect (Rozin & Royzman, 2001) and on team performance and creativity (Losada & Heaphy, 2004) than positive events, information and feedback. Other researchers have called for more research on negative leader behaviors and their consequences (Amabile et al., 2004; Denti & Hemlin, 2012a; Shaw, Erickson, & Harwey, 2011).

**Aims of this study**

First, this study aims at identifying project leader behaviors that stimulate or hinder innovation in R&D project teams. Additionally, the study seeks to identify the specific situations in which such leader behaviors occur and the consequences for innovation from such behaviors.
Method

Participants

The author and an assistant interviewed 72 individuals employed at R&D departments at two companies in the automotive industry. The participants were chiefly project team members working with innovation on product development, early stage development, and new technology research. The majority of the participants were engineers: 27.8 percent had a doctoral degree, 58.3 percent had a Master’s degree, and 13.9 percent had a Bachelor’s degree or non-degree education. The participants were predominantly men (80.6 percent) with an average of age 40.8 years (SD = 9.9 years), and had worked for their companies an average of 10.3 years (SD = 9.3 years).

Procedure

In our interviews, we used the critical incident technique (CIT) developed by Flanagan (1954). According to Flanagan, this technique is preferable to other interview techniques because it prompts interviewees to describe their experiences using specific and recent incidents as points of reference rather than to describe experiences in general terms. Butterfield, Borgen, Amundson, and Maglio (2005) claim that CIT increases the reliability and content validity of interview descriptions.

We asked each participant to recall “a recent incident where your project leader did something that stimulated you or your team, increasing your ability for innovation”. We described innovative ability to the participants in accordance with the OECD (2005) definition of innovation. “Ability for innovation means the ability to implement new ideas. Innovation differs from creativity in that creativity can be seen as generating new ideas, while innovation is the implementation of new ideas”.

We asked the participants to recall two incidents in which their leaders stimulated their innovative abilities and two incidents in which their leaders hindered their innovative abilities. When the participants had recalled a recent incident, we asked the following questions: i) Can you describe the situation? ii) What did the leader do that stimulated your ability for innovation? iii) What were the consequences? We audio-taped the interviews and later transcribed them.
**Data analysis**

Together, we collected 129 stimulating incidents and 102 hindering incidents that were relevant for our purpose. On average, the participants recalled 1.8 stimulating incidents (SD = .57) and 1.4 hindering incidents (SD = .79). Because the focus was the project leaders, I deleted incidents in which the project leaders had no control (e.g., financial issues and reward systems). All incidents for the study had to describe project leader behaviors in situations where the project leaders could exercise control.

I used Braun and Clarke’s (2006) category system for the thematic analysis of the data. I began by coding the incidents and inserting them in a matrix of three categories for the interview questions (situation, leader behavior, and consequence). A sampled coded incident is as follows: ‘Project start up, orientation phase’ (situation); ‘Project leader-provided guidance on whom the participants could contact and their areas of expertise’ (behavior); ‘More efficient work, less risk of losing time because the participant knew whom to contact’ (consequence).

Next, I divided the three categories into thematic sub-categories based on the meaning content of the coded incidents. I then checked for internal homogeneity (meaningful coherence of the codes within each category) and external heterogeneity (distinctiveness of the categories). In this phase, I placed incidents in more meaningful categories and sometimes renamed the categories to better reflect the coded incidents. Last, I wrote a definition for each category and each sub-category.

Although most participants could recall at least one specific incident, ten participants could not recall any specific incidents. Instead, they described general stimulating or hindering experiences with their project leaders. Thus, each incident was coded as either ‘specific’ or ‘general’. An example of a ‘general’ stimulating project leader behavior is the following: “It is important that the project leader states the objective clearly at the beginning of the project”. Of the stimulating incidents, 31 percent were coded as general; of the hindering incidents, 49 percent were coded as general.

A two-way Chi Square test showed that the general incidents and the specific incidents were distributed across the thematic categories similarly. In the two-way Chi Square test, the rows were incident type (specific or general) and the columns were the thematic categories for the main categories. The distribution of incidents in each main
category was unrelated to their coding as general or specific (for the stimulating incidents, main category situations: $\chi^2 = 1.59, \ df = 5, \ p > .05$; leader behaviors: $\chi^2 = 8.60, \ df = 6, \ p > .05$; consequences: $\chi^2 = 8.16, \ df = 5, \ p > .05$. For the hindering incidents, main category situations: $\chi^2 = 9.02, \ df = 4, \ p > .05$; leader behaviors: $\chi^2 = 1.94, \ df = 4, \ p > .05$; consequences: $\chi^2 = 6.50, \ df = 4, \ p > .05$). The general incidents, which were not overrepresented in any thematic category, were retained.

I also tested the categories for inter-rater reliability. To obtain a valid kappa value (Lombard, Snyder-Duch, & Campanella Bracken, 2002), I gave an external researcher the thematic category definitions and asked him to sort 15 percent of the codes for the six category groups (situations, leader behaviors, and consequences in both stimulating and hindering incidents). For the stimulating incidents, inter-rater agreement was substantial for situations and behaviors ($\kappa = .74$ and $\kappa = .61$, respectively), and moderate for consequences ($\kappa = .41$). For the hindering incidents, inter-rater agreement was perfect for situations ($\kappa = 1.0$), moderate for leader behaviors ($\kappa = .48$), and almost perfect for consequences ($\kappa = .81$) according to the classification that Landis and Koch (1977) propose.

Results

Stimulating and hindering situations

Table 1 presents the situations the participants described. Most categories were similar for the stimulating and the hindering incidents. Because of the overlap of categories between the stimulating and hindering situations, I combine the descriptions while noting when and how the categories differ.

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Table 1 about here

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Project coordination. This is the largest category for the stimulating incidents (26 percent) and for the hindering incidents (52 percent). It refers to the leaders’ day-to-day
project management. For both stimulating and hindering incidents, this category refers to task assignment and supervision (sub-category: Task coordination). For the stimulating incidents, the situation most frequently described was a special meeting/workshop situation in which brainstorming sessions on particular problems and goals were held (sub-category: Meetings/workshops). The participants also described situations in which the project leader presented project goals (sub-category: Goal direction) and discussed management of purchased technology and budget increases (sub-category: Resources). For the hindering incidents, the participants described situations in which the project leader coordinated information poorly (sub-category: Information), made sub-optimal decisions (sub-category: Decision making), provided little feedback on team members’ work, suggestions, and ideas (sub-category: Communication), and imposed administrative constraints (sub-category: Administration). One participant described a hindering situation in which collaboration was required for several projects (sub-category: Inter-project collaboration).

*Project phases.* These are situations that occurred either at the start of a project (sub-category: Project start) or at the end of a project (sub-category: Project end-phase). Both stimulating and hindering situations were identified for these two sub-categories.

*Problem situations.* These are situations described in both the stimulating and the hindering incidents. Typically, the participants described problem situations related to the implementation of new technology, but they also described problem situations in which they were unable to proceed with their tasks.

*Implementing ideas and solutions.* For both stimulating and hindering incidents, this category refers to situations in which participants wished to test or implement a new idea related to their individual work.

*Project outcomes.* This category refers to situations in which participants worked on tasks related to project goals and outcomes. In both stimulating and hindering incidents, participants reported situations related to the development of new technology (sub-category: New technology) and to work directed toward individual task goals related to the project objective (sub-category: Task-related work). Example tasks are report writing, and collecting, formatting, and analyzing data. For the stimulating incidents, participants also reported situations in which they worked on new product development and on new patents (sub-categories: New products and Patenting).
Stimulating situations: Positive climate. This category, which appeared only in the stimulating incidents, refers to incidents in which the project leader influenced the project team’s climate (e.g., by creating a team identity and by inspiring team commitment to the project objective). A representative statement is the following: “My project leader shared an idea of his and asked ‘what do you think of this?’ […] his behavior creates an open climate […] it sets the tone for the whole group”.

Stimulating and hindering leader behaviors

Table 2 presents a list of the innovation stimulating or hindering leader behaviors the participants described. First, I describe overlapping leader behaviors that both stimulate and hinder innovation. Thereafter, I describe the leader behaviors that are specific to the stimulating or hindering incidents.

Overlapping stimulating and hindering leader behaviors: Grants freedom to meet objectives; restricts autonomy. Granting team members the freedom to meet their individual objectives was the second largest category of stimulating behaviors: 25 percent of reported incidents (sub-category: Grants freedom to meet objectives). With such freedom, team members can use their own discretion in devising solutions to their tasks. A representative statement is the following: “My project leader drew up the fundamentals but said simply that the details and the solution were up to me to figure out”. When this freedom is limited, there may be hindrances to finding innovative solutions. Restricting freedom is the largest category of hindering behaviors: 45 percent of reported incidents (sub-category: Restricts autonomy). When imposing such restrictions, leaders give detailed instructions about the work and are too involved with the work (sub-category: Micro management). Another way to limit team members’ autonomy is to set time schedules for project tasks that are too restrictive. The result is that team members lack opportunities for deliberation on problems (sub-category: Grants insufficient time). The participants also
described incidents in which their project leaders, who had their own solutions (for example, to solve project objectives), were uninterested in solutions suggested by their team members (sub-category: Narrow focus). Project leaders were also described in four incidents as too demanding as far as team members’ use of administrative project tools (e.g., Excel spread sheets and various forms) (sub-category: Administration).

**Stimulating behavior: Facilitates idea development.** This category was the largest of the stimulating incidents: 33 percent of reported incidents. Project leaders encouraged project members to participate in idea-generating activities, such as special workshops, brainstorming sessions, and dedicated task forces. A representative statement is the following: “Our project leader started some brainstorming sessions. We sat down, maybe an hour with a problem we had to solve, and brainstormed possible solutions to that problem” (sub-category: Encourages activities to promote ideation). Project leaders also encouraged individual team members to generate ideas. They gave feedback on new ideas and set aside time to develop and test such ideas (sub-category: Encourages individual ideas). A representative statement is the following: “It was an idea that I and a colleague had. We were granted the freedom and time to test it” (sub-category: Gives time for idea development). Project leaders also encouraged new ideas by stimulating an open dialogue in which information and opinions could be more easily exchanged. A representative statement is: “[Project leader] teamed up with human resources and did some analyses on what kind of personalities we were, how we needed to communicate to understand each other” (sub-category: Encourages communication).

**Stimulating behavior: Provides expertise.** Project leaders also used their domain-specific expertise to stimulate innovation. They offered guidance to team members by helping them understand problems and pointing them to information sources for solutions. They also shared their insights about project members’ ideas: “My project leader simply gave me suggestions and hints, and some background on the area, what I should look more closer into—‘this might be a problem’—some broad suggestions and so forth” (sub-category: Provides guidance). The participants also described incidents in which project leaders gave them positive or negative feedback on their work as well as feedback on the entire project. Such feedback reduced ambiguity and helped team members continue their work in a more focused way (sub-category: Provides feedback). Project leaders also used
their networks to add competence to the teams seeking solutions to particular problems or making patent applications (sub-category: Provides expert networks).

**Stimulating behavior: Frames the project.** In this category, project leaders communicated the position of the project in the company innovation strategy. A representative statement is the following: “Then the motives. . . ‘why are we doing this?’ […] the best motives are when one can understand a connection to the company’s strategic orientation”. This communication of strategy gave the team members a better understanding of the purpose of their work. The project leaders also routinely avoided dealing with project specifications. Instead, they invited the team members to ask the following questions to consider the meaning of the project: “What is the purpose? Which functionality is required and why do we want this functionality?”.

**Stimulating behavior: Inspires and involves.** The goal of inspiring and involving team members was to stimulate enthusiasm and commitment. The project leaders tried to create a positive team climate, as one participant stated, “so that people can be engaged in launching activities regarding new cars, explaining to journalists what we have done […] it creates a feeling that I really contribute”. The project leaders also communicated the project successes to outsiders, emphasized the importance and necessity of the projects, set ambitious project goals, and drove the team to the completion of projects.

**Stimulating behavior: Shows decisiveness.** The participants described six incidents in which project leaders moved the project forward by acting decisively. These project leaders took the projects in new directions when necessary. For example, they were effective at pressuring sub-contractors to complete work on a timely basis.

**Stimulating behavior: Acquires resources through networks.** In order to improve the quality of their projects, project leaders relied on their networks to acquire resources such as money, technology, and information.

**Hindering behavior: Neglect.** The second largest innovation hindering behavior (40 percent of incidents) is the neglect of project management by the project leaders. For example, the participants reported incidents in which the project leaders failed to provide task-related and emotional support and were often unavailable (sub-category: Insufficient support). Some project leaders were selective concerning the information given to the team (e.g., information from upper management or customers). In addition, some project leaders
failed to explain adequately the projects’ objectives and tasks to team members (sub-category: Insufficient information). Furthermore, some project leaders exhibited disinterest and negativity as far as team members’ ideas (sub-category: Idea deafness).

**Hindering behavior: Improper decision making.** This category concerned project leaders who failed to make appropriate decisions in a timely fashion (e.g., when new project directions were needed). For example, in five incidents the project leaders continued with projects that should have ended (sub-category: Indecisiveness). Some project leaders, on the other hand, changed objectives and directions too frequently, causing team members to wait passively for the next objective (sub-category: Changes direction).

**Hindering behavior: Ambiguous expectations.** Five participants described incidents in which their project leaders were vague about which tasks the team should perform and which roles and responsibilities were needed to meet project goals.

**Hindering behavior: Claims undue honor.** Two participants said the project leaders claimed credit for successful projects and ideas in meetings with customers and upper management. A representative statement is the following: "I had a lot of the ideas […] some of the ideas he claimed as his own”.

**Stimulating and hindering consequences**

Table 3 shows the described consequences of the stimulating and hindering project leader behaviors. First, I present consequences that describe opposing facets of the same phenomena (e.g., the quality of solutions). Thereafter, I present consequences that are specific to the stimulating or hindering incidents.

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**Table 3 about here**

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*Overlapping stimulating and hindering consequences: Improved solutions; Inferior quality of solutions.** The largest category of the stimulating consequences (28 percent of incidents) refers to the quality of solutions. The participants described incidents in which
team members’ ideas led to solutions for problems, or solutions related to the project objective that were more innovative than expected (sub-category: Unexpected solutions) or had a better technical quality than expected (sub-category: Increased quality of solutions). A number of leader behaviors produced similar negative consequences. The participants described incidents in which the solutions to the project objective were of lesser quality than they could have been. A representative statement is the following: “It was a relatively complex and superfluously complicated solution, with greater risks for faults and bugs”.

**Overlapping stimulating and hindering consequences: New ideas; Halted idea generation and implementation.** In the second largest category of stimulating consequences (24 percent of incidents), the participants described incidents in which they had new ideas about project objectives or problems. For instance, one participant described an incident in which his project leader invited him to atypical “think-tank” group discussions on major problems at the company. This participant said: “When you get the opportunity to bounce ideas around with creative people, you end up actually leveraging or multiplying the opportunity for creative thinking.” The participants also reported the opposite result when asked about hindering incidents. They said that fewer ideas originated (sub-category: Fewer new ideas) and good ideas were not implemented. As a consequence, team members abandoned their ideas (sub-category: No implementation of ideas).

**Overlapping stimulating and hindering consequences: Motivation; Negative motivational and emotional reactions.** The participants also reported motivation gains and losses as well as emotional reactions. They described greater enthusiasm, energy, and drive when working on tasks and solving problems (sub-category: Increased motivation toward tasks) as well as increased feelings of responsibility and participation (sub-category: Increased ownership). In contrast, negative leader behaviors caused hindrances, such as diminished enthusiasm, initiative, and involvement (sub-category: Motivation loss). Participants also reported frustration, irritation, anger, and disappointment (sub-category: Negative emotions). Last, they said they focused too narrowly on completing their tasks with the consequence that they often used an existing solution instead of trying to devise a new solution (sub-category: Narrow cognition).
Overlapping stimulating and hindering consequences: Increased teamwork efficiency; Inefficient work. Ten incidents related to teamwork quality in which the participants described more focused and efficient collaboration as well as increased communication and information sharing in the team. This category’s counterpart is in the hindering incidents. The participants mainly described consequences in which their work was unfocused, inefficient, and unproductive (sub-category: Unfocused work). Additionally, when participants were required to prioritize other projects, they adopted a passive attitude toward the ongoing projects. A representative statement is the following: “Then I just react when someone wants me. I won’t take the initiative myself”. In five incidents, the projects suffered from delays and extra work owing to the poor implementation of solutions (sub-category: Unplanned work).

Stimulating consequence: Project advancement. After solving a problem (e.g., technical issues or monetary resources), the participants reported that the project could advance (sub-category: Project advancement). Four participants recalled incidents in which new ideas or new knowledge led to projects for new products or product or technology improvements (sub-category: Spin-offs).

Stimulating consequence: Knowledge and learning. This category refers to incidents in which participants described stimulating consequences such as new technical knowledge. A representative statement is the following: “We got a lot more knowledge within this [technical] area, so that I have recycled this technology in later projects where it has been valuable”.

Hindering consequence: Project costs. This category refers to inadequate solutions that lead to increased project costs (sub-category: Increased costs). Three participants described incidents in which they left the project team and even the workplace (sub-category: Turnover).
Discussion

The primary aim of this study is to identify project leader behaviors that stimulate or hinder innovation in R&D project teams. A secondary aim is to identify the situations in which these behaviors occur and the consequences these behaviors produce.

Stimulating leader behaviors and their consequences

The innovation stimulating behavior most frequently identified by the participants was the leaders’ facilitation of idea development. Leaders who encourage team members to develop ideas hold regular brainstorming meetings and sessions, provide feedback to team members, and set aside time for team exchanges of information and opinions. As Tierney and Farmer (2004) write, by expecting creativity leaders let team members know that creativity is desired. Other researchers have shown that supporting team members’ confidence in their creative self-efficacy has positive implications for innovative outcomes (Gong, Huang, & Fahr, 2009; Redmond, Mumford, & Teach, 1993). In this study, 23 percent of the consequences described in the incidents concerned new ideas. Another important consequence of stimulating project leader behavior was that solutions to project objectives or related problems became unexpectedly successful. The project leaders’ domain-related expertise was also an important behavior that produced positive consequences. Specifically, project leaders gave feedback and guidance and used their networks to find outside experts. As Mumford et al. (2012) maintain, novel problems often require creative solutions, even multiple solutions. Various researchers have addressed this issue of leader expertise. The technical expertise of leaders may help the team shape and understand difficult problems (Mumford, Connelly, & Gaddis, 2003), structure the project objective, identify the ideas most likely to succeed (Mumford et al., 2002), and contribute new knowledge and ideas (Hemlin & Olsson, 2011). The consequences identified in this study are consistent with these observations. The participants described numerous incidents in which they or the team solved technical problems using the leaders’ expertise.

Hindering leader behaviors and their consequences

The behavior perceived as most detrimental to innovation was the project leaders’ restriction of team members’ work autonomy. The leaders devised their own solutions to problems, focused too closely on team members’ work, set too rigid time constraints, and
overemphasized administrative tools and procedures. Other researchers have highlighted the importance of granting people freedom in the context of innovative work (e.g., Amabile et al., 1996; Anderson et al., 2004; Ekvall, 1996; Hemlin et al., 2008; Hunter, Bedell, & Mumford, 2007). Individuals who enjoy considerable work autonomy are more likely to generate and test ideas. As a result, better solutions are likely (Pirola-Merlo, 2000). In R&D settings, work autonomy may be especially valuable because tasks and problems are multifaceted and unpredictable (Mumford, Peterson, & Robledo, 2013). Engineers and scientists also tend to require a high degree of flexibility and freedom (Feist & Gorman, 1998). When their work autonomy was restricted, the participants felt less energetic and more frustrated. Other researchers agree that rigid supervisory control undermines intrinsic motivation (e.g., Deci & Ryan, 1987) and impairs creativity (Amabile et al., 1996; Shin & Zhou, 2003). Another consequence was the reduction of the participants’ task scope. As a result, they focused on completing their tasks without considering other approaches or different, perhaps better, solutions. The explanation was the project leaders’ emphasis on their own solutions that reduced the opportunity for team members to introduce other ideas.

Project management behavior vs. innovation stimulating behavior

There is considerable overlap between the leader behaviors described by the participants and the taxonomy of managerial practices described by Yukl (2002) and discussed in the introduction of this paper. However, the main behavior the participants identified that stimulated innovation does not clearly associate with any behavior in Yukl’s taxonomy: leaders’ specific facilitation of idea development. Most theories of innovation acknowledge that idea generation and idea implementation are the two basic components of innovative behavior (Anderson et al., 2004; Basadur, 2004; Rosing et al., 2011; West, 2002). Thus, this behavior is especially important in the R&D context when innovation is the objective. Furthermore, the leaders’ provision of expertise does not fit very well with the managerial practices Yukl (2002) lists. This behavior is probably particular to the R&D context because it allows project leaders to direct their teams through the erratic reality of

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1Yukl’s (2002) managerial practices: i. planning and organizing the project, ii. solving problems, iii. clarifying roles and objectives, iv. disseminating relevant information, v. monitoring progress, vi. motivating and inspiring, vii. involving employees in decision making, viii. delegating responsibility, ix. giving emotional support, x. taking an interest in developing and mentoring employees, xi. managing conflict and encouraging cooperation, xii. developing networks, xiii. recognizing performance, and xiv. rewarding performance
innovation work (Reiter-Palmon & Ilies, 2004). Other stimulating leader behaviors were more consistent with Yukl’s taxonomy—delegating responsibility and involving employees in decision making, clarifying roles and objectives, motivating and inspiring, monitoring progress, and developing networks. Interestingly, no participant in this study described incidents in which the project leaders managed conflict well or incidents in which they were rewarded (monetarily or with promotions) for their innovation.

There is consistency between the hindering behaviors identified in this research and Yukl’s managerial practices. The absence of certain behaviors such as delegating responsibility, consulting with team members on decisions, clarifying roles and objectives, acting supportively, and disseminating relevant information have negative consequences for team members’ innovative abilities.

Dilemmas in innovative project management

The results of this study can be summarized as four major dilemmas that R&D project leaders face.

1. Meet the specified requirements, or think more radically? Projects must meet the requirements made by constituents (e.g., customers inside and outside the company) to be successful. Several participants problematized this notion by emphasizing the importance of leader behaviors that prompted team members to think more about aspects such as functionality and usability rather than the specific requirements. It is obvious that project outcomes depend on the specification of requirements. If requirements are too detailed, there is reduced opportunity for innovative solutions. A dilemma occurs when the requirements pose severe restrictions on the possible solutions and when the project team wants to satisfy the product’s functionality in a radical way by avoiding the requirements. In such a situation, a project leader who believes in the new idea must champion the product by influencing constituents to accept the team’s more radical solutions (Byrne, Mumford, Barret, & Vessey, 2009; Mumford & Van Doorn, 2001).

2. Follow time plans, or do something new that takes more time? In the planning phase for projects, leaders typically search for opportunities and information, develop activities, forecast plan outcomes, refine the plan, and gather resources (Byrne et al., 2009). This study shows that time is an important factor in generating and testing ideas. However, this, too, poses a dilemma. There is seldom enough time for the necessary ideation and
testing. If project leaders set aside time for these activities, the project risks being delayed. The explanation of the dilemma may lie with the planning fallacy—the tendency of planners to underestimate how much time projects require. This may be the case even if the planner has considerable experience with similar projects (Lovallo & Kahneman, 2003). People usually make plans based on their knowledge and past experience rather than on projections about the future. In R&D settings, unexpected problems are the rule. Project progression is mainly non-linear, delays are common, and time budgets are usually inadequate. Yet, to produce innovative solutions, it is necessary to take the time to generate and test new ideas even though some solutions will fail.

3. **React too quickly or too slowly to changing requirements.** This dilemma concerns project leaders’ decision making. The participants described hindering incidents in which project leaders reacted too quickly when they changed the project objectives. The result was the team members responded passively. As they waited for the next directive, they worked inefficiently and often prioritized parallel projects. On the other hand, the participants also recalled incidents in which the project leaders acted too slowly when faced with new facts. These leaders often allowed the projects to run too long before ending them. The result was wasted resources and unproductive work. R&D settings are often erratic. Constituents’ requirements may change over time and new technology may become available (Reiter-Palmon & Ilies, 2004). Given their experience and expertise, good project leaders should be able to manage these potential problems. They should be able to define the mission and evaluate different solutions as they guide the project team (Byrne et al., 2009; Mumford et al., 2002).

4. **Allow freedom and relinquish control.** This study found that granting autonomy to team members is one of the most important leader behaviors that stimulated team members’ innovation. However, there is some risk with this management practice. Project leaders often have the ultimate responsibility for the success or failure of projects. Loss of control is a possibility when team members are allowed too much freedom. Project leaders have to bear in mind their responsibility to their constituents (e.g., customers, project committees, etc.). Pelz and Andrews (1966) identified this dilemma in their study on research scientists and their leaders. The dilemma for project leaders is to strike a balance between control and freedom when supervising their team members.
Limitations of this study

The primary limitation of this research is that it is a retrospective study that relies on the participants’ memories. Thus, the causality of inferences drawn in this study can be challenged. Second, as in all retrospective interview research, several factors may influence interviewees’ statements. In this study, factors other than the leaders’ behaviors may have influenced the participants’ observations. The critical incident technique is, however, designed to overcome this limitation because it prompts participants to relate their experiences to a real incident (Flanagan, 1954). It is probable that the participants’ descriptions of their actions and responses resulting from the leader behaviors are more reliable than the project-related consequences. Third, although the participants were given the definition of innovative ability, it is still possible they had different understandings of innovation. Such differences may have influenced their recall of critical incidents. Fourth, a bias may have been introduced by allowing descriptions of general experiences with project leaders despite the fact that the patterns of general and specific incidents were consistent. Fifth, this study risks overemphasis on the role of project leaders as drivers of R&D innovation. There are additional influential forces that affect innovations in R&D projects, such as the line organization and the ideas and initiative of individual engineers and scientists in project teams.

Summary and conclusions

Two main conclusions result from this study. Both conclusions have theoretical implications and managerial implications in R&D settings. The first conclusion is that project leaders of innovative project teams require general project management skills. Such skills are hygienic factors in the stimulation of innovation. For example, project leaders need to know how to manage and disseminate information and how to encourage and guide team members. Adequately managing the information flow in projects seems to do little to make the projects more innovative. However, if the project leader lacks in this skill, innovation is hampered. To stimulate innovation, leaders must in addition to general project management skills encourage ideas and provide guidance with the help of their expertise.

The second conclusion relates to the four project leader dilemmas described above. To cope with these dilemmas, project leaders must be willing to take risks in many areas. The risks, such as time delays, missed budgets, failed ideas, and upper management
criticism, are complex (Sharma, 1999) and inherent in innovation work (Mumford et al., 2002). Various researchers have discussed the propensity for taking risks in innovation taxonomies (Hunter et al., 2007) and in empirical studies (e.g., Amabile et al., 1996; Ekvall, 1996). From a project leader’s point of view, dealing with risks requires both will and courage (Dewett, 2007). However, project leaders who have resource networks can expect support if projects fail (Hemlin, 2006). Moreover, the project leaders’ expertise is a fundamental factor that influences their decisions about which ideas have value (Mumford et al., 2003). From an organizational perspective, upper management should encourage project leaders’ risk taking even though some experimentation may lead to failure (Hunter et al., 2007; Shalley & Gilson, 2004).

References


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**Acknowledgements**

Thanks to Nakima Ackerhans Schreiber who interviewed 22 of the study’s 72 participants for her Bachelor’s thesis (Ackerhans Schreiber, 2012). I also thank Magnus Jansson for his help with the inter-rater reliability of the study’s categories. Last, I thank Professor Sven Hemlin and Professor Jan Johansson Hanse for their valuable suggestions on this research and paper.
Table 1.
Categories and subcategories of perceived critical incident situations in which project leader behaviors stimulated or hindered R&D project team members’ innovative abilities (n = 72).

<table>
<thead>
<tr>
<th>Stimulating situations</th>
<th>Frequency (% of total incidents)</th>
<th>Hindering situations</th>
<th>Frequency (% of total incidents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category/subcategory</td>
<td></td>
<td>Category/subcategory</td>
<td></td>
</tr>
<tr>
<td>1 Project coordination</td>
<td>34 (26%)</td>
<td>1 Project coordination</td>
<td>53 (52%)</td>
</tr>
<tr>
<td>a) Meetings/workshops</td>
<td>18</td>
<td>a) Task coordination</td>
<td>20</td>
</tr>
<tr>
<td>b) Goal direction</td>
<td>9</td>
<td>b) Information</td>
<td>13</td>
</tr>
<tr>
<td>c) Task coordination</td>
<td>4</td>
<td>c) Decision making</td>
<td>8</td>
</tr>
<tr>
<td>d) Resources</td>
<td>3</td>
<td>d) Communication</td>
<td>6</td>
</tr>
<tr>
<td>2 Project phases</td>
<td>23 (18%)</td>
<td>e) Administration</td>
<td>5</td>
</tr>
<tr>
<td>a) Project start</td>
<td>21</td>
<td>f) Inter-project collaboration</td>
<td>1</td>
</tr>
<tr>
<td>b) Project end-phase</td>
<td>2</td>
<td>2 Project phases</td>
<td>20 (20%)</td>
</tr>
<tr>
<td>3 Problem situations</td>
<td>23 (18%)</td>
<td>a) Project start</td>
<td>12</td>
</tr>
<tr>
<td>4 Implementing ideas or solutions</td>
<td>19 (15%)</td>
<td>b) Project end-phase</td>
<td>8</td>
</tr>
<tr>
<td>5 Project outcomes</td>
<td>22 (17%)</td>
<td>3 Implementing ideas or solutions</td>
<td>19 (19%)</td>
</tr>
<tr>
<td>a) New technology</td>
<td>8</td>
<td>4 Project outcomes</td>
<td>8 (8%)</td>
</tr>
<tr>
<td>b) New products</td>
<td>6</td>
<td>a) Task related work</td>
<td>6</td>
</tr>
<tr>
<td>c) Task-related work</td>
<td>6</td>
<td>b) New technology</td>
<td>2</td>
</tr>
<tr>
<td>d) Patenting</td>
<td>2</td>
<td>5 Problem situations</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>6 Positive climate</td>
<td>8 (6%)</td>
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<tr>
<td>Total</td>
<td>129 (100%)</td>
<td>Total</td>
<td>102 (100%)</td>
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</tbody>
</table>
Table 2.
Categories and subcategories of perceived project leader behaviors that stimulated or hindered R&D project team members’ innovative abilities (n = 72).

<table>
<thead>
<tr>
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<th>Frequency (% of total incidents)</th>
<th>Category/subcategory</th>
<th>Frequency (% of total incidents)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Facilitates idea development</strong></td>
<td>43 (33%)</td>
<td>1 <strong>Restricts autonomy</strong></td>
<td>46 (45%)</td>
</tr>
<tr>
<td>a) Encourages activities to promote ideation</td>
<td>15</td>
<td>a) Micro management</td>
<td>18</td>
</tr>
<tr>
<td>b) Encourages individual ideas</td>
<td>12</td>
<td>b) Grants insufficient time</td>
<td>15</td>
</tr>
<tr>
<td>c) Encourages communication</td>
<td>9</td>
<td>c) Narrow focus</td>
<td>9</td>
</tr>
<tr>
<td>d) Gives time for idea development</td>
<td>7</td>
<td>d) Administration</td>
<td>4</td>
</tr>
<tr>
<td><strong>2 Grants freedom to meet objectives</strong></td>
<td>32 (25%)</td>
<td>2 <strong>Neglect</strong></td>
<td>41 (40%)</td>
</tr>
<tr>
<td>3 <strong>Provides expertise</strong></td>
<td>24 (19%)</td>
<td>a) Idea deafness</td>
<td>20</td>
</tr>
<tr>
<td>a) Provides guidance</td>
<td>15</td>
<td>b) Insufficient information</td>
<td>15</td>
</tr>
<tr>
<td>b) Provides feedback</td>
<td>6</td>
<td>c) Insufficient support</td>
<td>6</td>
</tr>
<tr>
<td>c) Provides expert networks</td>
<td>3</td>
<td>3 <strong>Improper decision making</strong></td>
<td>8 (8%)</td>
</tr>
<tr>
<td><strong>4 Frames the project</strong></td>
<td>10 (8%)</td>
<td>a) Indecisiveness</td>
<td>5</td>
</tr>
<tr>
<td>5 <strong>Inspires and involves</strong></td>
<td>10 (8%)</td>
<td>b) Changes direction</td>
<td>3</td>
</tr>
<tr>
<td><strong>6 Shows decisiveness</strong></td>
<td>6 (5%)</td>
<td>4 <strong>Ambiguous expectations</strong></td>
<td>5 (5%)</td>
</tr>
<tr>
<td><strong>7 Acquires resources through networks</strong></td>
<td>4 (3%)</td>
<td>5 <strong>Claims undue honor</strong></td>
<td>2 (2%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>129 (100%)</td>
<td><strong>Total</strong></td>
<td>102 (100%)</td>
</tr>
</tbody>
</table>
Table 3.
Categories and subcategories of the perceived consequences of stimulating or hindering R&D project leader behaviors (n = 72).

<table>
<thead>
<tr>
<th>Stimulating consequences</th>
<th>Frequency (% of total incidents)</th>
<th>Hindering consequences</th>
<th>Frequency (% of total incidents)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Improved solutions</strong></td>
<td>36 (28%)</td>
<td><strong>1 Negative motivational and emotional reactions</strong></td>
<td>43 (42%)</td>
</tr>
<tr>
<td>a) Unexpected solutions</td>
<td>18</td>
<td>a) Motivation loss</td>
<td>28</td>
</tr>
<tr>
<td>b) Increased quality of solutions</td>
<td>18</td>
<td>b) Negative emotions</td>
<td>8</td>
</tr>
<tr>
<td><strong>2 New ideas</strong></td>
<td>31 (24%)</td>
<td><strong>2 Inefficient work</strong></td>
<td>21 (20%)</td>
</tr>
<tr>
<td>a) Increased motivation toward tasks</td>
<td>15</td>
<td>a) Unfocused work</td>
<td>16</td>
</tr>
<tr>
<td>b) Increased ownership</td>
<td>11</td>
<td>b) Unplanned work</td>
<td>5</td>
</tr>
<tr>
<td><strong>4 Project advancement</strong></td>
<td>17 (13%)</td>
<td><strong>3 Inferior quality of solution</strong></td>
<td>19 (19%)</td>
</tr>
<tr>
<td>a) Project advancement</td>
<td>13</td>
<td>a) No implementation of ideas</td>
<td>7</td>
</tr>
<tr>
<td>b) Spin-offs</td>
<td>4</td>
<td>b) Fewer new ideas</td>
<td>6</td>
</tr>
<tr>
<td><strong>6 Increased teamwork efficiency</strong></td>
<td>10 (8%)</td>
<td><strong>5 Project costs</strong></td>
<td>6 (6%)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td>a) Increased costs</td>
<td>3</td>
</tr>
<tr>
<td>6 Knowledge and learning</td>
<td>9 (7%)</td>
<td>b) Turnover</td>
<td>3</td>
</tr>
</tbody>
</table>

| Total                    | 129 (100%)                      | Total                  | 102 (100%)                      |