Individual Innovation

The Connection Between Leadership and Employees' Innovative Work Behavior

ACADEMISCH PROEFSCHRIFT
ter verkrijging van de graad van doctor
aan de Universiteit van Amsterdam
op gezag van de Rector Magnificus
prof. dr. D.C. van den Boom
ten overstaan van een door het college voor promoties ingestelde
commissie, in het openbaar te verdedigen in de Agnietenkapel
op dinsdag 27 november 2007, te 12.00 uur door

Jeroen Petrus Johannes de Jong

geboren te Zoetermeer

Promotor: prof. dr. D.N. den Hartog

Overige leden: prof. dr. N.R. Anderson
prof. dr. J.J. Boonstra
prof. dr. W.L. Buitelaar
prof. dr. P.H.M. van Hoesel
prof. dr. J.J. van Muijen

Faculteit Economie en Bedrijfskunde

Individual Innovation

The Connection Between Leadership and
Employees' Innovative Work Behavior

J.P.J. de Jong

ISBN 978-90-371-0725-8

EIM
Postbus 7001
2701 AA Zoetermeer
tel.: 079-343 02 00
jjo@eim.nl

Dit onderzoek werd mede mogelijk gemaakt met steun uit het programmaonderzoek MKB en Ondernemerschap. EIM voert dit programma uit in opdracht van het Ministerie van Economische Zaken.

© 2007 J.P.J de Jong. Quoting numbers or text in papers, essays and books is permitted only when the source is clearly mentioned. No part of this publication may be copied and/or published in any form or by any means, or stored in a retrieval system, without the prior written permission of the author.

© 2007 J.P.J. de Jong. Het gebruik van cijfers en/of teksten als toelichting of ondersteuning in artikelen, scripties en boeken is toegestaan mits de bron duidelijk wordt vermeld. Vermenigvuldigen en/of openbaarmaking in welke vorm ook, alsmede opslag in een retrieval system, is uitsluitend toegestaan na schriftelijke toestemming van de auteur.

Contents

1 Introduction

In business today it is essential to innovate. Firms need to continuously renew and improve their offerings to secure long-term survival, profitability and growth. Firms face many challenges and opportunities; the increasingly more competitive world has created a continuous need for new ways of doing things. The rate of technological, social and institutional changes results in shorter life cycles of current products, services and business processes. As a consequence innovation is no longer reserved for those organizations and people doing scientific or technological work (Smith, 2002).

One option for organizations to become more innovative is to encourage their employees. Many practitioners and scientists now endorse the view that innovation by individual employees is a means to foster organizational success (e.g. Van de Ven, 1986; Smith, 2002), or as Katz (1964) already claimed '…an organization which depends solely upon its blueprints of prescribed behavior is a very fragile social system' (p.132). Work has become more knowledge-based and less rigidly defined and specified. In this context, employees are regarded as being important to realize innovations. In the innovation literature it is usually radical innovation that captures the imagination, but such innovations are, relatively rare while incremental innovations based on employees' efforts are much more common. Individual innovation is in fact central in many principles of management popular today, including total quality management (Ehigie & Akpan, 2004), continuous improvement schemes (Fuller, Marler & Hester, 2006), Kaizen (Imai, 1986), corporate venturing (Elfring, 2003), creative problem solving (Basadur, 2004) and organizational learning (Senge, 1990).

Previous studies suggest that organizations can indeed benefit from individual innovation. Campbell, Gasser and Oswald (1996) empirically demonstrated a positive link between innovation-specific behaviors and organizational performance. Miron, Erez and Naveh (2004) found that individual innovation does not diminish the quality and efficiency of normal work. Employees are well able to balance between being innovative and paying attention to their regular work. They conclude that personal and organizational characteristics necessary to promote innovation, quality and efficiency complement rather than compete with each other. In this context, Getz and Robinson (2003) posit an interesting rule of thumb: companies that track the source of

improvement ideas find that 80% of improvement ideas come from their employees and only 20% come through planned innovation activities.

1.1 Objectives

This study contributes to the literature on individual innovation in two respects. First, we add to the measurement of individual innovation by developing and empirically validating a multi-dimensional measure of innovative work behavior. Second and most important, we aim to improve our understanding of the antecedents of individual innovation by investigating which leader behaviors correlate with innovative work behavior. Both objectives are discussed hereafter.

Innovative work behavior

Individual innovation can be operationalized in various ways. Generally, the construct has been thought of in terms of personality characteristics, outputs and behaviors. For instance, Hurt, Joseph and Cook (1977) regarded individual innovation to be personality-based, defining it as a generalized willingness to change. Kirton's (1976) Adaption-Innovation Inventory measured two distinct cognitive styles ranging from adaptors who solve problems within existing perceptual frames and innovators who restructure them. Output-based measures include West's (1987) measure of role innovation (that records how many changes individuals have initiated in their jobs) and Bunce and West's (1995) composite innovation score (multiplying the perceived effectiveness of innovations by the number of innovations). Here we conceptualize individual innovation as a set of behaviors. In this perspective there are many studies that focus on creativity and idea generation, but as innovation theory has repeatedly stressed that innovation also includes the implementation of ideas (King & Anderson, 2002) we take a broader perspective.

The construct of *innovative work behavior* (IWB) is central in this thesis. Following Farr and Ford (1990) we define innovative work behavior as individuals' behavior to achieve the initiation and intentional introduction (within a work role, group or organization) of new and useful ideas, processes, products or procedures. IWB implies that individuals go beyond the scope of their job requirements to be innovative of their own free will. It includes idea generation as well as the types of behavior needed to implement improvements that will enhance personal and/or business performance. The construct of IWB thus captures both the initiation and implementation of ideas. In doing so, IWB differs from more limited constructs such as employee creativity which focuses on the discovery and generation of ideas. IWB is

also broader than proactiveness constructs such as proactive work behavior (Crant, 2000; Parker, Williams & Turner, 2006) and personal initiative (Frese, Kring, Soose & Zempel, 1996). Such constructs indicate whether individuals proactively implement change, but do not specifically capture the initiation part of the innovation process.

Most previous work assesses IWB as a one-dimensional construct (e.g. Scott & Bruce, 1994; Basu & Green, 1997) but as such it does not capture the richness and potential multidimensionality of the construct. A first aim of the research presented in this thesis is to contribute to the field of individual innovation by developing a multidimensional measure of IWB.

The role of the leader

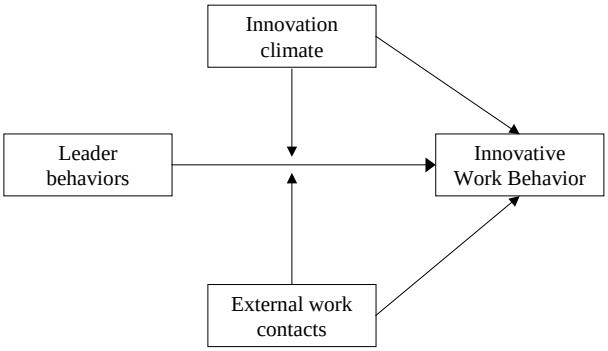
Previous work suggests that innovative work behavior is partly determined by interactions of individuals with other people (Zhou & Shalley, 2003; Anderson, de Dreu & Nijstad, 2004). Employees in organizations are for example likely to terminate their innovative efforts if their leader and/or colleagues discourage innovation. Here we focus on the role of the leader as a driving force behind employees' innovative work behavior. This is important: Basadur (2004) for instance recently advocated that in future business the most effective leaders 'will help individuals (…) to coordinate and integrate their differing styles through a process of applied creativity that includes continuously discovering and defining new problems, solving those problems and implementing the new solutions' (p. 103).

At the individual level the connection between leader behaviors and IWB needs to be explored in more detail. Leadership and innovation research are rather separated communities that have not yet sufficiently benefited from each other's results. Most leadership research uses performance- and commitment-based measures as dependent variables. Such measures represent rather passive behaviors (Parker *et al.*, 2006). The focus is usually on theory-based leadership styles like transformational leadership and participative leadership, but one cannot automatically expect models developed to predict performance in routine settings to be equally suitable for innovation (Mumford & Licuanan, 2004: p. 170). Vice versa, innovation research is dominated by studies that explore the impact of leadership at the organizational level. For many innovation researchers leadership remains an implicit factor (Rickards & Moger, 2006: p. 4). They are generally occupied with exploring a broad range of factors related to innovative outputs, and leadership is then treated as one such factor amongst many others. Examples include planning, features of innovative ideas and marketing efforts (Cooper, 2003).

The main objective of the research presented here is to investigate what behaviors are beneficial when leaders want to stimulate their employees' innovative behavior. We recognize that in addition to their leaders, individuals interact with other people including their colleagues and people from outside the organization such as clients and suppliers. Depending on their preferences and feedback towards innovative efforts, these other persons can both discourage or reinforce IWB. Our research therefore also includes measures of innovation climate and external work contacts. This enables us to assess the unique contribution that leaders can make. In doing so, our research takes a social perspective. It captures all types of actors that individuals meet at work.

We will also propose that innovation climate and external work contacts can neutralize innovation-stimulating leadership, i.e. we propose that favorable innovation climates and/or frequent external work contacts moderate the connection between leader behaviors and IWB. This is further discussed in chapter 4. In figure 1 we give a schematic representation of our research model.

figure 1. Schematic representation of our research model



Another distinction with previous work is that our empirical test of hypotheses related to figure 1 will focus on knowledge workers. This is a group of workers that has not received much attention in individual innovation studies so far. We elaborate on this in the next section.

1.2 Methodology and outline

Our research started with a literature review and in-depth interviews with various leaders. These activities served to identify relevant leader behaviors and to develop hypotheses. Next, two empirical studies were performed to develop measures and to test our hypotheses.

Literature review and in-depth interviews

We started with a study of relevant articles, books and reports to explore the nature of innovative work behavior and its connection with leader behaviors, innovation climate and external work contacts. More precise, we used the literature to define innovative work behavior and list its potential dimensions, to make an inventory of leader behaviors that may affect IWB, and to define and explore how perceptions of favorable innovation climates and external work contacts can moderate the connection between leader behaviors and IWB. We addressed scientific sources for relevant publications (databases such as Proquest, ScienceDirect and Econlit). Our literature review did not end after the initial exploration, instead we continued to study and process new publications during the subsequent phases of our research. The first phase also contained in-depth interviews with twelve leaders from small knowledge-intensive firms. These interviews helped us to identify leader behaviors with a potential to influence individual innovation. Various hypotheses were formulated as a basis for empirical testing.

Empirical test among knowledge workers

Our empirical tests focused on knowledge workers in small knowledge-intensive service firms. In the context of individual innovation an extensive empirical investigation of knowledge workers in commercial organizations has been lacking so far. Past work is strongly biased towards those contexts where 'innovation is a must', including employees of R&D departments within multinational firms (Elkins & Keller, 2003) and scientists, artists and musicians (Mumford, 2003). This implies that previous work focused mainly on individuals for whom innovative behavior is a primary work role. With only a few exceptions, research has not focused on those situations where innovative work behavior of employees is no primary task requirement.

The lack of attention for knowledge workers is remarkable as the last quarter of the twentieth century witnessed an increased knowledge-intensity of work (Hislop, 2005). In the advanced economies of the OECD, knowledge-intensive services account for a large part of value added, whereas the share of manufacturing sectors is in decline (OECD, 2000; Anxo & Storrie, 2001). In the field of individual innovation it has also been recommended that knowledge workers deserve more attention. Mumford (2003) concluded that empirical research into the related concept of creativity paid generous attention to professions widely recognized for their creative character (artists, scientists and musicians) while knowledge-intensive professions such as engineers, computer programmers, designers and marketeers were overlooked.

Our empirical work included the development of measures for IWB, leader behaviors, innovation climate and external work contacts. In a pilot study we collected data from 81 knowledge workers and their leaders. These data were used to test our measures and to improve their reliability. Next, in the main study we collected data from a large sample of knowledge workers from various firms. This survey covered 94 different organizations, including legal and accounting services, economic, engineering and information technology (IT) services. Responses were obtained from 703 employees and their leaders. These data were used to develop and validate a multidimensional scale of IWB, and to test our hypotheses on the connection between leader behaviors, innovation climate, external work contacts and IWB.

Outline

Chapter 2 first defines innovation and presents an overview of current streams in this field of research. The chapter continues with employees' innovative work behavior (IWB). Based on previous work we define the construct and discuss previous measures. We propose that IWB is a multi-dimensional construct with four dimensions: opportunity exploration, idea generation, championing and application.

Chapter 3 starts with defining leadership and discusses how it differs from related constructs such as management and entrepreneurship. We also summarize findings from previous studies that explored the connection between leadership and employees' IWB. The main part of this chapter presents the leader behaviors we identified from the literature and in-depth interviews. We discuss them in detail and develop hypotheses on their connection with innovative work behavior.

In chapter 4 we discuss innovation climate and external work contacts; two concepts we propose to correlate with IWB and also to moderate the connection between leader behaviors and IWB. Innovation climate expresses how individuals' colleagues may stimulate or discourage attempts to be innovative. External work contacts are hypothesized to be an antecedent of IWB as employees with frequent external contacts are expected to be in better positions to innovate (due to close contacts with need sources and innovative resources). We also discuss why we believe these concepts can neutralize innovation-stimulating leader behaviors.

Chapter 5 presents the pilot study. Respondents were employees and their leaders from a Dutch institute for applied research and consultancy. We worked with separate questionnaires (for employees and leaders) to prevent common source bias. The chapter describes how we created an item database and draft questionnaires, how the

data collection was organized, and how these data were analyzed to assess and improve the psychometric quality of our measures.

Chapter 6 discusses the main study. Respondents were employees and their leaders in 94 different organizations, all small knowledge-intensive service firms in the Netherlands. We elaborate on how we sampled firms, employees and leaders, how we checked representativeness, and what criteria were used to construct our final measures. Drawing on survey responses of 879 leaders and 703 employees we were able to validate a new, multidimensional measure of IWB, and to construct parsimonious measures for the other constructs in our research model.

Chapter 7 gives the results of our analyses. The nested structure of our data forced us to estimate a range of hierarchical multilevel regression models. We first tested what leader behaviors are indeed directly connected with employees' IWB, and if this is also true for innovation climate and external work contacts. Outcomes confirm about half of our hypotheses. The chapter ends with analyzing two-way interaction effects. We analyzed whether dimensions of innovation climate and external work contacts neutralize or stimulate the connection between leader behaviors and IWB. Again, our findings confirm some of our hypotheses.

Chapter 8 ends with our conclusions. It discusses our findings, implications for practitioners and directions for future research. We first draw conclusions on the measurement of innovative work behavior. Next, we present our general findings for innovation-stimulating leader behaviors, and elaborate on implications for practitioners and researchers. The thesis ends with some general remarks and directions for future research.

The annexes to this thesis provide overviews of the innovation literature (annex A) and leadership literature (annex B), an overview of managerial practices that was useful to code the interview results (annex C), the questionnaires that we used in the pilot (annex D) and main study (annex E), details of our measures and items (annex F) and two measures for innovation-stimulating leadership (annex G). These latter measures are a spin-off of our research. They summarize leader behaviors that are most significantly related with individual innovation and may be useful in future empirical work.

2 Innovative work behavior

This chapter starts with defining innovation and giving a short overview of key issues in the field. Our research contributes to the individual innovation literature (section 2.1). Next we discuss innovative work behavior. Section 2.2 defines the construct and presents an overview of previous measures. Section 2.3 elaborates on four dimensions that we hypothesize to form a multidimensional measure of IWB. Section 2.4 concludes with a classification of several antecedents of innovative work behavior. It is used to further position our research.

2.1 Innovation: scope and previous research

Definition

The past decades have witnessed a growing body of literature dedicated to innovation. In October 2006 a search in the Amazon.com database (the most exhaustive online database of books at that time) with the search string 'innovation' in the category 'books' provided details of no less than 165,640 publications.

Schumpeter (1934) is considered to be among the first to recognize the process of innovation and its impact on economic development. He described innovation as the creation and implementation of 'new combinations' related to new products, services, work processes or markets. Ever since, innovation has been re-defined many times. Each definition may reveal some important aspects of innovation, but the most common element is that all authors emphasize newness as an essential part of innovation. Newness including anything perceived to be new by the people doing it, or as something different for the organization into which the new thing is introduced. In addition to an innovation apparently being 'something new', definitions have more in common. King and Anderson (2002) define innovation as

- New to the social setting in which it is introduced, although not necessarily new to the person(s) introducing it
- Based on an idea, which is a necessary but not a sufficient condition for innovation

  Aimed at producing some kind of benefit

  Intentional rather than accidental

- Not a routine change
- Public in its effects (p. 2-3).

King and Anderson (2002) consider an innovation as something new to the social setting in which it is introduced (an individual, group, firm, industry, wider society) although not necessarily new to the person(s) introducing it. Ideas are necessary conditions for innovations. They are a starting point, but it cannot be called innovative without further development efforts. An innovation is aimed at producing some kind of benefit. Apart from financial gains, possible benefits might be personal growth, increased satisfaction, improved cohesiveness or better interpersonal communication.

Innovation is restricted to intentional attempts to derive anticipated benefits from change. Suppose that a group of workers cannot use e-mail due to a computer failure. If their sales results improve because they pick up the phone more often to communicate with their customers, this would not be an innovative action. If, however, firms deliberately take this action to improve client relations and sales results, one could describe it as innovative. Besides, innovation is not a routine change. The appointment of a new member of staff to replace one that retired cannot be considered as innovative, but the creation of an entirely new post could. Finally, innovation involves application; so just developing something new cannot be regarded as innovative unless it is used (King & Anderson, 2002).

Studying innovative objects or innovative subjects

Innovation is studied by many academic disciplines, including economics, management, history, sociology, psychology and industrial design. Innovation research can be roughly classified into two dominant approaches: studies that focus on different kinds of innovations (object-based) and studies with a focus on the subjects involved with the innovation (subject-based) (Archibugi & Sirilli, 2001). The key distinction between these approaches is the unit of analysis. Whereas object-based studies primarily focus on the innovation itself, subject-based studies focus on specific actors who initiate and implement innovations.

Examples of innovation as objects include new products, services or processes, radical or incremental innovations and the transfer of technologies. According to De Jong and Vermeulen (2005), research within the object approach can be further classified into five categories, including defining innovation, new product development, patterns of adoption and diffusion, transfer and classification of technologies, and innovative business development. Subject-based studies focus on the

role of actors and try to explore how these actors can innovate more effective and efficiently. This part of the literature includes research conducted at various levels, including countries, industries, organizations, groups and individuals. The principal features within each approach are given in table 1. For a detailed discussion of these main streams in innovation research see annex A.

table 1. Principal features in the innovation literature

Approach	*Principal features studied*	*Description*
Object	Define innovation	– Identify different types of innovations (e.g. architectural innovation, disruptive changes)
		– Identify innovation in new contexts like service industries
	New product development	– Development of new products (activity-stage models)
		– Success factors of new product development
		– Development of new services
	Adoption and diffusion	– Explain or predict adoption by (proposed) users of innovations, explain or predict patterns of diffusion over time
		– Explore key factors in adoption and diffusion (characteristics of adopter, innovation attributes, environment)
	Transfer of technology	– Classification, antecedents and consequences of technological change and transfer of technology
		– Technology policy paradigms
		– Emergence of dominant designs
	Innovative business development	– New technology based firms: innovative performance, behavior and success factors
		– Spin-off firms, venturing, role of incubators
Subject	Countries	– Explore and benchmark innovativeness of countries, measurement of innovation for policy purposes
		– Connection between innovation and economic development
		– National systems of innovation
	Industries	– Interaction between industry-level factors and innovation within industries
		– Patterns of innovation across industries
	Organizations	– Design of innovative organizations
		– Management of innovation
		– Networks and interactions between organizations
	Groups	– Innovation in work groups
		– Innovative work climates, management of group innovation
	Individuals	– Creativity, creative performance
		– Proactive behaviors including innovative work behavior
		– Antecedents of individual innovation

Source: De Jong and Vermeulen (2005).

Our study adds to innovation research at the individual level. As such it is positioned in the subject approach. Research at the individual level consists mainly of creativity studies that can basically be divided into the investigation of the characteristics of creative people and stimulants of individual creativity (McAdam & McClelland, 2002). A drawback of creativity research however is its prime focus on idea generation or the initiation of innovations. We here take a broader scope by investigating employees'

innovative work behavior, a construct that also captures implementation-oriented behaviors.

Within the field of individual innovation, there is a relatively new stream of research with a focus on proactive behaviors of individuals, i.e. taking self-initiated and future-oriented actions to change and improve the situation or oneself (Parker *et al.*, 2006). Examples of such behaviors include proactive work behavior (Crant, 2000), taking charge (Morrison & Phelps, 1999), voice (Van Dyne & LePine, 1998) and also innovative work behavior (Janssen, 2000). With the exception of innovative work behavior, these behaviors predominantly focus on individuals realizing change after an idea has been generated or a problem is identified. Proactive behaviors can be part of an innovation process, but are not necessarily innovative (Parker *et al.*, 2006). Innovative work behavior has a broader scope by explicitly including all innovation-related behaviors of individuals. Here, we will not pay much or explicit attention to the other proactive behaviors but rather focus on creativity and IWB; behaviors of individuals which are most explicitly associated with innovation. We further discuss this in the next section.

2.2 Innovative work behavior

Definition

As discussed in chapter 1 individual innovation can be operationalized in various ways. The construct has been thought of in terms of personality characteristics or outputs. Here we conceptualize individual innovation as a set of behaviors. Innovative work behavior (IWB) is central in our analysis. As yet there is no agreement on precisely how to define this construct.

As stated, the behavioral perspective of individual innovation includes many studies on creativity and idea generation (e.g. Mumford, 2000; McAdam & McClelland, 2002). However, innovation theory has repeatedly stressed that innovation also includes the implementation of ideas. The model most commonly used to describe the process of innovation is the activity-stage model (Zaltman, Duncan & Holbek, 1973; King & Anderson, 2002). This model focuses on the actual activities that are carried out to develop a new product, service or work process by breaking down the innovation process into a number of activities. In its most simple form activity-stage models distinguish between just two phases: initiation and implementation. Initiation is a divergent phase, including activities such as the recognition of problems and thinking about ways to improve things. This phase results in more suggestions for innovations,

such as new products, services or work processes. Implementation is a convergent phase directed towards the development and launch of innovations in order to acquire their benefits. The dividing line between the two phases is believed to be the point of the first adoption of the innovation; that is, the point at which the decision is made to implement the idea (King & Anderson, 2002).

Many authors have adopted activity-stage models to describe how innovations are initiated and developed (e.g. Duncan, 1976; Staw, 1990; Wolfe, 1994; Axtell, Holman, Unsworth, Wall, Waterson & Harrington, 2000). Both phases can be broken down into more detailed activities leading to a wide range of alternative models. Where they vary is in the extent to which they focus on the process before and after the decision to implement an idea. Some models describe the pre-adoption process in much more detail, focusing on activities such as idea generation, screening and evaluation (e.g. Mumford, 2000). Others concentrate on what happens after the decision to implement is made (Rogers, 1983). Finally, some researchers use models with more detailed attention for both phases (Wheelwright & Clark, 1992).

Activity-stage models have been heavily criticized for being simplistic. In the past decades many have stressed that innovation is an iterative, non-linear, disjunctive, cyclical happening; often stressful for those involved either as initiators or those affected by the implementation (e.g. Anderson *et al.*, 2004). However, we here follow Kanter's (1988) argument that activity-stage models are useful for analytical and didactical purposes. The conditions for innovation can be understood best if the innovation process is divided into its major tasks.

Individuals show various behaviors to initiate and implement innovations, and our definition of IWB needs to be broad enough to enable the inclusion of all such behaviors. For example, Kanter (1988) postulates that innovation consists of a set of behaviors carried out by individuals (and groups of individuals) within an organization, including idea generation, coalition building, idea realization and transfer. The phases of initiation and implementation are easily recognizable in these behaviors.

At the level of individuals, Farr and Ford (1990) previously defined the related construct of work role innovation as 'the intentional introduction within one's work role of new and useful ideas, processes, products, or procedures' (p. 63). Inspired by this definition and referring to the general definition of innovation presented in section 2.1, we define innovative work behavior as *individuals' behaviors directed towards the initiation and intentional introduction (within a work role, group or organization) of new and useful ideas, processes, products or procedures*. Innovative work behavior is

thus restricted to intentional efforts to provide beneficial novel outcomes. It entails both the initiation and implementation of innovations.

Innovative work behavior versus creativity

Employee creativity is usually defined as the production of new and useful ideas for products, services, processes and procedures (Amabile, 1988; 1996). A long research tradition dates back to the early 50s on creativity as a personal attribute. In its trace research on the creativity of employees in organizations has increased in the last 20 years (Zhou & Shalley, 2003).

The constructs of innovative work behavior and employee creativity have some differences (West & Farr, 1990; Scott & Bruce, 1994). Unlike creativity, IWB is explicitly intended to provide some kind of benefit. It has a clear applied component since it is expected to result in innovative output. IWB also captures employee behaviors intended to achieve the production of novel products, services and/or work processes. Creativity could be thought of as a subset of IWB, being most evident at the beginning of the innovation process when problems or performance gaps are recognized and ideas are generated in response to a perceived need for innovation (West, 2002).

Despite these differences, there are also similarities between employee creativity and IWB. This is first apparent from the kind of models proposed to describe how individuals assemble and use information when attempting to arrive at a creative solution. Wallas (1926) was among the first to draw up such a model. He proposed that creative ideas are born in four phases: preparation – incubation – illumination – verification. The preparation phase is characterized by the recognition and preliminary analysis of a problem. During the subsequent incubation phase no conscious mental work occurs. A person may be working consciously on other problems or simply relax and take a break. Unconsciously, however, the mind continues to work on the problem, forming trains of associations. Illumination occurs when the promising idea breaks through to conscious awareness. This is characterized by a 'flash,' a sudden enlightenment. Finally, verification involves evaluating, refining, and developing one's idea. Other authors have identified models similar to the one proposed by Wallas. Some of these models also pay attention to the implementation of creative ideas. For example, Parnes, Noller and Biondi (1977) identified a five-step process for creative problem solving that ends with acceptance finding. Likewise, Basadur (2004) distinguishes between problem finding activity (sensing and anticipating opportunities for change), problem conceptualization, problem solving and solution implementation.

Although the divergent steps prevail and implementation is not dealt with in so much detail, one can easily draw a parallel with the two-phase activity-stage models we discussed above.

Creativity researchers increasingly investigate so-called 'late cycle' skills, that is, the implementation of creative ideas. In a recent review article on creativity research, Mumford (2003) states that past creativity research has focused mainly on 'early cycle' creative skills and circumstances: capacities and characteristics that make it possible for people to generate new ideas. He recognizes that real-world performance – the expression, shaping and execution of ideas – represents 'another important component of creative work' (p. 116). Mumford (2003) implicitly considers the investigation of the implementation phase ('late cycle skills') as an important emerging issue. Studies along this line may prove particularly useful if they 'examine fields that place a premium on practical innovation, such as engineering, marketing and computer programming' (p. 116).

Summarizing, employee creativity and IWB are to some extent overlapping constructs; they increasingly resemble with each other. This becomes most evident when cross-references in recent articles are analyzed. Studies with a focus on creativity use references from studies that focused on innovative behavior and vice versa (see for example Zhou, 2003). Thus, the distinction between both constructs is one of emphasis rather than of substance. As a consequence we also use employee creativity studies to identify dimensions of innovative work behavior and to support our hypotheses on which leader behaviors are correlated with IWB (see chapter 3).

Previous measures

As a consequence of receiving most academic attention, measures of employee creativity are well-developed while the measurement of innovative work behavior is still in evolution. Previous work usually assessed IWB as being a one-dimensional construct, but recently it has been recognized that one-dimensional measures do not capture the richness and potential multidimensionality of the construct. In table 2 we provide an overview of the most important measures of employee creativity and innovative work behavior.

table 2. Measures of employee creativity and innovative work behavior

Study	*Items and dimensions*	*Sample*	*Reliability and validity*
Employee creativity (one-dimensional):			
Oldham & Cummings (1996)	3 items	171 employees from two manufacturing facilities	$\alpha = 0.90$; no validity reported
Tierney, Farmer & Graen (1999)	9 items	191 employees in the R&D department of a large chemical corporation	$\alpha = 0.95$; significant correlations with counts of invention disclosures and research reports
Zhou & George (2001)	13 items	Supervisors of 290 R&D-employees from six established companies and 40 new technology based firms in Korea	$\alpha = 0.95$; no validity reported
Innovative work behavior (one-dimensional):			
Scott & Bruce (1994)	6 items	Managers of 172 engineers, scientists and technicians in an R&D department	$\alpha = 0.89$; significant correlation with filed invention disclosures ($r = 0.33$)
Bunce & West (1995)	5 items	Sample 1 435 employees from a national health service Sample 2 281 employees from a national health service	Sample 1 $\alpha = 0.75$; no validity reported Sample 2 $\alpha = 0.80$; no validity reported
Spreitzer (1995)	4 items	Subordinates of 393 managers in an industrial company	$\alpha = 0.91$; no validity reported
Basu & Green (1997)	4 items	Supervisors of 225 employees of a printing manufacturer	$\alpha = 0.93$; no validity reported
Scott & Bruce (1998)	4 items	Sample 1 110 professionals in an R&D facility Sample 2 R&D engineers working at four locations of a manufacturer of electronic equipment	Sample 1 $\alpha = 0.86$; significant correlation with number of invention disclosures Sample 2 $\alpha = 0.84$
Janssen (2000)	9 items	Self-ratings of 170 employees of a food manufacturer and 110 supervisor ratings of innovative behavior	$\alpha = 0.95$ (self-ratings) and 0.96 (supervisor ratings); significant correlation between both scales ($r = 0.35$)
Kleysen & Street (2001)	14 items	Self-ratings of 225 employees from different organizations	$\alpha = 0.97$; inadequate fit of structural equation model
Innovative work behavior (multi-dimensional):			
Krause (2004)	Two dimensions (5 items for generation and testing of ideas; 3 items for implementation)	399 middle managers from different German organizations	α-values of 0.78 and 0.81 are reported; exploratory factor analysis shows the two factors are distinct.
Dorenbosch, van Engen & Verhagen (2005)	Two dimensions (10 items for creativity-oriented; 6 items for implementation-oriented behavior)	132 non-managerial employees in a Dutch local government organization	α-values of 0.90 and 0.88 are reported; the additive scale of both dimensions had $\alpha = 0.92$; no validity reported

Creativity measures

The table first lists three commonly used multiple-item measures for employee creativity, developed by Oldham and Cummings (1996), Tierney *et al.* (1999) and Zhou and George (2001). Their items typically relate to divergent behaviors such as idea generation and the exploration of sources of opportunity. Yet, some creativity scale are more balanced, for instance the Zhou and George (2001) scale takes also includes a few items related to the implementation of creative ideas.

There are also other creativity measures available (Zhou & Shalley, 2003). Amabile's (1983) consensual assessment technique, for example, uses expert ratings of the overall creativity of a solution or product. It provides a score for the quality of creative solutions, but it does not include whether ideas are implemented. As another alternative researchers use objective measures such as numbers of patents, invention disclosures, research papers and technical reports, and ideas submitted to employee suggestion programs. It is open to discussion whether these measures indeed record employee creativity. For example, patents and research papers probably indicate innovative outputs rather than creativity as they focus on the results of innovation processes. On the other hand, ideas submitted to suggestion programs clearly seem to relate to the initiation phase.

Multiple-item measures are frequently used in field studies, while the consensual assessment technique is most popular in laboratory experiments (Zhou & Shalley, 2003). Objective measures can be applied in both settings, but the drawback is that they tend to be available only for employees in fully creative professions. In other sectors these measures are hard to obtain.

One-dimensional IWB measures

Early measures of innovative work behavior were one-dimensional and short (see also table 2). Scott and Bruce (1994) first regarded innovative work behavior as a multistage process. Based on in-depth interviews with managers of an R&D facility and drawing on Kanter's (1988) work on the stages of innovation, they developed a six-item scale. As stated Kanter (1988) distinguished between four major tasks: idea generation, coalition building, idea realization and transfer. Leaving out the transfer task, Scott and Bruce's (1994) measure captures the behaviors of idea generation, coalition building and idea realization. In their subsequent 1998 article, Scott and Bruce used a more parsimonious version of this measure to explore the joint effect of subordinate problem-solving style and leader-member relations.

Other authors have operationalized IWB in more parsimonious and simple ways. Bunce and West (1995) used five items to measure the 'propensity to innovate', a measure that fits in with our definition of IWB. From the provided sample items one can conclude that this measure captures both phases of the innovation process (p. 205). Spreitzer (1995) used a four-item measure of IWB that served as a dependent variable to validate a four-dimensional scale of psychological empowerment in the workplace. Her measure was based on four items derived from the competing values model of Quinn (1988). Likewise, Basu and Green (1997) developed a four-item IWB scale to correlate with measures of leader-member exchange (LMX) and transformational leadership in leader-subordinate dyads. Both of their measures basically ask supervisors to rate employees' innovativeness and originality, without any reference to specific types of behavior.

Janssen's contribution (2000) may be regarded as significant progress. Referring to Scott and Bruce (1994), he regarded IWB as consisting of three dimensions, namely idea generation, idea promotion and idea implementation. After formulating items explicitly linked to these behaviors, his analysis of empirical data showed strong correlations between the dimensions. Janssen concluded that his items combined best into one single, additive scale. Likewise, Kleysen and Street (2001) hypothesized IWB to be a multidimensional construct. Unfortunately, inadequate questioning meant that their confirmatory factor model failed to converge. A one-dimensional measure of 14 items provided the best fit.

Multi-dimensional IWB measures

More recently measures are reported that not only hypothesize IWB to be multi-dimensional, but also find empirical evidence to support this. Exploring the connection between influence-based leadership and innovative behaviors, Krause (2004) presents an IWB measure with two dimensions: the generation and testing of ideas, and implementation. Dorenbosch *et al.* (2005) provide a similar scale of 16 items. They use it to test a model on the connections between flexibility in job design, commitment-oriented HRM practices, and innovation. Both measures draw on the above-mentioned representation of innovation as a two-phase process.

Even though recent measures tend to look at IWB in more detail, table 2 reveals some deficits that need to be accounted for when we develop and validate a multidimensional scale. First, to prevent socially desirable answers and common source bias, IWB data should preferably be collected from an independent source, such as a supervisor or a colleague. Although there are exceptions (e.g. Scott & Bruce,

1994; Janssen, 2000; Zhou & George, 2001) this rule-of-thumb is often violated. Most measures are based on employees' self-reports. Second, analyses of the validity of IWB measures are scarce. Some researchers demonstrated that their measure correlates with objective innovation outcomes (Scott & Bruce, 1994; 1998) or with self-reports of IWB (Janssen, 2000), but in most cases no test of validity was reported or even attempted.

2.3 Dimensions of innovative work behavior

To operationalize IWB as a multidimensional construct, we follow Scott and Bruce (1994) and Janssen (2000) by proposing that innovative work behaviors can be linked to the phases in the innovation process. Drawing on Kanter (1988) they derive various behaviors including the generation of ideas, coalition building and implementation. These behaviors are directly related with the activity-stage model: idea generation is a divergent behavior while coalition building and implementation are convergent behaviors. Idea generation is still a rather broad behavior also including opportunity recognition (Scott & Bruce, 1994: p. 581).

We here propose that idea generation and opportunity recognition are distinct dimensions of IWB. Creativity literature has repeatedly indicated that the recognition of problems and the generation of ideas involve distinct cognitive abilities (e.g. Runco & Chand, 1994; Basadur, 2004). Likewise, entrepreneurship literature regards the discovery of opportunities as an event that precedes idea generation, and both have been demonstrated to have distinct personality and environmental determinants (for example Krueger, 2000; Shane, 2003). We therefore propose that IWB is a four-dimensional construct, including 1. opportunity exploration, 2. idea generation, 3. championing and 4. application.

Opportunity exploration

Innovation usually starts with the detection of performance gaps - mismatches between actual and potential performance. Literature shows that the realization of something new begins with a person identifying opportunities (for instance Parnes *et al.*, 1977; Basadur, 2004). The start of an innovation process is often determined by chance: the discovery of an opportunity, a problem arising or a puzzle that needs to be solved. The trigger to opportunity identification may be a chance to improve conditions, or a threat requiring immediate response. Some opportunities for innovations may be easy to identify while are overlooked for a long period (Petroski, 1992).

The discovery of opportunities may seem difficult, but some people do appear to be consistently 'lucky' implying that their exploration behavior is different (Leonard & Swap, 2005). Opportunities can be discovered in a variety of sources, not limited to business contacts but also informal contacts such as relatives (Ozgen & Baron, 2007). Sources of opportunity, as defined by Drucker (1985), relate to the factors that can initiate innovations:

- The unexpected (unexpected successes, failures or outside events)
- Incongruities (gaps between 'what is' and 'what should be')
- Process needs (in reaction to identified problems or causes of failure)
- Changes in industrial- and/or market structures (changes in contemporary markets like rapid growth, re-segmentation, convergence of separate technologies, etc.)
- Demographics (changes in population features like birth rates, educational attainment, labor force composition)
- Changes in collective perceptions (manufacturing the pill for example was not a sensible business case fifty years ago, but nowadays it is)
- New knowledge (scientific, technical or social, or combinations of the three).

Opportunity exploration includes behaviors such as looking for ways to improve current product, services or processes, or trying to think about current work processes, product or services in alternative ways (see for instance Zaltman *et al.* 1973, Farr & Ford, 1990).

Idea generation

A creative idea is a necessary condition for innovation as it precedes the exploitation of opportunities. As Kanter (1988) states: 'Awareness of a need (opportunity) is one element; ability to construct new ways to address the need is a second' (p. 175). Mumford (2000) holds that ultimately individuals are the source of all ideas. Idea generation includes behaviors directed at generating concepts for the purpose of improvement. The generation of ideas may relate to new products, services or processes, the entry of new markets, improvements in current work processes, or in general terms, solutions to identified problems (examples include Zaltman *et al.* 1973; Van de Ven, 1986; Amabile, 1988).

The key to idea generation appears to be the combination and reorganization of information and existing concepts to solve problems and/or to improve performance. Rothenberg (1996), in his study of Nobel laureates, found that such new combinations often provide a basis for advances in science. Along similar lines, Mumford,

Baughman and Reiter-Palmon (1997) found that skill in combining and reorganizing concepts is one of the best predictors of creative achievement. Kanter (1988) speaks of 'kaleidoscopic thinking'. In a kaleidoscope a set of fragments form a pattern that is not locked into place. If the kaleidoscope is shaken or twisted, or the angle of the perspective is changed, the same fragments form an entirely new pattern. It is an apt metaphor for the generation of ideas to satisfy opportunities, because the kaleidoscope allows people to shake reality into a new pattern. Idea generation often consists of rearranging already existing pieces of knowledge, physical capital and other resources to create a new possibility.

Championing

Once a creative idea has taken shape it must be 'sold'. Although ideas can have some legitimacy, especially when they fill a performance gap, it is uncertain if ideas will result in successful new applications. Only if creative ideas are marginal (appear off-the-field so they can slip in unnoticed) or idiosyncratic (can be accepted by a few people without requiring much additional support) they are easy to implement (Kanter, 1988). However in most cases innovative ideas face resistance. First, innovations are usually accompanied by new tasks or ways of usage. When ideas are proposed, recipients will first explore how it will affect them or their functioning. In case their current knowledge and skills would be outdated, resistance is more likely. Second, people have a general tendency to perceive information selectively, i.e. consistent with their existing views. This implies that extremely innovative ideas receive no priority. A third source of resistance is a shared preference for familiar actions and events. People have a built-in tendency to return to their original behaviors, a tendency that sabotages change (Jones, 2004).

As a consequence there often is a need for coalition building in order to implement innovations. Champions are the ones who put effort into creative ideas. They are individuals in informal roles that push creative ideas beyond roadblocks in their organizations (Shane, 1994). Innovative individuals who take prime responsibility for the introduction of innovations are often not formally appointed, but rather those who feel strong personal commitment to particular ideas and are able to 'sell' it to others. Championing includes behaviors related to finding support and building coalitions, such as persuading and influencing other employees and pushing and negotiating (e.g. Zaltman *et al.*, 1973; Van de Ven, 1986; Howell & Higgins, 1990; King & Anderson, 2002).

Application

It often requires considerable effort from individuals to transform ideas into practical propositions. Application means doing what is needed to transform ideas into reality. It includes behaviors such as developing new products or work processes, and testing and modifying them (e.g. Van de Ven, 1986; Kanter, 1988; West & Farr, 1990). To be an aspect of IWB, such behaviors need to be proactive, i.e. self-starting (doing something without being told or without an explicit role requirement) and persistent (overcoming barriers to bring about change) (Parker *et al.*, 2006). A characteristic that helps to get ideas implemented is self-efficacy. This construct is defined as individuals' self-perceptions about their ability to produce and to regulate events in life (Bandura, 1982). Self-efficacy is related to individuals' perception that change can be successfully implemented in a given situation (Farr & Ford, 1990). Strong perceptions of self-efficacy result in individuals' approaching tasks with enthusiasm, expending great amounts of effort on task accomplishment, and persistence in the face of obstacles (Parker *et al.*, 2006). Those with serious doubts about their capability to succeed, on the other hand, are more likely to avoid the activity, exert little effort, and give up quickly. Since individual innovation may involve both uncertainties about future outcomes as well as possible resistance from others affected by change, individuals do not possess a reasonable amount of self-efficacy are less likely to put effort into implementing innovations (Farr & Ford, 1990).

In sum, the first aim of this research is to develop a multidimensional measure of IWB. We propose that IWB is four-dimensional. A critical aspect to validate the measure is to demonstrate convergent and discriminant validity (cf. Campbell & Fiske, 1959). Establishing convergent validity requires that all dimensions contribute to an overall construct of IWB. Discriminant validity demands that, although the dimensions are related, they reflect distinct components (Churchill, 1999). None should be equivalent to each other. We hypothesize

Hypothesis 1A: Opportunity exploration, idea generation, championing and application all contribute to an overall construct of innovative work behavior.

Hypothesis 1B: Opportunity exploration, idea generation, championing and application are four distinct dimensions of innovative work behavior.

To further validate the measure, we also need to assess criterion validity by exploring how IWB relates to other, independent measures of individual innovation (cf. Churchill, 1999). As stated, individual innovation can also be thought of in terms of innovative outputs. While opportunity exploration and idea generation result in the

discovery of creative ideas, championing and application eventually contribute to the implementation of innovations and thus result in outputs like new products, services or processes.

Output-based measures have been used before to assess criterion validity of IWB measures. Scott and Bruce (1994) for example analyzed a sample of engineers, technicians and scientists. They reported significant correlations between IWB and independently rated counts of invention disclosures. In their 1998 study among R&D professionals and engineers similar results were found (Scott & Bruce, 1998). We hypothesize

Hypothesis 1C: Innovative work behavior is positively related to employees' innovative output.

In our research among knowledge workers, output-based measures from secondary sources were lacking. We therefore used a measure from another independent source. Our empirical surveys ask leaders to rate the innovative work behavior of their employees, and employees to self-assess their innovative output (see chapter 5).

2.4 Antecedents of innovative work behavior

Having discussed how innovative work behavior can be operationalized, we now elaborate on potential antecedents. Examples of antecedents of individual innovation that were investigated in previous work are given in table 3. We do not claim this overview to be exhaustive; rather the table gives an impression of the scope of the field[1]. We will use it to further position this thesis.

Many factors have been consistently found to be facilitators of innovation at differing levels of analysis (Anderson *et al.*, 2004). A substantial body of research has now accumulated on a wide range of factors at the individual, work group and organization level. There is also a small body of research that focuses on environmental factors.

Individual innovation can first be explained with factors that vary at the level of individuals. Early individual innovation research focused primarily on the innovativeness of individuals as a trait or aspect of personality. Some individuals were believed to have an innate ability to be innovative and initiate change. Typical factors that are investigated include extraversion and tolerance of ambiguity. Other studies have explored the impact of cognitive features of individuals, or characteristics of their

[1] For a more detailed overview of facilitators of innovation, see Anderson *et al.* (2004).

jobs (table 3). Having specific knowledge and creativity-relevant skills are examples of such antecedents.

table 3. Examples of antecedents of individual innovation

Category	*Type*	*Examples of antecedents*
I Individual level	Personality features	Tolerance of ambiguity (Barron & Harrington, 1981; Patterson, 1999) Self-efficacy (Farr & Ford, 1990) Locus of control (Harper, 1996) Extraversion (Barrick & Mount, 1991) Proactiveness (Seibert, Kramer & Crant, 2001)
	Cognitive ability	Above average general intellect (Barron & Harrington, 1981) Domain-specific knowledge (Amabile, 1988; Shalley & Gilson, 2004) Problem-solving style (Scott & Bruce, 1998)
	Job features	Autonomy (Spreitzer, 1995; Parker *et al.*, 2006) Job control (Axtell *et al.*, 2000; Axtell, Holman & Wall, 2006) Job complexity (Oldham & Cummings, 1996) Job dissatisfaction (Zhou & George, 2001) External work contacts (De Jong & Den Hartog, 2005)
II Work group level	Leadership	Participative leadership (Axtell *et al.*, 2000; Kanter, 1983) Transformational leadership (Janssen, 2002; Shin & Zhou, 2003) Leader-member exchange (Scott & Bruce, 1994; 1998)
	Work group features	Support for innovation (Scott & Bruce, 1994; Axtell *et al.*, 2000) Evaluative context (Shalley & Perry-Smith, 2001)
III Organization level	Work organization	Few rules and procedures (Oldham & Cummings, 1996) Innovation strategy (De Jong & Den Hartog, 2005) Slack resources (Brand, 1998) Reward system (Eisenberger & Armeli, 1997; Baer, Oldham & Cummings, 2003) Use of creativity techniques (Leonard & Swap, 2005)
IV Other	Environment	Competition by differentiation (Ong, Wan & Chang, 2003) Type of industry (Hill & Johnson, 2003)

A second category of antecedent factors deals with work groups features that influence individual innovation. In the context of organizations no individual can innovate alone. Most new products or processes will eventually affect others in the work group. The body of research is substantially smaller here; considerably more research has been conducted at the individual and organizational levels of analysis, than at the level of work groups. Anderson *et al.* (2004) consider this a 'regrettable shortfall in the coverage of innovation research especially given the increasingly widespread use of teamwork in organizations' (p. 149). Yet, the main antecedents we address here are in fact at the work group level (leadership, team climate).

A third category of antecedent factors covers organizational characteristics that influence individual innovation. Similar to individual level antecedents, these factors have received much attention in previous work. Examples include the impact of innovation strategies, slack resources and rules and procedures (see table 3). A final field of research - still very small - investigates how environmental, extra-organizational factors influence individual innovation. Individuals work in

organizations that in turn operate in different business environments. In some industries innovation is a normal phenomenon (for example manufacturers of machinery and equipment, consultancy, IT services), while in others cost savings and non-innovative behavior are the norm (retail trade, hotels and restaurants) (Pavitt, 1984; Evangelista, 2000). Although one can imagine that in some industries innovative work behavior is more usual than in others, the exploration of such factors on individual innovation is still in a nascent phase.

This research starts from the view that employees' innovative work behavior is partly determined by their interactions with other people. As Van de Ven (1986) already stressed, innovation does not happen in a vacuum. Other people in the work environment influence employees' innovative efforts. Previous work suggests that employees in organizations are likely to terminate their innovative efforts if their leader and/or colleagues discourage innovation (e.g. Scott & Bruce, 1994; Krause, 2004). Kanter (1988) stressed the significance of interaction with other people to elicit and support innovative efforts. Likewise, Amabile's (1988) model of creativity and innovation proposed that factors in the work environment, such as supervisory support and social influences resulting from group interaction, are important antecedents to idea generation and implementation. Also, having frequent and diverse external work contacts – such as clients, suppliers, trade fairs - may help individuals to innovate as it gets them in closer contact with need sources (Perry-Smith & Shalley, 2003).

Our aim is to develop and validate a multidimensional measure of IWB, and to investigate whether and how leaders stimulate their employees' innovative behavior. We also analyze how colleagues (operationalized as employees' perceptions of innovation climate) and external work contacts influence IWB. In doing so, our research takes a social perspective; it encompasses all types of actors that individuals meet at work.

In terms of the four groups of antecedents shown in table 3, leader behavior and innovation climate are clearly are at the work group level while external work contacts are positioned at the individual level. Our empirical test accounts for this by applying a multilevel research design. The next chapters first elaborate on leader behaviors, innovation climate and external work contacts in relation to IWB and develop hypotheses.

3 Leadership

This chapter starts with defining leadership (section 3.1). Next, section 3.2 provides a short overview of previous studies exploring the connection between leader behaviors and individual innovation. Section 3.3 presents how we arrived at an overview of relevant leader behaviors. For this purpose we used the current literature and twelve in-depth interviews with leaders in small knowledge-intensive service firms. Section 3.4 gives a detailed overview of leader behaviors that potentially affect IWB, and develops hypotheses.

3.1 The scope of leadership

Definition

Like so many other scientific constructs, researchers define leadership according to their individual perspectives and aspects of the phenomenon of most interest to them. Definitions vary in terms of emphasis on leader ability, personality traits, influence relationships, individual versus group orientation, and appeal to self- versus collective interests. Definitions also vary as to whether they are primarily descriptive or normative in nature as well as in their relative emphasis on behavioral styles (Den Hartog & Koopman, 2001). Examples of definitions that have been proposed are presented in frame 1.

frame 1. Definitions of leadership

Leadership is...
...The behavior of an individual directing the activities of a group toward a shared goal (Hemphill & Coons, 1957).
…The influential increment over and above mechanical compliance with the routine directives of the organization (Katz & Kahn, 1978).
…The process of influencing the activities of an organized group toward goal achievement (Rauch & Behling, 1984).
…Defined in terms of a process of social influence whereby a leader steers members of a group towards a goal (Bryman, 1992).
…The ability of an individual to motivate others to forego self-interest in the interest of a collective vision, and to contribute to the attainment of that vision and to the collective by making significant personal self-sacrifices over and above the call of duty, willingly (House & Shamir, 1993).
…The process of influencing others to understand and agree about what needs to be done and how it can be done effectively, and the process of facilitating individual and collective efforts to accomplish the shared objectives (Yukl, 2002).

Source: Den Hartog & Koopman (2001: p. 167) and Yukl (2002: p. 3).

Bryman (1992) recognized that most leadership definitions reflect some basic elements, including 'group', 'influence' and 'goal'. As a core concept, we think of leadership as *the process of influencing others to guide, structure and facilitate activities and relationships in a group or organization towards some kind of desired outcome.*

A potential for controversy about the differences between leadership, management and entrepreneurship exists. This is relevant for the context of our research. Our empirical studies are located in small firms where entrepreneurs are usually also leading and managing other people. Some writers contend that leadership and management are qualitatively different (e.g. Bennis & Nanus, 1985; Zaleznik, 1977). The most extreme distinction involves the assumption that management and leadership cannot occur in the same person. The prevailing point of view however is that leading and managing are distinct processes, but one cannot assume that leaders and managers are different types of people. Mintzberg (1973) for example described leadership as one of 10 managerial roles. Kotter (1990) differentiated between them in terms of their intended outcomes. Management seeks to produce predictability and order by setting goals, organizing and monitoring, while leadership aims to produce change by developing a vision and communicating it to employees.

As for entrepreneurship, there is also risk of confusion. Entrepreneurship can be defined as an activity that involves the discovery, evaluation and exploitation of opportunities to introduce new goods and services, ways of organizing, markets, processes, and raw materials by organizing efforts that had not previously existed (Venkataraman, 1997; Shane & Venkataraman, 2000). Entrepreneurship is most often studied in the context of small businesses and self-employed people. Some researchers think of entrepreneurship and leadership as distinct roles (Shane, 2003). They point to the fact that when organizations grow, the entrepreneur usually needs to rethink his entrepreneurial behavior and start to worry about how followers must be directed towards specific goals.

Here, leadership, entrepreneurship and management are seen as distinct roles, however they are not exclusive and can be found in a single person. Our empirical research (see chapters 5-7) focuses on leaders in small knowledge-intensive service firms who may very well be a manager and/or entrepreneur, but who also influence their employees' behavior towards desired outcomes (i.e. are leaders).

Approaches to leadership

Leadership has been an important topic of investigation for many decades. In table 4 we present an overview of the main trends in this field. The dates in this table give a rough indication of the periods in which emphasis was on an approach. A new stage did not necessarily mean the previous approach had been abandoned completely; rather shift in emphasis had occurred (Bryman, 1992). We briefly mention the main approaches, based on Den Hartog and Koopman's (2001) overview of leadership research. For a detailed discussion we refer to annex B.

table 4. Trends in leadership theory and research

Period	*Approach*	*Core theme*
Up to late 1940s	Trait approach	Leaders are born; leadership is an innate ability
Late 1940s to late 1960s	Style approach	What do leaders do; effectiveness has to do with how the leader behaves
Late 1960s to early 1980s	Contingency approach	It all depends; effectiveness of leadership is affected by the situation/context
Since 1980s	New Leadership approach	Leaders convince through vision and inspire loyalty and emotional attachment

Source: Den Hartog and Koopman (2001: p. 168), based on Bryman (1992).

The trait approach studied personal characteristics of leaders with the implicit idea that leaders are born rather than made. Leaders were supposed to have certain stable characteristics that make them effective. The focus was on identifying and measuring traits to distinguish leaders from non-leaders or effective from ineffective leaders.

The style approach emerged because early trait research failed to provide a consistent picture of suitable leader traits. In this approach, researchers explored what leaders do; i.e. their behavioral style. One prominent line of research within this approach found that behavioral style can be described as varying along two dimensions, namely 'consideration' and 'initiating structure' (Fleishman & Harris, 1962). Alternative work concludes that three types of leader behavior differentiate between effective and ineffective leaders: task-oriented behavior (similar to initiating structure), relationship-oriented behavior (very similar to consideration), and participative leadership. Leaders who made extensive use of participative decision procedures are concluded to be more effective (Likert, 1967).

Both trait and style researchers proposed universal theories, suggesting that certain traits or behaviors would always be effective. On the contrary, the main proposition in contingency approaches is that effectiveness is situation-dependent. One influential contingency model is the Path-Goal theory of leadership. It describes how leaders affect the motivation and satisfaction of employees (House, 1971). The theory

claims that leadership is effective to the extent that a leader helps employees to attain their work goals and to experience satisfaction and gain rewards as a direct result of attaining those work goals. Yet, effective leader behavior is not proposed to be universal, but rather contingent on various task and employee characteristics.

From the 1980s onward a renewed interest in leadership arose. At the time, one particular aspect of leadership was relatively unexplored, namely providing a vision or overarching goal. This sense of direction, of knowing where one is going, helps leaders integrate and align their followers' efforts. Bryman (1992) referred to this paradigm as the new leadership approach. It attempts to explain how certain leaders are able to achieve extraordinary levels of followers' performance. In the literature the term 'transformational' leadership is most often used to refer to the new type of leadership (Bass, 1985). Transformational leadership goes beyond many traditional leadership theories. It predicts followers' emotional attachment to the organization and emotional and motivational arousal of followers as a consequence of the leader's behavior (House, Woycke & Fodor, 1988). Transformational leadership is operationalized in four dimensions, including 'charisma' (providing vision, instilling pride and increasing optimism), 'inspiration' (acting as a model for subordinates and communicating the vision), 'individual consideration' (coaching and mentoring, providing continuous feedback, and linking subordinates' needs to the organization's mission) and 'intellectual stimulation' (providing and eliciting challenging new ideas to stimulate rethinking old ways of doing things) (Den Hartog, 1997).

The aforementioned approaches provide a framework to classify leadership research that has been published in the past decades. In practice things are, of course, somewhat more complicated. As indicated by Bryman (1992) new approaches do not mean that previous ones are discarded; rather, shifts in emphasis occur. The contingency approach, for example, is still very popular today. Our research is behavior-based. We investigate the connection between leader behaviors and employees' innovative work behavior. Traits of leaders are regarded as given and stable. As a consequence, this thesis does not capture any literature on leader traits.

3.2 Previous work

Previous attempts to investigate the connection between leader behaviors and individual innovation were mainly directed at the impact of theory-based leadership styles, including transformational leadership, participative leadership, path-goal theory and leader-member relations (LMX). We will briefly discuss findings from previous work.

Transformational leadership

Transformational leadership has been hypothesized to encourage both employees' IWB (e.g. Krause, 2004) and the related construct of employee creativity (for instance Kahai, Sosik & Avolio, 2003). Transformational leadership has also been connected to performance measures of employees in creative professions such as R&D workers (for instance Keller, 2006). As transformational leaders stimulate employees to see problems in new ways and help them to develop to their full potential, the enhanced creativity of followers is easy to hypothesize. A transformational leader encourages experiments to explore new ways of doing things, to test new products, services and procedures, or in other terms, to abandon old ways of life and make way for new ones (Den Hartog, 1997). These arguments are used to hypothesize a positive influence on employees' IWB.

Empirical tests have however provided mixed results. As for creativity, Kahai *et al.* (2003) used an electronic meeting system in a laboratory experiment among students to investigate the impact of leadership, anonymity and rewards on creative outcomes. They find a positive impact of transformational leadership, but this correlation is lower than for other types of leadership. Jaussi and Dionne (2003) conducted an experiment with 364 students in the United States. One of their variables to explain performance in a creative exercise was transformational leadership. Their results suggest that transformational leadership has little effect on creativity. In contrast, Shin and Zhou (2003) used a sample of 290 employees and their supervisors from 46 Korean companies. One of their findings is that transformational leadership is positively related to employee creativity.

Work directed towards innovative outcomes finds a positive impact of transformational leadership. Waldman and Atwater (1992) investigated how leaders can enhance R&D project effectiveness. Drawing on interviews and surveys among R&D project members, leaders and higher-level managers they conclude that transformational leadership makes a positive difference. Keller (2006) studied transformational leadership as a longitudinal predictor of performance in 118 R&D project teams. He finds that transformational leadership predicts 1-year-later technical quality, schedule performance and cost performance, all indicators of a project team's ability to innovate. Transformational leadership also predicts 5-year-later speed to market, another indicator for the ability of a project team to capitalize on innovation.

Research on innovative work behavior has so far not been able to demonstrate a direct positive connection with transformational leadership. In a study among 225 employees and their leaders in a manufacturing plant Basu and Green (1997) find a

negative connection between transformational leadership and employees' innovative behavior. Similarly, Krause (2004) examined data from 399 middle managers to assess the influence of various leader behaviors on employees' innovative work behavior. Transformational leadership was unrelated while other leader behaviors were more important (e.g. providing of autonomy to middle managers). To sum up, previous work suggests a complex relationship among transformational leadership behaviors and measures of individual innovation. The relationship may be moderated by contextual variables.

Participative leadership

Participative leadership involves the use of various decision-making procedures that determine the extent to which people can influence leaders' decisions, and have autonomy to design and guide their own tasks (Yukl, 2002). It can take many forms, including consultation (leaders asking followers for their opinions, then making the decision alone), joint decision making (leaders meeting with others to discuss a problem and decide together) and delegation (leaders giving followers authority to make decisions, usually specifying the limits within which their final choices must fall). Such leadership offers a variety of potential benefits including higher decision quality, higher decision acceptance, more satisfaction with the decision making process, and more development of decision-making skills. Whether such benefits are reaped depends on who the followers are, how much influence they have, and other aspects of the decision situation (Yukl, 2002).

Participative leadership has been identified as an important antecedent of individual innovation (Rickards & Moger, 2006). Empirical support was for example found in early studies of effective managers (Kanter, 1983) and high-performing organizations (Peters & Waterman, 1982). In these studies effective managers used a substantial amount of consultation and delegation to encourage employees and to give them a sense of ownership for activities and decisions. This triggered idea generation and implementation efforts. More recent studies draw similar conclusions. Judge, Gryxell and Dooley (1997) interviewed R&D managers, research scientists and laboratory technicians from new biotechnology firms. Giving employees operational autonomy was one of the leader behaviors triggering an innovative culture. Another example is Axtell *et al.* (2000). Their survey among employees of a manufacturing plant demonstrates positive connections between participation and employees' self-ratings of suggestions and implementation efforts.

Path-goal theory

Path-Goal theory is one of the influential models in the contingency approach to leadership. It posits that effective leaders engage in behaviors to facilitate goal attainment and to maximize the value of employees' achievements, thereby affecting employees' expectancies, performance and satisfaction. Additionally, the relationship between leader behavior and outcome measures is proposed to be moderated by situational variables such as task and personality characteristics (House, 1971). The theory's leader behaviors have been empirically linked with job performance of employees in R&D organizations, a work context where innovation is a main role requirement. Empirical tests of this model suggest that employees' characteristics moderate the effectiveness of particular leader behaviors. For example, in a study examining 477 professional employees from four R&D organizations, Keller (1989) found that employees' need for clarity moderated the relationship between directive leader behaviors, job satisfaction and performance. Although directive leader behaviors are generally believed to impede innovative work behavior, some employee characteristics may moderate this relationship.

Leader-member relations (LMX) theory

The leader-member exchange theory (LMX) focuses on the social exchange relationships between leaders and employees. It proposes that the quality of social exchange relationships between leaders and followers influences important outcomes, like subordinate satisfaction, supervisor satisfaction, performance, commitment, role conflict, role clarity and turnover intentions (Yukl, 2002). This theory also suggests that the quality of the relationship between leaders and followers relates to innovativeness (Graen & Scandura, 1987). High-quality exchange relationships include providing employees with challenging tasks, support in situations of risk-taking, providing task-related resources, and recognition. Such behaviors all facilitate employees' innovative work behavior.

Consistent with this prediction Scott and Bruce (1994) found that high-quality exchange relationships were related to IWB. Similarly, Tierney *et al.* (1999) collected data from 191 leaders and employees in the R&D sector of a large chemical corporation and found a positive relationship between high-quality relationships and employee creativity. Janssen and Van Yperen (2004) used a dataset of 170 employees from an energy supplier and found a positive impact of LMX on innovative work behavior.

Previous work suggests more leader behaviors that may precede IWB. A detailed discussion of this literature follows in section 3.4. A drawback of most previous studies is their focus on theory-based leadership styles. It is uncertain if such leader behaviors, identified in routine settings, will automatically correlate with innovative work behavior. Constructs like transformational and participative leadership were originally proposed to assess leaders' impact on performance or effectiveness rather than innovation-related outcomes. In this context Mumford and Licuanan (2004) provided some important directions for future research. Based on a two-part special issue of LeadershipQuarterly on innovative leadership, they recommend a new wave of research on leadership in settings of innovative people. Parker and colleagues (2006) follow a similar argument with their claim that traditional measures of employee performance represent passive behaviors. Antecedents of such behaviors – including leadership - do not necessarily apply to proactive behaviors including innovation-related behaviors.

Empirical studies that explore the impact of multiple leader behaviors on individual innovation are still scarce. One exception is Ekvall and Arvonen's (1991; 1994) concept of change-centered leadership. Their work suggested this as a new dimension of leadership that complements the earlier two-dimensional model of initiating structure and consideration. So far this work has received hardly any attention within the field of leadership (Rickards & Moger, 2006).

3.3 Interview methodology

Rather than use a single existing model or inventory of leadership practices, we developed an inventory of leader behaviors that are likely to stimulate IWB. For this purpose we combined in-depth interviews and literature research. In-depth interviewing is a qualitative research technique that is particularly useful for exploration purposes (Eisenhardt, 1989; Churchill, 1999) while the use of literature is important to complement the results of such explorations (Strauss & Corbin, 1990). As our empirical studies focus on IWB among knowledge workers, these in-depth interviews were organized in the same setting. We now explain how we traced interview participants and discuss our methods of data collection and processing.

Participants

Alvesson (2000) provides a widely used definition of knowledge-intensive firms: 'companies where most work can be said to be of an intellectual nature and where well-qualified employees form the major part of the workforce' (p. 1101). Likewise,

Hislop (2005) defines knowledge workers as 'people whose work is primarily intellectual and non-routine in nature and involves the utilization and creation of knowledge' (p. 217). Occupations characterized as such include lawyers, consultants, IT and software designers, advertising executives, accountants, scientists, engineers,and architects (Hislop, 2005). Here we actively searched for leaders from sectors where knowledge workers are employed.

We selected twelve participants through purposive sampling. Each participant was a manager or owner of a small knowledge-intensive firm (< 100 employees). We searched for participants with varied innovation-stimulating leader behaviors. Since we wanted to gain some idea of what leader behaviors account for variation in individuals' innovative work behavior, we interviewed both leaders who aim to elicit employees' IWB ('best practitioners') and leaders who do not stress this explicitly ('average performers'). This helped us to reveal contrasts in seemingly important leader behaviors (cf. Yin, 1994).

To trace participants we contacted the Dutch non-profit consultancy organization Syntens. Commissioned by the Ministry of Economic Affairs, this organization aims to stimulate innovation in small firms by giving advice to managers and business owners. Syntens employs 250 consultants who maintain in-depth relationships with their clients. For the current study we contacted three senior consultants who were doing a project on employee suggestions systems in small firms. We asked them to propose suitable contact persons, i.e. 'best practitioners' (leaders who intensively stimulate their employees to be innovative) and 'average performers' (leaders who do not pay explicit attention to their employees' IWB). Drawing on their suggestions we were able to contact five 'best practitioners' and seven 'average performers' (frame 2).

frame 2. Characteristics of participants

BP	Participant 1 is a manager of new ventures. He works for a public relations organization with 80 employees. With five subordinates from various disciplines (communication, politics, engineering, business administration, psychology) he is responsible for the organization's main innovation activities.
BP	Participant 2 is the business owner and general manager of a software development firm specialized in language and speech technology. With 15 employees the company develops software that gives computers linguistic intelligence.
BP	Participant 3 is a regional manager in a consultancy firm in the Eastern part of the Netherlands. The firm employees 35 persons. Their mission is to advise and assist entrepreneurs with issues like personnel, strategy, marketing, etc. The participant manages 12 employees.
BP	Participant 4 is a business owner and general manager of a firm that makes scientific (technical) knowledge available to Dutch firms. They are occupied in research in a wide range of fields, but specialize in environmental engineering services. This participant employs and manages 25 persons.
BP	Participant 5 is a manager of a business consultancy firm. Its main focus is to support the implementation of processes of change in large firms. Our respondent manages 10 employees working on strategic research and consultancy services.

A	Participant 6 is the manager and owner of an IT firm with 25 employees. They specialize in building and maintaining applications for the Internet. Main clients are retail and wholesale traders with an interest in e-commerce.
A	Participant 7 is one of the owners/managers of a research firm for marketing and strategy. Employing 60 people, the core business is to provide management information for clients in businesses and governments. This participant manages 15 employees.
A	Participant 8 is in charge of an accountancy firm with 75 employees. Their main activity is to draw up annual reports for small and medium-sized firms. Our participant is one of the business owners.
A	Participant 9 is the owner/manager of an engineering firm with 25 employees. Their activities consist of developing and consulting on mechanical instruments, fire prevention and electro-technology.
A	Participant 10 is the owner/manager of an engineering organization. It has 15 employees and specializes in developing constructions for buildings and bridges.
A	Participant 11 is the owner/manager of an accountancy organization with 12 subordinates. Farmers are his major customers.
A	Participant 12 is a business owner providing advice to radio stations and recording studios about new machinery and technological equipment. He employs ten persons and is in charge of daily operations.

BP = Best Practitioner, A = Average performer.

Data collection

In-depth interviews were done using an unstructured format. We first asked respondents to describe their leadership styles, what role innovation plays in their organization, and whether and how employees are involved in innovation processes. After these general questions, we let the participants talk freely about their attitudes and behavior in this area. Respondents' initial replies and our probing for elaboration determined the direction. We always attempted to elaborate on the potential influence of respondents' self-described leadership styles on employees' innovative work behavior. In the second part of the interview we asked direct questions about how innovative behavior was (or could be) stimulated, and how it could be discouraged (see also frame 3).

frame 3. Outline of in-depth interviews

- How do you manage your employees? How would you describe your leadership style?
- What is the role of innovation in your firm? Do employees contribute to this process? How? To what extent do your people innovate?
- Do you explicitly stimulate employees' innovative work behavior? How?
- How could a leader discourage innovative work behavior of his employees?

The interviews lasted for an average of 90 minutes. Comprehensive notes were made of all answers and processed in an interview report immediately after each session.

Analysis

We studied the interview reports intensively to identify common categories of meaning. Categories of relevant leader behaviors were developed and checked for their suitability by looking for similar answers in the data, and also by making comparisons

between the best practitioners and average performers in our sample. An assistant researcher also worked independently on this process to ensure reliability. Differences in categories were discussed and resolved. Especially the answers of best practitioners were useful as they reflect more extreme cases of stimulating their employees' IWB. We found some aspects of behavior in which they seemed to differ from the average performers.

As recommended by Strauss and Corbin (1990), current literature served as background material in our analysis of interview data. We used Yukl's (2002) taxonomy of managerial practices as a first classification of leader behaviors (see annex C). This taxonomy consists of fourteen behavior constructs derived from empirical research and expert judgments. Basically it describes what leaders do in their daily work. At first sight, this more general taxonomy seemed to encompass many relevant leader behaviors and, indeed, we were able to retain some of its categories in our final overview. However, we dropped or redefined the constructs whenever we felt that they were redundant or did not reflect the situation as described by the interview participants and we used the information and insights emerging during the interview process as well as current literature to think of potential new categories and check for the suitability of existing ones.

3.4 Leader behaviors and hypotheses

The 'back and forth' process, moving between the interview data and contemporary literature, resulted in an inventory of thirteen leader behaviors that may be related to employees' innovative work behavior:

A. Innovative role-modeling
B. Intellectual stimulation
C. Stimulating knowledge diffusion
D. Providing vision
E. Consulting
F. Delegating
G. Support for innovation
H. Organizing feedback
I. Recognizing
J. Rewarding
K. Providing resources
L. Monitoring
M. Task assignment.

Five of these behaviors are also found in Yukl's (2002) taxonomy (consulting, delegating, recognizing, rewarding, monitoring). Yukl's practices of 'supporting', 'informing' and 'clarifying roles' were reformulated to fit better with our context of individual innovation into 'support for innovation', 'stimulating knowledge diffusion' and 'task assignment'. Yukl's (2002) other practices were not included in the final inventory, as they did not emerge from the interviews and are not, or only rarely, described in existing literature linking leadership to individual innovation. Instead various other behaviors emerged from the interviews that we also found in the literature. Examples include providing an innovation-based vision and innovative role-modeling. In the interviews, most of the thirteen behaviors were cited by or could be recognized in the answers of a majority of the participants. Yet, since our intention was to explore potentially relevant leader behaviors rather than empirical testing, the rate of incidence of each construct is less important here.

Below we elaborate on all identified behaviors. We illustrate them with interview quotes, explain why we hypothesize them to be antecedents of IWB, and discuss relevant findings from previous empirical studies to support our hypotheses.

A: Innovative role-modeling

Our first hypothesis is that leaders may stimulate their employees' IWB by being an example of innovative work behavior. Innovative role-modeling implies that a leader acts like an innovative person and motivates others to do the same. Typical behaviors include exploring opportunities, coming up with ideas, championing and putting effort into the development of ideas. Some interview participants explicitly give examples of role-modeling (frame 4).

frame 4. Quotes related to innovative role-modeling

BP	'If you want your people to innovate, you should be an example of innovation yourself. I am always looking for ways to do things better and increase results. I ask my customers for feedback on our current services and do my best to improve things.'
BP	'Watching commercials on television is one of my favorite sources to think out-of-the-box. You should try to connect your business problems to another context to find creative solutions.'
BP	'I initiate many changes and for certain ideas I am busy convincing my people of their value. They probably regard me as the guy who let innovation go and is always open to new things.'
A	'I used to have a boss who was never open to anything new. All he did was maintain the status quo. I always hesitated to introduce my ideas when I could not implement them myself. His attitude made very clear that innovation was nothing for us.'
A	'We think it is important to be cost efficient. You cannot spend money that you did not save first. When I change suppliers I make sure my people get to know about it in order to stress that efficiency is important'.

BP = Best Practitioner; A = Average performer.

A main argument to propose a positive connection between innovative role-modeling and IWB is provided by emulation theorists. They claim that individuals learn from behaviors they see demonstrated. Emulation theory competes with views that take an inheritance perspective (Simonton, 1983). People will learn from observation and interaction with others demonstrating a particular behavior, rather than simply having an innate ability to perform well in any given area. Emulation theorists base their anticipated reasoning for the effects of modeling on social learning theory which states that learning takes place vicariously by modeling and self-control processes (Bandura, 1969; 1986). If individuals are capable of a certain behavior, but do not demonstrate it, they are more likely to do so after a visual demonstration of the behavior or through the transmission of examples of appropriate rules and thought processes. Through vicarious learning, individuals do not merely observe an example of behavior but actively pay attention to and store a symbolic representation in their mind of how to behave in certain situations (Bandura, 1969). Thus, modeling is believed to help clarify role expectations and enhance employees' skill acquisition. It provides a behavioral direction towards individual innovation by providing standards for organizing thought, and by strengthening or weakening social inhibitions concerning innovative behaviors.

Although the presence of role models is common in daily life and organizational training modules, little research has looked at whether the presence of role models has an effect on innovative work behavior. Related research shows a link with the construct of employee creativity. Jaussi and Dionne (2003) demonstrated that leaders who act creatively make themselves available for creative emulation, which triggers more creativity in followers. Likewise, Shalley and Perry-Smith (2001) found that individuals who were given a creative work model were able to learn what is considered creative from this model, and this actually resulted in them exhibiting more creative behavior. Empirical evidence is also presented in the context of business. Tierney *et al.* (1999) examined creative performance among R&D-workers in a chemical company. They found that direct assessments of leaders' creative skills were positively related with innovation output measures such as invention disclosures, and with creativity measures obtained for employees. Mouly and Sankaran (1999) performed a qualitative study of the factors shaping innovation in a research and development laboratory. They concluded that a leader's creative capacity was a key determinant of employees' creative performance. We hypothesize

Hypothesis 2A: Innovative role-modeling is positively related to employees' innovative work behavior.

B: Intellectual stimulation

Intellectual stimulation is a dimension of transformational leadership. It increases followers' awareness of problems and stimulates rethinking old ways of doing things (Yukl, 2002). Intellectual stimulation has been demonstrated to motivate and inspire followers to perform beyond expectations (Den Hartog, 1997). In the interviews some best practitioners mentioned this behavior in order to stimulate individual innovation, while average performers did not seem to explicitly and deliberatly challenge their employees (frame 5).

frame 5. Quotes related to intellectual stimulation

BP	'To solve problems we make a 'criminal tour'. It means that I ask my people to think of something that is impossible or not ethical or prohibited by law, but that could actually serve as a solution. I ask them what a crook would do in this situation. It is a good way to arrive at new points of view we had never thought of.'
BP	'Last week I challenged them to think of a way to integrate three-dimensional computation software in our (engineering) work. Some people I really need to heat up from time to time.'
BP	'In communication services your customers are a valuable source of ideas. I encourage my personnel to recognize opportunities by listening carefully to what customers have to say.'
A	'Some workers come up with ideas, especially the younger ones. Most of their ideas are pretty naive it must say. It takes time to discover how our business works.'
A	'We explore new opportunities by reading business literature to catch up with new developments. It may inspire us to do things better.'

BP = Best Practitioner; A = Average performer.

Our hypothesis of a positive connection between intellectual stimulation and IWB derives from two arguments. First, intellectual stimulation is expected to enhance employees' intrinsic motivation which in turn stimulates IWB. Amabile (1983; 1988; 1996) linked intrinsic motivation with creative performance, a construct closely related to individual innovation. Her componential theory of creativity posits that task motivation is a main determinant of creativity. Individuals' motivation for their tasks can be either intrinsic or extrinsic. Intrinsic motivation is defined as 'any motivation that arises from the individual's positive reaction to the task itself; this reaction can be experienced as interest, involvement, curiosity, satisfaction, or positive challenge' (Amabile, 1996: p. 115). Extrinsic motivation is defined as 'any motivation that arises from sources outside of the task'. Amabile holds that people will be most creative (and innovative) when they are intrinsically rather than extrinsically motivated (Amabile, 1988).

In line with this, many researchers have identified factors that enhance innovative performance via promoting intrinsic motivation (Zhou & Shalley, 2003). Following Jung, Chow and Wu (2003) we propose that the more leaders stimulate their employees intellectually, the more they will be interested in and focus on their tasks rather than on

external worries and concerns. This enhanced interest in their tasks should enable them to search for new and better ways of doing things, which is likely to lead to high levels of IWB.

A second argument for intellectual stimulation is that the role expectations a leader has of employees can serve as an antecedent of their behavior. Perceived goals influence individuals' behavior through their impact on self-regulatory mechanisms (Carmeli & Schaubroeck, 2007). Goals regulate action directly by influencing what people pay attention to, how hard they work, and how long they persist in working on a task (Zhou & Shalley, 2003). Eden (1984) adds that leaders' expectations and employees' performance are not just connected because of direct communication. When leaders expect employees to demonstrate particular behaviors, employees will be aware that their leader is also encouraging and facilitating these behaviors. Applying this to the context of individual innovation, leaders' innovative role expectations may influence the occurrence of innovative activity by employees.

As most empirical studies treat intellectual stimulation as part of transformational leadership, we did not find previous attempts to isolate the connection between intellectual stimulation and IWB. Yet, we did find empirical work on related variables. Scott and Bruce (1994) demonstrated that when managers expect their employees to innovate, employees perceive their leader to encourage and facilitate their innovative efforts, and demonstrate more IWB. This result was recently replicated in a study of Israelian workers, in which Carmeli and Schaubroeck (2007) showed that perceived creative expectations of the leader influences individuals' creative involvement at work. The relationship is partially mediated by individuals' self-expectation for creativity (p. 44).

In a review of social and contextual factors that precede creativity, Shalley and Gilson (2004) discuss several studies on the use of creativity goals. When individuals know that creativity is important, they are more likely to be creative. Tierney and Farmer (2004) conducted a survey among 140 R&D employees. Results generally supported that supervisors holding higher expectations for employee creativity were perceived by employees as behaving more supportively of creativity. Other studies found that even when there was no explicitly formulated goal, individuals were more creative when they were informed that this was considered important. For instance, Speller and Schumacher (1975) found that individuals' scores on creativity tests improved after they were told that they would be taking a creativity test. Assuming that intellectual stimulation makes employees perceive innovation as important, these

findings suggest a positive connection between intellectual stimulation and IWB. We hypothesize

> *Hypothesis 2B: Intellectual stimulation is positively related to employees' innovative work behavior.*

C: Stimulating knowledge diffusion

Stimulating knowledge diffusion includes pushing personnel to share knowledge and to inform colleagues about their work, its progress and potential problems. In the interviews we found that best practitioners put a lot of effort in stimulating knowledge dissemination amongst the people in their organization. To average performers this did not seem to be very important (see frame 6).

frame 6. Quotes related to stimulating knowledge diffusion

BP	'It's always good when people are aware of how things are going. When you hear about one's problems (in engineering work), you may come up with suggestions or ideas for solutions if you have faced a similar problem in the past.'
BP	'It is important that everybody is well informed. It helps to keep my employees committed to their work and to prevent mistakes.'
BP	'I try to stimulate communication, especially between those workers with clearly separated jobs. I do not like the attitude of 'I just do my work and walk out of the door at five in the afternoon' but rather feel that one should be dedicated to anyone's job.'
A	'First and foremost employees need to do their (own) job well. If anything goes wrong I give them personal attention. In order to manage it is essential that I am well informed on what they are doing.'

BP = Best Practitioner; A = Average performer.

We propose that stimulating knowledge diffusion relates positively with IWB. Our main argument comes from social network theory. This theory considers the social networks of individuals as an important determinant of the resources one needs in order to innovate (Gabbay & Leenders, 1999). Having many contacts with diverse people enables individuals to better call upon necessary ingredients to innovate, including inspiration (Perry-Smith & Shalley, 2003) and resources (Kanter, 1988). In this context Kanter (1988) claimed that 'isolation of individuals tends to reduce innovation by limiting awareness of opportunity, alternative approaches, and the perspective of those functions that need to contribute other parts to make the innovation add up to a whole' (p. 177). To initiate and produce innovations she believes that complexity is essential. Or in the words of Kouzes and Posner (1987), 'without information, you can be certain that people will not extend themselves to take responsibility or to vent their creative energies' (p. 157). We propose that for innovative work behavior it may help if employees frequently exchange knowledge with their colleagues as this increases cross-fertilization and helps to overcome isolation of individuals within the

organization. Innovative individuals will benefit from relationships with other people, as this provides more sources of information, more angles of approach to problems, and more options to attract human and material resources.

In their literature review on leadership and creativity, Mumford, Scott, Gladdis and Strange (2002) proposed that part of the idea-generating ability of employees depends on being aware of the needs, trends and problems within their professional and business environment. Such knowledge provide individuals with sources of new ideas. Good internal communication facilitates the dissemination of ideas and contributes to a culture in which ideas are more likely to be translated into action. Leonard and Swap (2005) even regard interactive communication as the 'lifeblood of creative behavior'. One example they provide of a company that explicitly stimulates knowledge diffusion is Unilever, who creates internal knowledge networks for its professionals to share problems, ideas and creative solutions (p. 171).

Harborne and Johne (2003) report empirical evidence in support of a positive correlation between stimulating knowledge diffusion and IWB. In a study of 19 innovative banking projects they found that leaders in successful innovation projects focused heavily on informal communication to disseminate knowledge. Another example is a study by Allen, Katz, Grady and Slavin (1988). They investigated innovative projects in nine R&D organizations. Project performance was higher when leaders kept their researchers up-to-date with relevant scientific or technological knowledge. We hypothesize that

Hypothesis 2C: Stimulating knowledge diffusion is positively related to employees' innovative work behavior.

D: Providing vision

Some participants from the best practitioners group regarded innovation as a long-term phenomenon. We have labeled this phenomenon as providing an innovation-based vision. Participants in the average performers group did not seem to adhere to the idea of a vision (frame 7).

Arguments for a positive connection between providing an innovation-based vision and IWB include intrinsic motivation and role expectations. As discussed, employees' intrinsic motivation is important for their innovative efforts. The more employees are dedicated to their tasks at hand, the more interest, involvement, curiosity and satisfaction they will derive from it resulting in enhanced IWB. Following Jung *et al.* (2003) we propose that when leaders articulate a compelling vision to energize employees to contribute to innovation, employees are expected to be excited and

energized to work hard towards achieving higher goals and objectives. In this process, they are likely to focus on their tasks at hand, rather than on issues external to the task. This increases excitement, energy, and concentration, and is expected to result in higher levels of innovative work behavior.

frame 7. Quotes related to providing vision

BP	'First you need a fundament of what kind of innovations you want. We want to be a leading firm in speech and language technology.'
BP	'I want to innovate endlessly to create value for customers and to improve our methods of delivering services. My people are aware that innovation is important, and I am sure this influences their daily behavior. If not, they should reconsider working here.'
BP	'I seek evidence that a person has thought carefully about his idea, and that it fits within our strategy. Strategic fit makes it much easier to persuade others.'
A	'Planning for the future is mostly a waste of time. I am running this business for over 30 years now, and I can tell you things never work out like you planned. In our market you have to live with the fact that customers dictate your revenues. And we are humble to that principle.'
A	'Entrepreneurs who are dedicated to a vision are always good for a laugh. I occasionally meet them at the local bank's meetings. Most of them go bankrupt.'

BP = Best Practitioner; A = Average performer.

An innovation-based vision is also likely to make employees perceive that their leaders expect them to innovate. Similar to our hypothesis on intellectual stimulation we propose that when leaders expect employees to demonstrate particular behaviors, they are more likely to do so. A vision may increase attention and effort by providing clear directions toward which individuals can direct their energies (cf. Bass, 1985). Providing an innovation-based vision can therefore enhance the occurrence of innovative activity by employees.

Most individual innovation studies merge the construct of vision with other dimensions of transformational leadership. We did not find any previous work that aimed to isolate the connection between vision and IWB. There are, however, studies that demonstrate an empirical connection with alternative measures such as creative output and innovative outcomes. Sosik, Kahai and Avolio (1998) showed that providing a vision results in enhanced creative output on a computer-based brainstorming task. For innovative outcomes, Hounsell (1992) demonstrated that having a vision resulted in successful research and development outcomes, while Shin (1997) found that leaders in service firms who expressed a clear vision of innovation realized better innovation results.

Another relevant study was done by Gebert, Boerner and Lanwehr (2003) in 101 service organizations. They claim that stimulating employees to be innovative entails certain risks. For example, there may be too many ideas, innovation may become an objective in itself, or too broad a spectrum of initiatives may be covered. Gebert and

colleagues propose a construct called 'integration' as the clarity of the strategic course set by the organization, and the capacity to reach agreement on fundamental issues. In their research at the firm level more innovativeness emerged due to common objectives and principles. Here we suggest a similar process at the individual level. Thus

Hypothesis 2D: Providing an innovation-based vision is positively related to employees' innovative work behavior.

E: Consulting

Consulting involves efforts to encourage and facilitate employees' participation in decision-making (Yukl, 2002). In the interviews, best practitioners seemed more proactive in their consultation of employees. They kept an eye on employees' motivation for which they thought participation was a major antecedent (see frame 8).

frame 8. Quotes related to consulting

BP	'Before deciding what to do, I usually consult my employees, especially when the consequences would affect their work. It makes them more committed. It also stimulates them to make suggestions. That's why we have a special meeting every three months at which important decisions are made together. Everybody has a voice and can state their opinion on matters that personally affect their work.'
BP	'People should generate ideas themselves. This is necessary to have them implemented. People are usually less motivated for others' ideas.'
BP	'It is dangerous to strive for innovation on your own. An innovation must be supported by others, in particular the ones who are going to work with it. Thus I always ask for their suggestions on how we should implement something new.'
A	'In my business there are two kinds of horses: workhorses and racehorses. The latter type has all the inspiration and knows what should be done and how it should be done. As I am the racehorse here, I prefer to recruit workhorses.'

BP = Best Practitioner; A = Average performer.

Individuals will experience high levels of intrinsic motivation when they feel self-determining in relation to a given task (Jung *et al.*, 2003). In general, people are intrinsically motivated for actions and they have initiated themselves or when they have had the chance to shape the design and conditions of implementation. When individuals perceive that they can participate in decision-making, their curiosity and interest is likely to increase. This will maintain or enhance their intrinsic motivation and is expected to result in higher levels of IWB (cf. Amabile, 1988).

Recent research in this area includes a study by Amabile, Schatzel, Moneta and Kramer (2004). They investigated teams of knowledge workers using daily reports on critical incidents in the behavior of team leaders. The research included a comparison between two R&D teams that differed dramatically in creativity and their perceptions of leader support for innovation. The leader in the successful team strongly encouraged employees to be involved in decision-making during weekly meetings. In contrast, the

leader of the unsuccessful team never asked for input in decision-making. This lack of consultation not only undermined motivation, but also deprived the project of fresh perspectives that could have made it perform better.

Another example is a case study by Ruigrok, Achtenhagen, Rügg-Stürm and Wagner (2000) that suggested a positive relationship between a 'shared leadership' style and employees' innovativeness. Shared leadership – a leadership style characterized by frequent consultation – enhanced involvement and motivation to make suggestions and to strive for successful implementation. Thus, we hypothesize

Hypothesis 2E: Consulting is positively related to employees' innovative work behavior.

F: Delegating

Delegating is a form of power-sharing process that occurs when leaders give employees autonomy to determine independently how to do a job or certain task (Yukl, 2002). Many interview participants mentioned they considered it important to provide employees with autonomy in their work. This was most prominent with the best practitioners (see frame 9).

frame 9. Quotes related to delegating

BP	'When you delegate certain responsibilities to others, they will probably start to think of it as their problem. Recently I made one of my employees responsible for obtaining an ISO certificate. It made her energy spark.'
BP	'I give my personnel as much freedom as possible. It is a way to learn something new. And it improves their ability to solve problems for customers in a creative way.'
BP	'When we implement something I delegate tasks as much as possible. It is all about giving trust and responsibility. I do not want to be in their way.'
BP	'As a manager, you should not try to improve an idea or provide directions for how to carry it out. It just devastates one's motivation to work hard. I always politely ask them for permission before I start making suggestions.'
A	'I am never involved in the development of new services. As soon as we have decided to go ahead, I try to delegate things to my employees. I am too dominant and they would not dare to question my opinion.'

BP = Best Practitioner; A = Average performer.

Delegating is expected to correlate with IWB because people tend to work harder on their own projects than on someone else's. Delegation implies that leaders transfer their ownership of challenges to others. Parker and Axtell (2001) suggest that job autonomy is positively related to the extent that employees feel responsible for problems and goals beyond their immediate individual tasks. Chen and Aryee (2007) add that the opportunity to exercise self-direction and control makes employees feel important, competent and respected. This will motivate employees to experiment with new ways of doing their job leading to innovative behavior. We expect individuals able to do

their work as they see fit will be more intrinsically motivated, and more likely to innovate.

Situation control theory also suggests a positive correlation between delegating and IWB. Gebert (1987) originally proposed situation control theory to explore the psychological mechanisms underlying individuals' decision to innovate. Drawing on Lazarus's (1966) cognitive stress-coping theory one basic assumption is that innovations arise form performance gaps, i.e. divergence between a desired and an actual state. Individuals can perceive such gaps as either a threat or challenge, depending on their appraisal of situation control. Two considerations are important here (Gebert, 1987). First, individuals judge whether they personally possess the necessary resources (authority to act, decision-making competence, time, budget, staff, knowledge) to improve the situation. If insufficient control is perceived, individuals assess the likelihood of reducing the discrepancy between the desired and actual state by procuring resources elsewhere. The result of this appraisal depends of various factors and also includes how individuals perceive their relation with their leader. The appraisal of situation control determines whether individuals perceive situations as being susceptible to change. In case of sufficient perceived control, innovative work behavior becomes likely. When perceived control is insufficient individuals may react with denial, indifference or even resignation (Gebert, 1987). We propose that delegation is likely to improve employees' perceptions of being in control to improve situations, and thus makes innovative work behavior more likely.

Previous work supports a positive correlation between delegating and IWB. Chen and Aryee (2007) surveyed 171 employees and their leaders in a Chinese manufacturing plant. A positive connection between delegation and innovative behavior is found. Their findings highlight the importance of motivation in order to innovate, as the connection is moderated by employees' feelings of being important, competent and capable (i.e. organization-based self-esteem) and being respected as an 'organizational insider'. Krause (2004) investigated whether leaders could exert influence on the innovation process by granting their employees freedom and autonomy. She found that these constructs relate positively to various types of innovative behavior, including the generation and testing and the implementation of ideas. In an empirical study among 360 knowledge workers in 36 service firms, De Jong and Den Hartog (2005) showed that perceived autonomy is directly related to employees' innovative behavior. Spreitzer (1995) also showed that when employees experience autonomy, they feel less constrained and are more likely to demonstrate innovative behaviors. We hypothesize

Hypothesis 2F: Delegating is positively related to employees' innovative work behavior.

G: Support for innovation

Support is the psychological and physical assistance provided by a leader (Yukl, 2002). Here, support for innovation relates to how leaders respond to employees' innovative efforts such as idea suggestions or implementation trials. Most best practitioners in our interviews told us that they tried to support or at least respond positively to their employees' initiatives while average performers did not explicitly do so (frame 10).

frame 10. Quotes related to support for innovation

BP	'People know that I just love new ideas. That's why my people come up with suggestions regularly. They always excite me.'
BP	'A manager must be kind and friendly and have a lot of patience to listen to ideas. For employees this lowers the barrier for suggestion making and striving for realization.'
BP	'You can really discourage innovative behavior by being unreliable. Introducing something new is always rimmed with start-up problems. When you abandon someone as soon as these appear, you can forget successful innovation.'
A	'I am quite indifferent to those who think that things should be done differently. Most of the times I let them go ahead. When they succeed I applaud their efforts, but most of the time they just fall on their face.'
A	'Yes, some of my people occasionally propose new ideas. Ah, what should one do with them?'

BP = Best Practitioner; A = Average performer.

Support for innovation is expected to correlate with IWB as support is an antecedent of employees' intrinsic motivation. Support implies that leaders demonstrate a high degree of confidence in their employees, not blaming them for every mistake or wrong decision. In any innovation process things are likely to go wrong. No one can predict which ideas will be successful (King & Anderson, 2002). Support for innovation enables employees to be relaxed and focus on the generation and/or implementation of innovative ideas, rather than having to worry about how to act should their leader criticize them. This strengthens their intrinsic motivation (Jung *et al.*, 2003; Dewett, 2007). And, as innovative people generally explore first and ask permission later (Mumford, 2000), the consequence of no support would be that individuals withdraw an innovative idea when confronted with premature criticism – while their ideas are still in an early stage.

Support for innovation can also result in a better appraisal of situation control. Should individuals identify an innovative opportunity, support for innovation would lead to perceptions that necessary resources to innovate can be obtained. Individuals will perceive that it is more likely that their leader will embrace their ideas and support implementation (Gebert *et al.*, 2003). This makes innovative activities more likely.

Various empirical studies connect support for innovation with IWB. Krause (2004) showed that support for innovative efforts was a predictor of the innovative work behavior of middle managers. Detert and Burris (2007), using a sample of restaurant workers, showed that managerial openness, i.e. subordinates' perceptions that their boss listens and is interested in their ideas, and at least sometimes takes action, is positively related to their willingness to speak up and make suggestions. Janssen (2005) found a positive relationship between supervisor supportiveness and employees' IWB. In addition, perceived support moderated the relationship between employees' perceived influence in the workplace and their levels of innovative behavior. In a recent study of R&D workers, Dewett (2007) empirically demonstrated that employees' intrinsic motivation mediated the relationship between supervisor encouragement and employees' creative behavior. Finally, Axtell *et al.* (2006) investigated how innovative work behaviors developed in an English manufacturing plant. In this plant, team-working was introduced with the aim of stimulating individual innovation. They found that especially in early stages - directly after team-working for individual innovation was introduced - increased management support was related with changes in idea implementation. In sum, we hypothesize

Hypothesis 2G: Support for innovation is positively related to employees' innovative work behavior.

H: Organizing feedback

Some participants from the best practitioners group mentioned that feedback could improve innovation success. Concepts for new products, services or processes were believed to improve considerably by making sure that their initiators receive feedback on initial versions of their ideas. Feedback can come from many sources, including not only leaders but also colleagues and customers. Feedback may thus be organized in different ways. Leaders can give it themselves, but may also appoint employees to do this job, or suggest to present initial concepts of the idea to groups of customers (frame 11).

In general, feedback provides mechanisms for improving performance (Yukl, 2002). Specific feedback for innovation can be expected to have a similar effect on innovative work behavior. If individuals are provided with behaviorally relevant information that can be used to learn, develop, and make improvements to their ideas this may further trigger their innovative work behavior.

frame 11. Quotes related to organizing feedback

BP	'Feedback makes an idea better. I usually ask our customers to comment on an idea. I want to know if they would buy it. If yes, I feel more convinced of its value. Sometimes a concept for a new service is completely changed due to their feedback.'
BP	'In case of innovative ideas I tell a person what can be improved. A new consultancy service must always be slightly changed and adapted to client wishes.'
BP	'A sparring partner is an important element in how we innovate. The idea generator is often very excited about it and does not want to hear any criticism. I appoint one of his colleagues as a sparring partner who keeps more distance. With his comments and additional ideas they can increase the chances of successful implementation.'
BP	'When someone comes up with an idea, I invite him to talk about it with other people to see what they think. If he or she is still enthusiastic after two weeks, it may be something worthwhile.'

BP = Best Practitioner.

Social network theory suggests that innovation benefits from having access to differential sources of information (Perry-Smith & Shalley, 2003). It predicts that the exposure of individuals to diverse people and information will spark new ideas and helps to find verbal and enacted support for implementation. When leaders ensure that feedback is provided, an additional source of information becomes available. Similarly, Kanter (1988) argued that individual innovation is favored by the frequent exchange of ideas and cross-fertilization of information among employees.

Hellström and Hellström (2002) found a positive connection between feedback and individual innovation. Based on their qualitative research in a Swedish telecom firm, they concluded that employees' willingness to innovate depends on personal feedback that is given as soon as an idea is proposed. Positive, non-destructive feedback is perceived as a source of improvement. Lubart (1994) asked college students to write stories or make drawings that were ranked in terms of creativeness. As students worked on these production tasks, however, they were asked, at various times, to evaluate their work. It was found that early self-evaluation eventually resulted in more creative outcomes. Finally, innovation research at the organizational level shows that feedback from customers can boost new product success rates. Research into new product development for example has demonstrated the positive impact of early feedback from customers, for instance Cooper (2003) recommends that those who develop new products should not to refrain from testing them, i.e. evaluate them with clients and use their feedback to further refine an initial concept. Von Hippel (2005) even suspects that so-called user innovation, which implies that organizations increasingly develop innovations in partnerships with their customers and benefit from their ideas and modifications of products, will be a key organizational innovation model in the near future. We expect that

Hypothesis 2H: Organizing feedback on innovative efforts is positively related

to employees' innovative work behavior.

I: Recognizing

Recognizing involves giving praise and showing appreciation for innovative performance, significant achievements, special efforts and important contributions. Some of the best practitioners among our interviewees mentioned that recognition was part of their management style. They indicated to be eager to recognize the efforts of their employees (see frame 12).

frame 12. Quotes related to recognizing

BP	'Creativity is stimulated by giving them a pat on their back. That can work miracles.'
BP	'Making results at work count, that's for sure. But it means more than money. Freedom to act, being hugged by your boss, that's a real motivator.'
BP	'When someone makes a suggestion I try to pay a lot of attention to such an initiative. Just ignoring it would be detrimental for their motivation.'
BP	'You should prevent people from stealing ideas. It's really important to give the original inventors due credit.'
A	'When anyone wants innovation there is nothing wrong with a little suspicion. We can start taking an idea seriously only after the financial consequences have been thoroughly evaluated.'
A	'Yes, some of my people occasionally propose new ideas. Ah, what should one do with them?'

BP = Best Practitioner; A = Average performer.

When leaders recognize their employees' innovative efforts they pay attention to their needs and wants, show implicit sympathy for their ideas, and encourage personal development and expression. As a consequence employees are likely to be more interested in and focus on their tasks instead of on extraneous worries and fears, and they are more likely to take risks and to freely explore and experiment with ideas and approaches (cf. Jung *et al.*, 2003; Zhou & Shalley, 2003).

Also, employees will likely perceive that innovation pays off when it is recognized. Economic decision-making theory suggests that individuals attempt to make rational decisions (Schoemaker, 1993). As full rationality asks for a careful collection of information and knowledge of all alternatives and their consequences (March & Simon, 1958; Allison, 1971), individuals in practice do not take completely rational decisions but rather seek for a satisfactory solution (Simon, 1957). Nonetheless, individuals will judge if it makes sense to innovate, i.e. if there is something to gain from being innovative. In this context Farr and Ford (1990) assume that the likelihood of individuals being innovative depends on their perceived pay-off achieved through change. Even if individuals sense a need to innovate, innovative behaviors are less likely if they feel that the pay-offs from such behaviors are too low or lacking. Here, we propose that people will be more likely to innovate when they

believe that the expected value of innovation exceeds the opportunity cost for alternative use of their time. The more a leader recognizes and openly appreciates an individual's innovative efforts, the more employees will perceive a positive pay-off and demonstrate innovative work behavior.

Various empirical studies demonstrate a positive correlation between recognition and individual innovation. Drawing on interviews with leaders and employees in new biotechnology firms Judge *et al.* (1997) conclude that personal recognition boosts innovation. From a case study within a Canadian transport firm, Nijhof, Krabbendam and Looise (2002) conclude that when employees have innovative ideas their initiatives are devastated if they have to spend to much time convincing their managers of the potential. Janssen (2002) shows that leaders positively affect IWB by being responsive, i.e. paying attention to innovative ideas and by making a fair and open judgment. Finally, Redmond, Mumford and Teach (1993) asked undergraduates to develop advertising campaigns for a new product under conditions where confederate leaders either did, or did not, recognize innovative practices by stressing an undergraduate's competence. They found that recognition led to higher-quality campaigns and a more effective application of creative problem-solving skills. In line with these studies we hypothesize

Hypothesis 2I: Recognizing innovative efforts is positively related to employees' innovative work behavior.

J: Rewarding

Rewarding innovation includes leader behaviors such as providing or recommending pay increases and bonuses for innovative performances. Our interview participants had different opinions on rewarding innovation. Some of them mentioned that monetary rewards could be supportive, but others stressed that monetary rewards should be no objective by itself. We found no clear differences between best practitioners and average performers here (frame 13).

frame 13. Quotes related to rewarding

BP	'My employees will see the result of their efforts in their salary. Making contributions to change is one of my reward criteria.'
BP	'Extra money is good if it is a minor amount, but I think that acknowledgement is most important. Extra money can help because it implicitly tells you that doing things better is a good thing.'
A	'Some people become involved very late. Actually, some workers are first involved when we start programming new software applications. They have not initiated the idea and salary can be a effective tool to communicate what is expected of them.'
A	'Pay is one of my mechanisms to change behavior, although I never use it by itself.'

BP = Best Practitioner; A = Average performer.

A positive correlation between rewarding and IWB is suggested by those who propose that individuals must perceive a pay-off in order to recognize and exploit ideas (e.g. Schoemaker, 1993; Shane, 2003). Likewise, the earlier discussed idea of role expectations also suggests a positive correlation between rewarding and IWB. Rewards for innovation make employees perceive that innovation is the norm and that leaders expect them to innovate. Such role expectations are likely to influence their innovative work behavior (Zhou & Shalley, 2003).

The connection between rewarding and IWB is however not without debate. Intrinsic motivation theory suggests that individual innovation may actually be diminished as a consequence of rewarding innovative behavior (Amabile, 1988). Extrinsic motivation - which diminishes IWB - is based on incentives coming from outside a person. These include monetary rewards. Providing rewards could actually 'crowd out' intrinsic motivation, leading to diminished performance (Frey & Jegen, 2001). Yet, as modest amounts of money can be regarded as a form of recognition, we hypothesize a positive connection between rewarding and individual innovation here.

No previous research made a connection between monetary rewards and innovative work behavior, but in the related field of creativity several relevant studies were done. Some find support for a positive connection between concrete tangible rewards and creativity. For example, Eisenberger and Rhoades (2001) compared the creativity of movie and short-story titles developed by two groups of students. One group was rewarded during a prior training task (generating creative uses for common objects) and the other group received no monetary rewards. The first group outperformed the second one in terms of the number of ideas generated. Other studies show negative effects or demonstrate that monetary rewards have weak or negligible effects on individuals' creativity. For example, Kruglanski, Friedman and Zeevi (1971) gave two creativity tasks to Israeli students who either had or had not been promised a reward. Results showed that non-rewarded students exhibited higher creativity than rewarded students did. We tentatively hypothesize

Hypothesis 2J: Rewarding innovation is positively related to employees' innovative work behavior.

K: Providing resources

Participants in the interviews stressed that support for innovation should not just be expressed in words, but also in an enacted form by providing time and money for innovation. Best practitioners more often argued that time and money is essential to implement ideas, and that a lack of resources will probably discourage employees to

propose their ideas. On the contrary, average performeers seemed less willing to provide resources (frame 14).

frame 14. Quotes related to providing resources

BP	'Being enthusiastic about an idea is one thing, but your employees will not believe you if you do not get them the stuff to develop it.'
BP	'I give some of my people a budget to carry out new projects (in consultancy services).'
A	'At the moment we do not innovate at all. We have had a vacancy for over six months now and we need all our time to keep up with our current business.'
A	'Small-mindedness can impede well-meant innovative efforts. It's not difficult to get minor ideas through, but it is very hard to get me excited when large investments have to be made. In the end, it is my money you know.'

BP = Best Practitioner; A = Average performer.

When leaders provide resources for innovation, they give employees discretion to act on their innovative ideas. Consequently, employees feel truly encouraged to attempt new and different approaches in their work, to operate independently and to develop their capacity to think for themselves. This is likely to boost their intrinsic motivation and felt responsibility to contribute to change, and is expected to result in higher levels of innovative work behavior (Jung *et al.*, 2003). Besides, when employees are provided with appropriate resources, including funds, materials and facilities, they are more likely to perceive they are in control and that they are able to improve a situation that is in need of change. This also makes innovative work behaviors more likely (Gebert, 1987; Krause, 2004).

Empirical support is provided in a number of studies. Fuller *et al.* (2006) surveyed 115 employees of a not-for-profit utility company. They found out that access to resources induced higher levels of felt responsibility to contribute to constructive change. In turn, this raised employees' proactive behavior, i.e. continuous improvement efforts. Ekvall and Ryhammer (1999) examined a variety of organizational variables that might influence innovation among scholars working at a Swedish university and found that the availability of resources was most strongly related to their innovative results. Judge *et al.* (1997) concluded that 'slack' resources helped to create an innovative culture. Nijhof *et al.* (2002) even recommend to completely exempt employees from their tasks in order to concentrate their efforts on the development and implementation of promising ideas. When employees are assigned to work on innovations only part-time they experience working on innovation projects as additional to their daily jobs, which often results in longer development times. We hypothesize

Hypothesis 2K: Providing resources for innovation is positively related to

employees' innovative work behavior.

L: Monitoring

Monitoring refers to the extent to which leaders intensively look after their employees to ensure that they do exactly what they are told, perform tasks in expected ways, and refrain from behaviors that supervisors might disapprove (Zhou, 2003). Monitoring includes leader practices such as gathering information about work activities and checking on the progress of work and the quality of outputs. Monitoring can take many forms, ranging from direct observations of work operations to holding progress reviews with employees involved in specific tasks (Yukl, 2002). The interviews revealed that the average performers seemed more inclined to monitor their employees (frame 15).

frame 15. Quotes related to monitoring

BP	'I once knew a fellow-entrepreneur who was very directive. Actually, he was proud that his people were less productive when he was out of office. His people would not dare to deviate from his instructions. He is not in our business anymore.'
BP	'I believe it is good when someone initially fails when trying out something new. In the end you will get better results. If I supervised them closely they would just obey me and stop thinking themselves.'
A	'In accountancy work is embedded in many rules and procedures. We have to obey the law, so that is what we are doing.'
A	'To be competitive we follow a low-cost strategy. I frequently check whether my people do not spend too much time on a single customer.'
A	'We can start taking an idea seriously only after the financial consequences have been thoroughly evaluated.'

BP = Best Practitioner; A = Average performer.

We expect a negative connection between monitoring and employees' IWB. When people are intensively monitored on performance they may be discouraged to take risks. Monitoring implies that employees feel pressure to think, feel, or behave in certain pre-defined ways. This can undermine their motivation and shift their attention away from work activities and toward external concerns (Deci & Ryan, 1987). Monitoring may make innovative employees worry about what their supervisor would think. As a result employees could be less likely to concentrate on and be inspired by their tasks. This will reduce their IWB. Monitoring could also lead to negative appraisals of situation control (Gebert *et al.*, 2003). We argue that, when their normal tasks are closely monitored, individuals will be aware that they do not have the means to change a situation when they detect performance gaps. This again diminishes employees' IWB.

Relevant empirical findings include a study by Hitt, Hoskisson, Johnson and Moesel (1996). They sampled 250 firms that reported R&D expenditures between 1985 and 1991. Strict financial controls were associated with less internal innovation (as a

result of employees' innovative work behavior). As a consequence of close monitoring employees prefered to stick to tried and tested routines, ensuring that their targets would be realized. Oldham and Cummings (1996) surveyed 171 employees of two manufacturing plants. They demonstrated that controlling supervision (pressuring employees to think, feel or behave in certain ways) was negatively related to employees' creative performance. Based on their qualitative comparison of two innovation teams, Amabile *et al.* (2004) reported that the supervisor of the unsuccessful team overly controlled workers by issuing orders and spending much time checking subordinate performance. Ehigie and Akpan (2004) explored the impact of leadership styles on the practice of total quality management in Nigeria. Their construct of total quality management was operationalized with behaviors similar to those used to operationalize IWB. Based on a study among 418 employees within seven courier organizations, they concluded that those who perceived their leader as being low in performance-oriented monitoring had better results from total quality management. We hypothesize

Hypothesis 2L: Monitoring is negatively related to employees' innovative work behavior.

M: Task assignment

Task assignment involves leader behaviors aimed to clarify work roles, responsibilities and requirements. The purpose of task assignment is to guide work activity and make sure that people know what is expected of them (Jones, 2004). Here, we hypothesize that assigning challenging tasks to employees positively affects their IWB. Task assignment was rarely mentioned in our interview reports (for some exceptions, see frame 16). This is probably due to the fact that in small firms jobs tend to be broad and overlapping by default, and there are not many options for alternative assignments. However, various previous studies gave us strong arguments to include task assignment (see hereafter).

frame 16. Quotes related to task assignment

BP	'Challenging work triggers suggestions and extra efforts. My employees are involved in the whole process of service delivery, from acquisition to the final approval of the annual reports. It's good for their motivation, as they will get to see the whole picture.'
A	'It is essential that a person likes his job. If he enjoys his work he is more interested in delivering high quality.'

BP = Best Practitioner; A = Average performer.

When work is challenging individuals tend to be curious, willing to take risks, and persistent in the face of obstacles. Their intrinsic motivation is stimulated and this

should facilitate the development of new and potentially useful ideas and eagerness to implement them. According to Amabile (1996), matching people with the right assignments is a powerful way for leaders to stimulate innovation. Managers can match people with jobs that require their own specific expertise and their skills in creative thinking and in doing so spark intrinsic motivation.

Thamhain and Gemmill (1974) present an early study that links task assignment and individual innovation. Their study, involving 88 project managers and employees in the R&D-department of an electronics company, shows that influence methods focusing on challenge rather than authority are associated with higher R&D project manager performance ratings. Other researchers found similar results. Oldham and Cummings (1996) showed that employees produce their most creative work when they are working on complex, challenging tasks. Tesluk, Farr and Klein (1997) stress task rotation as a relevant practice to enhance innovative work behavior. They recommend that tasks and jobs are frequently exchanged among employees. Such practices broaden employees' points of view, because it makes them familiar with each other's work and problems, and boosts their motivation to do things better. Finally, in a sample of knowledge workers De Jong and Den Hartog (2005) demonstrated that perceptions of job variety are directly related to innovative work behavior. Our hypothesis is

> *Hypothesis 2M: Assigning challenging tasks is positively related to employees' innovative work behavior.*

In all, we identified thirteen leader behaviors that may influence employees' innovative work behavior. We stress that the literature search and in-depth interviews were exploratory and just meant to develop hypotheses. The hypotheses will be empirically tested from chapter 5 onwards.

Another result from our interviews was that some participants explicitly stressed they perceived their ability to influence employee innovation as limited. They indicated that innovative behavior could reflect innate abilities of their employees, or be a consequence of their interaction with colleagues and/or external customers. The next chapter first elaborates on these other potential antecedents of IWB.

4 Innovation climate and external work contacts

Except for their leaders, employees interact with other people including their colleagues and persons from outside the organization. Perceptions of how one's colleagues feel about innovation become evident in the construct of innovation climate. External contacts such as customers and suppliers can be sources of inspiration or innovative resources, and may also influence IWB. We therefore include innovation climate and external work contacts as other potential antecedents in our research. Section 4.1 defines innovation climate, discusses its dimensions and how we expect these to connect with IWB, and elaborates why we hypothesize innovation climate to moderate the connection between leader behaviors and IWB. Section 4.2 does the same for external work contacts.

4.1 Innovation climate

Climate and culture

Climate may be defined as the feelings, attitudes and behavioral tendencies that characterize organizational life (Nystrom, 1990). It indicates to people what is important and how this may be accomplished, and relates to incumbents' perceptions of the events, practices and procedures and the kinds of behaviors that are rewarded, supported, and expected (Schneider, 1990). Climate is at the heart of the informal structure of a work group or organization. Groups can exert powerful pressures on employees to adjust their behavior. The stonger employees are attracted to a group and wish to remain part of it, the more likely they are to conform to the majority view within the group. People thus generally conform to norms and values and comply with socially desired group behaviors. Deviant persons will be subject to strong persuasive pressures and eventually, if they do not conform, exclusion from the group follows (Tesluk *et al.*, 1997).

Climate is strongly related to organizational culture. The latter has been defined as the meaning conveyed in beliefs and values, behavioral norms and expectations, stories, rites and ceremonies, and organizational structures (Tesluk *et al.*, 1997). Until the early 1990s both constructs were studied by different groups of researchers who mostly ignored each other (Reichers & Schneider, 1990). Since then, it has been

recognized that both subjects overlap but there are also differences. The most critical distinction is that culture is believed to operate at a greater level of abstraction. Climate may be most accurately understood as a manifestation of culture. While climate refers to organization members' perceptions of policies, practices and procedures, culture represents the basic values and assumptions that underlie those policies, practices and procedures (Reichers & Schneider, 1990).

Here our focus is on innovation climate. Schneider (1990) advised against the use of general climate measures. He made a plea for facet-specific climate approaches (i.e. climate has a focus and is linked to something of interest). He suggested that dimensions of climate would differ according to the purpose of the investigation and the criterion of interest. General measures can easily contain dimensions that are unrelevant for a specific study. In line with this we adopt a facet-specific approach, and focus on innovation climate.

In larger organizations it makes sense to distinguish between climate perceptions at different levels, for example organizational versus work group climates. Because individuals' perceptions of climate will depend most on the interactions with persons they most frequently work with, Anderson and West (1998) stress that individual perceptions of climate are related to the 'proximal work group'. This is the permanent or semi-permanent team of employees to which one is assigned, with whom a person identifies, and with whom one interacts regularly in order to perform work-related tasks. As our empirical studies (chapter 5 and 6) focus on employees in small firms, distinguishing between the work group and organizational level is less relevant. Nonetheless we use the term 'work group' here and in measurement we focus on the work group level.

Previous work

A positive connection between innovation climate and employees' innovative work behavior seems evident. As mentioned, people conform to norms and values in their work group and comply with socially desired group behaviors. The more these norms and values stress that innovation is desired, the more individuals within that group will be triggered to innovate. In the related field of creativity, most studies have demonstrated positive connections between creative climate measures and creative output at the organizational, group and individual level (Hunter, Bedell & Mumford, 2007). Our in-depth interviews (see chapter 3) with leaders in knowledge-intensive service firms also suggested innovation climate as an antecedent of IWB. Both best practitioners and average performers considered it important (see frame 17).

frame 17. Quotes related to innovation climate

BP	'It is not just me who is important. I am not the first to hear about new ideas. Normally you talk to your colleagues first. If they reject them, I will probably never hear about them at all.'
BP	'I used to work in a research firm where people did not like new ideas. Anything new was not welcome. They made you feel ridiculous when you were creative. It discouraged me from proposing anything. I caught myself demonstrating the same attitude.'
A	'If none of your colleagues seems to like change, you don't come up with ideas.'
A	'Some of my people don't like change, especially the older ones. You should try to create a subtle atmosphere then. I take forceful action against those who always react negatively to ideas and don't contribute to change.'

BP = Best Practitioner; A = Average performer.

Although a positive correlation with IWB has strong face validity, most empirical work explored climate's effects on organizational and team level innovations (Burningham & West, 1995; West & Anderson, 1996; Amabile, Conti, Coon, Lazenby & Herron, 1996; Nijhof *et al.*, 2002). Only a limited number of studies tried to establish an empirical connection at the individual level. Bunce and West (1995) found that a supportive climate explained no additional variance in individuals' propensity to innovate (a construct similar to IWB) when personality characteristics were taken into account. De Jong and Den Hartog (2005) expected a supportive innovation climate to correlate positively with IWB, but did not find support for this.

In contradiction, Axtell *et al.* (2000) found that innovation climate is important to realize innovative outcomes. They concluded that it makes a difference if employees find their colleagues to be supportive as soon as promising ideas have been approved and need to be implemented. In more recent work, Axtell *et al.* (2006) add that a positive correlation between team support for innovation and idea implementation is most likely when teams have become cohesive, which typically happens in later stages when team members are accustomed to each other. Likewise, in a recent study of Korean workers Choi (2007) found a positive correlation between innovation climate and employees' change-oriented citizenship behavior, a construct almost identical with IWB. It was however noticed that Korean workers 'tend to be more collectivistic', so in other countries different results could be obtained (p. 482).

Bain, Mann and Pirola-Merlo (2001) also found positive correlations between some (but not all) of their climate measures and individuals' self-ratings of innovation. Finally, Scott and Bruce (1994) hypothesized that perceptions of innovation climate trigger innovative work behavior, but only a weak connection was found. Perceived support for innovation positively related to IWB while another climate dimension ('resource supply') had a negative effect.

In sum, results of previous work are mixed. Here we address how innovation climate and IWB are related in a sample of knowledge workers in small firms. As Scott and Bruce (1994) and also Bain *et al.* (2001) found contradicting effects for separate dimensions of innovation climate, we have also operationalized climate as a multi-dimensional construct.

Dimensions of innovation climate

West and colleagues developed the most widely accepted model of innovation climate. West (1990) made a first attempt to systematize research at the group level to see how innovation in groups is attempted. His seminal theory of innovation climate gives a number of antecedent factors which were developed, measured, validated and applied in subsequent work (Bunce & West, 1995; West & Anderson, 1996; Anderson & West, 1998; De Dreu & West, 2001). Four basic dimensions of innovation climate include: A. participative safety, B. striving for excellence, C. support for innovation and D. vision. We use the first three dimensions to analyze innovation climate and how it correlates with leader behaviors and IWB.

The fourth dimension of vision was dropped from our analysis. West (1990) defined vision as an idea of a valued outcome that represents a higher order goal and motivating force at work. Work groups with clearly defined objectives are more likely to be effective and to develop new goal-appropriate methods of working since their efforts have focus and direction. Although this dimension can be related to IWB we did not include it, as we already identified providing an innovation-based vision as a leader behavior that may be connected with IWB, and also because our research is located in small knowledge-intensive service firms. Given the dominant position of leaders/entrepreneurs in such firms (Nooteboom, 1994; Bodewes & De Jong, 2003) these constructs were expected to overlap too strongly.

We also considered alternative models of innovation climate but saw these as less optimal for our purposes. Examples are Ekvall's (1996) ten-dimensional model of creative climate and Amabile *et al.*'s (1996) KEYS instrument to assess creative work environments. Both measures primarily focus on climate for creativity rather than innovation. Besides, the validity of both models can be improved, while West's multidimensional measure has been extensively used and validated (Mathisen & Einarsen, 2004). We now discuss the three dimensions of innovation climate captured in our research.

A. Participative safety

Participative safety implies that employees perceive an interpersonally non-threatening atmosphere. When employees realize their colleagues' attitudes and behavior are protecting their welfare and interests in ways that allow them to experiment, deviate from the prevailing norms and standards and maintain a deviating standpoint, the climate can be described as having a strong socio-emotional support. West (1990) proposed participative safety as a dimension of innovation climate, based on the thought that involvement in decision-making is motivated and reinforced when employees perceive the environment to be interpersonally non-threatening (p. 311). Others have also described participative safety as a dimension of innovation climate, stressing that employees should feel psychologically safe, such that no blame and punishment will be assigned for pursuing new ideas or breaking with the status quo (Edmondson, 1999).

We hypothesize that the more individuals perceive participative safety in their work group, the more likely they are to be innovative. High participative safety will enable risk-taking and willingness to suggest new ideas without fear of personal censure. Participative safety is likely to correlate with positive appraisals of situation control, i.e. individuals judge to have the authority to propose new ideas and to act upon these ideas (Gebert, 1987; Gebert *et al.*, 2003). Thus, participative safety makes it more likely that individuals will perceive a situation as being susceptible to change.

Also, participative safety likely induces employees' awareness that they are self-determining, resulting in enhanced intrinsic motivation for a task, while unsafe situations make it more likely that they perceive their thoughts, feelings and actions to be constrained (Zhou & Shalley, 2003). In line with this reasoning Ford (1996) theorized that employees' decision to innovate is preceded by their expectation of reasonable responses regarding such behavior. Basadur (2004) warned that when confronted with new ideas, people are often prematurely critical, shutting down the flow of productive thinking. Rather than building on promising but imperfect ideas, most people tend to discard their ideas in situations of premature criticism. We hypothesize

> *Hypothesis 3A: Perceived participative safety in the work group is positively related to employees' innovative work behavior.*

B. Striving for excellence

A second aspect of innovation climate is a concern among group members about the excellence of task performance, characterized by evaluations, modifications and

positive-critical appraisals. In highly innovative climates, high standards of performance are encouraged and a diversity of approaches to achieving excellence is tolerated. Within a work group this is evidenced by emphasis on individual and team accountability, control systems for evaluating and modifying performance, a critical approach to the quality of task performance, inter-team advice, feedback, mutual monitoring, appraisal of performance and ideas or, in other words, 'a concern to maximize quality of task performance' (West, 1990, p. 314). In later work, this aspect of innovative climate was labeled 'task orientation', implying that employees evaluate their current practices and proactively search for improvements (Anderson & West, 1998).

We expect that striving for excellence and innovative work behavior are correlated constructs. Striving for excellence communicates implicit or explicit role expectations to individuals in the work group; they should behave in such a way that excellence will be achieved (Tesluk *et al.*, 1997). In such groups high standards of performance are encouraged and a diversity of approaches towards achieving excellence will be tolerated (West, 1990). When individuals perceive that people in their work group strive for excellence, they are more likely to perceive to be in control after a performance gap has been detected. Such positive appraisals are expected to result in enhanced innovative work behavior.

A related construct is reflexivity, which can be defined as the extent to which group members reflect upon and communicate about the group's objectives, strategies and processes, and adapt them to current or anticipated circumstances. Schippers (2003) demonstrated that reflexivity among work group members during the execution of a task results in a better quality of the outcomes of work processes. Likewise, De Dreu (2002) showed that reflexivity moderates the relationship between minority dissent and innovativeness. Rather than attempting to equate new and old experiences, reflexivity causes people to search for what is unique in a new problem and consider new and innovative solutions, rather than using available solutions from the past. In sum, we expect

Hypothesis 3B: Perceived striving for excellence in the work group is positively related to employees' innovative work behavior.

C. Support for innovation

A third dimension of innovation climate included here relates to the approval and practical support of attempts to introduce new and improved ways of doing things (West, 1990: p. 315). In many instances groups, as part of their objectives or social

desirability, express support for the development of new and improved ways of working, but often do not provide 'enacted' support in terms of time and/or money investments. West (1990) therefore distinguishes between 'articulated' and 'enacted' support for innovation, and claims that both types of support are necessary for attempts to introduce innovations. Support for innovation takes various forms, including verbal support within and outside group meetings, group and interpersonal cooperation in the development and application of new ideas, and the provision of time and resources by group members to develop and apply ideas.

When support for innovation in a work group is frequently articulated and enacted, individuals in that work group are more likely to be aware that a situation is in their control and susceptible to change (cf. Gebert, 1987; Gebert *et al.*, 2003). Support for innovation is also likely to correlate with individuals' perceptions that they are self-determining, resulting in enhanced intrinsic motivation. In all, support for innovation is expected to make the individual become more alert to the possibility of innovation since appropriate social cues exist. They will find it easier to bring ideas to fruition as support and resources will generally be available from others in the work group.

In previous empirical work, support for innovation is the most frequently studied dimension of innovation climate (for instance De Jong & Den Hartog, 2005; Scott & Bruce, 1994). Previous attempts to establish a relationship between innovation climate and individual innovation used measures that were usually limited to this particular dimension. Brand (1998) for instance explored the multinational firm 3M, where individuals are allowed to devote a percentage of their work time to the development of their own ideas and those who are successful are rewarded. Support for innovation is an important driver of individuals' innovative efforts there. We expect

> *Hypothesis 3C: Perceived support for innovation in the work group is positively related to employees' innovative work behavior.*

Interactions

Leaders influence the nature of work group climates in various ways (Yukl, 2002). Climate perceptions often originate from a leader whose own beliefs, values, and assumptions provide a basic model of how a group should operate. They can nurture an innovation climate by instilling values and a normative system that support a diversity of beliefs, free exchange of information and open questioning. Such perceptions become enacted and articulated according to what the leader pays attention to and responds to critical situations and crises, and as a result of the types of criteria emphasized in the reward, promotion, recruitment, and selection policies, and through

his patterns of behavior (Schein, 1992). In this context, West (1990) explicitly links his climate dimensions to the presence of particular leadership styles. He mentioned that those in positions of power often have more influence over norms than followers, so leaders are expected to be very influential in creating a feasible innovation climate (p. 315).

If and how aspects of leadership and climate interact to influence individual innovation is still an uncharted area of research. Literature reviews like that of Elkins and Keller (2003) show that empirical work on the relationship between leadership and innovation uses dependent variables such as output-based innovation measures or perception-based measures of innovation climate. When predicting individual innovation interaction effects between leader behaviors and innovation climate remain unexplored.

Here, we hypothesize that innovation climate moderates the relationschip between leadership and employees' IWB in such a way that non-innovative climates will coincide with a stronger connection between leader behaviors and IWB. Our reasoning to support this hypothesis is rooted in leadership substitutes theory (for a similar application, see Den Hartog, De Hoogh and Keegan (2007)). Kerr and Jermier (1978) proposed this theory to identify aspects of the situation that reduce the importance of what leaders do. In the initial version of their model, they were mostly concerned with identifying situational variables that could neutralize the effects of leadership, or even be a substitute for leadership. They proposed so-called 'neutralizers': situational variables that nullify the effects of leaders' actions. For example, leaders' lack of authority to reward effective performance is a situational constraint that serves as a neutralizer, whereas employees' lack of interest in an incentive offered by their leader is a condition that makes the behavior pointless. Leader substitutes theory de-emphasizes the importance of formal leaders by showing how their influence can be replaced or diminished by other variables. Potential neutralizers also include work group climates (Kerr & Jermier, 1978; Howell, Dorfman & Kerr, 1986).

According to Yukl (2002), one of the situational variables that can neutralize any kind of supportive leadership is a highly cohesive work group in which employees obtain psychological support from each other when needed (p. 218). We propose this also applies to innovation-stimulating leader behaviors. Innovation climate may neutralize the impact of leader efforts to stimulate individual innovation when social pressures exist that stimulate employees to participate, to strive for excellence and to support the innovative efforts of their colleagues. In work groups with favorable innovation climates, innovation-stimulating behaviors by the formal leader may even

be replaced by similar leader behaviors carried out by people in the work group. When innovation climate is favorable, leadership functions may be shared among members of the work group, rather than being performed entirely by a single formal leader.

In contradiction, when innovation climate is unfavorable, i.e. participative safety is low, groups members do not strive for excellence and refrain from supporting innovative behaviors, we expect that the connection between leader behaviors and employees' IWB is strengthened as there is no neutralizing effect of climate. Besides, leaders can arguably have a bigger impact on innovative practices in such situations. Team development models suggest that, initially, employees in a work group are leader-focused but seek independence from the leader as the group matures and common norms and behavioral standards develop (Chang, Bordia & Duck, 2003). An example includes the start-up of self-managed work groups where initially coaching and encouragement from external, formal leaders is necessary to get the work group taking off. As the work group evolves, employees can gradually assume more responsibility for and proactiveness in working towards their objectives. This makes leader behaviors less influential and also less urgent (Manz & Sims, 1989).

In the context of individual innovation, Parker and Jackson (1993) present a relevant example. Their study of teamworking reveals that the move from a passive climate to one of employee ownership and involvement required a lot of initial support from management before employees started to take initiatives and make their own decisions. Moreover, as described in many change models, direct management involvement may eventually decrease as responsibility for innovation is devolved to the shopfloor level and becomes a requirement for all employees (Caldwell, 2003). Thus, in matured work groups the impact of leader behaviors will be smaller while in unfavorable innovation climates the connection between leaders behaviors and IWB is expected to be bigger. In sum we define the following (exploratory) hypothesis

> *Hypothesis 4: Leader behaviors and innovation climate interact, such that the connection between leader behaviors and employees' IWB is stronger when innovation climate dimensions are perceived as unfavorable.*

4.2 External work contacts

Previous research demonstrated that individual innovation also depends on the nature of individuals' jobs. Relevant antecedents include the amount of control over a task (Axtell *et al.*, 2006), job dissatisfaction (Zhou & George, 2001) and job complexity (Oldham & Cummings, 1996). Another aspect in which workers' tasks and roles differ is the frequency and amount of their external work contacts. Examples include

meetings with customers, suppliers, representatives from competitors, but also attending to conferences and fairs, training courses, and being involved in co-operation projects with other firms.

Literature on organizational and team innovation has repeatedly stressed the importance of external contacts (Tidd, Bessant & Pavitt, 2001; Afuah, 2003). Just a few decades ago innovation was organized in large, specialized departments in large firms. The innovation process could be compared with a relay race where the baton (innovation) was passed on in separate stages by isolated individuals. In contrast, modern innovation demands 'rugby teams', with the ball (innovation) being moved towards the try line through collaborative team working and continued interaction with coaches and substitute players (external partners) (Nonaka & Takeuchi, 1995).

Recent insights also stress the importance of external linkages. Meeus, Oerlemans and Hage (2001) suggest that the growing complexity of innovation contributes to the increasing interactivity of innovation processes, as the more complex an innovation, the more likely it is that not all relevant knowledge is available within the organization. Fleming and Marx (2006) discuss that due to the adoption of information technology and increase of knowledge-intensive work, today's employees maintain more frequent interactions with outsiders. Such contacts can lead to new creative insights, and they strengthen relationships with regular external partners that can help to develop innovations. Chesbrough (2003) implicitly summarized many of these insights under the label of 'open innovation' to describe the process of continued interaction with the environment that is necessary to initiate and implement innovations.

Connection with innovative work behavior

Although organizational and team-level innovation research has repeatedly stressed the importance of external work contacts, the phenomenon is relatively unexplored at the level of individuals. Kimberly and Evanisko (1981) found that contact with professionals outside the organization was related to the increased adoption of innovations. Kasperson (1978) found that scientists with access to different scientific disciplines were rated as making a more creative contribution to their field. Recently the importance of others in generating new ideas and implementing these ideas received more attention. Perry-Smith and Shalley (2003) developed propositions on the association between social relationships and employee creativity. Also De Jong and Den Hartog (2005) demonstrated a positive connection between external work contacts and innovative work behavior of knowledge workers.

From the in-depth interviews (see chapter 3) we can also conclude that external work contacts need to be included when trying to explain individual innovation. Participants stressed that some of their employees were more innovative because they were in a better position to discover and implement ideas (frame 18). Both the best practitioners and average performers in our sample mentioned the importance of external contacts.

frame 18. Quotes related to external work contacts

BP	'My salespeople are the ones who come up with ideas most often. They have daily contacts with our customers and are the first to hear about their needs.'
BP	'Actually, I am the one who is most innovative. But you cannot compare me with my employees. I have by far the largest network.'
A	'Having frequent contact with people from other accountancy firms is a bonus. Most of my younger people are still training to become an accountant. They have a part-time job here. But during their training they meet other trainees at the Accountancy Society and learn how they work.'
A	'Those who maintain our contacts with customers are the ones who are most successful in developing new services.'
A	'Being able to discuss and test with customers is very worthwhile. We can test a new software program over and over again, but a customer will always find new ways to improve it.'

BP = Best Practitioner; A = Average performer.

In certain jobs - such as sales representatives, customer service providers and purchasers of supplies – people maintain more frequent and diverse external work contacts. We expect them to be in a better position to innovate as they are exposed to more innovative opportunities and can better assess the feasibility of innovative ideas and obtain resources to support implementation.

In terms of social network theory, having many external work contacts can be interpreted as having many and diverse social relationships. Highly diverse networks consist of persons with distinct, non-redundant abilities, so that large and varied sources can be called upon (Perry-Smith & Shalley, 2003). Network linkages can be described in terms of tie strength, with strong ties being characterized by frequent interaction, emotional intensity and extensive reciprocity that takes place between two individuals, while weak ties are not necessarily reciprocal and involve less frequent interaction (Granovetter, 1973). People connected by weak ties are more likely to differ because they are not immersed in the same interconnected web of relationships (Lincoln & Miller, 1979). As Granovetter (1982, p. 106) states, people with weak ties are 'less confined to the provincial news and views of their close friends', so weak ties are more likely to connect people with diverse perspectives, different outlooks, varying interests, and diverse approaches to problems.

Employees with frequent and diverse external contacts likely have more diverse networks with many weak ties. This access to non-redundant information and diverse

social circles facilitates a variety of processes helpful for innovative work behavior. Exposure to different approaches and perspectives provides the individual with better options for opportunity exploration. As Kanter (1988) states, ‘contacts with those who see the world differently is a logical prerequisite to seeing it differently ourselves’ (p. 175). External work contacts can also enhance individuals’ ability to generate different alternatives and facilitate flexible thinking, as weak ties tend not to enforce strong cultural values and modes of thinking. Simonton (1999) indicates that communication with others in a work domain should enhance one's understanding of the area and facilitate the generation of approaches that are feasible and appropriate, but also unique. Finally, weak ties are non-redundant, so they provide a broader source of resources to enable the implementation of innovative ideas (Perry-Smith & Shalley, 2003). In sum, we expect

Hypothesis 5: The amount of external work contacts is positively related to the employee’s innovative work behavior.

Interactions

To some extent leaders are able to influence the amount of external contacts their employees have. Leaders usually have an important voice in the tasks and responsibilities of employees. They decide who will visit customers after a complaint, or who is allowed to attend conferences or demonstrations of suppliers’ new applications. In most organizations leaders decide about the nature of new and current jobs and this also includes external work contacts.

We hypothesize that in situations of frequent external work contacts leaders may be less able to influence their employees’ innovative efforts. This hypothesis is again supported with leadership substitutes theory. When discussing situational variables that may neutralize the impact of leadership, Kerr and Jermier (1978) also give the example of dispersed employee work sites. When there is a physical distance between a leader and his followers, the leader is less able to influence what his employees do and how they do it. Although to our knowledge this proposition has not been tested empirically, we argue the same reasoning may apply to innovation-stimulating leader behaviors. Frequent external work contacts likely imply less physical contact with leaders, so the connection between leader behaviors and IWB is expected to diminish. Or in the words of Yukl (2002): ‘Leader behaviors are neutralized when employees are geographically dispersed and have only infrequent contact with their leader, as in the case of many sales representatives’ (p. 218).

A similar argumentation can be derived from the emerging literature on employees in virtual teams. In virtual teams, employees are geographically separated. They seldom meet face-to-face. Most of their communication relies on computer and telecommunications technology (Yukl, 2002). Researchers have begun to examine the possible differences between co-located and geographically dispersed employees and leaders. The main challenge here is how leaders can remain effective when face-to-face meetings and options for direct transfer of tacit knowledge are lacking (Bordia, 1997; Duarte & Snyder, 1999). Although virtual teams are an extreme example of employees with external work contacts (external from the point of view of the leader), this literature suggests that in case of frequent external contacts the connection between leader behaviors and IWB is weaker.

A final argument for the proposed interaction effect is rooted in industrial organization theory. In this line of research it has been demonstrated that innovation is not always a free choice. This can be easily explained with Porter's (1979) five forces of competition model. Porter showed that the competitive situation of organizations depends on the intensity of competition with other firms, the threat of new entrants, the threat of alternative products that can satisfy client needs, the bargaining power of customers and the bargaining power of suppliers. These forces can oblige an organization to innovate. When, for example, an organization completely depends on a single large customer, that customer is in a position to demand things that cannot be refused. Similarly, other industrial organization studies showed that innovations may be imposed by suppliers, customers or knowledge institutions (Pavitt, 1984; De Jong & Marsili, 2006). When we translate this to the level of individuals, this suggests that in many situations individuals will be forced to innovate due to environmental circumstances. We reason that this applies most to those employees with frequent external work contacts, and this may diminish the impact of innovation-stimulating leader behaviors. Suppose, for example, that sales representatives have to deal with customers who demand new features in products. Even if their leaders discourage innovation, they would probably still try to satisfy their customers' needs in order to maintain their assignments in the future. In sum, we hypothesize

> *Hypothesis 6: Leader behaviors and external work contacts interact, such that the connection between leader behaviors and employees' IWB is stronger in situations of few external work contacts.*

5 Pilot study

We performed two empirical studies to explore the connection between leader behaviors, innovation climate, external work contacts and innovative work behavior. The first was an extensive pilot study performed to develop various measures. Section 5.1 describes the sample and how we organized data collection. Section 5.2 provides the details of our measures, and section 5.3 our findings. Our hypotheses were tested in the main survey presented in chapters 6 and 7.

5.1 Sample and data collection

The pilot was done at a Dutch institute for economic research and consultancy services (the institute where the author of this thesis is employed). The institute's customer base entails policy makers from Dutch ministries, provinces and cities, representatives of intermediate organizations (such as sector organizations, Chambers of Commerce and the antitrust authority), large financial institutions, various services of the European Commission and large enterprises. Response was received from 81 employees, all knowledge workers, accompanied by ratings of their IWB from their supervisors. At the time of the survey - summer of 2003 - the target firm employed 130 people; 102 of them were invited to participate (participation was voluntary). There were also employees providing domestic services (cleaning, copying, restaurant services, etc) but as their work was very dissimilar and clearly not knowledge-based, they took no part in the survey.

We organized the collection of data around two sources. First, employees answered questions on aspects of leadership, their external work contacts and perceptions of innovation climate. They also rated the innovative outputs in their work; this measure is later used to validate our multidimensional IWB-measure. All employees received an introductory letter explaining the purpose of the survey. One week later they were sent the questionnaire itself along with a covering letter that assured data confidentiality and provided details of a contact person should there be any questions. We also provided a stamped envelope in which respondents could return the completed questionnaire. Eventually, 81 employees participated, a response rate of 79%. Their mean age was 42 years. Eighty-six percent of the respondents had a university education. Sixty-four percent was male.

We requested the ten supervisors of the respondents to rate their employees' IWB. We visited each manager and gave verbal instructions for the completion of 17 items for each of their subordinates (see hereafter). Each supervisor then filled in the questionnaire for their subordinates and handed it to the researcher. All responses were processed in SPSS. Responses were paired by means of unique user IDs that had been printed on the questionnaires. These were removed after matching. In all, our dataset contained 81 cases.

After completing the questionnaire, we verbally asked both employees and leaders to comment on the flow and explanations in the questionnaire. One significant finding was that about a quarter of the respondents complained about the length of their questionnaire. Some even told us they had to reserve separate periods of time to fully complete it, and were only motivated to do so because of their connection to the researcher. We realized it was essential to shorten the scales. The item-selection process to enhance reliability therefore also served to eliminate any superfluous items (see hereafter).

5.2 Measures

We composed multi-item scales to measure our constructs. First, an item pool was created to compose scales for innovative work behavior, the thirteen leader behaviors, perceptions of innovation climate and external work contacts. Items were formulated as statements (propositions), and respondents were invited to complete these on five-point Likert-type scales. To ensure that a construct's domain was adequately covered, many items were selected and/or adapted from relevant previous work (cf. Churchill, 1999, p. 454-458). Annex F provides details of all measures used to construct the pilot questionnaires.

One drawback of many leadership measures is that in their wording of items they do not accurately refer to the appropriate level of analysis. In an overview of leadership studies from the past ten years, Yammarino, Dionne, Uk and Dansereau (2005) found that no less than 47 percent of the leadership measures fails to mention an explicit referent. As our focus was at the individual level, we formulated items in such a manner that employees provided information about their own situation. For example, employees were asked to rate the statement 'My leader praises *me* for innovative efforts' rather than 'My leader praises subordinates for innovative efforts'.

We asked four experts in the field of psychological measurement to provide feedback on preliminary versions of our questionnaires and a priori scales. This led to minor changes in the wording of items. A few items were dropped or reformulated.

Next, all a priori scales and questions were incorporated in the leader and employee questionnaires (both are presented in full in annex D).

Innovative work behavior

We initially constructed an extensive multiple-item scale to measure employees' innovative work behavior. It entailed 17 items to be completed on a five-point scale (ranging from 'never' to 'always'). We used the previous IWB items formulated by Janssen (2000), Scott and Bruce (1994), Tierney *et al.* (1999) and Kleysen and Street (2001) as sources of inspiration (see also annex F). Because most items had to be translated into Dutch, items were sometimes re-worded.

In all, five items related to opportunity exploration (sample item is 'How often does this employee wonder how things can be improved?'), four items related to idea generation ('How often does this employee find new approaches to execute tasks?'), another four items dealt with championing ('How often does this employee attempt to convince people to support an innovative idea?') and four items measured application behavior ('How often does this employee contribute to the implementation of new ideas?').

Leader behaviors

For the measurement of leader behaviors we also used insights from previous work. All items used in the pilot can be found in annex F.

A: Innovative role-modeling

This scale initially contained seven items. Most items were selected from a scale developed by Janssen and Buil (1998) measuring the innovative work behavior of leaders. Two more items were selected from Basu and Green's (1997) innovative attitude scale that was developed in a study among 225 leader-member dyads in a Fortune 500 manufacturing plant. Similar to our measure of employees' IWB, items related to opportunity exploration, idea generation, championing and application. A sample item is 'My leader proposes new work processes, techniques or instruments'.

B: Intellectual stimulation

This scale initially consisted of seven items. We used the intellectual stimulation scale that is part of the Value Based Leadership Questionnaire (VBLQ) (House, Delbecq & Taris, 1997). This scale was further developed and adapted to the Dutch situation by Den Hartog (1997). A sample item is 'My leader challenges me to think about old

problems in new ways'. We also added one new item: 'My leader expects me to be concerned with more than just my own tasks'.

C: Stimulating knowledge diffusion

We developed six items for this scale. Two items were inspired by Jaworski and Kohli's (1993) intelligence dissemination scale. This scale focuses on employees' climate perceptions rather than leader behavior, so we adjusted both items. As the domain of our construct differs slightly, we added four items to inquire whether leaders stimulated knowledge diffusion with colleagues. A sample item is 'My leader stresses that I should share knowledge with my colleagues'.

D: Providing vision

The Multifactor Leadership Questionnaire (MLQ) contains items to measure providing vision (Bass & Avolio, 1989). The aforementioned VBLQ also pays attention to providing vision. In her Inspirational Leadership in Organizations (ILO) questionnaire Den Hartog (1997) further modified and adapted the corresponding items. We used four items from these measures and added two more items from De Jong and Den Hartog's (2005) scale measuring leaders' strategic attention for innovation. A sample item is 'My leader articulates a vision of innovation for our firm'.

E: Consulting

Relevant items on consultation are usually part of participative leadership scales. However, our focus was narrower, we aimed to measure whether leaders encourage and facilitate employees to join in decision-making. Den Hartog (1997) and Koopman (1980) provided a multiple-item scale for participative leadership that contained four items on such consultation. Parker, Chmiel and Wall (1997) developed a participation scale that contained another useful item. We also took an item from House and Dessler's (1974) supportive leadership scale. In total we selected six items. An example is 'My leader asks for my opinion'.

F: Delegating

Using six items we aimed to measure whether leaders give their subordinates autonomy to determine independently how to do a job. As with consultation, delegation items are sometimes part of participative leadership scales. Koopman (1980) and Den Hartog's (1997) measures, as previously mentioned, provided us with two items. We derived more items from current autonomy scales, including Spreitzer's (1995) subscale of empowerment and Jackson, Wall, Martin & Davids's (1993) scale

for individual method control. A sample item is ‘My leader allows me to decide myself how I do my work’.

G: Support for innovation

Providing support is a leader behavior that is often found in leadership measures (Yukl, Wall & Lepsinger, 1990). However the focus has not been on support for innovation in particular. Therefore we developed six items ourselves, taking Yukl’s (2002) description of providing support as a guideline, and adjusted the items to account for employees’ innovative efforts. A sample item includes ‘My leader supports me when I want to improve things’.

H: Organizing feedback

As with support for innovation, we found no current measures for leaders’ organizing feedback. Most studies on the connection between feedback and the related construct of creativity use laboratory experiments to manipulate feedback behavior (Zhou & Shalley, 2003). We developed seven items ourselves. Following the results of our in-depth interviews some items accounted for providing feedback directly (for instance ‘My leader makes suggestions on how to implement something new’) while others relate to those who organize feedback indirectly (‘My leader invites others to provide feedback on my ideas’).

I: Recognizing

Using six items we aimed to measure whether leaders praise and show appreciation to employees for being innovative. Three items were taken from Kohli’s (1985) measure of contingent approving supervisory behavior. We derived more items from Yukl *et al.*’s (1990) managerial practices survey which contains a recognition construct. A sample item from our scale is ‘My leader publicly recognizes me when I am innovative’.

J: Rewarding

This five-item scale measured the extent to which monetary rewards are given for innovative behavior. We developed three items ourselves (for instance ‘My leader offers bonuses for my innovative contributions’) and added two items that were taken from Jaworski and Kohli’s (1993) scale for reward system orientation.

K: Providing resources

This scale consisted of five items. We aimed to measure whether leaders provide employees with sufficient time and money to work out ideas. In earlier research we had

already developed a multiple-item scale for the availability of resources (De Jong & Den Hartog, 2005). To further enhance scale reliability we decided to add another two self-developed items. A sample item includes 'My leader provides me with time to work out ideas'.

L: Monitoring

In the literature monitoring is a well-covered aspect of leader behavior. We were able to use seven items from various sources such as House *et al.* (1997), Bass and Avolio (1989) and Den Hartog (1997), originally intended to measure related constructs such as active management by exception and direct supervision. A sample item is 'My leader points out to me if my work is not up to par'.

M: Task assignment

In an earlier study we developed a measure for perceived job variety that contained relevant items (De Jong & Den Hartog, 2005). We reformulated these items as leader behaviors ('My leader assigns me a broad range of tasks') and added more items from Jackson *et al.*'s (1993) scale for problem solving demand. Altogether, this scale consisted of six items.

Innovation climate

We used 17 items to measure innovation climate dimensions (participative safety, striving for excellence and support for innovation). Most items were derived from Anderson and West (1998) who developed and empirically validated their 'team climate inventory' (TCI). This measure is based on West's social psychology of innovation in groups and measures employees' perceptions of innovation climate. The TCI has been demonstrated to be of acceptable psychometric quality, and is much more acceptable than alternative climate measures such as Ekvall's (1996) CCQ (Mathisen & Einarsen, 2004). The TCI contains many items from other measures of innovation climate, including the frequently cited measures for 'support for creativity' and 'tolerance of differences' by Siegel and Kaemmerer (1978). In the sub-scale for striving for excellence we also included some items from Schippers' (2003) reflexivity measure. Five items related to participative safety ('People in my company feel at ease with each other'), six items covered striving for excellence ('During task execution, we assess whether we are on the right track'), and the remaining items dealt with support for innovation ('My colleagues co-operate in order to help to develop and apply new ideas').

External work contacts

For this measure we used a scale developed in an earlier study (De Jong & Den Hartog, 2005). It consisted of five items, for example 'I keep in touch with prospective customers of my firm'. We added three more items drawing on Afuah's overview (2003) of functional sources of innovation. He stresses that various parties such as competitors, knowledge institutes and universities can enhance the innovation process and be a source of opportunity.

Other measures

The employee questionnaire covered two other subjects. First, we asked employees to self-rate their *innovative output*. As our measure of IWB is central in our analyses we wanted to validate it using a different but related measure, to be collected from a different source. In previous work researchers used hard indicators like invention disclosures (Scott & Bruce, 1994; 1998) or technical reports (Tierney *et al.*, 1999), but among non-R&D workers such measures are usually not available. As we focus on knowledge workers, we chose a measure of self-rated innovative output, i.e. employees indicated to what extent they produced suggestions and contributed to actual innovations in their work.

In a survey among manufacturing workers Axtell *et al.* (2000) applied a similar, two-dimensional measure. They asked employees to indicate the results of both phases of the innovation process. The initiation stage is expected to result in suggestions, while the implementation stage should lead to implemented new products, services, and the like. In our survey employees indicated how often they offered suggestions to improve current products/services, develop new products/services, improve current work practices, acquire new customers, improve organization processes, and acquire new knowledge. They also indicated how often they contributed to implementing such changes. This scale initially contained 12 items: all presented in annex F.

Also included in the employee questionnaire were open questions about a critical incident. Employees were asked how their leaders had reacted the last time they proposed ideas. Respondents first indicated whether they had any recent experiences with suggesting and/or implementing ideas. If yes, they were asked how their leader had reacted. These questions served to check if we had overlooked any leader behaviors.

5.3 Scale construction

Most important in the analysis of the pilot sample was the examination of the factor structure of our initial IWB measure. This was done using exploratory factor analysis with oblique rotation. Since our primary objective was to identify latent dimensions rather than data reduction, this method is preferred to principal component analysis and/or orthogonal rotation (Hair, Anderson, Tatham and Black, 1998: p. 102). We dealt with our measure of innovation climate in the same way. Exploratory factor analysis with oblique rotation served to select a parsimonious set of items that maintained a three-dimensional structure. For the other scales, exploratory factor analysis was used to check one-dimensionality, an essential feature of any simple multiple-item scale (Hair *et al.* 1998). The items in a one-dimensional scale should be strongly correlated to represent a single construct, so exploratory factor analysis should reveal that a large part of the variance between a set of items is explained by the first factor (Anderson, Gerbing & Hunter, 1987).

Reliability statistics were calculated for all scales and dimensions. We assessed Cronbach's α, mean inter-item correlations and item-rest correlations (IRCs). The latter criteria were adopted because α tends to vary with the number of items in a scale and may be high even when items are somewhat interrelated but multidimensional (Cortina, 1993). Recommended critical values are 0.70 for α, 0.40 for mean inter-item correlations, and 0.30 for item-rest correlations (Cortina, 1993; Hair *et al.*, 1998).

As respondents had indicated that our questionnaires were too long, we aimed to shorten our measures by performing an item-selection process. By interpreting factor loadings and IRCs we subsequently dropped various items. To maintain sufficient breadth of coverage of our constructs we did not strive only for maximum reliability indices and percentages of explained variances. Some items were retained if we felt that the item-selection process might otherwise result in a subset of items with no full coverage of a construct's domain.

Innovative work behavior

Pre-analysis tests for the suitability of data for factor analysis were computed as recommended by Hair *et al.* (1998). The Kaiser-Meyer-Olkin (KMO) measure for sampling adequacy was 0.93 and the Bartlett test of sphericity was significant at $p < 0.001$, indicating the data were suitable for factor analytic procedures. An initial principal factor analysis was computed without iteration. Only the first two factors had eigenvalues greater than unity. However, when there are fewer than twenty variables, the latent root criterion tends to extract too few factors (Hair *et al.*, 1998). Application

of the scree criterion (Catell, 1966) suggested a four dimensional solution. A further analysis with oblique rotation was computed limiting the number of factors to four. This solution contained some ambiguous factor loadings. According to Hair *et al.* (1998) factor loadings should exceed 0.30 and preferably 0.50 (for practical significance), while any crossloading should be smaller than 0.30. After an item-selection process with the application of these rules-of-thumb, a shortened scale of ten items emerged, explaining 83% of the variance. This solution is shown in table 5. For an overview of omitted items we refer to appendix F. The table also shows that each dimension has sufficient reliability ($\alpha > 0.70$ and mean correlation > 0.40).

table 5. Exploratory factor analysis of innovative work behavior (n=81)

Item: How often does this employee...	*Factor 1 (Idea generation)*	*Factor 2 (Opportunity exploration)*	*Factor 3 (Champi-oning)*	*Factor 4 (Appli-cation)*
(x1)...pay attention to issues that are no part of his/her daily work?	0.20	**0.52**	-0.25	-0.10
(x2)...wonder how things can be improved?	0.19	**0.59**	-0.22	-0.12
(x3)...search out new working methods, techniques or instruments?	**0.75**	-0.12	-0.18	-0.03
(x4)...generate original solutions to problems?	**0.85**	0.07	-0.06	0.03
(x5)...find new approaches to execute tasks?	**0.79**	0.17	0.15	-0.13
(x6)...encourage key organization members to be enthusiastic about innovative ideas?	0.02	0.03	**-0.92**	-0.06
(x7)...attempt to convince people to support an innovative idea?	0.05	0.12	**-0.76**	-0.09
(x8)...systematically introduce innovative ideas into work practices?	0.29	-0.26	-0.18	**-0.56**
(x9)...contribute to the implementation of new ideas?	-0.01	0.05	0.05	**-0.95**
(x10)...put effort into the development of new things?	0.02	0.12	-0.22	**-0.69**
Explained variance	49.9%	15.7%	9.8%	7.4%
Cronbach's α (of bold items)	0.90	0.88	0.95	0.93
Mean correlation (bold items)	0.74	0.78	0.90	0.82

Leader behaviors

The item-selection process resulted in shortened measures with an average of four items. In support of one-dimensionality, exploratory factor analysis revealed that for each measure the first factor explained more than 50% of the variance, while only a single factor had an eigenvalue greater than unity. All measures had satisfactory reliability statistics (table 6). The dropped items can be found in annex F.

table 6. Reliability and one-dimensionality of leader behavior measures (n=81)

	No. of items		*Variance explained*	*Reliability*		
Measure	*A priori*	*Selected*		*α*	*Mean r*	*Lowest IRC*
Innovative role-modeling	7	4	71%	0.87	0.62	0.66
Intellectual stimulation	7	4	56%	0.74	0.42	0.47
Stimulating knowledge diffusion	6	4	61%	0.79	0.48	0.51
Providing vision	6	4	77%	0.90	0.70	0.74
Consulting	6	4	80%	0.92	0.74	0.78
Delegating	6	4	74%	0.88	0.64	0.66
Support for innovation	6	4	70%	0.85	0.58	0.60
Organizing feedback	7	4	64%	0.80	0.49	0.51
Recognizing	6	4	72%	0.87	0.63	0.59
Rewarding	5	3	79%	0.87	0.68	0.66
Providing resources	5	3	81%	0.89	0.72	0.73
Monitoring	7	4	62%	0.79	0.48	0.52
Task assignment	6	4	80%	0.91	0.72	0.63

Innovation climate

Although West's (1990) model was originally formulated as a group-level model, past research has repeatedly shown that its dimensions can also be re-produced at the individual level (Anderson & West, 1998; Ragazzoni, Baiardi, Zotti, Anderson & West, 2002; Mathisen, Torsheim & Einarsen, 2006). Using data from 81 employees the KMO measure of sampling adequacy equaled 0.91, while the Bartlett test of sphericity was significant at $p < 0.001$. Our pilot data on innovation climate could thus be analyzed with factor analytic procedures. Again an initial principal factor analysis was computed without iteration. Application of scree criterion suggested a three dimensional solution. A subsequent analysis with oblique rotation was forced to extract three factors. Although we immediately found a satisfying factor structure we performed an item-selection process to obtain more parsimonious measures. We subsequently dropped items with factor loadings < 0.50 or with cross-loadings that were just below 0.30. We retained 11 items; four of them related to participative safety, three to striving for excellence, and four to support for innovation. The final solution explained 75% of the variance (see table 7). Reliability statistics for each dimension were acceptable.

table 7. Exploratory factor analysis of innovation climate (n=81)

Item	*Factor 1 (Support for innovation)*	*Factor 2 (Participative safety)*	*Factor 3 (Striving for excellence)*
My colleagues feel understood and accepted by each other.	0.11	**0.58**	-0.14
People in my company feel at ease with each other.	-0.04	**0.51**	-0.18
Everyone is listened to, even when he/she has a minority view.	0.02	**0.85**	0.01
My colleagues accept deviating views.	-0.01	**0.79**	0.08
We provide each other with useful ideas to enable us to do a better job.	0.07	0.21	**-0.70**
During task execution, we assess whether we are on the right track.	-0.02	-0.01	**-0.92**
We build on each other's ideas in order to achieve the best possible outcomes.	0.22	0.05	**-0.60**
My colleagues are always searching for fresh, new ways of looking at problems.	**0.69**	0.11	-0.12
My colleagues co-operate in order to help develop and apply new ideas.	**0.87**	-0.11	-0.12
My colleagues provide and share resources to help in the application of new ideas.	**0.89**	-0.11	-0.04
My colleagues provide practical support for new ideas and their application.	**0.83**	0.19	0.12
Explained variance	50.3%	16.2%	8.4%
Cronbach's α (of bold items)	0.91	0.80	0.89
Mean correlation (bold items)	0.72	0.50	0.72

External work contacts

Our initial scale consisted of eight items. From these we selected five items to construct a parsimonious and reliable one-dimensional scale. Exploratory factor analysis showed that 63% of the variance was explained with the first factor. Cronbach's α was 0.85, while the mean correlation among the selected items equaled 0.52 and the lowest IRC was 0.50. The reduced scale covers contacts with customers, other firms and knowledge sources such as universities, trade shows and fairs (see annex F).

Other measures

To measure employees' innovative output we asked respondents how often they made suggestions related to six objects of innovation: improve current products/services, develop new products/services, improve current work practices, acquire new customers, improve organizational processes and acquire new knowledge. We also asked how much effort they put into implementing such innovations.

Contrary to Axtell *et al.* (2000), we could not derive a two-dimensional scale from the 12 items. Exploratory factor analysis demonstrated that all items loaded on a

single factor. This may be a consequence of the context of our pilot survey. Axtell *et al.* (2000) derived their two-dimensional measure in a study among workers in a manufacturing plant. Such firms usually have fixed modes of production and standardized products. When production workers generate ideas, they usually have to consult their leaders to approve it before the idea can be implemented. This context makes it more likely that both phases of the innovation process are clearly separated. In the context of our pilot in an institute for research and consultancy, generating ideas and directly implementing them may be easier as most knowledge workers have the authority to determine how to plan and act in their work. In this context the output of both phases of the innovation process is more likely to be diffuse and correlated.

Thus, a one-dimensional measure for self-rated innovative output proved to be best in terms of dimensionality and reliability. As we had asked respondents to assess each object of innovation twice, and correlation analysis revealed that in practice it is hard to distinguish between making suggestions and implementation efforts, we selected only one item of each pair. As a result a six-item scale emerged (see annex F). One-dimensionality was demonstrated by exploratory factor analysis (the first factor explained 54% of the variance) and satisfactory reliability statistics (α = 0.82, main correlation = 0.44, lowest IRC = 0.45).

The employee survey also contained open-ended questions on how leaders had responded to employees' innovative efforts. When asked for recent ideas or implementation efforts, 45% of the respondents indicated that they had had some innovative idea in the past few months, and 53% asserted to have done an implementation effort. Most idea generators had communicated their idea to their leader (85%) and most implementers perceived that their efforts were noticed by their leader (85%). Next, open-ended questions provided a check on any missing leader behaviors. Examples of how leaders had replied to their employees' innovative efforts included providing support ('he was enthusiastic and thought it was worth a try'), providing resources ('she complimented me, but failed to provide me with what I needed'), organizing feedback ('my leader brought in some colleagues to provide feedback'), recognition ('she paid me compliments and saw a lot of opportunities to implement it') and innovative role-modeling ('my leader was very enthusiastic and wanted to implement it as soon as he could'). Given that such behaviors were already present in our overview, and the fact that our main study was also in knowledge-intensive services, we concluded there was no need to further extend our overview of leader behaviors.

6 Main study

The main study was done among 703 knowledge workers and their leaders in 94 different organizations. This chapter presents how the study was organized and how we constructed our final measures. Section 6.1 discusses the sampling of respondents, the questionnaires and the process of data collection. Section 6.2 describes our multidimensional measure of innovative work behavior. Section 6.3 reveals the final versions of our measures of leader behaviors, innovation climate and external work contacts. Our results will follow in chapter 7.

6.1 Sample, questionnaires and data collection

The sample in our main survey was drawn from people working in four types of knowledge-intensive services: IT (software developers, IT consultants), legal and accounting (lawyers, legal advisors, accountants), economic (management consultants, economic and social researchers, public relation consultants, advertising designers) and engineering services (including architects and technical designers). In IT services employees work in a turbulent environment. Industrial relationships continuously change with frequent entries and exits of firms, and as a consequence of technological discontinuities (Afuah, 2003). In legal and accounting services, the need for employees to be innovative is probably less pronounced. Many innovations in this sector are imposed by amendments to the law. This makes changes in government polices an important source of innovation. In line with this, using a sample of 202 Australian service managers Hill and Johnson (2003) revealed that in legal and accounting services leaders perceive creativity to be less important (p. 225). Nevertheless, at the time of our survey - fall of 2003 - individuals' innovative efforts were becoming more important. Dutch legal and accounting services faced enormous changes in legislation and government policies, including the liberalization of the Notary law and intensified supervision by Dutch authorities as a consequence of an economic recession. These changes induced a considerable amount of competition among previously autonomous organizations. Finally, both economic and engineering service workers operate in an environment where needs of customers can change every day. It is thus reasonable to expect that individual innovation also contributes to the success of organizations here.

Except for a focus on knowledge workers, another distinctive feature of our main study is that we aim for employees in small firms (< 100 employees). In both leadership and innovation research data has mostly come from large organizations or departments within such organizations. As a consequence, employees in small firms have not yet been studied sufficiently in individual innovation studies.

Questionnaires

We organized the data collection process around two sources. Employees completed a questionnaire on leader behaviors, innovation climate, external work contacts and their own innovative output. Leaders provided ratings for each of their employees' innovative work behavior. As the pilot survey had considerably reduced the length of our measures, both questionnaires took less time to complete. Annex E shows both questionnaires used in the main study. The employee questionnaire no longer contained open-ended questions.

To the leader questionnaire, we added some indicators for the organization's innovative output. These indicators served to assess whether the sampled firms were representative, as will be discussed later. Guidelines for the measurement of innovative output were adopted from the Oslo Manual (OECD, 2005). This manual aims to capture the state-of-the-art in the measurement of organizational innovation. We asked leaders to indicate if their firm had realized various types of innovations in the past three years, including new or improved products/services, strategies, organizational structures and marketing concepts. Where there were product innovations we also asked for the percentage of turnover due to these new products or services.

Sampling and data collection

As there is no exhaustive database of knowledge workers in the Netherlands we lacked a suitable framework to sample participants directly. Therefore the sampling process was divided in two steps. We first searched for small knowledge-intensive firms that were willing to participate. Next, we asked entrepreneurs/leaders in these firms to sample their knowledge workers (employees within the firm).

In the first step a random sample of 1,190 firms was drawn from an exhaustive database that contains all Dutch organizations. Firms were sampled based on NACE (sector) codes and size classes. Relevant NACE codes included 72 (IT services), 7411, 7412 (legal and accounting services), 7413, 7414, 744 (economic services) and 742 (engineering services). Size classes were restricted to firms with no more than 100 employees (Dutch definition of small enterprises) and no less than 10 employees. The latter restriction was made because databases of firms always contain incorrectly

classified organizations in their lowest size class, and the smallest firms would not be able to sample enough employees.

Firms were given a letter with information about the objectives of the survey and the activities required. To encourage participation, we promised to send a benchmark report that presented the firm's scores in comparison with other participating firms. It was possible to indicate willingness to participate by sending in an email, fax back form or answer sheet. Since the survey would impose quite a burden and we did not have specific contact persons in the firms we invited, participation rates were relatively low. Eventually 94 firms were willing to participate.

To check whether the participating firms represented a typical group of firms, we compared the industrial distribution of the participating firms with population figures. In 2003 the Dutch population of knowledge-intensive service firms with 10-100 employees consisted of 5,130 firms, with an industrial distribution of 22% (IT services), 18% (legal and accounting), 34% (economic services) and 27% (engineering)[2]. This distribution was similar among the participating firms: 15% (IT), 13% (legal and accounting), 44% (economic) and 29% (engineering). A χ^2-test demonstrated no significant differences between both distributions ($p = 0.09$). Economic service firms were somewhat over-represented, which is not surprising as this group also includes research and consultancy services. Such firms may have a professional interest in the subject of our survey on leadership and individual innovation. Next, we compared our participants with population figures on the aforementioned indicators for innovation output. Population figures were provided by Statistics Netherlands based on their Community Innovation Survey that is executed every two years and that uses identical questions (CBS, 2003). The results of the comparison are presented in table 8.

The participants scored slightly above average on the indicators of process innovation, but they scored below the corresponding population figures on the indicators for product innovation (new products/services and share of turnover). Binomial and one-sample t-tests revealed no significant differences at the 5%-level, with the exception of innovation in strategies. In the group of participating firms we found a larger share of firms having implemented new or improved strategies (59% vs. 51%, $p = 0.03$). As this is only a single indicator and the difference with the population figure is modest, we concluded that the participating firms were not a-typical. Despite

[2] Figures retrieved from EIM's Active Firms database (www.eim.net).

the low participation rate we did not anticipate that the results of our subsequent analyses would be compromised.

table 8. Comparison of participants and population firms on innovation output indicators

Indicator	*Population (a)*	*Participants (n=94)*
Introduction of new or improved products/services in past 3 years (share of firms)	92%	89%
Estimated percentage of turnover due to such new or improved products/services	25%	22%
Implementation of new or improved strategies in past 3 years (share of firms)	51%	59%^
Implementation of new or improved organizational structures in past 3 years (share of firms)	36%	42%
Implementation of new or improved marketing concepts in past 3 years (share of firms)	38%	43%

(a) Population figures provided by Statistics Netherlands based on the CIS3 survey.
^ $p < 0.05$.

Ninety-four firms took part in the main survey. Altogether they employed 2,720 people, an average size of 29 employees. We asked entrepreneurs/leaders for details of knowledge workers within their firms. To diminish their burden, larger firms (> 20 employees) were asked to draw a random sample of ten employees, based on whose date of birth came up first. In total 905 employees and 94 entrepreneurs/leaders were invited to participate on a voluntary basis. The entrepreneurs/leaders received a questionnaire (see annex E) that inquired about the innovative work behavior of selected employees. A stamped-addressed envelope was provided for returning the completed questionnaire. A high response rate of 97 percent emerged (ratings for 879 employees).

For the employee survey, we asked leaders to first announce the survey to their people. This ensured that employees would not be surprised by a questionnaire that covered delicate subjects such as leadership. We sent out the employee questionnaire (annex E) along with a covering letter and a stamped envelope one week later. Eventually 703 employees participated, a response rate of 78 percent. Sixty-six percent of them were male, 14 percent was employed in IT services, 12 percent in legal and accounting services, 42 percent in economic services, and 32 percent in engineering services.

Using χ^2-tests, we compared the distributions of responding employees and non-respondents as to gender and type of sector. Neither test revealed a significant difference ($p=0.56$ and $p=0.11$, respectively) providing some evidence that non-response bias was not problematic. We also used a procedure proposed by Armstrong

and Overton (1977) as an additional test of non-response bias. They suggest comparing those participants that respond immediately after the start of the survey with those that respond just before the deadline. Assuming that late respondents are more similar to non-respondents than early respondents, significant differences in our measures would indicate non-response bias. A comparison of the first and last 25 percent of respondents revealed no significant differences. Although this procedure can be criticised (as this assumption may not be valid), it provides at least some support that non-response bias was not problematic.

All responses were processed in SPSS. Both questionnaires contained a unique user ID that served to pair responses from employees with the ratings assigned to them by their leaders. After merging both files 693 matched cases with responses from both leaders and employees remained.

6.2 Measuring innovative work behavior

The main sample was used to empirically replicate the four-dimensional measure of IWB, including the assessment of convergent, discriminant and criterion validity. We first repeated the exploratory factor and reliability analysis as discussed in chapter 5, now drawing directly on the 10 remaining items and a much bigger sample of 879 cases. These analyses provided similar results. As for the initial exploratory factor analysis, application of the scree criterion again suggested four factors, while now only the first factor had an eigenvalue exceeding 1.0. Principal factor analysis with oblique rotation that was forced to extract four factors revealed the expected pattern of factor loadings; all items loaded > 0.50 on their supposed dimension, while all cross-loadings were < 0.30. Reliability was good for all dimensions ($\alpha > 0.70$ and mean correlation > 0.40). These results are not presented in detail here, but are available from the author on request.

Convergent and discriminant validity

To test hypotheses 1A and 1B we used confirmatory factor analysis (CFA) with structural equation modeling. This is a frequently used method to examine convergent and discriminant validity. CFA provides a more rigorous test of a scale's validity than traditional multitrait-multimethod analysis (cf. Campbell & Fiske, 1959). To perform this analysis we used AMOS, a software package for structural equation modeling (Arbuckle & Wothke, 1999). Such models have no single statistical test that best describes the 'strength' of a model's output. Instead, various fit measures are available. We followed the advice of Hair *et al.* (1998) to assess fit from three perspectives,

namely those of absolute, incremental and parsimonious fit. Absolute fit determines the degree to which a model can reproduce observed correlations between its variables. Incremental fit compares a proposed model to some baseline model that all models should exceed. Parsimonious fit measures relate the goodness-of-fit of the model to the number of estimated coefficients required to achieve this level of fit. The basic objective is to diagnose whether model fit has been achieved by 'overfitting' data with too many coefficients (p. 653-659).

We followed the established practice of comparing various models. The idea is that the strongest test of a proposed model is to identify and test competing models that represent different hypothetical relationships (Hair *et al.* 1998). Our overview of previous measures of IWB (as presented in chapter 2) suggested three alternative models. First, a simple model with all items loading onto a single factor was run. This model mirrors previous scales that depict innovative work behavior as a one-dimensional construct (for instance Spreitzer, 1995; Basu & Green, 1997). Second, a two-factor model was run in which the items of opportunity exploration and idea generation loaded on the first factor, and the championing and application items on the second factor. This model mirrors previous measures in Krause (2004) and Dorenbosch *et al.* (2005). It builds on the widely used two-stage model of initiation and implementation. Third, a three-factor model was estimated. We now followed Janssen (2000) and assumed that individual innovation consists of idea generation (also including opportunity exploration), championing and application. Finally, we estimated a four-factor model that specified each item to load on its presupposed dimension.

The second, third and fourth model were all specified as second-order CFA models. The factor structure was further specified to account for the relationships among the first-order factors (in this case, the proposed dimensions of IWB) to estimate the contribution of the various dimensions to an overall construct of innovative work behavior. In table 9 we give the results.

table 9. Overall fit indices for innovative work behavior scales (threshold values in brackets) (n=879)

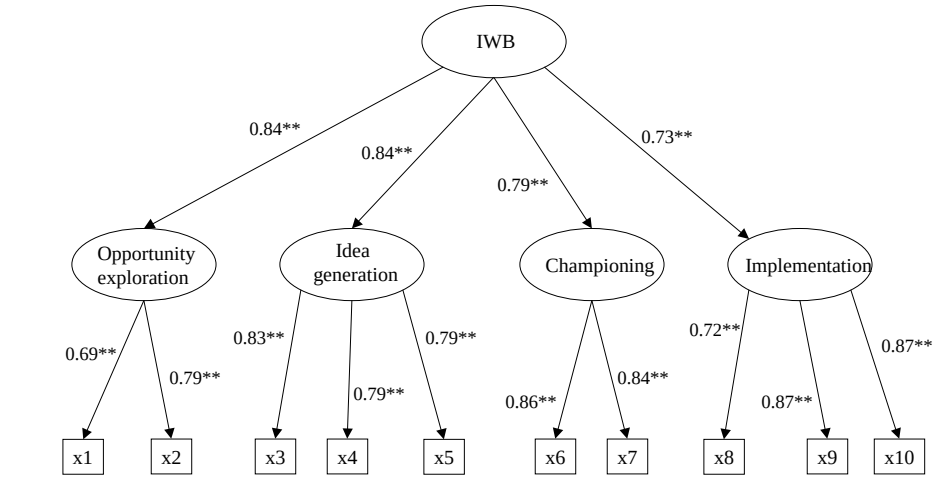
	Absolute fit		*Incremental fit*		*Parsimonious fit*
Model	*GFI (> 0.90)*	*RMSEA (< 0.08)*	*TLI (> 0.90)*	*NFI (> 0.90)*	*χ^2/df (< 5.0)*
One factor	0.78	0.18	0.81	0.85	30.19
Two factors	0.85	0.15	0.88	0.90	20.49
Three factors	0.96	0.07	0.97	0.97	5.80
Four factors	0.97	0.06	0.98	0.98	4.63

This table reports measures of absolute fit (GFI and RMSEA), incremental fit (TLI and NFI) and a parsimonious fit measure (χ^2/df). Reported threshold values are taken from

Hair *et al.* (1998: p. 653-659). As for χ^2/df, the recommended threshold value is 3.0, but since χ^2 is sensitive to sample size values up to 5.0 are acceptable for large samples (p. 658). Results indicated that the four-factor model provides the best fit. Values of all indices are within acceptable ranges. The three-factor model scores four out of five: χ^2/df only just failed to meet the (generously chosen) threshold value of 5.0. It can be regarded as a marginally acceptable model. Both other models provided a weak fit.

In figure 2 we present the factor loadings of the four-factor CFA model. Each first- and second-order factor loading is statistically significant at $p < 0.001$. The results support hypothesis 1A of convergent validity.

figure 2. Second order confirmatory factor analysis of innovative work behavior (n=879)



** p < 0.001.

A number of alternative four-factor models were run to assess discriminant validity. Rather than modeling a second order factor of IWB, these models all had plain correlations between the four dimensions. A first unconstrained model revealed significant correlations ($p < 0.001$) between all dimensions of IWB, ranging from 0.60 (between opportunity exploration and application) to 0.74 (opportunity exploration and idea generation). Next, we ran six models that subsequently fixed the correlations between a pair of dimensions on unity. Discriminant validity is indicated when all constrained models have a deteriorated fit compared to the unconstrained model (Bollen, 1989). For this purpose, we assessed the $\Delta\chi^2$-statistic. In each case a model with a less than optimal fit emerged ($\Delta\chi^2 > 38.0$ with one additional degree of freedom), providing some support for hypothesis 1B.

Although some evidence for divergent validity is found, the correlations between the dimensions of IWB are strong and significant (> 0.60). In many constrained models various fit measures still satisfied their threshold values (no output shown here). The strong correlations demonstrate that among knowledge workers the dimensions of opportunity exploration, idea generation, championing and application go hand in hand. Therefore, in subsequent analyses we combined the four dimensions to create a summative scale of innovative work behavior. Knowledge workers' innovative behavior is most likely an integrated construct, emerging from a joint appearance of its dimensions. In chapter 8 we further elaborate on the discriminant validity of our IWB-measure.

Criterion validity

We assessed criterion validity by analyzing how the summated ratings of IWB related to employees' self-rated innovative output. The latter construct is a different and independently rated measure of individual innovation. We expected a positive connection between both constructs (hypothesis 1C). As part of our pilot we had already constructed a six-item innovative output measure (also see annex F). We first assessed whether this measure was one-dimensional and reliable. Exploratory factor analysis confirmed that a major part of the variance between the six items was explained by the first factor (52%). The items were internally consistent as all reliability statistics met their critical values ($\alpha = 0.82$, main correlation = 0.43, lowest IRC = 0.50).

We used hierarchical multilevel regression analysis to test hypothesis 1C. Since our main sample has a nested structure (employees within firms) plain OLS regression would provide inaccurate standard errors and false tests of significance (Snijders & Bosker, 1999; Bliese, 2000). We modeled employees' innovative output as a dependent variable and leaders' ratings of IWB as a predictor variable. To examine whether data with a nested structure call for multilevel analysis, Snijders and Bosker (1999) recommended calculating the intraclass correlation coefficient (ICC) and performing one-way analysis of variance. The ICC estimates the share of variance in a dependent variable that is due to group membership, while analysis of variance reveals any significant differences between groups of employees in different organizations. A positive ICC combined with a significant F-value indicates that multilevel regression is necessary. This was indeed the case for our dependent measure (ICC = 0.10 and $F = 1.84$, $p < 0.001$).

Hierarchical multilevel regression explicitly accounts for nested structures in data. It allows simultaneous examination of the effects of group level and individual level variables on individual level outcomes, while accounting for the non-independence of observations within groups. A multilevel regression equation divides the variance of the outcome variable across various levels, i.e. the levels of employees (individuals) and organizations. Similar to OLS regression, the multilevel regression equation contains a fixed part with estimates of effect parameters for independent variables and t-tests to assess their significance. A major difference is the random part of the equation. This part includes error terms for each extra level that is specified beyond the individual level.

A simple variant of the hierarchical multilevel regression model is the random intercept model. Such models treat differences between firms as a source of variance in the intercept of the regression equation. More complicated are random slope models, which also allow effect parameters to differ across firms (Snijders & Bosker, 1999, p. 38-85). Here, we first estimated random intercept models and subsequently checked if random slope models would provide a better fit. As this was not the case, we here present the estimates of the random intercept models.

The analysis included firm size, gender and type of sector as control variables. Size is a dummy variable, with knowledge workers employed in a firm with more than 20 employees coded 1 and with fewer than 20 employees coded 0. Research among fast-growing firms has shown that this is a general threshold where the leader/entrepreneur needs to introduce explicit organizational arrangements in order to maintain an effective lead of operations (Greiner, 1972; Churchill & Lewis, 1983). We suspect that such arrangements may well affect innovation practices. Gender was a dummy variable with males coded 1 and females coded 0. Sector was a proxy for organizations' environmental characteristics that may influence innovation practices, including technological development, competition and new legislation (Shane, 2003). All analyses included dummies for legal and accounting, economic and engineering services. Knowledge workers in IT services were the reference group.

Since hierarchical multilevel regression uses maximum-likelihood estimates, model fit is assessed by comparing deviance measures of subsequent models: a decrease of the deviance measure (Δdev) is related to Δdf (degrees of freedom) and tested against a χ^2-distribution[3]. Testing hypothesis 1C included the estimation of three

[3] Due to the multiple errors terms and maximum-likelihood estimators, R^2–values are not obtained directly. Pseudo-R^2's can be computed but their values are hard to interpret. Additional predictors can result in lower values, and their values can even be negative (Snijders & Bosker, 1999).

models using innovative output as a dependent variable. The analyses were run with the MIXED procedure in SPSS and included the following steps:

- Estimation of an empty model (no predictors) to provide the initial value of the deviance measure (model 1)
- Estimation of a random intercept model with all control variables (size, gender, type of industry) (model 2)
- Estimation of a random intercept model with all control variables and innovative work behavior (model 3).

In table 10 we show the outcomes of these multilevel regressions. The initial deviance measure was 1434.11. Entering the dummy variables of size, gender and type of industry significantly increased model fit (Δdev = 44.21 with Δdf = 5, $p < 0.001$). T-tests revealed this effect is due to gender. Males report higher innovative outputs than females. The other control variables had no significant parameters.

table 10. Hierarchical multilevel regression of innovative output (n=693)

	Model 1	*Model 2*	*Model 3*
Standardized effect parameters:			
Size		-0.03	0.00
Gender		0.22**	0.19**
Sector: legal services		-0.09	0.01
Sector: consultancy services		0.04	0.02
Sector: engineering services		-0.12	-0.12
Innovative work behavior			0.40**
Model fit:			
Deviance	1434.11	1389.90	1258.71
Δ Deviance		44.21	131.19
Δ Df		5	1
Significance		**	**

** $p < 0.001$.

Entering ratings of innovative work behavior in the third model provided a much better fit (Δdev = 131.19 with Δdf = 1, $p < 0.001$). T-tests revealed that the positive effect parameter of innovative work behavior was very significant ($b = 0.40$, $p < 0.001$) providing strong support for hypothesis 1C. We also computed multilevel regression equations using each dimension of IWB as a predicator of self-rated innovative output. These analyses provided similar results.

Our result of a positive connection between IWB and innovative output is similar to the correlations reported in previous innovative behavior studies that use independent measures for validation purposes (Scott & Bruce, 1994; Janssen, 2000). Bearing in mind that some differences between both ratings are likely to occur as we

have used different measures from independent sources, the results support the criterion validity of our measure.

6.3 Construction of other measures

Final versions of our measures for the behaviors of leaders and external work contacts were constructed after an assessment of one-dimensionality and reliability. The climate measure was investigated as to its reliability and convergent and discriminant validity.

Leader behaviors

Exploratory factor analysis was again applied to check each measure's one-dimensionality. Various reliability statistics were also computed. Based on our findings we decided to omit three more items. The delegating scale contained an item 'My leader allows me to set my own goals'. The item-rest correlation for this item was remarkably low, only just exceeding the critical value of 0.30. The reliability of the delegating scale improved significantly after removing this item. For the same reason, items were dropped from the organizing feedback scale ('My leader makes suggestions on how to implement something new') and the task assignment scale ('My leader appeals to me for help with difficult projects'). Both had low IRCs and reliability improved greatly when they were omitted. In table 11 we show that each final measure was one-dimensional, as the first factor accounted for at least 60 percent of the variance. In addition, reliability statistics met their threshold values. Details of the final items in each measure can be found in annex F.

table 11. Reliability and one-dimensionality of leader behavior measures using main survey data (n=703)

	No. of items		*Variance explained*	*Reliability*		
Measure	*A priori*	*Final*		*α*	*Mean r*	*Lowest IRC*
Innovative role-modeling	4	4	60%	0.78	0.47	0.56
Intellectual stimulation	4	4	64%	0.81	0.51	0.54
Stimulating knowledge diffusion	4	4	63%	0.80	0.50	0.58
Providing vision	4	4	70%	0.86	0.60	0.62
Consulting	4	4	71%	0.86	0.61	0.67
Delegating	4	3	80%	0.84	0.64	0.63
Support for innovation	4	4	65%	0.82	0.53	0.55
Organizing feedback	4	3	74%	0.82	0.60	0.63
Recognizing	4	4	72%	0.87	0.62	0.67
Rewarding	3	3	73%	0.81	0.59	0.52
Providing resources	3	3	73%	0.81	0.59	0.62
Monitoring	4	4	63%	0.80	0.50	0.51
Task assignment	4	3	84%	0.90	0.76	0.58

Innovation climate

We started with exploratory factor analysis to see if the proposed three-dimensional structure could be confirmed. Surprisingly, results were dissimilar from the pilot survey. Although the latent root criterion suggested three factors, application of the scree criterion revealed that four different factors could be better. After principal factor analysis with oblique rotation, table 12 shows the details of this four-factor solution. It captures 72 percent of the variance. The dimensions of support for innovation and striving for excellence were maintained, but participative safety was split up in two dimensions, labeled as 'fellowship' and 'minority acceptance'. Fellowship indicates whether employees feel at ease and are aware of an atmosphere that is interpersonally pleasant. Minority acceptance assesses whether it is acceptable to articulate a deviating view. As all items loaded > 0.50, cross-loadings were below 0.30 and reliability statistics were acceptable, the four-factor solution might be more suitable than a three-dimensional solution.

table 12. Exploratory factor analysis of innovation climate using main survey data (n=703)

Item	*Factor 1 (Support for innovation)*	*Factor 2 (Minority acceptance)*	*Factor 3 (Striving for excellence)*	*Factor 4 (Fellow-ship)*
My colleagues feel understood and accepted by each other.	0.01	0.06	-0.02	**-0.81**
People in my company feel at ease with each other.	0.04	0.22	0.06	**-0.51**
Everyone is listened to, even when he/she has a minority view.	0.02	**0.67**	0.03	-0.02
My colleagues accept deviating views.	0.03	**0.71**	0.00	-0.10
We provide each other with useful ideas to enable us to do a better job.	-0.01	0.17	**0.74**	0.06
During task execution we assess whether we are on the right track.	0.04	-0.04	**0.72**	0.03
We build on each other's ideas in order to achieve the best possible outcomes.	0.08	-0.09	**0.50**	-0.25
My colleagues are always searching for fresh, new ways of looking at problems.	**0.76**	-0.02	-0.02	-0.02
My colleagues co-operate in order to help develop and apply new ideas.	**0.84**	0.00	-0.03	-0.01
My colleagues provide and share resources to help in the application of new ideas.	**0.80**	0.03	-0.02	0.08
My colleagues provide practical support for new ideas and their application.	**0.57**	0.02	0.15	-0.07
Explained variance	41.1%	14.9%	9.7%	6.4%
Cronbach's α (of bold items)	0.85	0.71	0.73	0.74
Mean correlation (between bold items)	0.58	0.55	0.48	0.59

We applied confirmatory factor analysis (CFA) to investigate which solution was to be preferred and to investigate convergent and discriminant validity. Again we compared the fit of various models (cf. Hair *et al.*, 1998). Three models were identified for this

purpose. First, we ran a simple model with all climate items loading onto a single factor. Since Anderson and West (1998) clearly demonstrated that innovation climate is a multi-dimensional phenomenon, we did not expect this model to be acceptable. We regarded it as a baseline that both other models should exceed. Second, we ran the proposed three-factor model that specified four items to load on participative safety, three items on striving for excellence and four items on support for innovation. Finally, we estimated a four-factor model with items specified to load as highlighted in bold in table 12. The three- and four-factor solutions were both designed as second-order CFA models; the factor structure was further specified to account for the relationships among the first-order factors (proposed dimensions of innovation climate) to estimate the contribution of the various dimensions to the overall construct of innovative climate. The CFA results are shown in table 13.

table 13. Overall fit indices for innovation climate models (threshold values in brackets) (n=703)

	Absolute fit		*Incremental fit*		*Parsimonious fit*
Model	*GFI (> 0.90)*	*RMSEA (< 0.08)*	*TLI (> 0.90)*	*NFI (> 0.90)*	*χ^2/df (< 5.0)*
One factor	0.78	0.16	0.64	0.70	19.76
Three factors	0.96	0.07	0.94	0.94	4.12
Four factors	0.97	0.06	0.97	0.97	3.16

The results confirmed that a one-factor model gave an inadequate description of the correlations between the items. In terms of absolute, incremental and parsimonious fit both the three- and four-factor model were acceptable. Because the four-factor model had the most favorable fit, and the χ^2/df-statistic of 3.16 indicated that its performance on the absolute and incremental fit statistics was not a result of overfitting data with too many parameters, we used the four-factor model in subsequent analyses. This implies that we distinguished between four dimensions of innovation climate, including striving for excellence and support for innovation, and the participative safety dimension split into ‘fellowship’ and ‘minority acceptance’.

To assess whether the four-factor model met common criteria of convergent validity, we looked at the first- and second-order factor loadings. These were all positive and significant at $p < 0.001$ (relevant output can be obtained from the author). Alternative four-factor models were run to examine discriminant validity. Rather than modeling a second order factor of innovative climate, these models all had plain correlations between the four dimensions. A first unconstrained model demonstrated that correlations between all dimensions were positive and significant ($p < 0.001$), ranging from 0.32 (between striving for excellence and minority acceptance) to 0.57

(between minority acceptance and fellowship). Next, we ran six models that subsequently fixed the correlations between each pair of dimensions on unity. Each of these models had a less optimal fit in terms of $\Delta\chi^2$ (> 47.0 with one additional degree of freedom). This clearly supports discriminant validity.

External work contacts

Drawing on the main survey data (703 employees), the five remaining items in this scale were re-analyzed. Exploratory factor analysis showed that 57% of the variance was explained by the first factor while only the first factor had an eigenvalue exceeding unity. Cronbach's α now was 0.81, the mean correlation was 0.46 and the IRCs ranged from 0.51 to 0.66. Thus, external work contacts was a one-dimensional and internally consistent measure. In the next chapter we will test our hypotheses 2-6 on the connection between leader behaviors and IWB and interaction effects with innovation climate and external work contacts.

7 Results

This chapter presents the results of our analyses investigating how leader behaviors correlate with employees' innovative work behavior. Section 7.1 presents descriptive statistics of the variables we used. In section 7.2 we test our hypotheses on the direct connections between IWB and leader behaviors, innovation climate and external work contacts. A range of hierarchical multilevel regression models is estimated for this purpose. In section 7.3 we end with an examination of two-way interaction effects between leadership and innovation climate and external work contacts.

7.1 Descriptives

In table 14 we provide means, standard deviations and correlations for the relevant measures in our analyses. Looking at the mean scores of our leadership measures, stimulating knowledge diffusion, delegation, providing support for innovation and challenging task assignment are most common among the leaders surveyed in our sample ($M > 3.70$). On the contrary, providing explicit monetary rewards for innovation is less common ($M = 2.54$). Of the climate dimensions, we note that fellowship and minority acceptance are judged more positively than support for innovation in the work group.

Not all leader behaviors have positive bivariate correlations with innovative work behavior. Six behaviors are strongly related ($p < 0.001$): consulting, delegating, support for innovation, recognizing, providing resources and assigning employees with challenging tasks. Two others, namely providing vision and rewarding, do have the expected positive sign, but their size is rather modest ($r < 0.10$) and p-values fall within the range of 0.01 and 0.05. No bivariate correlation with IWB is found for innovative role-modeling, intellectual stimulation, stimulating knowledge diffusion, organizing feedback and monitoring. Another result is that each dimension of innovation climate is unrelated with IWB. Finally external work contacts is strongly correlated with IWB ($r = 0.27$, $p < 0.001$).

table 14. Descriptives (n=[693,879])

			Correlations																		
Scale	*Mean*	*SD*	*[1]*	*[2]*	*[3]*	*[4]*	*[5]*	*[6]*	*[7]*	*[8]*	*[9]*	*[10]*	*[11]*	*[12]*	*[13]*	*[14]*	*[15]*	*[16]*	*[17]*	*[18]*	*[19]*	*[20]*
1. Innovative work behavior	3.08	0.82																				
2. Innovative role-modeling	3.55	0.69	0.02																			
3. Intellectual stimulation	3.39	0.72	0.03	0.60**																		
4. Stimulating knowledge diffusion	3.87	0.63	0.06	0.40**	0.45**																	
5. Providing vision	3.23	0.86	0.08^	0.63**	0.52**	0.39**																
6. Consulting	3.31	0.82	0.22**	0.45**	0.44**	0.44**	0.39**															
7. Delegating	4.03	0.67	0.18**	0.18**	0.07	0.34**	0.13**	0.36**														
8. Support for innovation	3.74	0.65	0.16**	0.51**	0.48**	0.41**	0.47**	0.58**	0.33**													
9. Organizing feedback	3.38	0.80	0.06	0.47**	0.45**	0.44**	0.51**	0.53**	0.21**	0.52**												
10. Recognizing	3.51	0.72	0.20**	0.48**	0.43**	0.43**	0.50**	0.57**	0.30**	0.71**	0.54**											
11. Rewarding	2.54	0.83	0.09^	0.30**	0.31**	0.24**	0.34**	0.37**	0.15**	0.33**	0.27**	0.39**										
12. Providing resources	3.18	0.75	0.15**	0.41**	0.35**	0.34**	0.41**	0.50**	0.29**	0.54**	0.47**	0.53**	0.35**									
13. Monitoring	3.29	0.70	-0.06	0.30**	0.43**	0.34**	0.31**	0.24**	-0.02	0.24**	0.23**	0.24**	0.17**	0.19**								
14. Task assignment	3.71	0.72	0.14**	0.36**	0.40**	0.36**	0.33**	0.39**	0.27**	0.45**	0.36**	0.40**	0.26**	0.35**	0.32**							
15. Climate: fellowship	3.79	0.66	-0.01	0.15**	0.16**	0.25**	0.17**	0.13*	0.21**	0.23**	0.22**	0.25**	0.04	0.19**	0.12*	0.20**						
16. Climate: minority acceptance	3.81	0.64	-0.04	0.13**	0.09^	0.26**	0.13**	0.15**	0.19**	0.23**	0.26**	0.24**	0.08^	0.13*	0.12*	0.24**	0.57**					
17. Climate: striving for excellence	3.59	0.68	0.01	0.23**	0.28**	0.31**	0.23**	0.23**	0.13**	0.24**	0.24**	0.25**	0.12*	0.22**	0.27**	0.24**	0.39**	0.32**				
18. Climate: support for innovation	3.39	0.67	-0.02	0.30**	0.33**	0.33**	0.39**	0.27**	0.15**	0.28**	0.37**	0.28**	0.18**	0.35**	0.27**	0.31**	0.36**	0.33**	0.52**			
19. External work contacts	2.83	0.88	0.27**	0.11*	0.16**	0.24**	0.08^	0.23**	0.15**	0.11*	0.10*	0.16**	0.12*	0.10*	0.10^	0.25**	0.03	0.00	0.10*	0.09*		
20. Firm size (dummy >= 20 empl.)	0.66	0.47	-0.10*	- 0.07*	-0.05	-0.05	0.03	- 0.19**	-0.04	-0.07	-0.06	-0.10*	0.01	-0.08^	-0.05	-0.07	-0.09*	-0.04	0.02	-0.05	0.00	
21. Gender (dummy male)	0.67	0.47	0.08^	-0.10^	-0.02	0.06	-0.02	0.02	-0.02	-0.01	0.05	-0.01	0.00	-0.02	-0.03	-0.01	-0.04	-0.01	-0.01	-0.03	0.31**	0.18**

** p < 0.001; * p < 0.01; ^ p < 0.05.

Most predictor variables are significantly correlated (table 14). In leadership research this is not an unusual phenomenon. As no correlation exceeds 0.75 and most pairs of variables share less than 25% variance with each other, the risk of multicollinearity is limited. Multicollinearity is not considered problematic until multiple correlations reach about 0.80 (Hair *et al.*, 1998: p. 189). In our causal analyses (to be discussed hereafter) we further checked multicollinearity by examining variance inflation factors (VIF) and conditions indices (CI). Values of these measures always fell well within the recommended thresholds of 10 (VIF) and 30 (CI) (cf. Hair *et al.*, 1998: p. 220). This confirms that multicollinearity was not problematic.

Variables we used as control variables in our analyses included firm size, gender and sector dummies. Just as in the regression of innovative output on IWB in the preceding chapter, size is a dummy variable for those employed in a firm with more than 20 employees coded 1. Formal organizational arrangements such as task descriptions are usually made at this size. When work relations become more formalized and directed by rules and procedures, opportunities to be innovative may be smaller (Bodewes, 2000), so a negative correlation with IWB is expected. Indeed, table 14 reveals that the size dummy and IWB correlate negatively ($r = -0.10$, $p < 0.01$).

Gender was again a dummy variable with males coded 1 and females coded 0. Its correlation with IWB was positive and significant at the 0.05 level. Gender serves as a proxy for type of function. In the Netherlands females are still relatively often employed in part-time jobs that may provide them with less opportunities to innovate. Sector dummies are proxies for the organization's larger economic and competitive environment, as this may influence individuals' opportunities to innovate (Ong *et al.*, 2003). Dummies are used for legal, consultancy and engineering services - IT services is the reference group (no descriptives shown in table 14).

7.2 Causal analysis

Hierarchical multilevel regression

To test hypotheses 2A-2M, 3A-3C and 5 we analyzed how our measures of leader behaviors, innovation climate and external work contacts are related to the summated ratings of IWB. As our data has a nested structure we again applied hierarchical multilevel regression analysis with employees' IWB as the dependent variable. The intraclass correlation coefficient (ICC) of IWB was 0.21, indicating that its variance is partly due to being employed in a specific firm. Moreover, one-way analysis of variance demonstrated significant differences in IWB between employees in different

firms ($F=3.72$, $p < 0.001$). Under such conditions hierarchical multilevel regression is recommended (Snijders & Bosker, 1999). Using multilevel techniques is still rare both leadership and innovation research. Yammarino and colleagues (2005) suggested that in the past ten years, only 15 percent of the empirical leadership studies adequately dealt with multilevel issues in their analysis phase (p. 894). Likewise, innovation researchers tend to treat layered data structures as being single-level, implying that mistakes are made in the estimates of parameters and their significance (Anderson *et al.*, 2004).

Testing our hypotheses included the estimation of sixteen models. All continuous predictors variables were first rescaled into centered scores (Aiken & West, 1991). This eased our interpretation of effect parameters, and was required to compute product terms for the investigation of interaction effects (see hereafter). In order to test for a significant connection between IWB and each leader behavior, we used innovation climate and external work contacts as additional control variables. This provides a more rigorous test of our hypotheses 2A-2M, i.e. if what leaders do correlates with IWB even if innovation climate and external work contacts are controlled for. We estimated the following models:

- Estimation of an empty model for an initial value of the deviance measure (model I)
- Estimation of a model with control variables firm size, gender and sector dummies (model II)
- Estimation of a model with all control variables: firm size, gender, sector dummies, dimensions of innovation climate and external work contacts (model III)
- Estimation of a range of models including all control variables and each of the thirteen leader behaviors entered subsequently (models IV through XVI).

We again checked whether random slopes, allowing different effect parameters for different firms, would provide a better model fit. This was almost never the case. Neither would random slope models induce different conclusions on our hypotheses, therefore we present our estimates of the random intercept models here.

Testing hypotheses

Results are shown in table 15. Model I is the baseline model with an initial deviance of 2034.34. The deviance measure must be interpreted as 'smaller is better'. Differences in deviance values are tested against a χ^2-distribution[4].

Model II enters dummies for firm size, gender and type of sector. It yields a better equation than the baseline model (Δdev = 21.90, $p < 0.001$). Both firm size and gender are significant at $p = 0.05$ with the expected sign. Knowledge workers in larger firms seem more confined in their opportunities to innovate. Males also receive better reports of IWB from their leaders. This could be due to the fact that on average male workers have better career developments and in a better position to be innovative (senior assignments with more diverse projects, rather than being junior or parttime employees). Finally, leaders in legal services report their employees are less innovative ($b = -0.17$, $p < 0.05$). Knowledge workers in legal services seem to be at a disadvantage as far as opportunities to be innovative are concerned. Most changes in their work are governed by changes in legislation.

Model III adds the dimensions of innovation climate and external work contacts. Again model fit improves significantly (Δdev = 498.48). Hypothesis 5 proposed that external work contacts are positively related to employees' innovative work behavior. This hypothesis is strongly supported as we find a standardized effect parameter of 0.27 with $p < 0.001$.

A remarkable result is that the dimensions of innovation climate are unrelated with employees' IWB. Hypotheses 3A-3C proposed that innovative work behavior is positively related to perceptions of participative safety, striving for excellence and support for innovation. As all effect parameters are insignificant at $p = 0.05$, these hypotheses are rejected. When each dimension is entered seperately, similar results are found (output available from the author on request). In chapter 8 we elaborate on the connection between innovation climate and IWB.

[4] Although hard to interpret, we also computed pseudo-R^2's (not presented in the table). At the individual level R_1^2 ranged from 0.15 to 0.20. At the firm level R_2^2 ranged from 0.20 to 0.25.

table 15. Hierarchical multilevel regression models of innovative work behavior (n=693)

	Models															
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*	*XIII*	*XIV*	*XV*	*XVI*
Standardized effect parameters:																
Firm size		-0.12^	-0.10	-0.10	-0.10	-0.10	-0.10	-0.07	-0.09	-0.10	-0.10	-0.09	-0.10	-0.09	-0.10	-0.09
Gender		0.07^	-0.01	-0.02	-0.02	-0.01	-0.01	-0.02	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01	-0.02	0.00
Sector: legal services		-0.17^	-0.26**	-0.26**	-0.26**	-0.26**	-0.26**	-0.26**	-0.24*	-0.26**	-0.26**	-0.25*	-0.24**	-0.26**	-0.26*	-0.28**
Sector: consultancy services		0.04	-0.07	-0.07	-0.07	-0.07	-0.07	-0.07	-0.05	-0.08	-0.07	-0.07	-0.06	-0.08	-0.07	-0.07
Sector: engineering services		-0.01	-0.07	-0.06	-0.06	-0.07	-0.07	-0.05	-0.04	-0.05	-0.07	-0.03	-0.06	-0.06	-0.06	-0.07
Climate: fellowship			-0.01	-0.01	-0.01	-0.02	-0.02	0.00	-0.03	-0.02	-0.01	-0.03	-0.01	-0.02	-0.02	-0.01
Climate: minority acceptance			-0.02	-0.02	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.02	-0.04	-0.02	-0.01	-0.02	-0.05
Climate: striving for excellence			0.07	0.07	0.07	0.07	0.07	0.05	0.07	0.06	0.07	0.05	0.07	0.07	0.09^	0.07
Climate: support for innovation			-0.05	-0.05	-0.05	-0.05	-0.06	-0.08	-0.06	-0.08	-0.06	-0.08	-0.05	-0.09^	-0.03	-0.09^
External work contacts			0.27**	0.27**	0.27**	0.27**	0.27**	0.24**	0.25**	0.26**	0.27**	0.25**	0.27**	0.27**	0.28**	0.24**
Innovative role-modeling				0.01												
Intellectual stimulation					0.02											
Stimulating knowledge diffusion						0.03										
Providing vision							0.05									
Consulting								0.18**								
Delegating									0.17**							
Support for innovation										0.18**						
Organizing feedback											0.04					
Recognizing												0.21**				
Rewarding													0.07			
Providing resources														0.15**		
Monitoring															-0.09^	
Task assignment																0.16**
Model fit:																
Deviance (previous model)		2034.34	2012.44	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96	1513.96
Deviance	2034.34	2012.44	1513.96	1513.93	1513.93	1513.46	1511.68	1487.12	1486.16	1489.06	1511.38	1472.81	1508.19	1489.31	1507.76	1490.29
Δ Deviance		21.90	498.48	0.03	0.03	0.50	2.28	26.84	27.80	24.90	2.58	41.15	5.77	24.65	6.20	23.67
Δ Df		5	5	1	1	1	1	1	1	1	1	1	1	1	1	1
Significance		**	**					**	**	**		**	^	**	^	**

** p < 0.001; * p < 0.01; ^ p < 0.05.

The remaining models in table 15 provide tests of direct connections between innovative work behavior and our leader behaviors. Hypothesis 2A proposed that innovative role-modeling relates positively with IWB. Model IV shows that this hypothesis is rejected (Δdev = 0.03, n.s.). Hypothesis 2B proposed that intellectual stimulation is positively related to employees' IWB. In our sample of knowledge workers this hypothesis also needs to be rejected (model V).

Hypothesis 2C proposed that stimulating knowledge diffusion relates positively with employees' IWB. Again this hypothesis is rejected (model VI). Hypothesis 2D claimed that providing an innovation-based vision correlates with employees' innovative work behavior. Model VII shows that entering the construct gives no better fit (Δdev = 0.03, n.s.) and no significant effect parameter, so this hypothesis is also rejected.

Hypothesis 2E proposed that consulting employees relates positively to their innovative work behavior. Looking at model VIII, this hypothesis is confirmed. After extending the equation with consulting, model fit improves significantly (Δdev = 26.84, $p < 0.001$). The effect parameter is positive (b = 0.18) and significant at $p < 0.001$. Hypothesis 2F proposed that delegating relates positively with employees' IWB. This hypothesis is also confirmed (Δdev = 27.80, b = 0.17, $p < 0.001$). Hypothesis 2G proposed a positive connection between leader support for innovation and IWB. Again, this hypothesis is confirmed (Δdev = 24.90, b = 0.18, $p < 0.001$).

Hypothesis 2H proposed that organizing feedback relates positively to employees' IWB. This hypothesis is rejected (model XI). Hypothesis 2I proposed that recognition correlates with IWB. This hypothesis is confirmed (Δdev = 41.15, b = 0.21, $p < 0.001$). Hypothesis 2J proposed that rewarding innovation correlates with IWB. This hypothesis is rejected (model XIII).

Hypothesis 2K proposed that providing resources for innovation correlates with IWB. Model XIV supports this hypothesis (Δdev = 24.65, b = 0.15, $p < 0.001$). Hypothesis 2L proposed that monitoring is negatively related to employees' innovative work behavior. Looking at model XV, this hypothesis receives modest support. Entering monitoring into the equation gives a better fit (Δdev = 6.20). The effect parameter has the expected negative sign (b = -0.09) and is significant at $p < 0.05$. Finally, hypothesis 2M proposed that assigning employees with challenging tasks is positively related to IWB. Model XVI supports this hypothesis (Δdev = 23.67, b = 0.16, $p < 0.001$).

In sum, six leader behaviors are significantly related to employees' IWB, namely consulting, delegating, support for innovation, recognizing, providing resources and

task assignment. Besides, monitoring is related with the expected negative sign, but only significant at the five percent level. It is striking that all leader behaviors with an origin in transformational leadership and social network theories (for instance intellectual stimulation, providing vision, stimulating knowledge diffusion) are not directly related with IWB in this sample. We elaborate on this in the discussion section.

A counterintuitive result is the negative effect parameter of the climate dimension 'support for innovation' in some of the estimated models (table 15). Its connection with IWB becomes significant with the opposite sign when providing resources and task assignment are entered into the equation (models XIV and XVI). As there is no bivariate correlation between work group support and IWB (see table 14) this may indicate that this support for innovation is a suppressor variable. The positive correlations between support for innovation and both leader behaviors, accompanied by the significant correlation between these leader behaviors and IWB (table 14) and the lack of a significant correlation between support for innovation and IWB, suggest that suppression is occurring (Cohen, West, Aiken & Cohen, 1983). Providing resources and task assignment likely suppress some variance in work group support that is irrelevant to IWB. When this error variance is partialled out, or suppressed, the remaining variance is more strongly related to IWB. Our interpretation is that the negative effect parameters do not indicate a true negative impact, but rather that a supportive innovation climate is a suppressor variable and not significantly related to IWB. For the positive effect parameter of striving for excellence (model XV) our reasoning is similar. We do not conclude that it is truly related with IWB.

Having established what kind of leader behaviors correlate significantly with employees' IWB, we constructed summarizing measures of innovation-stimulating leadership (ISL). Innovation-stimulating leadership is defined as all leader behaviors that stimulate individuals to initiate and intentionally introduce new and useful ideas, processes, products or procedures within their work role, group or organization. We developed two versions of the ISL, i.e. a full multidimensional version of 19 items and a shortened version of six items. They are both reliable and valid, and may be useful in future research on individual innovation. Details of these measures are given in annex G.

7.3 Interaction effects

Interaction effects were estimated to test hypotheses 4 and 6. We first calculated mean centered scores for all measures and took the product of all pairs of interest (Aiken & West, 1991). The significance of interactions can be derived from the regression

coefficients of these product terms, after the main effects of separate predictors are partialed out. In models IV through XVI we had already entered relevant main effects into the regression equation: firm size, gender, type of sector, dimensions of innovation climate, external work contacts and leader behaviors (table 15). Next, interaction terms were included. If these provide better fit measures and significant regression coefficients, the interaction terms add significantly to the prediction of innovative work behavior, showing that moderation is present.

We started by analyzing the interactions between innovative role-modeling (the first leader behavior) and each of the climate dimensions and external work contacts. Model IV provided a baseline value of the deviance measure. We next estimated five models in which we subsequently entered product terms between innovative role-modeling and fellowship (model IV-1), minority acceptance (model IV-2), striving for excellence (IV-3), support for innovation (IV-4) and external work contacts (IV-5). These analyses were repeated for the other leader behaviors. All models were specified with random intercepts as interaction terms with random slopes are difficult to interpret (Snijders & Bosker, 1999). In all we found twelve significant interactions. These are presented in table 16. Space limitations prevent us from reporting the models with insignificant interaction terms. These are available from the author on request.

For external work contacts our findings are straightforward. Hypothesis 6 proposed that external work contacts interact with leader behaviors, such that the connection between leader behaviors and employees' IWB is stronger in situations of few external work contacts. As no significant interactions were obtained, this hypothesis is rejected. Apparently frequent and diverse external contacts is no neutralizer of innovation-stimulating leader behaviors. Despite being exposed to outsiders more intensively, leader behaviors are similarly correlated with IWB while external work contacts have a direct and independent impact on IWB.

Hypothesis 4 proposed that (dimensions of) innovation climate interact with leader behaviors, such that the connection between leader behaviors and IWB is stronger in situation of unfavorable innovation climates. Here, we found a number of significant interactions. Support for innovation in work groups moderated nine behaviors of leaders: innovative role-modeling, intellectual stimulation, providing vision, consulting, delegating, leader support for innovation, recognizing, providing resources and monitoring. Standardized regression coefficients for the product terms were negative and significant with at least $p < 0.05$. Other significant interactions included fellowship (moderating intellectual stimulation), minority acceptance (moderating consulting) and striving for excellence (moderating assigning employees

with challenging tasks). Results in table 16 and the probing of significant interactions (see hereafter) provide partial support for hypothesis 4.

table 16. Hierarchical multilevel regression models of IWB with interaction effects (n=693)

	Models											
	IV-4	*V-1*	*V-4*	*VII-4*	*VIII-2*	*VIII-4*	*IX-4*	*X-4*	*XII-4*	*XIV-4*	*XV-4*	*XVI-3*
Standardized effect parameters:												
Firm size	-0.10	-0.10	-0.10	-0.10	-0.07	-0.07	-0.10	-0.10	-0.09	-0.10	-0.10	-0.09
Gender	-0.01	-0.02	-0.02	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02	0.00
Sector: legal services	-0.27**	-0.26**	-0.27**	-0.27**	-0.26**	-0.26**	-0.25*	-0.28**	-0.26*	-0.27**	-0.26**	-0.28**
Sector: consultancy services	-0.07	-0.07	-0.07	-0.06	-0.07	-0.07	-0.05	-0.09	-0.07	-0.09	-0.08	-0.07
Sector: engineering services	-0.07	-0.07	-0.07	-0.06	-0.05	-0.05	-0.04	-0.06	-0.04	-0.06	-0.06	-0.07
Climate: fellowship (F)	-0.02	-0.03	-0.02	-0.02	0.00	-0.01	-0.04	-0.02	-0.02	-0.02	-0.02	-0.02
Climate: minority acc. (MA)	-0.02	-0.02	-0.02	-0.02	-0.04	-0.02	-0.02	-0.02	-0.04	-0.01	-0.01	-0.03
Climate: striving for exc. (SE)	0.07	0.07	0.07	0.07	0.05	0.05	0.07	0.06	0.06	0.07	0.09^	0.07
Climate: support for inn. (SI)	-0.06	-0.05	-0.05	-0.08	-0.08	-0.08	-0.06	-0.09^	-0.09^	-0.10^	-0.05	-0.09^
External work contacts (EWC)	0.27**	0.27**	0.27**	0.27**	0.24**	0.24**	0.26**	0.26**	0.25***	0.27**	0.29**	0.24**
Innovative role-modeling (IR)	0.01											
IR * SI	-0.06^											
Intellectual stimulation (IS)		0.02	0.02									
IS * F		-0.07^										
IS * SI			-0.06^									
Providing vision (PV)				0.04								
PV * SI				-0.07^								
Consulting (C)					0.18**	0.18**						
C * MA					-0.07^							
C * SI						-0.08^						
Delegating (D)							0.16**					
D * SI							-0.07^					
Support for innovation (S)								0.17**				
S * SI								-0.10*				
Recognizing (R)									0.20**			
R * SI									-0.08^			
Providing resources (PR)										0.14**		
PR * SI										-0.09^		
Monitoring (M)											-0.09*	
M * SI											-0.06^	
Task assignment (TA)												0.15**
TA * SE												-0.08*
Model fit:												
Deviance (previous model)	1513.93	1513.93	1513.93	1511.68	1487.12	1487.12	1486.16	1489.06	1472.81	1489.31	1507.76	1490.29
Deviance	1509.74	1509.31	1509.57	1507.57	1483.09	1481.44	1481.91	1479.44	1467.28	1482.92	1503.26	1482.71
Δ Deviance	4.19	4.62	4.36	4.11	4.03	5.68	4.25	9.62	5.53	6.39	4.50	7.58
Δ Df	1	1	1	1	1	1	1	1	1	1	1	1
Significance	^	^	^	^	^	^	^	*	^	^	^	*

** p < 0.001; * p < 0.01; ^ p < 0.05.

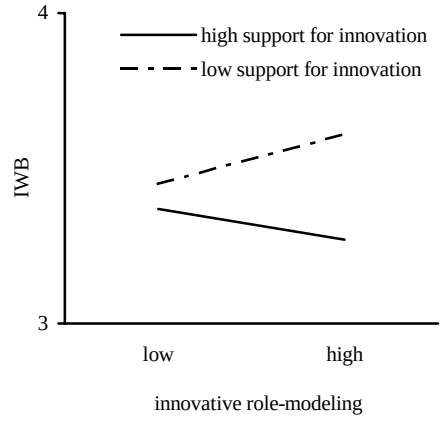
Probing of significant interactions

To further analyze the significant interaction effects, the total regression equations were rearranged in simple regressions given conditional values of the relevant moderator (M + 1 SD; M – 1 SD). By substituting different values for moderator variables different slopes were obtained for IWB on particular leader behaviors. This enabled us to assess the relationship between a leader behavior and IWB at low and high values of the moderating variable. Simple regression equations were portrayed in two-dimensional pictures for ease of interpretation (cf. Aiken & West, 1991).

A: Innovative role-modeling

The connection between innovative role-modeling and employees' IWB is moderated by perceived support for innovation in the work group. Simple regressions of IWB on innovative role-modeling for high and low values of group support (M + 1 SD, M – 1 SD) are presented in figure 3.

figure 3. Regression of IWB on innovative role-modeling for high and low support for innovation (n=693)

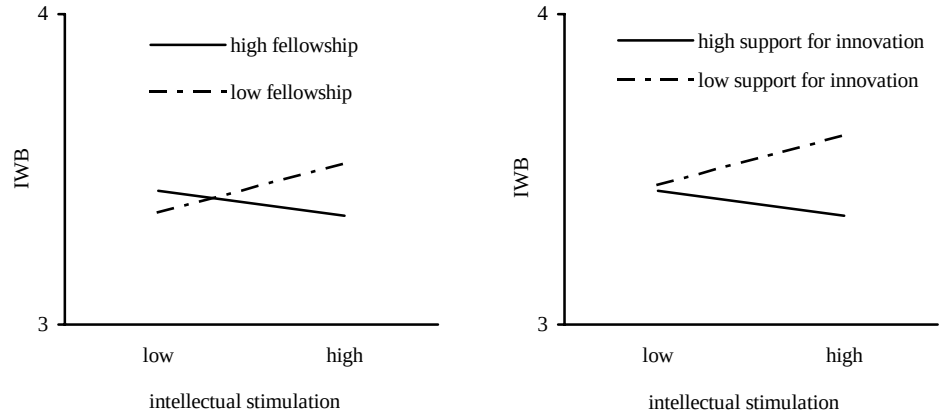


When support for innovation in the work group is high, innovative role-modeling is slightly negatively correlated with IWB (b = -0.05). In contradiction, when knowledge workers perceive low group support innovative role-modeling is positively related to IWB (b = 0.08). The difference between both slopes is significant at $p < 0.05$. This suggests that in situations of unfavorable support it helps if leaders act as innovative role-models to stimulate IWB.

B: Intellectual stimulation

The impact of intellectual stimulation is moderated by fellowship and support for innovation in the work group. Simple regressions are presented in figure 4. The left hand picture shows that intellectual stimulation is positively related with IWB in case of low fellowship, i.e. when individuals do not feel at ease with their colleagues (b = 0.08). In case of high fellowship the relationship is slightly negative. The right picture illustrates that intellectual stimulation is positively connected to IWB in case of low support for innovation (b = 0.08) rather than in a highly supportive climate (b = -0.04). Again, differences between these slopes are both significant at $p < 0.05$. It suggests that in situations of low fellowship or lacking support leaders can trigger their employees to innovate by stimulating them intellectually.

figure 4. Regression of IWB on intellectual stimulation for high and low fellowship and support for innovation (n=693)



C: Stimulating knowledge diffusion

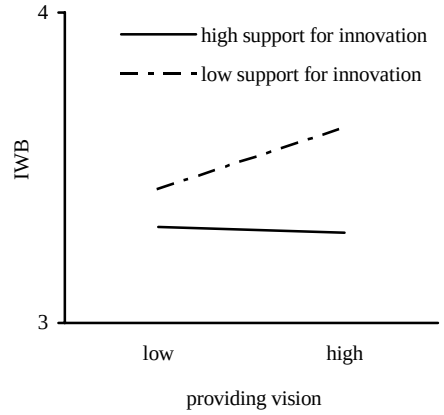
We found no significant interactions for stimulating knowledge diffusion. As we also had to reject our hypothesis of a direct connection with IWB, it seems that stimulating knowledge diffusion is unrelated to individual innovation. In chapter 8 we elaborate on this.

D: Providing vision

The connection between providing an innovation-based vision and IWB is moderated by support for innovation in the work group. Simple regressions for high and low values of this moderator variable are shown in figure 5.

When support is high, providing an innovation-based vision remains unrelated to innovative work behavior. In contrast, when knowledge workers perceive low support from their colleagues, providing vision correlates with higher levels of IWB ($b = 0.10$ versus $b = -0.01$, $p < 0.05$). Although we had to reject our hypothesis on a direct connection, providing an innovation-based vision does seem to contribute to individual innovation when followers perceive an unsupportive innovation climate.

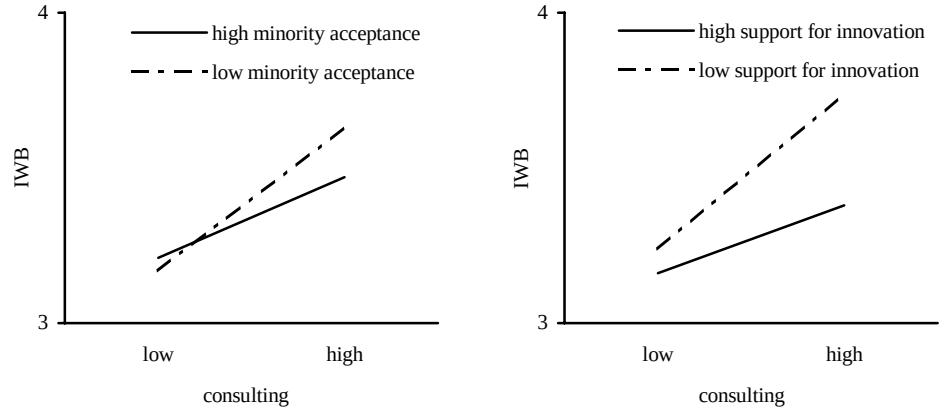
figure 5. Regression of IWB on providing vision for high and low support for innovation (n=693)



E: Consulting

For consulting we found significant interactions for minority acceptance and support for innovation (figure 6). We also found that consulting and IWB are directly related (hypothesis 2E). Both dimensions of innovation climate further moderated the strength of this relationship.

figure 6. Regression of IWB on consulting for high and low minority acceptance and support for innovation (n=693)



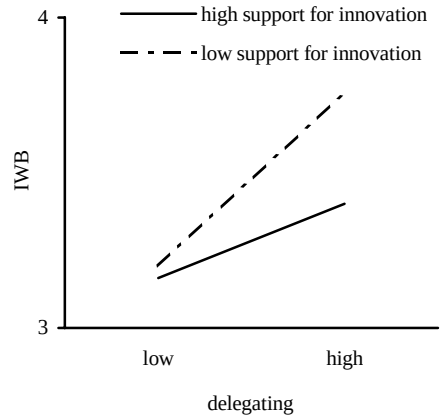
For low minority acceptance, consulting is more strongly associated with innovative work behavior than for high minority acceptance ($b = 0.23$ versus $b = 0.13$, $p < 0.01$). Besides, when low support for innovation is found, consulting is more strongly

associated with IWB than in situations of high support (b = 0.25 versus b = 0.11, $p < 0.05$). For consulting, this confirms our suspicion that leaders can do more to stimulate employees' IWB in situations of unfavorable innovation climates.

F: Delegating

The connection between delegating and IWB is moderated by support for innovation. Simple regressions are portrayed in figure 7.

figure 7. Regression of IWB on delegating for high and low support for innovation (n=693)

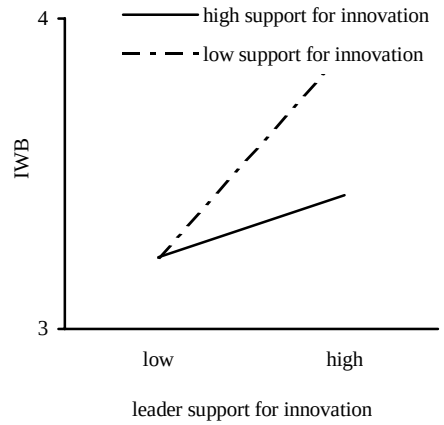


If work group support is high delegating and IWB are related (b = 0.12), but when support is low their connection is much stronger (b = 0.28). Differences between both slopes are significant at $p < 0.05$.

G: Support for innovation

The effect of leaders' support for innovation on IWB is moderated by work group support for innovation (figure 8). When work group support is low, leader support is more strongly associated with innovative work behavior than in situations of high work group support (b = 0.33 versus b = 0.10, $p < 0.01$). Apparently, the less favorable support for innovation in work groups, the more leaders can influence innovative work behavior of followers by personal support for their innovative efforts.

figure 8. Regression of IWB on leader support for high and low support for innovation (n=693)



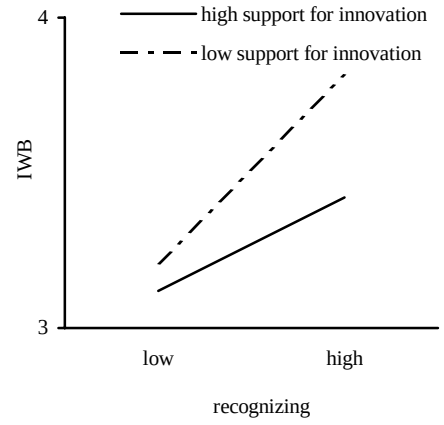
H: Organizing feedback

We found no significant interactions for organizing feedback. We also rejected our hypothesis of a direct connection with IWB, thus we find that organizing feedback is unrelated to innovative work behavior. In chapter 8 we elaborate on this.

I: Recognizing

The connection between recognizing and IWB is again moderated by support for innovation in the work group (figure 9).

figure 9. Regression of IWB on recognizing for high and low support for innovation (n=693)



When perceived work group support is low, recognizing correlates stronger with innovative work behavior than in situations of high perceived support (b = 0.30 versus b = 0.15, $p < 0.05$). This suggests that the more unfavorable work group support for innovation, the more leaders can influence IWB by recognizing and praising their employees' innovative efforts.

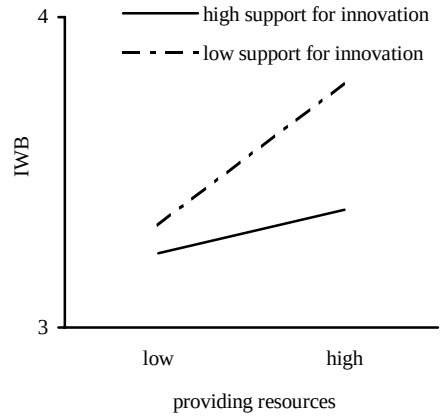
J: Rewarding

We found no significant interactions that moderated the connection between rewarding and IWB. In the discussion section, we will elaborate on this.

K: Providing resources

The relationship between providing resources for innovation and employees' IWB is also moderated by work group support for innovation (figure 10).

figure 10. Regression of IWB on providing resources for high and low support for innovation (n=693)



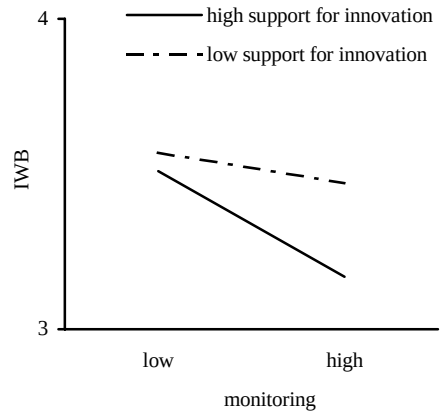
We again conclude that when support of colleagues is low, providing resources is stronger related with IWB than when support is high (b = 0.23 versus b=0.07, $p < 0.05$). This suggests that when employees experience high support from their colleagues, leaders providing resources makes less difference.

L: Monitoring

The connection between monitoring and IWB is also moderated by work group support. We found a negative direct association between monitoring and IWB, suggesting that monitoring impedes individual innovation (hypothesis 2L). As figure 11 illustrates, high work group support correlates with a negative connection between

monitoring and IWB (b = -0.17) while such a connection is barely present in case of low support. Both slopes differ at $p < 0.05$. This suggests that strict monitoring has a more negative impact on IWB within work groups that actively support the innovative efforts of their members.

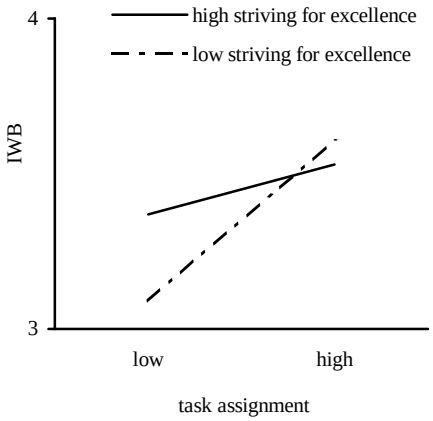
figure 11. Regression of IWB on monitoring for high and low support for innovation (n=693)



M: Task assignment

The connection between assigning knowledge workers with challenging tasks and IWB is moderated by striving for excellence (figure 12). When individuals perceive their work group does not strive for excellence, challenging task assignment is strongly associated with their innovative work behavior (b = 0.26). On the contrary, when striving for excellence is high, the connection between task assignment and IWB is much weaker (b = 0.08). Both slopes differ significantly at $p < 0.01$. Apparently the assignment of challenging tasks is most useful in situations where a group of knowledge workers do not pro-actively strive for innovations. If striving for excellence is already high, assigning them challenging tasks makes less difference.

figure 12. Regression of IWB on task assignment for high and low striving for excellence (n=693)



8 Discussion

This study developed and validated a multi-dimensional measure of employees' innovative work behavior, and investigated how leader behaviors correlate with IWB. Section 8.1 discusses our findings for the measurement of innovative work behavior. We draw conclusions, discuss the implications and limitations of our findings, and provide directions for future research. Section 8.2 discusses the role of leader behaviors. We also elaborate on the implications of our research for practitioners and on potential reasons why some hypotheses were rejected. We also discuss our findings on innovation climate and external work contacts in this paragraph. Section 8.3 ends this thesis with our final comments, limitations and directions for future research.

8.1 Measurement of innovative work behavior

We attempted to contribute to the individual innovation literature by developing a comprehensive, yet short measure of employees' innovative work behavior. The measure captures both divergent and convergent behaviors of individuals. In contradiction with most previous measures we operationalized IWB as a multi-dimensional construct, consisting of opportunity exploration, idea generation, championing and application. The proposed measure has ten items. Our empirical tests have demonstrated these to be reliable and valid in terms of convergent and criterion validity.

In future empirical studies on individual innovation, behavior-based measures will likely be increasingly seen. With the exception of people in innovative professions (R&D workers, scientists) output-based innovation measures for individual innovation such as patents counts and technical reports are hard to obtain. Given that future research is most needed in those contexts where innovation and plain work performance are dissimilar (Mumford, 2003) we expect that behavior-based measures of individual innovation will be increasingly applied. As our measure captures what individuals actually do when they innovate, we recommended it as a good alternative to indicate individual innovation in non-innovative professions.

However, the IWB measure is in need of more development. Our nomological net to test criterion validity included only a single variable (self-rated innovative outputs). Future research should explore criterion validity in more detail by developing and

testing larger nomological networks including other work context and outcome variables.

Another drawback of the proposed multi-dimensional measure is that its discriminant validity is not convincing. The dimensions of opportunity exploration, idea generation, championing and application correlate highly and may be best seen as combining additively to create an overall scale of innovative work behavior. One could argue that the high intercorrelations make sense and actually provide strong evidence of the psychometric quality of the construct, because in reality the innovation process is reciprocal and recurring, making it reasonable to expect that various innovative behaviors are highly correlated. In that line, Scott and Bruce (1994) mentioned that since innovation is actually characterized by discontinuous activities rather than discrete, sequential stages, 'individuals can be expected to be involved in any combination of (innovative) behaviors at any one time' (p. 582).

Yet, we feel that discriminant validity needs to be further studied in future research. The strong intercorrelations suggest the need for continued work on this aspect. Two directions for future research can be suggested. First, we collected ratings of IWB by asking employees' supervisors. An opportunity to improve discriminant validity may be to collect data from different sources. Supervisor ratings may be somewhat biased due to a leader's overall and holistic view of the capabilities and performance level of their employees. This may have caused substantial intercorrelations between the dimensions of IWB. Rather, it would be interesting to investigate discriminant validity based on ratings by colleagues or even clients rather than leaders.

Another promising direction is to measure IWB in different work contexts. Our validation study focused on knowledge workers in small firms. High intercorrelations between the IWB dimensions can be expected here. Critical features of most knowledge-intensive jobs include high levels of autonomy and no formal rules for innovation (Hislop, 2005). In such contexts employees are probably better able to innovate on their own, that is discover and implement innovative opportunities themselves. In organizations with formal innovation processes discriminant validity could be better, because the outcomes of the stages of the innovation process and the various innovative behaviors can be better recognized. For example, Van Dijk and Van den Ende (2002) described the use of employee suggestion systems by Dutch multinational enterprises to stimulate individual innovation. We expect that the phases of the innovation process are more distinct in such contexts, and thus a better discriminant validity can be expected. Some evidence for this proposition can be

derived from Axtell *et al.*'s (2000) investigation of determinants of employees' suggestions and implementation efforts. The context of their survey was a manufacturing plant with structured work processes. Their output-based measure of individual innovation had two distinct factors, while our similar measure in the pilot study showed just one. In sum, investigating the dimensions of IWB using different sources of data and in different work contexts could make a valuable contribution to our understanding of the construct.

8.2 Innovation-stimulating leader behaviors

The main objective of this thesis was to investigate which leader behaviors are related to employees' innovative work behavior. Thirteen leader behaviors were identified and empirically tested in relation to IWB. We also analyzed whether and how innovation climate and external work contacts moderate the connection between leader behaviors and IWB. This section first summarizes and discusses our main findings. Next, a detailed discussion follows for each leader behavior. We elaborate on the implications for practitioners and for future research.

General findings

Our empirical findings on the connection between leader behaviors and employees' IWB are summarized in table 17. As we found no significant interactions between leader behaviors and external work contacts, this column is omitted from the table.

Seven leader behaviors are significantly related to IWB with the expected sign. The cross-sectional research design precluded testing for directionality of results, but nonetheless our results are relevant to practitioners. First, our results confirm that close monitoring is negatively associated with employees' IWB. Being too focused on employees' effectiveness and efficiency will discourage them to initiate and implement innovations. Our findings rather suggest a number of issues for practitioners with a desire to stimulate individual innovation. Looking at the other significant leader behaviors (table 17) two main aspects of innovation-stimulating leadership can be identified: *participation* and *direct support*.

Participation is associated with the significant leader behaviors of consulting, delegating and task assignment. We conclude that these behaviors stimulate individual innovation. The more employees can participate in decision-making, have freedom to plan and act, and feel challenged by their tasks, the more enthusiastic and committed they will be. This likely enhances their intrinsic motivation and makes them perceive to

be in control and able to change situations. As a result employees can be expected to initiate innovations more often and be more committed to implementing them.

table 17. Summary of empirical findings on the connection between leader behaviors and IWB

Leader behaviors:	*Direct connection with IWB*	*Interactions with dimensions of innovation climate: connection with IWB is…*
Innovative role-modeling	None	Positive when work group support for innovation is low.
Intellectual stimulation	None	Positive when fellowship in the work group is low; Positive when work group support for innovation is low.
Stimulating knowledge diffusion	None	None
Providing vision	None	Positive when work group support for innovation is low.
Consulting	Positive	More positive when minority acceptance is low; More positive when work group support for innovation is low.
Delegating	Positive	More positive when work group support for innovation is low.
Support for innovation	Positive	More positive when work group support for innovation is low.
Organizing feedback	None	None
Recognizing	Positive	More positive when work group support for innovation is low.
Rewarding	None	None
Providing resources	Positive	More positive when work group support for innovation is low.
Monitoring	Negative	More negative when work group support for innovation is high.
Task assignment	Positive	More positive when striving for excellence is low.
Control variables:		
Innovation climate	None	
External work contacts	Positive	

Direct support relates to the significant leader behaviors of support, recognition and providing resources for innovation. We conclude that when employees initiate innovations and give their best to implement ideas, direct support is essential to keep it that way. Without verbal and enacted support employees are more likely to refrain from future attempts to generate ideas and implement them. The more leaders demonstrate confidence in their employees, keep themselves from excessively blaming their mistakes, praise and appreciate innovative efforts, and demonstrate enacted support by providing time and money, the more employees can focus on being innovative rather than having to worry of being punished. This also likely stimulates employees' intrinsic motivation and their appraisal of being able to effectively repair shortcomings in their work environment. In addition, recognition seems to make employees perceive that innovation pays off. These behaviors all trigger employees' IWB.

We note that in practice all leaders will to some extent allow or discourage followers' participation (Yukl, 2002). Some leaders will do it, even if they are unaware

or do not strive for innovation, and others leave it. As a consequence it is impossible for leaders not to affect their employees' innovative work behavior. Besides, direct support behaviors can be demonstrated on purpose to respond to or stimulate innovative efforts. This is fairly important, as it stresses that leaders who want to stimulate individual innovation are to some extent in control. They should work simultaneously in two directions and be consistent and persistent in demonstrating both types of behaviors.

Another result is that the connection between leader behaviors and IWB is stronger in situations of an unfavorable innovation climate. This applies to all leader behaviors with a direct connection with IWB, but also to some leader behaviours without such a relationship (table 17). How employees perceive support in their work group is the most important aspect of innovation climate that moderates how leader behaviors and IWB are related. Nine out of 13 leader behaviors are (more) related with IWB when employees perceive this climate dimension as unfavorable. Innovative role-modeling, intellectual stimulation and providing vision are related with IWB only in situations of low work group support. Consultation, delegation, leader support for innovation, recognition and providing resources relate stronger with IWB when work group support is low. Besides, the negative connection between monitoring and IWB is stronger when support for innovation in the work group is high, suggesting that under favorable work group conditions leaders could actually diminish innovative efforts of followers by being too restrictive.

Other dimensions of innovation climate gave significant interactions as well. When employees perceive low fellowship (do not feel at ease with their colleagues), intellectual stimulation is positively related with IWB while it remains unrelated in case of high fellowship. Consultation is related stronger when minority acceptance is low. Finally, when employees perceive low striving for excellence, challenging tasks stimulate their innovative efforts to a larger degree.

These results partially support our hypothesis that leader behaviors are stronger related with IWB in unfavourable work group situations. It confirms that aspects of innovation climate neutralize the impact of specific leader behaviors. In work groups with favorable innovation climates, leader behaviors such as innovative role-modeling, intellectual stimulation and providing vision make less difference. Rather, it takes unfavourable climate for these behaviors to be (potentially) influential. For the other leader behaviors our results demonstrate that situational characteristics fortify (or diminish) the impact of leadership. When innovation climates are unfavorable the

connection with employees' IWB is strengthened as there is no neutralizing effect of climate.

Some leader behaviors remained unrelated with IWB (stimulating knowledge diffusion, organizing feedback and rewarding, see table 17). Of course these constructs can be truly insignificant. Our in-depth interviews to identify interesting leader behaviors reflected only a limited number of cases, certainly not representative for any larger group of firms. They were just meant to identify leader behaviors that could be potential determinants of IWB, and had an exploratory nature. Yet, it is too early to conclude that these aspects of leadership are unrelevant for individual innovation. Our research could have overlooked relevant moderator variables. This is further discussed in the next section.

We also hypothesized that innovation climate and external work contacts were directly connected with employees' IWB. A non-intuitive result is that (dimensions of) innovation climate had no direct relationship with IWB. There may be specific reasons for this outcome, to be discussed hereafter. Results however confirmed a significant connection between external work contacts and IWB. The more employees report to have frequent and diverse external work contacts, the more their leaders report them to be innovative. This underscores Perry-Smith and Shalley's proposition (2003) on the need to empirically explore the social side of individual innovation, and to explicit pay attention to (external) network contacts when doing so.

Detailed discussion and implications

Our findings suggest a number of issues for practitioners who are leading knowledge workers. In this section we revisit each of the thirteen leader behaviors. We discuss implications for practitioners and elaborate on why some leader behaviors were unrelated with IWB. In doing so we suggest other constructs that may help to explore the connection with individual innovation in future research. The section ends with a similar discussion for innovation climate and external work contacts.

A: Innovative role-modeling

Innovative role-modeling is positively related to IWB when work group support for innovation is low. This finding suggests that when employees perceive their colleagues not to support their innovative efforts, leaders can stimulate IWB by being an example of innovative behavior themselves. In contradiction, when employees perceive support from their colleagues innovative role-modeling makes no difference.

For practitioners typical modeling behaviors include active exploration of opportunities, coming up with ideas, championing and implementing innovative ideas.

History has shown various examples of such innovative leaders. Lee Iaccoca, the former president of Chrysler Motor Company, for example perceived opportunities in re-launching the convertible car. For a quick market analysis he ordered to take a car off the assembly line and cut off the roof. He assessed his idea's market potential by driving downtown to count the hands of people who stopped and waved. This approach differed dramatically from the usual product development process that would have taken at least three years (Smith, 2002: p. 167).

As our findings indicate that role-modeling is important in specific situations, we suggest that future research should further explore how role-modeling is connected with IWB. We propose that other factors may also moderate its impact. An example includes if followers' identification with their leader. Krause (2004) suggests that this makes a difference if one investigates the connection between influence-based leadership (a construct similar with innovative role-modeling) and IWB. She suggests that influence-based leadership will be connected only if leaders are perceived to be positive identification figures (cf. Raven, 1992), i.e. perceived to be persuasive, inspiring, sympathetic and attractive. Future research should investigate if the connection between role-modeling and innovative behavior is moderated by the degree of follower identification.

Another potential moderator is unconventional leader behavior. Unconventional leader behavior relates to visual statements made to followers that are outside conventional norms (like standing on furniture, hanging ideas on clotheslines). Jaussi and Dionne (2003) suspected that such behavior would encourage risk-taking and would make followers feel more comfortable to take risks. They hypothesized that creative performance would be an interactive function of their perception of the leader as a model for creativity (role-modeling) and unconventional behavior, in such a way that creative performance would be best when both factors are high. In an experiment with students this hypothesis was confirmed. So future research could also include unconventional leader behavior are a moderating variable.

B: Intellectual stimulation

Some leaders directly invite their employees to come up with ideas and to strive for implementation. Intellectual stimulation intends to stimulate employees' awareness of problems and rethinking old ways of doing things. Our findings indicate that intellectual stimulation enhances IWB in situations of low fellowship (employees do not feel at ease and perceive a mutually unpleasant atmosphere) and in situations of

low support for innovation in the work group. In contradiction, when innovation climates in work groups are favourable, intellectual stimulation is unrelated with IWB.

For practitioners we conclude that intellectual stimulation makes a difference in unfavourable innovation climates. Here it can help to directly trigger employees' innovative thoughts and by raising innovative expectations. Typical practices include asking employees to evaluate current practices, asking questions about current ways of doing things, make suggestions and stimulating their thoughts and imagination. Where there is an unfavorable climate, a leader could set the tone by creating an open-minded environment in which everyone feels free to challenge current processes, procedures and operations.

For researchers, we again recommend that future work should investigate other variables that can moderate the connection with IWB. Previous work suggests that the impact of intellectual stimulation may be contingent on leaders' approachability. Janssen (2002) empirically demonstrated that transformational leadership and innovative behavior are related when employees perceive their leaders easy to approach. As intellectual stimulation is one particular dimension of transformational leadership, its connection with IWB can also be moderated by approachability, a communication-related personality characteristic of the leader. In this context, Detert and Burris (2007) offer a similar explanation for not finding a relationship between transformational leadership and employees' voice behavior. A transformational leader 'may be seen as egalitarian and empowering (…) or as so dominant and convinced of the rightness of his/her own ideas (…) that others dare not offer their own' (p. 881).

C: Stimulating knowledge diffusion

We found no relationship between stimulating knowledge diffusion and employees' IWB. Also we found no interaction effects. This is remarkable as previous work has suggested and even demonstrated that cross-fertilization with other areas of expertise can be quite helpful to discover innovative opportunities (Perry-Smith, 2006). Before we can conclude that knowledge diffusion is not important, future research should thoroughly evaluate and check our findings in other research contexts.

Proposing a positive connection between stimulating knowledge diffusion and IWB was rooted in social network theory. This theory implies that being exposed to highly diverse and non-redundant others provides better opportunities to innovate. We stress that one particular reason for missing a connection with IWB can be our research context of small firms. Stimulating knowledge diffusion within such firms does not necessarily expose employees with new opportunities and/or sources of innovation. In

this respect Perry-Smith (2006) recently investigated how tie strength with other persons in the organization affects individual creative contributions. Using a sample of 109 research scientists in two laboratories she demonstrated that weak ties (network contacts characterized by infrequent and non-reciprocal interaction and no emotional intensity) related positively with employee creativity; strong ties did not. Yet, our main survey was located in small firms where employees are probably well aware of the knowledge and expertise of their colleagues. Within such organizations most interpersonal relationships are expected to be strong ties. We might obtain a significant connection between stimulating knowledge diffusion and IWB in situations of very diverse work groups or in large firms where individuals have a better chance to extend their intra-organizational networks of weak ties. Future research should investigate this.

D: Providing vision

Our findings indicate that providing an innovation-based vision stimulates innovative work behavior in case of low support for innovation in the work group. A vision provides a direction for activities that employees can develop in their future work. It also sets the limits for employees' innovative activities by providing general guidelines, i.e. innovations should fit the vision to prevent that a too large and diverse number of initiatives emerges. This helps to trigger employees' innovative behavior when they perceive no verbal and enacted support from their colleagues. On the other hand our results also suggest that when work group support for innovation is high, further stressing an innovation-based vision makes no difference. In such circumstances practitioners may rather focus on other behaviors (see hereafter).

For future research there are of course other variables that can moderate the connection between providing vision and IWB. Like intellectual stimulation, providing vision is a dimension of transformational leadership, so we can also expect providing an innovation-based vision to be contingent on leaders' approachability (cf. Janssen, 2002). Another explanation is provided by researchers who investigated the impact of vision on general outcomes such as follower motivation. Results of this work suggest that a positive impact of providing vision (whether it is innovation-based or not) is contingent on follower identification. Shamir, House and Arthur (1993) empirically linked followers' identification with the organization's vision to heightened levels of motivation and better performance. The sense of purpose that a vision of the future inspires acts as a motivating force for those who share the vision (Den Hartog, 2003). In the context of individual innovation, this would mean that just providing an

innovation-based vision may be not enough. It may better or only correlate with IWB if employees personally identify with the vision and are aroused and motivated by it.

E: Consulting

Our findings show that consulting is directly and strongly related to employees' IWB. Besides, it has an even stronger impact in situations of unfavorable innovation climates, that is when perceived minority acceptance and support for innovation in the work group are low.

Implications for practitioners are rather straightforward. Consultation is beneficial to stimulate employees' IWB. This applies even more in situations of unfavorable innovation climates, but also when work group climate favors innovation. Consultation implies that leaders check with their people before initiating changes that may affect them, incorporating their ideas and suggestions in decisions, and encouraging and facilitating their participation in decision-making. Consulting encourages followers to generate ideas and increases their motivation and feelings of being in control to strive to implement these ideas.

Japanese businesses provide an example of how far practitioners can go in consulting employees. Unlike Western leaders, Japanese leaders typically attempt to unify the efforts and ideas of their followers (cf. Imai, 1986). During processes of change Japanese leaders usually involve many people. Together they study every aspect of a new product or service, incorporating important features. Once the process of change is completed it has reached a high level of thoroughness. Although this is a laborious process, the final change is more likely to be implemented, supported, and carried out enthusiastically with fewer errors and delays.

F: Delegating

Our research demonstrates that delegating is also strongly related to employees' IWB. In situations of low support for innovation in the work group, the connection is even stronger. Delegation means that leaders give their employees autonomy to determine independently how to do their jobs or certain tasks. There is little or no delegation if someone must ask his boss what to do whenever there is a problem or something unusual occurs. These are things that all leaders should account for, even if support for innovation in their work group is high.

Thus, recommended leader practices include allowing employees to have substantial responsibility and discretion to carry out work activities, and to make important decisions independently. On the contrary, leaders should refrain from

centralized leadership styles as this will just maintain the status quo and provide employees with less space for innovative activities.

G: Support for innovation

Support for innovation is another behavior that leaders can demonstrate deliberately to stimulate employees' IWB. Our empirical test among knowledge workers demonstrates it is directly connected with IWB, and the connection becomes stronger if employees perceive low innovation support from their colleagues.

Leader support includes a variety of behaviors that show consideration, acceptance, and concern for people who are involved in innovative activities. Typical leader practices are being friendly, patient and helpful whenever employees explore opportunities, come up with ideas, or face problems in the implementation stage. Leader support helps employees to act creatively and generate ideas. In this context, Smith (2002) gave similar recommendations to practitioners. He suggested dos and don'ts for leaders after listening to someone's idea. Supportive replies would be 'I am glad you came up with this' and 'Full steam ahead!'. Discouraging replies would be 'We have not budgeted for that this year' and 'We have done that before and it will not work' (p. 177-178).

H: Organizing feedback

We found that organizing feedback was not related with IWB. No direct connection was found, and interaction effects with innovation climate and external work contacts were insignificant. Despite these findings feedback may still be an important antecedent of IWB. Flaws in our research design have probably caused the insignificant results.

Our motivation to hypothesize a positive relationship between organizing feedback and IWB was that if employees receive behaviorally relevant information on their initial ideas, they can use the feedback to learn, develop, and make improvements to their ideas. Afterwards, we suspect that our measure of organizing feedback should have been operationalized differently. Previous work suggests that it is not just the presence of feedback, but rather how feedback is given that determines its consequences for creativity and innovation. Shalley and Gilson (2004) point out that feedback may be informational or controlling. Controlling feedback has a punitive nature and implies a low tolerance for errors, while informational feedback is supportive, and directed at providing help and developing and improving an idea. Controlling feedback has been demonstrated to have a negative affect on the related construct of employee creativity, while informational feedback has a positive impact

(Zhou, 1998; Shalley & Perry-Smith, 2001). In the context of our research, the fact that knowledge workers perceive that their leader organizes feedback does not determine how or what kind of feedback is given, so our findings probably average the impact of both types of feedback. Had our measure placed more emphasis on the informational component, the results might have been different. This is a clear direction for future research.

I: Recognizing

Recognizing employees' innovative efforts is another important antecedent of individual innovation. Its connection with IWB is positive and significant, becomes stronger in situations of low work group support for innovation, and is still present when work group support is high. This implies that leaders should be aware of the potential impact of how they respond to employees coming up with ideas or trying to implement ideas.

Although most leaders claim to recognize their employees' innovative efforts, current practices often show that most leaders only encourage a few outstanding employees. The innovative efforts of the vast majority of workers usually go unnoticed. Top performers usually receive credits for being innovative while the majority feels left out and uncared for (Smith, 2002). Major forms of recognition include praise (oral compliments), awards (like certificates of achievement, increased autonomy) and ceremonies or public occasions (Yukl, 2002). Such forms of recognition ensure that employees' achievement is acknowledged and becomes visible to others.

J: Rewarding

Providing monetary rewards for innovation is one of the leader behaviors we find to be unrelated with IWB. Interactions with innovation climate and external work contacts were also insignificant. As stated in chapter 3, the connection between monetary rewards and individual innovation is not without debate. Monetary rewards can make individuals perceive that innovation is expected and will pay off, but it can also diminish intrinsic motivation for a task, and as a consequence reduce innovative work behavior. In future research, it is important to explore which of these effects is stronger in practice. From the literature we derived a number of potential moderating variables that can be tested in such research.

The connection between monetary rewards and IWB may be contingent on how employees' perceive these rewards: as controlling or supporting. Bearing in mind that intrinsic motivation enhances innovative behavior, the question is what happens to

employees' intrinsic motivation when monetary rewards – an extrinsic motivator - are introduced. According to Frey and Jegen (2001) external interventions crowd out intrinsic motivation only if individuals perceive them to be controlling. In that case, employees 'work for the money' rather than for their tasks. In contradiction, monetary rewards strengthen intrinsic motivation if individuals perceive them as supportive. This suggests that a positive connection between monetary rewards and IWB is expected when employees perceive rewards as supporting. If they perceive them as controlling, a negative relationship is expected. In fact this may explain why our results here are insignificant; the connection may be a composite effect.

Other potential moderators include job complexity and individuals' cognitive style. Baer and colleagues (2003) empirically explored how monetary rewards are related with employee creativity. They hypothesized that the relation is moderated by job complexity and individuals' cognitive style (adaptive vs. innovative). For people in complex jobs the effect of monetary rewards is hypothesized to be negative. People in relatively complex jobs are expected to experience high intrinsic motivation, and monetary rewards will crowd out this motivation. In contrast, for people in relatively simple jobs monetary rewards are expected to boost creative performance. Extra monetary rewards provide them with new challenges and ways to 'exert personal control' (p.572) and increase their work motivation. Likewise, Baer *et al.* (2003) hypothesize that individuals with a preference for innovations ('innovative style') will not be influenced by monetary rewards as much as those with a preference for operating within given structures and systems without challenging the status quo ('adaptive style'). Drawing on a sample of 171 employees from two manufacturing firms, most of their hypotheses on the role of job complexity and cognitive style were confirmed. We recommend further investigating similar moderating variables in future individual innovation studies.

K: Providing resources

Providing resources for innovation is directly connected with employees' IWB and (again) stronger related when perceived work group support for innovation is low. It simply suggests that leaders should provide time and money to their employees if they want them to innovate and keep it that way. When leaders provide such enacted support employees will be able to implement innovative ideas and keep thinking about innovative opportunities in the future. On the other hand, if leaders refrain from providing resources, employees can never implement their ideas. As a consequence

they will probably feel de-motivated, and likely many other leader behaviors to stimulate individual innovation (like support and recognition) may be less productive.

Famous examples of how resources for innovation can be provided include those of multinational firms, for instance 3M allows its employees to spend 15 percent of their work time on individual innovation projects. Hewlett Packard gives 10 percent, plus continuous access to labs and equipment. Both companies have many examples of important innovations that came out of employees working on undeclared projects, partly in their spare time (Leonard & Swap, 2005).

L: Monitoring

For monitoring we were able to confirm the proposed negative correlation with IWB, Employees' innovative behavior can be devastated when leaders check on effectiveness and efficiency too often, and continuously stress tried and tested routines. Monitoring is not productive for innovative behavior, especially in situations where there is high support for innovation in the work group. Excessive monitoring is often exhibited for typical reasons (for example a need to increase short-term financial performance), but our results confirm that leaders should be aware of how it is connected with innovative behavior.

For future research there are more variables that can moderate the connection between monitoring and IWB. One example is the influence of personalized control. In large firms, Barkema (1995) investigated how the owners of firms could best supervise their managers' performance. One could expect that monitoring results in a diminished performance, but Barkema found that the intensity of the personal relationship between the owner and manager moderated the connection between monitoring and performance. In a very personal relationship (frequent personal visits and discussions) monitoring shifted managers' attention to what their bosses wanted, resulting in decreased intrinsic motivation and bad outcomes. In contrast impersonal relationships (if managers are controlled by some strict performance standards, but have only few contacts with their bosses) correlations between monitoring and performance became positive. In the context of individual innovation, Barkema's finding suggest that the negative connection between monitoring and IWB could be diminished for those employees who maintain very impersonal relationships with their boss. Even in small firms this situation can easily occur, i.e. compare sales representatives who are outside the firm most of their time, and staff working in the office every day.

M: Task assignment

Assigning challenging tasks to employees is found to elicit innovative work behavior. The connection between task assignment and IWB becomes even stronger when employees perceive their colleagues not to strive for excellence.

So, our findings suggest that leaders should realize that their criteria and choices to assign tasks to employees partly determine their motivation to innovate. In order to assign challenging tasks, leaders should first be aware of how their employees perceive their work. They should balance between challenge and employees' levels of competency. If one's level of competency (skill set, mastery, etc.) is appropriately matched to a given challenge, the person generally feels a sense of energy, focus and motivation; intrinsic motivation will enhance creativity and innovation. If, however, the challenge exceeds the level of competency, a person will usually feel stressed. It is also possible for the level of competency to outgrow the challenge and so that boredom sets in.

In all, any package of tasks should be tailor-made. A specific way to increase perceived challenge is job rotation. As employees take their previous experiences with them to new workplaces, ideas and improvements are more likely to result. Southwest Airlines provides an example of how job rotation can be beneficial. All managers at Southwest work at jobs other than their primary jobs four days a year. They may work as a luggage handler, gate agent, flight attendant, or any other position, as long as it is in the front-line. This helps them to learn more about the company, its services and current service quality, resulting in enhanced innovative behavior (Leonard & Swap, 2005).

Innovation climate

One remarkable result of our empirial test is that innovation climate is not directly related to IWB. Of course it is possible that climate is not important for individual innovation, especially when individuals are able to innovate without the help of others. In this context Frese, Teng and Wijnen (1999) argued that employees with sufficient autonomy may just implement their ideas rather than voice them to others. Likewise, a recent meta-analysis suggested that the connection between creative climate and creative output is much weaker at the individual level (Hunter *et al.,* 2007). This suggests that how colleagues respond to individual innovation may not be too important.

On the other hand, there are other reasons to suspect why a direct empirical connection was not established. First, finding no correlation may just be a consequence

of our research context. In knowledge-intensive services groups of employees are usually 'coacting' groups, i.e. there is a low degree of role interdependence among employees (cf. Yukl, 2002). Within their organizations lawyers, computer programmers, consultants and engineers all perform the same type of work, but they do not depend on their colleagues and can work relatively autonomous. In interdependent groups of employees other results could be obtained. This is something that should be explored in future research. In fact the independence of work group members could explain contradictory results in previous work on the connection between climate perceptions and individual innovation (also see our discussion in chapter 4). De Jong and Den Hartog (2005) and Scott and Bruce (1994) found no impact or only a modest impact in samples of knowledge workers and R&D workers, while Axtell *et al.* (2000) found a positive correlation among workers in a manufacturing plant. In this latter study groups of employees are likely to be more dependent of each other in their daily work. In this context, the recent meta-analysis by Hunter and colleagues (2007) found that the connection between creative climate and creative output is weaker in services industries (as compared to manufacturing).

A second reason may be that a positive correlation is masked by the fact that innovative employees have different climate perceptions than their non-innovative colleagues. Janssen (2003) demonstrated that innovative employees generally perceive more conflict and dissatisfaction with their colleagues. Innovative employees meet resistance to change as they challenge established products and processes. This leads to increased conflict and decreased interpersonal satisfaction (p. 356). We propose that conflict and satisfaction could cause unfavorable climate perceptions in the group of innovative employees, thus, climate perceptions of innovative workers are distorted in a different way than perceptions of non-innovative workers. Future research should use control measures for conflict and satisfaction to get a better view of the connection between innovation climate and IWB.

Axtell *et al.* (2000) provide a final possible explanation. They conclude that innovation climate is important only to realize innovative outcomes, that is, in the implementation stage of the innovation process. In more recent work, they refine this conclusion by demonstrating that a positive correlation between innovation climate and idea implementation is most likely when team members are accustomed to each other (Axtell *et al.*, 2006). Their findings suggest that future investigations of innovation climate should try to distinguish between various stages of innovation.

External work contacts

Our results also confirm the importance of external work contacts as a source of innovation at the individual level. In all regression models our measure of external work contacts was positively and significantly related with IWB. Employees who reported having frequent contacts with clients, suppliers, competitors and representatives from knowledge institutes, were consistently rated as being more innovative by their leaders. Apparently, it is tougher to generate ideas and be innovative when one is isolated or surrounded by people from inside. Employees can enrich their pool of ideas and innovative results by being stimulated to go outside, i.e. by having frequent contacts with people and environments that are 'alien'.

8.3 Final remarks, limitations and suggestions

Today many leaders face the challenge of innovating continuously to keep their organizations in business. For this purpose innovative work behavior of employees is important. We investigated what behaviors are beneficial when leaders want to stimulate their employees' innovative behavior. Our research put forward a number of suggestions for practitioners.

In sum, stimulating IWB asks for participation and direct support. These aspects of leadership are more strongly related with IWB when employees perceive low support for innovation in their work group, stressing that innovation-stimulating leadership makes an even bigger difference in unfavorable circumstances. We note that leader behaviors rooted in participative leadership research (consultation, delegation) are stronger related with IWB, while those that stem from transformational leadership (providing vision, intellectual stimulation, innovative role-modeling) are connected only in situations of an unfavorable innovation climate.

The previous paragraph already elaborated on why some leader behaviors were insignificant, suggesting new variables that could moderate the connection between leader behaviors and IWB. Our significant interaction effects demonstrated the usefulness of contingency approaches in studying antecedents of individual innovation. The impact of many leader behaviors proved to be contingent on aspects of innovation climate, suggesting that continued work with other contingency factors can be beneficial.

Except for this plea to investigate other potential moderating variables, there are also general directions for future research. First, we used various theoretical arguments to support our hypotheses on the relationships between leader behaviors, innovation climate, external work contacts and IWB. These included intrinsic motivation,

perceived situation control, role expectations, perceived pay-offs and social network theory. Our empirical studies did not include direct measures for these constructs. Future work should investigate whether these arguments indeed serve as mediators between leadership and individual innovation. Such hypotheses have been tested before (e.g. Zhou & Shalley, 2003) but it is remarkable that previous work did not attempt to model several of these together. It would be interesting to simultaneously investigate if and how constructs like intrinsic motivation, situation control and perceived pay-off mediate the connection between leader behaviors and individual innovation, and to see which ones are most important.

Our research had a general limitation, namely that our surveys were cross-sectional. Any conclusions on the directionality of our results are weakened by the research design. Strictly speaking our results only demonstrate that leader behaviors and employees' IWB are connected, but no causal relationships have been established. Our understanding of how leaders influence their employees' innovative work behavior may move a step further when it is examined with longitudinal data or in experimental settings.

Another important direction is that future studies should test the robustness of our findings by doing research in other contexts. We here focused on knowledge workers. Although this context clearly differs from the bulk of previous research among R&D workers and scientists, there are still many other professions waiting to be explored. Knowledge-intensive services should probably be distinguished from organizations with other ways of pursuing innovation, such as supplier-dominated firms where innovation means nothing more than adopting inventions of suppliers (Pavitt, 1984; De Jong & Marsili, 2006). Examples are retailers, hotels and restaurants, farmers and construction workers. As stated, we suspect that our insignificant findings for stimulating knowledge diffusion and innovation climate may be a consequence of our research context. The same applies to the limited discriminant validity of our IWB measure. These observations make it even more interesting to extend our work to other contexts.

A related recommendation is that most leadership research during the past half-century was done in the United States and Western Europe (Den Hartog & Koopman, 2001). This implies that previous work overlooks the fact that different cultural groups may have different conceptions of what leadership should entail. As Hofstede (1993: p. 81) stated: 'in a global perspective, US management theories contain a number of idiosyncrasies not necessarily shared by management elsewhere'. Following from these different conceptions, the evaluation and meaning of many leader behaviors and

characteristics can strongly vary across cultures. For innovation research, similar arguments are relevant. Cultural values likely influence if and how innovation is enacted and cultivated in different countries (Rank, Pace & Frese, 2004). It stresses that it is important to replicate our research in other cultures.

Annexes

Annex A: Overview of innovation research

Innovation is studied in many academic disciplines, including economics, management, history, sociology, psychology and industrial design. Much of the work done is isolated within these disciplines. There is little exchange of knowledge between them. To shed a light on what innovation research contains, De Jong and Vermeulen (2005) made an inventory of the main research streams in the field. Innovation research can be roughly classified into two dominant approaches: studies that focus on various kinds of innovations (object-based) and studies with a focus on the subjects involved with innovation (subject-based). The key distinction between the two approaches is the unit of analysis. Whereas object-based studies primarily focus on the innovation itself, subject-based studies focus on specific actors who initiate and implement innovations. The principal features studied within each approach are listed, along with their prevailing academic disciplines, in table 18.

table 18. Principal features in innovation research with prevailing academic disciplines

Approach	*Principal features studied*	*Prevailing academic disciplines*
Object	Define innovation	All
	New product development	Industrial Design, Management
	Adoption and diffusion	Management
	Transfer of technology	Economics, History, Sociology
	Innovative business development	Management, Economics
Subject	Countries	Economics, History, Sociology
	Industries	Economics
	Organizations	Management
	Groups	Psychology, Management
	Individuals	Psychology, Management

Source: De Jong & Vermeulen (2005: p. 21).

Define innovation

Attempts to define innovation are found across all academic disciplines. Some decades ago innovation was often regarded as something limited to new objects with a technological component. Innovation was regarded to be similar with R&D-output. For this reason service firms were considered not to be innovative (Johne & Storey, 1998). More recently however, the Community Innovation Survey (the main source of innovation statistics in the European Union) took a broader view by including non-technological indicators (OECD, 2005).

Among many other subjects important research in this field focuses on identifying different types of innovations. Traditional innovation studies distinguish between product and process innovation only (Tidd *et al.*, 2001). Another important feature is the scope of the innovation: new to the world, the sector, a scientific community, a market, or just the firm (Garcia & Calantone, 2002). More recently types of innovation have been based on their consequences for firms' technological and market capabilities (Abernathy & Clark, 1985), component and architectural knowledge (Henderson & Clark, 1990), the impact of disruptive technological changes (Christensen, 1997), consequences for a firm's suppliers, customers and other stakeholders (Porter, 1985) or preferences of the top management (Hambrick & Mason, 1984). Such classifications are used to explain what kinds of firms are most likely to innovate: small new entrants or large-sized incumbents (for a detailed discussion see Afuah, 2003).

New product development

New product development (NPD) literature basically deals with how new products are developed and explores its success factors (Brown & Eisenhardt, 1995). Industrial designers and management scientists publish profusely in this line of research. Factors that contribute to the success of new products (and also services) include characteristics of the product, firm, market and innovation process. These determinants are documented extensively for both products (Cooper, 2003) and services (De Brentani, 2001). This part of the literature has been criticized for being overly simplistic and for a lack of theoretical foundations. Success factor studies are regarded as 'fishing expeditions with too many variables and inadequate methodology using single sources of data' (Brown & Eisenhardt, 1995).

Models of innovation are proposed to provide those who are responsible for new product development with some idea of the activities that should be performed. In general, most innovation researchers use activity-stage models to describe the process of innovation, depicting the process as a number of sequential activities (King & Anderson, 2002). NPD models may cover various steps (like idea development, screening, planning, testing, commercializing), but what they all have in common is a distinction between a divergent, creative phase and convergent, implementation-oriented phase that is separated by the decision to implement an idea. A critique is that research evidence so far raises serious doubts as to whether NPD processes indeed pass through discrete stages. For these reasons alternative models have been proposed that better account for the interactive and reciprocal nature of the innovation process (Buijs, 2003). Yet, these models still point to some major tasks that should be performed.

Recently, attempts have been made to develop similar models for new service development (NSD). Because services tend to be intangible, simultaneously produced and consumed, and heterogeneous, it is commonly accepted that the essential activities of NSD would be dissimilar. Although the determinants of successful NSD are reasonably well covered, research into models of NSD is still in a nascent phase (Johne & Storey, 1998).

Adoption and diffusion

The adoption process begins where the innovation process ends. Examples include the adoption of new products by customers, the application of new work methods by employees, the execution of environmental regulations by firms or the acceptance of trade agreements by countries. Innovations need to be accepted, adopted and applied by their proposed users in order to be successful. Given the high failure rate of innovations, this may be seen as a difficult task (Cooper, 2003). After innovations have been adopted and implemented by single users, widespread diffusion takes place. Diffusion refers to the spread of innovations through populations of potential adopters (Rogers, 1983). The main objective of this type of research is to explain or predict patterns of diffusion over time. There are several key factors that affect diffusion: characteristics of the adopter, the social network of the adopter, innovation attributes, environmental characteristics, communication processes and characteristics of those launching the innovation (Wolfe, 1994).

Some major examples of adoption and diffusion research are found in management and marketing literature. Rogers (1983), for example, distinguishes between five stages of adoption: awareness – interest – evaluation – trial – adoption. He stresses that those adopting an innovation may differ in the degree to which they are ahead of others in the social system. 'Innovators' and 'early adopters' are most willing to try something new, while 'laggards' are mostly tradition bound and suspicious of change. The management of change literature adds some reasons why adopting units (individuals, groups, etc.) are unwilling to accept change (Jones, 2004). Any renewal can bring along insecurity, uncertainty and stress. Additionally, cognitive biases may be of influence, especially when the adopting unit consists of groups or individuals.

Transfer of technology

Literature on technology transfer deals with the classification, antecedents and consequences of technological change. Technology transfer can be defined as the movement of know-how, technical knowledge or technology from one setting to

another (Bozeman, 2000). Historians contributed to this field with studies of the nature of technological change (Cardwell, 1994). Sociologists examined the impact of technologies on social behaviors (for instance Ellul, 1964), the problems associated with social control of technology (Bijker, Hughes & Pinch, 1987) and technology assessment (De Hoe, Smits & Petrella, 1987).

Economic research focuses mainly on technology policy paradigms and the determinants of effective technology transfer (Bozeman, 2000). In technology policy, three competing paradigms are identified. The market failure paradigm assumes that free markets serve as the most efficient allocator of technological knowledge. There may, however, be a role for government in science and technology policy in order to remove barriers to the free market. The mission paradigm pleads for an active involvement by arguing that governments should perform R&D in ground-breaking technologies (including biotechnology, nano-technology and IT). The cooperative paradigm postulates that various actors should cooperate in technology development and transfer. This paradigm implies that governments should first and foremost stimulate the interaction between innovating actors (firms, knowledge institutes, schools, etc.).

Economic research dealing with the effectiveness of technology transfer can be descriptive or postulate criteria for effectiveness (Bozeman, 2000). Descriptive studies include those that take a dynamic view by following the evolution of technologies during their lifecycle. Technologies can be regarded as having a life of their own with radical and incremental phases. Some models describe how, after a period of rapid technological development, a dominant design of a technology emerges. Eventually the dominant design will fade or disappear rapidly when a ground breaking new technology is introduced (Abernathy & Utterback, 1978).

Innovative business development

Innovative business development is a subject of increased attention from economic and management scientists. Until the early 1980s, small firms were mainly seen as the remnants of an earlier, primitive mode of production that would, over time, be replaced by modern large companies. Nowadays, the economic viability of small-scale production and its ability to contribute to innovation is no longer questioned (Audretsch, 1998). Particular strong interest has been developed in new technology based firms (NTBFs), operating mainly in the field of emerging high-potential technologies like IT and biotechnology. NTBFs distinguish themselves from most regular firms by carrying out in-house research activities (Bürgel & Murray, 2000).

Yet, innovation processes in such firms are regarded to be fundamentally different from similar processes in large firms. Main obstacles include the recruitment of highly educated staff, funding problems due to the risk-bearing nature of their activities, and the balance between research and commercialization (Oakey & Mukhtar, 1999).

An huge amount of research provides detailed information about the innovative performance of NTBFs and their success factors, including internal sources (characteristics of the entrepreneur, quality of human capital, research and training efforts) and external sources (like the frequency of interaction with suppliers, customers, competitors, universities, government agencies, etc.) (Oakey & Mukhtar, 1999). A drawback is that although there are many case studies, quantitative evidence is still scarce.

Other topics in this stream include the type of entrepreneurship within or originating from established firms. A special form of NTBF is seen in spin-off firms. These are innovative start-ups founded with the support of some kind of parent organization (multinational, large firm or university) to commercialize technological knowledge (Braaksma & De Jong, 2005). Another type is a new business with support from incubators. In this case, NTBFs receive support from a public or private support organization that may be financed by a venture capitalist, government or knowledge institute.

Country level

Within the subject approach, the most abstract level of research relates to the exploration and benchmarking of the innovativeness of countries, and the investigation of the impact of innovation on economic development. This field attracts the interest of scientists from historical and economic communities in particular. Historians have compared the evolution of innovation in different societies (Needham, 1969). Such studies usually take a broad perspective with a focus on historical, economic and socio-cultural differences between countries and their respective effect on innovation.

Economists are first and foremost concerned with the measurement of innovation. Their research is mainly focused on measuring inputs and outputs of innovation by collecting comprehensive and standardized statistics (Clark & Guy, 1998). Measures such as R&D expenditure, patent counts and university graduates are used to describe innovation across nations. In the European Union, the Community Innovation Survey (CIS) is the main source of these data. After criticism that current indicators do not adequately capture innovation, the most recent version of its manual made a shift from

the traditional input-output models towards a more holistic approach to measure innovation (OECD, 2005).

Other economic studies on this level deal with the relationship between innovation and economic growth (Mulder, de Groot & Hofkes, 2001), the relationship between innovation and employment (Freeman, Clark and Soete, 1982), economic analyses of the process of innovation at a 'human society' level (Stoneman, 1983) and descriptions of so-called national innovation systems, capturing all actors that play a role in the development of innovations in an economic system (Nelson, 1992). Many studies at national level also explore policy measures to stimulate innovation. Their recommendations relate to the supply of technologies, stimulating demand for technologies and improving information flows through networks (Clark & Guy, 1998).

Industry level

In this domain industrial economics is the prevailing academic discipline and this research first and foremost explores the interaction between industry-level factors and the innovative activities within particular industries. Examples of such factors are market structures (Scherer, 1965), customer preferences (Schmookler, 1966), concentration of firms (Malerba & Orsenigo, 1996) and technological regimes (Dosi, 1988).

One important stream of research deals with patterns of innovation across industries. Research provides taxonomies of the innovative behavior of firms and helps practitioners to shape policy decisions and firm strategies. In his pioneering article, Pavitt (1984) proposed a taxonomy that distinguishes different categories of industries based on the structural characteristics of their firms, organization of innovative activities and sources of knowledge. Focusing on manufacturing industries he came up with four groups: science-based (e.g. electrical/electronics and chemicals), specialized suppliers (non-electrical machinery and instruments), supplier dominated (paper and textiles) and scale intensive firms (vehicles and metals). The Pavitt taxonomy has been refined to the services sector and also to include small firms (De Jong & Marsili, 2006).

Other studies compare the presence, determinants and effects of innovation across industries (e.g. Da Silveira, 2001) or focus on a specified group of firms such as SMEs (Acs & Audretsch, 1990). Differences between industries are seldom investigated, since most researchers have no options that allow the inclusion of a wide range of industries in their samples (Hoffman, Parejo, Bessant & Perren, 1998). Usually the focus is on a single sector, implying that results cannot be generalized.

Organizational level

The bulk of innovation research focuses on the organizational level. Such research has resulted in a plethora of innovation studies covering the design of innovative organizations. Factors related to strategy, organizational structure, culture, leadership, resources and external contacts have been well documented as drivers of innovation success (Damanpour, 1991; Wolfe, 1994; Nonaka & Takeuchi, 1995). Some of the many topics included are the management of innovative personnel and reward systems (Katz, 1997), the effectiveness of means of integrating innovation into the organization's strategy (Kantrow, 1980), tools for analyzing and formulating innovation strategies (Goodman & Lawless, 1994) and the access of firms to resources such as finances and network activities (Freel, 2003).

A trend in the past decade was that network-based research received increased attention (Clark & Guy, 1998; Hoang & Antoncic, 2003). Collaboration between firms is increasingly necessary due to increased technological complexity. Many firms do not have sufficient organizational resources or capabilities to develop these complex innovations themselves. Therefore, they seek collaboration with other parties. Network research has focused on three essential components of networks: the content of the relationship with network partners, the governance of these relationships, and the patterns that emerge from crosscutting ties between partners (Hoang & Antoncic, 2003).

Group level

Organizations increasingly arrange their work in groups with shared responsibilities for specific targets. The analysis of innovation at the group level is a relatively unexplored phenomenon that goes back only fifteen years (West & Farr, 1990). This field is crowded with psychologists and management scientists that focus on the joint behavior of those that develop innovations (usually employees within firms). In their eyes, innovation is certainly not limited to new products or technologies. It may include any goal-oriented change. Group level innovation studies focus on antecedent variables that play an important role in creating an innovative work climate, such as setting challenging goals, using adequate control techniques, providing sufficient financial resources and using positive feedback mechanisms (West & Altink, 1996).

Other studies focus on those individuals that play an important role in enabling group innovation. Support from top management, the presence of champions (those who can convince stakeholders to provide time, support and resources), commitment of group members and feelings of ownership are important issues studied in this type of

research (West & Altink, 1996; McDonough, 2000). Brown and Eisenhardt (1995) explicitly draw attention to communication problems that may arise between group members working on a particular task. People with different functional backgrounds may find themselves locked in a situation in which a lack of mutual understanding impedes successful innovation.

Individual level

The most detailed level of innovation research is the level of individuals. Psychologists make the most significant contributions in this field. By far most of their research deals with creativity, defined as the generation of new ideas (Amabile, 1988). Creativity research regards individuals as the fundament of any organization (Mumford, 2000; McAdam & McClelland, 2002). This body of research has been split into several areas, including the characteristics of creative people and stimulants of individual creativity (McAdam & McClelland, 2002).

Traits of creative individuals are often discussed in early research on creativity (Gough, 1979). Researchers tried to isolate personality characteristics of creative people in order to understand why they were creative. These traits included, for example, a desire for autonomy and social independence, tolerance for ambiguity and a propensity for risk taking. Major enablers of individual creativity are goals and expectations for creative activity, positive evaluation, feedback and leadership (Zhou & Shalley, 2003). More recently, situational influences have been taken into account more explicitly, stressing broader organizational and institutional forces that may affect creative behavior (Mumford, 2003).

A broad scope is employed by those who (also) focus on the application of ideas. This includes the investigation of constructs like proactive work behavior (Crant, 2000), taking charge (Morrison & Phelps, 1999), voice (Van Dyne & LePine, 1998) and also innovative work behavior (Janssen, 2000).

Annex B: Overview of leadership research

Prior to the 1980s the main approaches to leadership were the trait, style and contingency approach. Several alternative ways to conceptualize and study leadership have been proposed from the early 1980s onward. Most influential has been the research into transformational leadership. This research pays attention to the role of vision and charisma in influencing followers and can be thought of as the flag-bearer of the new leadership approach. Various alternative ways of looking at leadership have also been developed beyond the main trends. Approaches and trends in leadership research have been listed and discussed by Den Hartog and Koopman (2001) and Yukl (2002). Below we elaborate on the following approaches to studying leadership:

- Trait approach
- Style approach
- Contingency approach
- New leadership approach
- Other approaches and trends in leadership research

Trait approach

Early research into leadership emphasized personal characteristics of leaders. The implicit idea was that leaders are born rather than made. The focus was on identifying and measuring traits that distinguished leaders from non-leaders. Three main categories of personal characteristics were included in the search for relevant traits. First, physical features like height, physique, appearance and age were studied. Second, research included ability characteristics such as intelligence, knowledge and fluency of speech. And third, personality traits like dominance, emotional control, expressiveness and extraversion were investigated (Bryman, 1992).

Research up to 1950 failed to yield a consistent picture of leader traits, causing a slowdown in this area. After about 25 years the interest in traits possessed by leaders revived. After reviewing 163 studies that had been reported between 1949 and 1970, Stogdill (1974) showed that, contrary to what had been concluded from earlier reviews, various universal personal traits and skills were indeed associated with leadership. Other studies also showed that traits or personal characteristics do indeed play a more significant role in leadership than was concluded earlier. For example, Kirkpatrick and Locke's (1991) review suggests that drive, a desire to lead, honesty and integrity, self-

confidence, cognitive ability and knowledge of the business are personal characteristics that distinguish leaders from non-leaders. Other traits predicting effective leadership include a high energy level and stress tolerance, an internal locus-of-control orientation, emotional maturity and a low need for affiliation (Yukl, 2002). The type of 'traits' under consideration in the 'reviving' trait approach differ from those in earlier studies. Bryman (1992) warned that there was a danger that the term 'trait' would become so wide that would it apply to any variable on which leaders and non-leaders differ, even certain behavioral patterns such as those discussed below.

Disillusionment followed the lack of empirical evidence for the existence of a uniform profile in the early years of trait research. This led to a new emphasis in leadership research, the style approach.

Style approach

The second major trend in researching leadership emphasized leader behavior. In this approach effectiveness of leaders depends on the leadership style exerted. Whereas the trait approach focused on stable personal characteristics, which were usually thought to be largely innate (implying the importance of the selection of effective leaders), the style approach implied that leadership is a behavioral pattern, which can be learned. Thus, according to this approach, once the 'right' style had been discovered, people could be trained to exhibit the desired behavior and become better leaders (Den Hartog & Koopman, 2001).

Most influential in this period was probably the series of questionnaire-based Ohio State studies. The Ohio State researchers concluded that leadership style could be best described as varying along two dimensions, i.e. 'consideration' and 'initiating structure' (Fleishman & Harris, 1962). A second major research program concerning leader behavior in this period was carried out at the University of Michigan. The results of these studies (summarized by Likert, 1967) show that they found three types of leader behavior differentiating between effective and ineffective managers: task-oriented behavior (similar to initiating structure), relationship-oriented behavior (very similar to consideration) and participative leadership. Style researchers often proposed 'universal' theories of effective leader behavior. In other words, theories predicted that a certain way of leading would (nearly) always be effective. For instance, the most effective leaders were sometimes proposed to be both highly relationship- and task-oriented, 'high-high' leaders (Blake & Mouton, 1982). Other prominent universal theories were based on the idea that leaders who make extensive use of participative decision procedures are more effective than other leaders (Likert, 1967).

There have been many criticisms of the style approach. Included among the criticisms are the inconsistent findings and measurement problems, informal leadership, the problem of the group, the problem of causality and, most pressing, the lack of situational analysis (Bryman, 1992). Korman (1966) showed that the magnitude and direction of correlations between leadership styles and outcomes were highly variable and divergent. Identified measurement problems included contamination by employees' implicit theories of leadership (assumptions about what makes a person an effective leader). Assumed causality was a problem in the early studies, but this also applies to trait studies. Many studies were cross-sectional, meaning that the notion that leadership style constitutes the independent rather than the dependent variable is an assumption instead of a conclusion based on investigation of this view. It has been shown that causality can run both ways (Bryman, 1992).

The failure of the style approach to pay attention to situational characteristics that act as possible moderators of the relationship between leadership and outcomes is its most serious problem (Den Hartog & Koopman, 2001). It is now widely recognized that there is no 'one-best-way' of guiding followers. Possible moderators include task and personality characteristics, but environmental factors or organizational culture could also influence the shape or form of the relationship between leadership style and outcomes. Attempts to address this situational issue led to the next main trend, contingency approaches to study leadership.

Contingency approach

Many contingency approaches can be considered as an attempt to repair what researchers saw as the deficiencies of the approaches previously mentioned. The main proposition in contingency approaches is that the effectiveness of a given leadership style is contingent on the situation, implying that leader behaviors may be effective in some situations but not in others (Den Hartog & Koopman, 2001).

The earliest contingency theory of leader effectiveness was Fiedler´s theory (1967). Fiedler is well known but heavily criticized for his 'least-preferred-co-worker' (LPC) measure. The basis assumption is that a leader's description of the person with whom he has the greatest difficulty working reflects a basic leadership style. A second assumption is that the basic leadership style that contributes most to group performance varies with the situation. Fiedler (1967) included leader member relations, position power and task structure as contingencies of effective leadership.

Hersey and Blanchard's (1969) situational leadership theory (SLT) has been a popular basis for leadership training for many years. Originally SLT proposes that

leaders should attune their behavior to fit the ‘maturity’ or, in later writing, the ‘development level’ of a group of followers as a whole as well as its individual members. Combining high or low task and relationship behavior creates four different leadership styles: telling (high task, low relations), selling (high, high), participating (low task, high relations) and delegating (low, low). These styles are to some extent appropriate for different types of team members. For team members who are, for instance, low on willingness and ability a ‘telling’ style is appropriate (Den Hartog & Koopman, 2001).

Another example of a contingency theory focuses on criteria to determine whether or not leaders should involve employees in different kinds of decision-making (Vroom & Yetton, 1973). In their normative decision-making model, Vroom and Yetton try to indicate which decision procedure will be most effective in specific situations. They distinguish between various decision procedures, ranging from autocratic (the leader decides without asking others for input such as opinions or suggestions) to a joint decision (the leader shares the problem with his employees and the solution reflects agreement in the group). The effectiveness of decision procedures depends on various aspects of the situation, including the amount of relevant information held by the leader, the likelihood that employees will accept an autocratic decision and the extent to which the decision problem is unstructured. Vroom and Yetton´s model provides a set of rules that help to identify whether a decision procedure in a given situation is appropriate. Empirical support for this model is generally found to be adequate, but a drawback is that it deals with only a small part of the domain of leadership (Yukl, 2002).

New leadership approach

From the 1980s onward a renewed interest in the concept of leadership itself arose in both scientific and professional fields. At the time studying leader behavior used to focus on how leaders facilitate group maintenance and what they had to do to ensure task accomplishment. Both task- and relationship-oriented behaviors are indeed important for effective leadership. However, there was another important leadership function that was not studied as often before the 1980s, namely providing a vision or overarching goal. This sense of direction, of knowing where one is going, helps leaders integrate and align their followers’ efforts (Den Hartog & Koopman, 2001).

Bryman (1992) refers to this paradigm as ‘the new leadership’ approach. Terms used to describe these ‘new leaders’ include: transformational, charismatic, transforming, inspirational, visionary, or value-based. Despite the broad array of terms

used by different authors there seem to be more similarities than differences between their views of the phenomenon of leadership (Den Hartog & Koopman, 2001). The theories attempt to explain how certain leaders are able to achieve extraordinary levels of followers' motivation, admiration, commitment, respect, trust, dedication, loyalty and performance, as well as outstanding organizational accomplishments like the founding and expansion of successful new businesses or corporate turnarounds.

In literature the term 'transformational' leadership is most often used to refer to the new type of leadership. The rise of transformational leadership is attributed largely to Bass and his colleagues (Bass 1985; Hater & Bass, 1988; Yammarino & Bass, 1990). They regard transformational leadership as a new paradigm, neither replacing nor explained by other models such as the relations-oriented-task-oriented leadership model. It is often compared and sometimes opposed to 'transactional' leadership.

Transactional leadership captures many leadership theories that were developed before the 1980s. Transactional leadership is founded on the idea that leader-follower relations are based on a series of exchanges or implicit bargains between leaders and followers (Burns, 1978). Followers receive certain valued outcomes (like wages or prestige) when they act in line with the leader's wishes. According to Burns the exchange can be economic, political, or psychological in nature. Bass (1985) notes that in organizational research leadership has generally been conceptualized as such a cost-benefit exchange process. House *et al.* (1988) hold that the general notion in these theories is that when the job and the environment of the follower fail to provide the necessary motivation, direction, and satisfaction, the leader, through his or her behavior, will be effective in compensating for the deficiencies. The leader clarifies the performance criteria, in other words what he expects from his employees, and what they receive in return.

Transformational leadership goes beyond the cost-benefit exchange of transactional leadership by motivating and inspiring followers to perform beyond expectations (Bass, 1985). Transformational leadership theories predict followers' emotional attachment to the organization and the emotional and motivational arousal of followers as a consequence of the leader's behavior (House *et al.*, 1988). Hater and Bass state: 'The dynamics of transformational leadership involve strong personal identification with the leader, joining in a shared vision of the future or going beyond the self-interest exchange of rewards for compliance' (1988: p. 695). Transformational leaders broaden and elevate the interests of followers, generate awareness and acceptance among followers about the objectives and mission of the group, and motivate followers to go beyond their own self-interest for the good of the group.

Bass (1985) defines both transactional and transformational leadership as comprising several dimensions. Transactional leadership is generally proposed to consist of 'contingent reward' (leaders reward followers for attaining pre-specified performance levels) and 'management by exception' (leader take action only when things go wrong and standards are not met). Transformational leadership is operationalized in four dimensions, including 'charisma' (providing vision, instilling pride and increasing optimism), 'inspiration' (acting as a model for subordinates and communicating the vision), 'individual consideration' (coaching and mentoring, providing continuous feedback, and linking subordinates' needs to the organization's mission) and 'intellectual stimulation' (providing and eliciting challenging new ideas to stimulate rethinking old ways of doing things) (Den Hartog, 1997). As for the first dimension of charisma, there is also an impressive stream of literature that makes charismatic leadership the heart of the matter. Max Weber's (1947) early charisma concept included an exceptional leader, a (crisis) situation, the leader's vision or mission presenting a solution to the crisis, followers who were attracted to the leader and the vision, and validation of the charismatic qualities of the leader through repeated success. Academic discussion focuses on the extent to which charisma can be influenced by what leaders do and by their past performance. Others distinguish between various types of charisma, for instance personalized and socialized charismatic leaders (Den Hartog & Koopman, 2001).

Among the observed effects of transformational and charismatic leadership we find enhanced perceptions of leader effectiveness, satisfaction with the leader, trust in the leader, trust in management and colleagues, organizational commitment, business unit performance, subordinate/work group performance and organizational citizenship behaviors. The dark side of charismatic leadership however may include poor interpersonal relationships, negative consequences of impression management, poor administrative practices, negative consequences of self-confidence, and failure to plan for succession (Den Hartog & Koopman, 2001).

Other approaches and trends in leadership research

In the past twenty years, not all work on leadership can be classified as new leadership. The general dissatisfaction and pessimism that arose from inconsistent research findings on contingency models stimulated researchers to search for other remedies to revive leadership theory as well. Here we discuss the power-influence approach and LMX theory.

Power-influence research examines influence processes between leaders and other people. For instance, Yukl and his colleagues looked at influence tactics that leaders could use (Kipnis, Schmidt & Wilkinson, 1980; Yukl & Tracey, 1992). Leaders could attempt to get things done by using various tactics, such as pressure (threats, requests, persistent reminders or frequent checks to influence an employee in a desired direction) or consultation (a leader asks for the participation of a subordinate in planning a strategy, activity or change that requires target support and assistance). The use of different influence tactics is compared in terms of their relative effectiveness for getting people to do what the leader wants.

Leader-Member Exchange (LMX) theory focuses on the dyadic social exchange between leader and subordinate. For a long time researchers in the leadership field tended to use group average scores rather than individual perceptions as indications for leadership style. However, the past fifteen years have increasingly witnessed studies differentiating between various employees. This means treating individual followers and their relationship with the leader as interchangeable. The various exchanges that leaders can develop with different individual subordinates is the focus of the work of Graen and colleagues (Graen & Cashman, 1975; Graen & Scandura, 1987; Graen & Uhl-Bien, 1995). They define social exchange relationships as a set of mutually influencing transactions. Social exchanges can be described in terms of three stages: 1. initial testing, including evaluations of motive, attitude, resources, role expectations; 2. development of mutual trust, loyalty, and respect; 3. development of mutual commitment to organizational goals. It has been argued that one of the most important initial aspects of the exchange relationship is subordinate performance in response to a series of requests from the supervisor. Reactions to such requests can then influence and anchor the leader's perceptions of trustworthiness and loyalty (Yukl, 2002).

Annex C: Yukl's taxonomy of managerial practices

Planning and Organizing: Determining long-term objectives and strategies, allocating resources according to priorities, determining how to use personnel and resources to accomplish a task efficiently, and determining how to improve coordination, productivity, and the effectiveness of the organizational unit.

Problem Solving: Identifying work-related problems, analyzing problems in a timely but systematic manner to identify causes and find solutions, and acting decisively to implement solutions to resolve important problems or crises.

Clarifying Roles and Objectives: Assigning tasks, providing direction about how to do the work, and communicating a clear understanding of job responsibilities, task objectives, deadlines, and performance expectations.

Informing: Disseminating relevant information to people who need it to do their work, providing written materials and documents, and answering requests for technical information.

Monitoring: Gathering information about work activities and external conditions affecting the work, checking on the progress and quality of the work, evaluating the performance of individuals and the organizational unit, analyzing trends, and forecasting external events.

Motivating and Inspiring: Using influence techniques that appeal to emotion or logic to generate enthusiasm for the work, commitment to task objectives, and compliance with requests for cooperation, assistance, support, or resources; and setting an example of appropriate behavior.

Consulting: Checking with people before making changes that affect them, encouraging suggestions for improvement, inviting participation in decision making, and incorporating the ideas and suggestions of others in decisions.

Delegating: Allowing subordinates to have substantial responsibility and discretion in carrying out work activities, handling problems, and making important decisions.

Supporting: Acting in a friendly and considerate way, being patient and helpful, showing sympathy and support when someone is upset or anxious, listening to complaints and problems, and taking care of someone's interests.

Developing and Mentoring: Providing coaching and helpful career advice and doing things to facilitate a person's skill acquisition, professional development, and career advancement.

Managing Conflict and Team Building: Facilitating the constructive resolution of conflict, and encouraging cooperation, teamwork, and identification with the work unit.

Networking: Socializing informally, developing contacts with people who are a source of information and support, and maintaining contacts through periodic interaction, including visits, telephone calls, correspondence, and attendance at meetings and social events.

Recognizing: Providing praise and recognition for effective performance, significant achievements, and special contributions; and expressing appreciation for someone's contributions and special efforts.

Rewarding: Providing or recommending tangible rewards, such as a pay increase or promotion for effective performance, significant achievements, and demonstrated competence.

Source: Yukl (2002: p. 64).

Annex D: Questionnaires pilot study

Leader survey

Leiderschap & innovatief gedrag – vragenlijst leidinggevende

Afdeling/business unit: [.....]
Code: [.....] *(bedrijfscode niet verwijderen svp)*

Vooraf

- In deze vragenlijst geeft u een oordeel over het innovatieve gedrag van uw medewerkers.
- Het invullen neemt 10 à 15 minuten in beslag. Denk bij het geven van antwoorden niet te lang na. Uw eerste ingeving is de beste.
- De informatie in deze vragenlijst is *strikt vertrouwelijk*. We verwerken uw antwoorden in een geanonimiseerd databestand waarin gegevens over individuele personen niet te herleiden zijn. Andere personen of instanties krijgen onder geen beding inzage in uw antwoorden of gegevens.
- Wij danken u hartelijk voor uw medewerking!

LB. Innovatief gedrag van medewerkers
Hoe innovatief vindt u uw medewerkers? De volgende vragen gaan over de door u geselecteerde medewerkers.

Medewerker: [.....] Code: [.....] Afdeling/BV: [.....]

	Item: Hoe vaak komt het voor dat *deze medewerker* …	nooit	zelden	soms	regel-matig	(bijna) altijd
1	... aandacht besteedt aan zaken die niet tot zijn/haar directe taak behoren?	❑	❑	❑	❑	❑
2	... zoekt naar mogelijkheden om dingen te verbeteren?	❑	❑	❑	❑	❑
3	... nadenkt over mogelijkheden om te vernieuwen?	❑	❑	❑	❑	❑
4	... zich openlijk afvraagt hoe dingen beter zouden kunnen?	❑	❑	❑	❑	❑
5	... zoekt naar mogelijkheden voor nieuwe producten of diensten?	❑	❑	❑	❑	❑
6	... nieuwe werkwijzen, technieken of instrumenten voorstelt?	❑	❑	❑	❑	❑
7	... originele oplossingen bedenkt?	❑	❑	❑	❑	❑
8	... met ideeën komt?	❑	❑	❑	❑	❑
9	... nieuwe benaderingen bedenkt voor de uitvoering van taken?	❑	❑	❑	❑	❑
10	... steun mobiliseert voor vernieuwingen?	❑	❑	❑	❑	❑
11	... bijval oogst voor vernieuwende ideeën?	❑	❑	❑	❑	❑
12	... sleutelfiguren enthousiast maakt voor vernieuwingen?	❑	❑	❑	❑	❑
13	... mensen over de streep probeert te trekken om vernieuwingen te steunen?	❑	❑	❑	❑	❑
14	... ideeën uitwerkt tot concrete resultaten?	❑	❑	❑	❑	❑
15	... vernieuwingen planmatig invoert?	❑	❑	❑	❑	❑
16	... een bijdrage levert aan de invoering van vernieuwingen?	❑	❑	❑	❑	❑
17	... zich inspant om vernieuwingen gerealiseerd te krijgen?	❑	❑	❑	❑	❑

(Innovative work behavior was rated similarly for other employees in the sample)

Leiderschap & innovatief gedrag – vragenlijst medewerker

Afdeling/Business Unit: [.....]
Naam: [.....]
Code: [.....]

Vooraf

- Deze vragenlijst bestaat uit zes delen: suggesties voor vernieuwing en verandering (blok A), je bijdrage aan de implementatie daarvan (blok B), houding leidinggevende (blok C), aansturing leidinggevende (blok D), werkklimaat (blok E) en externe contacten (blok F).
- Het invullen neemt 10 à 15 minuten in beslag. Denk bij het geven van antwoorden niet te lang na. Je eerste ingeving is de beste. Als je een antwoord niet weet of geen mening hebt, vul dan niets in.
- Wij danken je hartelijk voor je medewerking!

A. Suggesties

	Hoe vaak doe je in uw werk suggesties om … *(kruis aan)*	nooit	zelden	soms	regel-matig	(vrijwel) altijd
1	... bestaande producten of diensten te verbeteren?	❑	❑	❑	❑	❑
2	... nieuwe producten of diensten te ontwikkelen?	❑	❑	❑	❑	❑
3	... werkmethoden te verbeteren?	❑	❑	❑	❑	❑
4	... nieuwe klantgroepen te werven?	❑	❑	❑	❑	❑
5	... het werk anders te organiseren?	❑	❑	❑	❑	❑
6	... nieuwe kennis op te doen?	❑	❑	❑	❑	❑

B. Je bijdrage aan implementatie van vernieuwing/verandering

	En hoe vaak draag je in je werk actief bij aan...	nooit	zelden	soms	regel-matig	(vrijwel) altijd
1	... de verbetering van bestaande producten of diensten?	❑	❑	❑	❑	❑
2	... de ontwikkeling van nieuwe producten of diensten?	❑	❑	❑	❑	❑
3	... de verbetering van werkmethoden?	❑	❑	❑	❑	❑
4	... de werving van nieuwe klantgroepen?	❑	❑	❑	❑	❑
5	... veranderingen in de organisatie van het werk?	❑	❑	❑	❑	❑
6	... het opdoen van nieuwe kennis?	❑	❑	❑	❑	❑

C. Leidinggevende

Hoe gaat je leidinggevende naar jouw mening om met vernieuwing en verandering? Geef aan in welke mate je het eens bent met de volgende stellingen.

	Mijn leidinggevende... *(kruis aan)*	helemaal oneens	mee oneens	niet mee eens of oneens	mee eens	helemaal eens
1	... zoekt naar mogelijkheden om zaken te verbeteren of te veranderen.	❑	❑	❑	❑	❑
2	... vraagt zich openlijk af hoe dingen beter zouden kunnen.	❑	❑	❑	❑	❑
3	... experimenteert met nieuwe manieren om dingen te doen.	❑	❑	❑	❑	❑
4	... stelt nieuwe werkwijzen, technieken of instrumenten voor	❑	❑	❑	❑	❑
5	... overtuigt anderen van de toegevoegde waarde van een	❑	❑	❑	❑	❑

	vernieuwend idee.					
6	... zorgt voor vernieuwing van onze producten, diensten en werkmethoden.	❑	❑	❑	❑	❑
7	... is innovatief.	❑	❑	❑	❑	❑
8	... daagt mij uit om problemen op een andere manier te bekijken.	❑	❑	❑	❑	❑
9	... heeft ideeën die mij dwongen zaken, die ik nooit eerder betwijfeld had, opnieuw te overdenken.	❑	❑	❑	❑	❑
10	... laat mij nadenken over de manier waarop ik mijn werk doe.	❑	❑	❑	❑	❑
11	... heeft ideeën waardoor ik mijn manier van werken opnieuw overweeg.	❑	❑	❑	❑	❑
12	... vraagt me om te helpen bij het oplossen van problemen.	❑	❑	❑	❑	❑
13	... stimuleert mij om de kwaliteit van eigen werk te beoordelen.	❑	❑	❑	❑	❑
14	... verwacht dat ik verder kijk dan alleen mijn eigen werk.	❑	❑	❑	❑	❑
15	... draagt een visie uit over de waarde van innovatie in mijn BV.	❑	❑	❑	❑	❑
16	... schetst een opwindend beeld van wat vernieuwing ons kan brengen.	❑	❑	❑	❑	❑
17	... communiceert een uitdagende visie over vernieuwing in mijn BV.	❑	❑	❑	❑	❑
18	... maakt duidelijk waar wij als BV naar toe zouden moeten.	❑	❑	❑	❑	❑
19	... schenkt expliciete aandacht aan innovatie en de rol daarvan voor de toekomst.	❑	❑	❑	❑	❑
20	... wil graag het 'nieuwste van het nieuwste' bieden aan klanten.	❑	❑	❑	❑	❑
21	... steunt mij als ik een idee heb.	❑	❑	❑	❑	❑
22	... toont interesse als ik met een idee kom.	❑	❑	❑	❑	❑
23	... vindt het leuk als ik vernieuwende ideeën heb.	❑	❑	❑	❑	❑
24	... vertrouwt in mijn vermogen om bij te dragen aan vernieuwing.	❑	❑	❑	❑	❑
25	... geeft mij de steun die nodig is om zaken te kunnen verbeteren.	❑	❑	❑	❑	❑
26	... is iemand waar je op kunt rekenen, ook als je iets onderneemt dat minder succesvol is.	❑	❑	❑	❑	❑
27	... geeft advies hoe je iets nieuws het best kunt doorvoeren	❑	❑	❑	❑	❑
28	... geeft opbouwende kritiek als ik iets nieuws probeer	❑	❑	❑	❑	❑
29	... zorgt dat verschillende mensen kunnen meepraten over een vernieuwend idee	❑	❑	❑	❑	❑
30	... kijkt of onze klanten wel op een nieuw product of nieuwe dienst zitten te wachten.	❑	❑	❑	❑	❑
31	... laat medewerkers discussiëren over vernieuwende ideeën.	❑	❑	❑	❑	❑
32	... houdt rekening met de mening van klanten voordat er nieuwe producten of diensten worden ingevoerd.	❑	❑	❑	❑	❑
33	... vergroot het draagvlak voor vernieuwingen door mensen te laten meebeslissen.	❑	❑	❑	❑	❑
34	... waardeert het openlijk als ik bijdraag aan innovatie.	❑	❑	❑	❑	❑
35	... prijst mij voor vernieuwende inspanningen.	❑	❑	❑	❑	❑
36	... herkent mijn bijdrage aan innovatie in de BV.	❑	❑	❑	❑	❑
37	... vertelt mij in geuren en kleuren over vernieuwende ideeën van anderen.	❑	❑	❑	❑	❑
38	... geeft medewerkers de credits voor vernieuwende ideeën.	❑	❑	❑	❑	❑
39	... stelt vernieuwingsinspanningen van medewerkers als voorbeeld.	❑	❑	❑	❑	❑
40	... geeft bonussen en/of extraatjes voor bijdragen aan innovatie.	❑	❑	❑	❑	❑
41	... houdt bij het vaststellen van mijn beloning rekening met mijn bijdragen aan vernieuwing.	❑	❑	❑	❑	❑

42	... laat innovatief gedrag meetellen in de hoogte van mijn salaris.	❑	❑	❑	❑	❑
43	... beloont mijn vernieuwende inspanningen.	❑	❑	❑	❑	❑
44	... beoordeelt mij op innovatief gedrag.	❑	❑	❑	❑	❑
45	... geeft me de tijd om ideeën uit te werken.	❑	❑	❑	❑	❑
46	... geeft me de ruimte om dingen uit te proberen.	❑	❑	❑	❑	❑
47	... verschaft mij de middelen die nodig zijn voor innovatie.	❑	❑	❑	❑	❑
48	... heeft tijd en geld over voor vernieuwende inspanningen van mij.	❑	❑	❑	❑	❑
49	... doet tegen mij niet moeilijk over investeringen.	❑	❑	❑	❑	❑

50 Heb je in de afgelopen maanden een vernieuwend idee gehad?
- ❑ ja
- ❑ nee → ga naar vraag 53

51 Heb je je leidinggevende hiervan op de hoogte gesteld?
- ❑ ja
- ❑ nee → ga naar vraag 53

52 Omschrijf hoe je leidinggevende op het idee reageerde.
.....
.....
.....

53 Heb je in de afgelopen maanden actief bijgedragen aan de ontwikkeling van ideeën?
- ❑ ja
- ❑ nee → ga naar blok D

54 Was je leidinggevende hiervan op de hoogte, of zijn je inspanningen hem/haar opgevallen?
- ❑ ja
- ❑ nee → ga naar blok D

55 Omschrijf de reactie van je leidinggevende op je inspanningen.
.....
.....
.....

D. Leidinggevende (vervolg)

De volgende vragen gaan opnieuw over je leidinggevende.

	Mijn leidinggevende... *(kruis aan)*	helemaal oneens	mee oneens	niet mee eens of oneens	mee eens	helemaal eens
1	... betrekt me in besluiten die van belang zijn voor mijn werk.	❑	❑	❑	❑	❑
2	... vraagt naar mijn mening.	❑	❑	❑	❑	❑
3	... raadpleegt mij bij belangrijke veranderingen.	❑	❑	❑	❑	❑
4	... geeft inspraak in beslissingen die mijn werk betreffen.	❑	❑	❑	❑	❑
5	... laat mij meepraten over langetermijnplannen.	❑	❑	❑	❑	❑
6	... houdt rekening met mijn suggesties.	❑	❑	❑	❑	❑
7	... geeft me de kans verantwoordelijkheid te dragen.	❑	❑	❑	❑	❑
8	... staat me toe om zelf doelen te stellen.	❑	❑	❑	❑	❑
9	... laat mij zelf beslissen hoe ik mijn werk aanpak.	❑	❑	❑	❑	❑
10	... geeft mij controle over wat er gebeurt in mijn werk.	❑	❑	❑	❑	❑
11	... laat me onafhankelijk en vrij te werk gaan.	❑	❑	❑	❑	❑
12	... geeft mij zeggenschap over de indeling van mijn tijd.	❑	❑	❑	❑	❑
13	... vindt het belangrijk dat ik kennis deel met collega's.	❑	❑	❑	❑	❑
14	... stimuleert mij om te overleggen met collega's.	❑	❑	❑	❑	❑

15	... zou ontevreden zijn als ik informatie voor mezelf houd.	❑	❑	❑	❑	❑
16	... juicht het toe als ik ook met collega's praat over minder succesvolle werkervaringen.	❑	❑	❑	❑	❑
17	... organiseert bijeenkomsten waarin ik wordt geïnformeerd over het reilen en zeilen in de BV.	❑	❑	❑	❑	❑
18	... stimuleert dat ik ook informeel met collega's overleg.	❑	❑	❑	❑	❑
19	... geeft mij uitdagend werk.	❑	❑	❑	❑	❑
20	... laat mij interessant werk doen.	❑	❑	❑	❑	❑
21	... laat mij gevarieerd werk doen.	❑	❑	❑	❑	❑
22	... maakt mij enthousiast voor mijn werk.	❑	❑	❑	❑	❑
23	... doet op mij een beroep voor moeilijke projecten.	❑	❑	❑	❑	❑
24	... geeft mij de kans om iets te leren.	❑	❑	❑	❑	❑
25	... controleert regelmatig de voortgang en kwaliteit van mijn werk.	❑	❑	❑	❑	❑
26	... let goed op of mijn doelstellingen wel gehaald worden.	❑	❑	❑	❑	❑
27	... vestigt de aandacht op fouten die ik maak.	❑	❑	❑	❑	❑
28	... let op of mijn prestaties goed genoeg zijn.	❑	❑	❑	❑	❑
29	... tolereert van mij geen fouten.	❑	❑	❑	❑	❑
30	... zou zijn/haar afkeuring laten blijken als ik op een laag niveau presteer.	❑	❑	❑	❑	❑
31	... wil dat ik bepaalde regels en procedures volg.	❑	❑	❑	❑	❑

E. Werkklimaat

De volgende vragen gaan over de omgang met collega's. Geef aan in welke mate je het eens bent met de volgende stellingen.

		helemaal oneens	mee oneens	niet mee eens of oneens	mee eens	helemaal eens
1	Mijn collega's hebben een houding van 'samen uit, samen thuis'.	❑	❑	❑	❑	❑
2	Mijn collega's voelen zich door elkaar begrepen en geaccepteerd.	❑	❑	❑	❑	❑
3	Iedere collega kan zijn mening kwijt, zelfs als hij/zij een minderheidsstandpunt heeft.	❑	❑	❑	❑	❑
4	Een afwijkende mening wordt door mijn collega's geaccepteerd.	❑	❑	❑	❑	❑
5	Mijn collega's voelen zich bij elkaar op hun gemak.	❑	❑	❑	❑	❑
6	Wij doen elkaar suggesties om beter te presteren.	❑	❑	❑	❑	❑
7	Wij kijken naar elkaars werk om verbeterpunten te vinden.	❑	❑	❑	❑	❑
8	Onze werkmethoden stellen wij ter discussie.	❑	❑	❑	❑	❑
9	Wij pikken elkaars ideeën op om betere uitkomsten te behalen.	❑	❑	❑	❑	❑
10	Wij bespreken of we als team effectief samenwerken.	❑	❑	❑	❑	❑
11	Wij gaan na wat we kunnen leren van reeds voltooide acties.	❑	❑	❑	❑	❑
12	Hulp om nieuwe ideeën te ontwikkelen is in mijn BV verkrijgbaar.	❑	❑	❑	❑	❑
13	Mijn collega's reageren open op veranderingen.	❑	❑	❑	❑	❑
14	Mijn collega's zoeken naar nieuwe methoden en inzichten.	❑	❑	❑	❑	❑
15	Mijn collega's werken samen om nieuwe ideeën te ontwikkelen.	❑	❑	❑	❑	❑
16	Mijn collega's zorgen voor middelen om ideeën te kunnen uitvoeren.	❑	❑	❑	❑	❑
17	Mijn collega's geven elkaar praktische steun voor nieuwe ideeën en de uitvoering daarvan.	❑	❑	❑	❑	❑

F. Externe contacten

De laatste vragen gaan over je contacten met externe partijen. Geef bij elke stelling aan hoe vaak dit voorkomt.

		helemaal niet	zelden	soms	regel-matig	(vrijwel) altijd
1	Ik bezoek in mijn werk externe klanten.	❑	❑	❑	❑	❑
2	Ik heb contact met potentiële klanten van mijn BV.	❑	❑	❑	❑	❑
3	Ik geef 'after sales' service aan externe klanten.	❑	❑	❑	❑	❑
4	Ik bezoek voor mijn werk conferenties, beurzen en/of tentoonstellingen.	❑	❑	❑	❑	❑
5	Ik houd bij waar onze concurrenten mee bezig zijn.	❑	❑	❑	❑	❑
6	Ik praat met mensen van andere bedrijven uit onze branche.	❑	❑	❑	❑	❑
7	Ik heb in mijn werk contact met mensen van kennis-/ onderwijsinstellingen.	❑	❑	❑	❑	❑
8	Ik heb in mijn werk contact met leveranciers en/of onderaannemers.	❑	❑	❑	❑	❑

Annex E: Questionnaires main study

Leader survey

Leiderschap & innovatief gedrag – vragenlijst leidinggevende

Bedrijf: [.....]
Code: [.....] *(antwoordcode voor verwerking, niet verwijderen svp)*

Vooraf
- Deze vragenlijst bestaat uit twee delen: vernieuwingen in uw bedrijf en het innovatieve gedrag van uw medewerkers.
- Het invullen neemt 10 à 15 minuten in beslag. Denk bij het geven van antwoorden niet te lang na. Uw eerste ingeving is de beste.
- De informatie in deze vragenlijst is *strikt vertrouwelijk*. Wij verwerkeb uw antwoorden in een geanonimiseerd databestand waarin gegevens over individuele personen niet te herleiden zijn. Andere personen of instanties krijgen onder geen beding inzage in uw antwoorden of gegevens.
- De vragenlijst kunt u in de antwoordenveloppe terugsturen. Een postzegel is niet nodig.
- Vragen of opmerkingen? Neem contact op met Jeroen de Jong (079 343 02 12, e-mail jjo@eim.nl).
- Wij danken u hartelijk voor uw medewerking!

LA. Vernieuwingen in uw bedrijf

1 Heeft uw bedrijf de afgelopen 3 jaar producten of diensten op de markt gebracht die *nieuw of duidelijk verbeterd* zijn?

- ❑ ja
- ❑ nee → ga naar vraag 4

2 Welk deel van uw omzet verwacht u in 2003 te behalen met deze producten en/of diensten *(maak een schatting)*?

- ❑ < 10%
- ❑ 10% - < 20%
- ❑ 20% - < 30%
- ❑ 30% - < 50%
- ❑ 50% of meer
- ❑ weet niet/niet van toepassing

3 Waren een of enkele van deze producten/diensten ook nieuw voor uw bedrijfstak?

- ❑ ja
- ❑ nee
- ❑ weet niet/niet van toepassing

4 Op welk van de volgende gebieden heeft uw bedrijf de afgelopen drie jaar vernieuwingen of duidelijke verbeteringen doorgevoerd (kruis aan)?

a.	Strategie (langetermijndoelstellingen en implementatie)	❑ ja	❑ nee
b.	Management (toepassen van nieuwe managementtechnieken)	❑ ja	❑ nee

c.	Organisatiestructuur (ingrijpende veranderingen in de organisatiestructuur)	❑ ja	❑ nee
d.	Marketing (toepassen en/of ontwikkelen van marketingconcepten)	❑ ja	❑ nee
e.	Werkmethoden (gebruik van methoden en technieken om diensten voort te brengen die niet vergelijkbaar zijn met eerdere werkmethoden)	❑ ja	❑ nee
f.	Afzetmarkten (bedienen van nieuwe groepen afnemers)	❑ ja	❑ nee

LB. Innovatief gedrag van medewerkers

Hoe innovatief vindt u uw medewerkers? De volgende vragen gaan over de door u geselecteerde medewerkers. Met behulp van tien stellingen geeft u per medewerker aan hoe vaak hij/zij zich innovatief gedraagt.

Medewerker: [.....] Code: [.....] Bedrijfscode: [.....]

	Hoe vaak komt het voor dat *deze medewerker* …	nooit	zelden	soms	regel-matig	(vrijwel) altijd
1	... aandacht besteedt aan zaken die niet tot zijn/haar directe taak behoren?	❑	❑	❑	❑	❑
2	... zich openlijk afvraagt hoe dingen beter zouden kunnen?	❑	❑	❑	❑	❑
3	... nieuwe werkwijzen, technieken of methoden voorstelt?	❑	❑	❑	❑	❑
4	... originele oplossingen bedenkt?	❑	❑	❑	❑	❑
5	... nieuwe benaderingen bedenkt voor de uitvoering van taken?	❑	❑	❑	❑	❑
6	... sleutelfiguren enthousiast maakt voor vernieuwingen?	❑	❑	❑	❑	❑
7	... mensen over de streep probeert te trekken om vernieuwingen te steunen?	❑	❑	❑	❑	❑
8	... vernieuwingen planmatig invoert?	❑	❑	❑	❑	❑
9	... een bijdrage levert aan de invoering van vernieuwingen?	❑	❑	❑	❑	❑
10	... zich inspant om vernieuwingen gerealiseerd te krijgen?	❑	❑	❑	❑	❑

(Innovative work behavior was rated similarly for other employees in the sample)

Leiderschap & innovatief gedrag – vragenlijst medewerker

Code: [.....] – [.....] *(antwoordcode voor verwerking niet verwijderen s.v.p.)*

Vooraf

- Deze vragenlijst bestaat uit vier delen: uw bijdrage aan vernieuwing (blok A), management (blok B), werkklimaat (blok C) en externe contacten (blok D).
- Het invullen neemt 10 à 15 minuten in beslag. Denk bij het geven van antwoorden niet te lang na. Uw eerste ingeving is de beste. Als u een antwoord niet weet of geen mening hebt, vul dan niets in.
- De informatie in deze vragenlijst is *strikt vertrouwelijk*. Wij verwerken uw antwoorden in een geanonimiseerd databestand waarin gegevens over individuele personen niet te herleiden zijn. Andere personen krijgen onder geen beding inzage in uw antwoorden of gegevens.
- Vragen of opmerkingen? Neem contact op met Jeroen de Jong (079 343 02 12, e-mail jjo@eim.nl).
- De vragenlijst kunt u in de antwoordenveloppe terugsturen. Een postzegel is niet nodig. Wij danken u hartelijk voor uw medewerking!

A. Uw bijdrage aan vernieuwing

De eerste vragen gaan over hoe vaak u in uw werk een bijdrage levert aan vernieuwing en verandering.

	Hoe vaak doet u in uw werk *suggesties* om …	nooit	zelden	soms	regel-matig	(vrijwel) altijd
1	... bestaande producten of diensten te verbeteren?	❑	❑	❑	❑	❑
2	... werkmethoden te verbeteren?	❑	❑	❑	❑	❑
3	... nieuwe kennis op te doen?	❑	❑	❑	❑	❑

	Hoe vaak draagt u in uw werk *actief bij aan...*	nooit	zelden	soms	regel-matig	(vrijwel) altijd
4	... de ontwikkeling van nieuwe producten of diensten?	❑	❑	❑	❑	❑
5	... de werving van nieuwe klantgroepen?	❑	❑	❑	❑	❑
6	... veranderingen in de organisatie van het werk?	❑	❑	❑	❑	❑

B. Leidinggevende

De volgende vragen gaan over uw leidinggevende. Hieronder verstaan wij de persoon of personen van wie u in uw *dagelijks werk* leiding krijgt. In welke mate bent u het eens met de volgende stellingen?

	Mijn leidinggevende... *(kruis aan)*	helemaal mee oneens	mee oneens	neu-traal	mee eens	helemaal mee eens
1	... vraagt zich openlijk af hoe dingen beter zouden kunnen.	❑	❑	❑	❑	❑
2	... experimenteert met nieuwe manieren om dingen te doen.	❑	❑	❑	❑	❑
3	... stelt nieuwe werkwijzen, technieken of instrumenten voor	❑	❑	❑	❑	❑
4	... overtuigt anderen van de toegevoegde waarde van een vernieuwend idee.	❑	❑	❑	❑	❑
5	... daagt mij uit om problemen op een andere manier te bekijken.	❑	❑	❑	❑	❑
6	... laat mij nadenken over de manier waarop ik mijn werk	❑	❑	❑	❑	❑

	doe.					
7	... heeft ideeën waardoor ik mijn manier van werken opnieuw overweeg.	❑	❑	❑	❑	❑
8	... stimuleert mij om de kwaliteit van eigen werk te beoordelen.	❑	❑	❑	❑	❑
9	... draagt een visie uit over de waarde van innovatie in mijn bedrijf.	❑	❑	❑	❑	❑
10	... schetst een opwindend beeld van wat vernieuwing ons kan brengen.	❑	❑	❑	❑	❑
11	... maakt duidelijk waar wij als bedrijf naartoe zouden moeten.	❑	❑	❑	❑	❑
12	... schenkt expliciete aandacht aan innovatie en de rol daarvan voor de toekomst.	❑	❑	❑	❑	❑
13	... toont interesse als ik met een idee kom.	❑	❑	❑	❑	❑
14	... vindt het leuk als ik vernieuwende ideeën heb.	❑	❑	❑	❑	❑
15	... geeft mij de steun die nodig is om zaken te kunnen verbeteren.	❑	❑	❑	❑	❑
16	... is iemand waar je op kunt rekenen, ook als je iets onderneemt dat minder succesvol is.	❑	❑	❑	❑	❑
17	... geeft advies hoe je iets nieuws het best kunt doorvoeren	❑	❑	❑	❑	❑
18	... zorgt dat verschillende mensen kunnen meepraten over een vernieuwend idee	❑	❑	❑	❑	❑
19	... laat medewerkers discussiëren over vernieuwende ideeën.	❑	❑	❑	❑	❑
20	... vergroot het draagvlak voor vernieuwingen door mensen te laten meebeslissen.	❑	❑	❑	❑	❑
21	... waardeert het openlijk als ik bijdraag aan innovatie.	❑	❑	❑	❑	❑
22	... prijst mij voor vernieuwende inspanningen.	❑	❑	❑	❑	❑
23	... herkent mijn bijdrage aan innovatie in het bedrijf.	❑	❑	❑	❑	❑
24	... geeft medewerkers de credits voor vernieuwende ideeën.	❑	❑	❑	❑	❑
25	... geeft bonussen en/of extraatjes voor bijdragen aan innovatie.	❑	❑	❑	❑	❑
26	... houdt bij het vaststellen van mijn beloning rekening met mijn bijdragen aan vernieuwing.	❑	❑	❑	❑	❑
27	... laat innovatief gedrag meetellen in de hoogte van mijn salaris.	❑	❑	❑	❑	❑
28	... geeft me de tijd om ideeën uit te werken.	❑	❑	❑	❑	❑
29	... verschaft mij de middelen die nodig zijn voor innovatie.	❑	❑	❑	❑	❑
30	... heeft tijd en geld over voor vernieuwende inspanningen van mij.	❑	❑	❑	❑	❑
31	... vraagt naar mijn mening.	❑	❑	❑	❑	❑
32	... raadpleegt mij bij belangrijke veranderingen.	❑	❑	❑	❑	❑
33	... laat mij meepraten over langetermijnplannen.	❑	❑	❑	❑	❑
34	... houdt rekening met mijn suggesties.	❑	❑	❑	❑	❑
35	... staat me toe om zelf doelen te stellen.	❑	❑	❑	❑	❑
36	... laat mij zelf beslissen hoe ik mijn werk aanpak.	❑	❑	❑	❑	❑
37	... laat me onafhankelijk en vrij te werk gaan.	❑	❑	❑	❑	❑
38	... geeft mij zeggenschap over de indeling van mijn tijd.	❑	❑	❑	❑	❑
39	... vindt het belangrijk dat ik kennis deel met collega's.	❑	❑	❑	❑	❑
40	... stimuleert mij om te overleggen met collega's.	❑	❑	❑	❑	❑
41	... zou ontevreden zijn als ik informatie voor mezelf houd.	❑	❑	❑	❑	❑
42	... juicht het toe als ik ook met collega's praat over minder succesvolle werkervaringen.	❑	❑	❑	❑	❑
43	... geeft mij uitdagend werk.	❑	❑	❑	❑	❑
44	... laat mij interessant werk doen.	❑	❑	❑	❑	❑
45	... laat mij gevarieerd werk doen.	❑	❑	❑	❑	❑
46	... doet op mij een beroep voor moeilijke projecten.	❑	❑	❑	❑	❑
47	... controleert regelmatig de voortgang en de kwaliteit van mijn werk.	❑	❑	❑	❑	❑
48	... let goed op of mijn doelstellingen wel gehaald worden.	❑	❑	❑	❑	❑

49	... vestigt de aandacht op fouten die ik maak.	❑	❑	❑	❑	❑
50	... let op of mijn prestaties goed genoeg zijn.	❑	❑	❑	❑	❑

C. Werkklimaat

De volgende vragen gaan over de verhouding met uw collega's. Hieronder verstaan wij de personen met wie u in uw *dagelijks werk* te maken heeft. In welke mate bent u het eens bent met de volgende stellingen?

		helemaal mee oneens	mee oneens	neu-traal	mee eens	helemaal mee eens
1	Mijn collega's voelen zich door elkaar begrepen en geaccepteerd.	❑	❑	❑	❑	❑
2	Iedere collega kan zijn mening kwijt, zelfs als hij/zij een minderheidsstandpunt heeft.	❑	❑	❑	❑	❑
3	Een afwijkende mening wordt door mijn collega's geaccepteerd.	❑	❑	❑	❑	❑
4	Mijn collega's voelen zich bij elkaar op hun gemak.	❑	❑	❑	❑	❑
5	Wij doen elkaar suggesties om beter te presteren.	❑	❑	❑	❑	❑
6	Wij kijken naar elkaars werk om verbeterpunten te vinden.	❑	❑	❑	❑	❑
7	Wij pikken elkaars ideeën op om betere uitkomsten te behalen.	❑	❑	❑	❑	❑
8	Mijn collega's zoeken naar nieuwe methoden en inzichten.	❑	❑	❑	❑	❑
9	Mijn collega's werken samen om nieuwe ideeën te ontwikkelen.	❑	❑	❑	❑	❑
10	Mijn collega's zorgen voor middelen om ideeën te kunnen uitvoeren.	❑	❑	❑	❑	❑
11	Mijn collega's geven elkaar praktische steun voor nieuwe ideeën en de uitvoering daarvan.	❑	❑	❑	❑	❑

D. Externe contacten

De laatste vragen gaan over uw contacten met externe partijen. Geef bij elke stelling aan hoe vaak dit voorkomt.

		helemaal niet	zelden	soms	regel-matig	(vrijwel) altijd
1	Ik bezoek in mijn werk externe klanten.	❑	❑	❑	❑	❑
2	Ik heb contact met potentiële klanten van mijn bedrijf.	❑	❑	❑	❑	❑
3	Ik bezoek voor mijn werk conferenties, beurzen en/of tentoonstellingen.	❑	❑	❑	❑	❑
4	Ik praat met mensen van andere bedrijven uit onze branche.	❑	❑	❑	❑	❑
5	Ik heb in mijn werk contact met mensen van kennis-/onderwijsinstellingen.	❑	❑	❑	❑	❑

Annex F: Measures and items

[a] item dropped in pilot survey
[b] item dropped in main survey
[dim] dimension (of multi-dimensional scale)

Innovative work behavior
Sources of items: Scott and Bruce (1994), Tierney *et al.* (1999), Kleysen and Street (2001), Janssen (2000), self-constructed
Rated by: leader
Response codes: 1=never, 2=seldom, 3=occasionally, 4=regularly, 5=always
Final Items: How often does this employee...
…pay attention to issues that are no part of his/her daily work? [opportunity exploration]
…wonder how things can be improved? [opportunity exploration]
…search out new working methods, techniques or instruments? [idea generation]
…generate original solutions to problems? [idea generation]
…find new approaches to execute tasks? [idea generation]
…encourage key organization members to be enthusiastic about innovative ideas? [champ.]
…attempt to convince people to support an innovative idea? [championing]
…systematically introduce innovative ideas into work practices? [application]
…contribute to the implementation of new ideas? [application]
…put effort into the development of new things? [application]

Dropped items: How often does this employee…
…look for opportunities to improve things? [a]
…consider innovative opportunities? [a]
…explore new products or services? [a]
…create new ideas? [a]
…mobilize support for innovative ideas? [a]
…acquire approval for innovative ideas? [a]
…transform innovative ideas into useful applications? [a]

Innovative role-modeling
Sources of items: Basu and Green (1997), Janssen and Buil (1998)

Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…asks himself how things can be done better.
…experiments with new ways of doing things.
…proposes new work processes, techniques or instruments.
…convinces others of new ideas.

Dropped items: My leader…
…explores opportunities. [a]
…introduces novelty in products, services and procedures. [a]
…is innovative. [a]

Intellectual stimulation
Sources of items: Den Hartog (1997), House *et al.* (1997), self-constructed
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…challenges me to think about old problems in new ways.
…asks questions that prompt me to think about the way I do things.
…has ideas that challenge me to re-examine some of my basic assumptions about my work.
…encourages me to judge the quality of my work.

Dropped items: My leader…
…has ideas that force me to rethink things that I never questioned before. [a]
…asks me to find solutions to problems. [a]
…expects me to be concerned with more than just my own tasks. [a]

Stimulating knowledge diffusion
Sources of items: Jaworski and Kohlie (1993), self-constructed
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…

…stresses that I should share knowledge with my colleagues.
…stimulates me to interact with my colleagues.
…would be unsatisfied if I kept information to myself.
…encourages me to inform my colleagues about less successful work experiences.

Dropped items: My leader…
…organizes meetings to inform me about trends and developments in our firm. [a]
…stimulates having informal 'hall talk' with my colleagues. [a]

Providing vision
Sources of items: Bass and Avolio (1989), Den Hartog (1997), House *et al.* (1997), De Jong and Den Hartog (2005)
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…articulates a vision of innovation for our firm.
…paints an exciting picture of what renewal will bring us.
…has a clear sense of where he wants us to be in the future.
…pays explicit attention to innovation and its role in future development.

Dropped items: My leader…
…communicates an exciting vision about modernization in our firm. [a]
…aims to deliver the 'newest' and 'hottest' services to our customers. [a]

Consulting
Sources of items: House and Dessler (1974), Koopman (1980), Den Hartog (1997), Parker *et al.* (1997)
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…asks for my opinion.
…consults me about important changes.
…lets me influence decisions about long term plans and directions.
…asks me to suggest how to carry out assignments.

Dropped items: My leader…
…involves me in decisions that affect my work. [a]
…allows me to have a say in matters concerning my work. [a]

Delegating
Sources of items: Koopman (1980), Jackson *et al.* (1993), Spreitzer (1995), Den Hartog (1997)
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…allows me to decide myself how I do my work.
…gives me considerable independence and freedom.
…allows me to determine my own time planning.

Dropped items: My leader…
…offers me the possibility to bear responsibility. [a]
…gives me significant autonomy in determining how I do my job. [a]
…allows me to set my own goals. [b]

Support for innovation
Sources of items: Yukl *et al.* (1990), self-constructed
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…shows sincere interest whenever I come up with an idea.
…reacts enthusiastically to my creative thoughts.
…supports me when I want to improve things.
…is someone you can count on, even when you initiate something unsuccessful.

Dropped items: My leader…
…supports my ideas. [a]
…is confident about my abilities to contribute to renewal and change. [a]

Organizing feedback
Sources of items: self-constructed

Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…invites others to provide feedback on my ideas.
…lets employees discuss my new ideas.
…builds support for my innovations by having people participate in decision-making.

Dropped items: My leader…
…gives positive feedback when I try out something new. [a]
…checks if our customers actually need a new product or service. [a]
…accounts for customers' opinions before a new product or service is implemented. [a]
…makes suggestions on how to implement something new. [b]

Recognizing
Sources of items: Kohli (1985), Yukl *et al.* (1990)
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…publicly recognizes me when I am innovative.
…praises my innovative efforts.
…recognizes my contribution to innovation.
…Gives me credit for innovative ideas.

Dropped items: My leader…
…informs me enthusiastically about others' innovative ideas. [a]
…puts a 'spotlight of praise' on employees' innovative efforts. [a]

Rewarding
Sources of items: Jaworski and Kohlie (1993), self-constructed
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…offers bonuses for my innovative contributions.
…takes my innovative efforts into account when determining formal rewards.

…show the results of innovative behavior in my pay.

Dropped items: My leader…
…rewards my innovative efforts. [a]
…settles with me for innovative behavior. [a]

Providing resources
Sources of items: De Jong and Den Hartog (2005), self-constructed
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…provides me with time to work out ideas.
…provides me with the means necessary for innovation.
…is willing to invest time and money in innovative efforts.

Dropped items: My leader…
…provides me with sufficient means to try out new things. [a]
…is willing to consider my investment proposals. [a]

Monitoring
Sources of items: Bass and Avolio (1989), Den Hartog (1997), House *et al.* (1997)
Rated by: employee
Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree
Final Items: My leader…
…frequently checks on the progress and quality of my work.
…monitors whether I keep up with my objectives.
…focuses attention on errors I make.
…points out to me if my work is not up to par.

Dropped items: My leader…
…keeps careful track of my mistakes. [a]
…would indicate disapproval if I performed at a low level. [a]
…maintains definite standards of performance. [a]

Task assignment

Sources of items: Jackson *et al.* (1993), De Jong and Den Hartog (2005), self-constructed

Rated by: employee

Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree

Final Items: My leader…

…provides me with a challenging job.

…assigns me interesting work.

…assigns me a broad range of tasks.

Dropped items: My leader…

…makes me enthusiastic about work assignments. [a]

…provides me with learning opportunities. [a]

…appeals to me for assistance when tackling difficult projects. [b]

Innovation climate

Sources of items: Siegel and Kaemmerer (1978), Anderson and West (1998), Schippers (2003), self-constructed

Rated by: employee

Response codes: 1=totally disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=totally agree

Final Items:

My colleagues feel understood and accepted by each other. [fellowship]

People in my company feel at ease with each other. [fellowship]

Everyone is listened to, even when he/she has a minority view. [minority acceptance]

My colleagues accept deviating views. [minority acceptance]

We provide each other with useful ideas to enable us to do a better job. [striving for excellence]

During task execution, we assess whether we are on the right track. [striving for excellence]

We build on each other's ideas in order to achieve the best possible outcomes. [str. for exc.]

My colleagues are always searching for fresh, new ways of looking at problems. [supp. inn.]

My colleagues co-operate in order to help to develop and apply new ideas. [support innovation]

My colleagues provide and share resources to help in applying new ideas. [support innovation]

My colleagues provide practical support for new ideas and their application. [support inn.]

Dropped items:

My colleagues have an 'we are in it together' attitude. [a]
Our methods of getting a job done are often discussed. [a]
We regularly discuss whether the team is working effectively. [a]
We work out what we have learnt from past activities. [a]
In my firm, assistance in developing ideas is readily available. [a]
My colleagues are open and responsive to change. [a]

External work contacts
Sources of items: Afuah (2003), De Jong and Den Hartog (2005)
Rated by: employee
Response codes: 1=never, 2=seldom, 3=occasionally, 4=regularly, 5=always
Final Items:
During my work I visit external customers.
I keep in touch with prospective customers of my firm.
I visit conferences, trade fairs and/or expositions.
I talk to people from other companies in our market.
I keep in touch with people from universities/knowledge institutions.

Dropped items:
I provide after-sales service to external customers. [a]
I monitor our competitors' actions. [a]
I have contacts with suppliers and/or subcontractors. [a]

Innovative output
Sources of items: Axtell *et al.* (2000), self-constructed
Rated by: employee
Response codes: 1=never, 2=seldom, 3=occasionally, 4=regularly, 5=always
Final Items: In your job, how often do you…
…suggest improving current products or services?
…suggest improving current work practices?
…suggest acquiring new knowledge?
…actively contribute to developing new products or services?
…actively contribute to acquiring new customers?
…actively contribute to changing the work organization?

Dropped items: In your job, how often do you…
…suggest developing new products or services? [a]

…suggest acquiring new customers? [a]
…suggest changing the work organization? [a]
…actively contribute to improving current products or services? [a]
…actively contribute to improving current work practices? [a]
…actively contribute to acquiring new knowledge? [a]

Annex G: Measuring innovation-stimulating leadership

A spin-off of our research includes developing two measures of innovation-stimulating leadership. We developed a full, multi-dimensional version (19 items) and a shortened version (6 items). Both measures summarize the significant leader behaviors we found to be connected to employees' IWB (see chapter 7). They can be useful to those who want to explore antecedents of individual innovation in future work.

We define innovation-stimulating leadership (ISL) as all leader behaviors that stimulate individuals to initiate and intentionally introduce new and useful ideas, processes, products or procedures within their work role, group or organization. Our analysis of direct effects resulted in seven significant leader behaviors (consulting, delegating, support for innovation, recognizing, providing resources, monitoring and task assignment). Monitoring is discarded because this construct was only weakly related to individual innovation. Besides it is negatively connected and as such not representative of innovation-stimulating leadership. The proposed ISL measures thus capture only those leader behaviors our study suggested that are, beyond doubt, part of the domain of innovation-stimulating leadership.

Full measure

Given that the six remaining leader behaviors correlate directly with employees' IWB (see chapter 7) they were modeled as a multidimensional scale of innovation-stimulating leadership. Our main survey used 21 items to measure these leader behaviors. To qualify as a multi-dimensional scale evidence is needed on their convergent, discriminant and criterion validity.

A first basic requirement is that exploratory factor analysis reproduces a factor structure with six dimensions. Pre-analysis tests like the Kaiser-Meyer-Olkin measure and the Bartlett test of sphericity indicated that the main survey data of the 21 items were suitable for factor analysis (KMO = 0.91, p(Bartlett) < 0.001). An initial principal factor analysis without iteration indicated that five factors had an eigenvalue greater than unity, but the scree criterion suggested a six-dimensional solution. A principal factor analysis with oblique rotation that extracted six factors reproduced most of the expected pattern of factor loadings. We only needed to drop two items from the support for innovation scale because of ambiguous factor loadings ('My leader supports me when I want to improve things' and 'My leader is someone you can count on, even

when you initiate something unsuccessful'). For the 19 remaining items, all factor loadings exceeded 0.50 while cross-loadings were below 0.30. This six-dimensional solution explained 76.7 percent of the variance (table 19). We checked whether a similar result could be obtained from the pilot survey data. Exploratory factor analysis with the same specifications confirmed that the two support items should be removed, and gave a similar matrix of factor loadings.

table 19. Exploratory factor analysis of innovation-stimulating leader behaviors (n=703)

Item: My leader…	*Factor 1 (recog-nizing)*	*Factor 2 (dele-gating)*	*Factor 3 (task ass.)*	*Factor4 (con-sulting)*	*Factor 5 (providing resources)*	*Factor 6 (support for inn.)*
…asks for my opinion.	0.01	0.08	-0.03	**-0.53**	0.11	-0.16
…consults me regarding important changes.*	-0.01	-0.03	0.02	**-0.93**	-0.01	0.04
…lets me influence decisions about long term plans and directions.	0.01	0.02	-0.03	**-0.79**	-0.01	0.04
…asks me to suggest how to carry out assignments.	0.09	0.03	-0.05	**-0.55**	0.05	-0.17
…allows me to decide myself how I do my work.	-0.02	**0.82**	-0.03	-0.01	0.02	0.04
…gives me considerable opportunities for independence and freedom.*	0.04	**0.91**	0.00	0.04	-0.04	0.00
…allows me to determine my own time planning.	-0.01	**0.67**	0.02	-0.03	0.02	-0.03
…shows sincere interest whenever I come up with an idea.*	-0.02	-0.02	-0.05	-0.08	0.01	**-0.88**
…reacts enthusiastically to my creative thoughts.	0.23	0.07	0.01	0.02	0.04	**-0.62**
…publicly recognizes me when I am innovative.	**0.70**	0.01	-0.03	0.02	0.03	-0.11
…praises my innovative efforts.*	**0.87**	-0.03	0.02	0.04	0.00	-0.02
…gives me recognition for innovative contributions.	**0.75**	0.03	-0.04	-0.11	-0.03	0.03
…provides me with credits for innovative ideas.	**0.63**	0.03	-0.04	-0.03	0.09	0.00
…provides me with time to work out ideas.	-0.06	0.05	0.01	0.01	**0.71**	-0.04
…provides me with means that are necessary for innovation.*	0.01	-0.05	-0.08	0.01	**0.80**	-0.01
…is willing to invest time and money in innovative efforts.	0.15	0.01	0.04	-0.06	**0.72**	0.07
…provides me with a challenging job.	0.06	-0.03	**-0.86**	-0.05	-0.01	0.04
…assigns me interesting work.*	-0.04	-0.02	**-0.95**	0.00	0.04	-0.02
…assigns me a broad range of tasks.	0.01	0.06	**-0.79**	0.04	-0.01	-0.02
Explained variance	40.4%	10.0%	9.1%	6.8%	6.4%	4.0%
Cronbach's a (of bold items)	0.87	0.84	0.90	0.86	0.81	0.85
Mean correlation (between bold items)	0.62	0.64	0.76	0.61	0.59	0.74

* Selected for shortened ISL measure.

Next we analyzed if the six-dimensional measure was satisfactory in terms of convergent, discriminant and criterion validity. A second-order CFA model was specified with each item loading on its proposed dimension (cf. table 19), and the six dimensions were further specified to load on a single, higher-order factor called 'innovation-stimulating leadership'. Measures of absolute, incremental and parsimonious fit were all good (GFI = 0.94, RMSEA = 0.05, TLI = 0.96, NFI = 0.95, χ^2/df = 2.99). Convergent validity was demonstrated by the fact that all items were significant at the 0.1 percent level with standardized factor loadings exceeding 0.67. In

addition the six dimensions all contributed significantly to the overall construct of innovation-stimulating leadership. Their standardized loadings were at least 0.45 ($p < 0.001$).

A number of alternative six-factor models were run to assess discriminant validity. Rather than modeling a second order factor, these models all had plain correlations between the six dimensions. We ran a range of alternative models that subsequently fixed the correlations between each pair of dimensions on unity. These models all suffered from a deteriorated fit compared to the unconstrained model ($\Delta\chi^2 > 205.2$ with $\Delta df = 1$, $p < 0.001$). Thus, discriminant validity was clearly supported (cf. Bollen, 1989).

Finally, we related the summated rating of innovation-stimulating leadership to employees' IWB. As this measure had also served to identify innovation-stimulating leader behaviors, solid evidence for criterion validity is not given here. We estimated various hierarchical multilevel regression models in which we subsequently entered the control variables (firm size, gender, sector dummies, climate dimensions and external work contacts) and the summated score for innovation-stimulating leadership. In the final step model fit improved significantly ($\Delta dev = 52.41$) while the standardized effect parameter of ISL was positive and significant ($b = 0.28$, $p < 0.001$). Output of these analyses can be obtained from the author on request.

We note that, as the ISL measure is built from those leader behaviors with a positive connection with IWB, it is no surprise that we found a relation with the criterion. Thus we do not regard this as support for criterion validity. More convincing evidence should be obtained from analyzing a full nomological net with new constructs.

Shortened measure

The full version of the ISL contains 19 items and is probably too long for most empirical applications. It would create a heavy burden on respondents, and in any questionnaire it would not leave much room for other measures of interest. Therefore we also developed a shortened version of the ISL. It consists of six items. Following Hair *et al.* (1998: p. 116) we examined the matrix of factor loadings; for each dimension we selected a single item. We consistently selected the items with the highest loading as indicated in table 19. This approach is straightforward unless theoretical considerations suggest another item as more appropiate (Hair *et al.*, 1998: p. 116). Here, after serious consideration we felt that selecting other items would not provide a better reflection of the domain of the six dimensions.

Obviously, selecting single surrogate variables as representative of a dimension has several disadvantages. Measurement errors are probably bigger and there is also the risk of potentially misleading results by selecting only a single variable to represent a perhaps more complex construct (Hair *et al.*, 1998: p. 116). We, however, do not expect that using the shortened measure would greatly compromise one's view of innovation-stimulating leadership. Plain correlation analysis shows that both measures are in fact very similar ($r = 0.96$, $p < 0.001$).

We assessed whether the shortened ISL is reliable and valid. Reliability statistics are satisfactory. Cronbach's α is 0.74 and the item-rest correlations range from 0.31 (delegating) up to 0.58 (leader support for innovation). The mean inter-item correlation of 0.32 was slightly below the common threshold of 0.40 (Cortina, 1993; Hair *et al.*, 1998), but given that the shortened ISL summarizes multiple dimensions we regard this value as acceptable. Validity was first assessed using a confirmatory factor model that specified the six items to load on a single factor. It had a good absolute, incremental and parsimonious fit (GFI = 0.99, RMSEA = 0.06, TLI = 0.96, NFI = 0.96, χ^2/df = 3.28). Convergent validity was supported by the fact that all factor loadings were positive and significant at $p < 0.001$ (no output shown here). Finally, we checked the relationship with IWB with a multilevel regression of innovative work behavior on the shortened ISL measure (table 20).

table 20. Hierarchical multilevel regression of IWB on control variables and innovation-stimulating leadership (n=693)

	Model III	*Model XVII*
Standardized effect parameters:		
Firm size	-0.10	-0.08
Gender	-0.01	-0.01
Sector: legal services	-0.26**	-0.26**
Sector: consultancy services	-0.07	-0.06
Sector: engineering services	-0.07	-0.03
Climate: fellowship	-0.01	-0.02
Climate: minority acceptance	-0.02	-0.04
Climate: striving for excellence	0.07	0.04
Climate: support for innovation	-0.05	-0.10^
External work contacts	0.27**	0.23**
ISL measure (shortened version)		0.26**
Model fit:		
Deviance	1513.96	1467.05
Δ Deviance		46.91
Δ Df		1
Significance		**

** $p < 0.001$; ^ $p < 0.05$.

We first estimated a model with firm size, gender, sector dummies, climate dimensions and external work contacts as control variables. Subsequently we entered the shortened

ISL as additional predictor. A comparison of both deviance measures confirms that that the shortened ISL is strongly related to employees' innovative work behavior. Again, an independent test of criterion validity is needed to draw further conclusions here. Future research with new data and including a full nomological net with other measures of individual innovation is needed. However, the analyses presented here attempt a first step in the development of an ISL measure.

References

Abernathy, W.J. & J.M. Utterback (1978), Patterns of innovation in technology, *Technology Review*, 80 (7), 40-47.

Abernathy, W.J. & K.B. Clark (1985), Mapping the winds of creative destruction, *Research Policy*, 14(3), 3-22.

Acs Z.J. & Audretsch D. (1990), *Innovation and Small Firms*, Cambridge: MIT Press.

Afuah, A. (2003), *Innovation Management, strategies, implementation, profits*, New York: Oxford University Press.

Aiken, L.S. & S.G. West (1991), *Multiple regression: testing and interpreting interactions*, Thousand Oaks: Sage.

Allen, T., R. Katz, J.J. Grady & N. Slavin (1988), Project team aging and performance: the roles of project and functional managers, *R&D management*, 18, 295-308.

Allison, G.T. (1971), *Essence of Decision: Explaining the Cuban Missile Crisis*, Boston: Little Brown.

Alvesson, M. (2000), Social identity and the problem of loyalty in knowledge-intensive companies, *Journal of Management Studies*, 37(8), 1101-1123.

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

Amabile, T.M. (1988), A model of creativity and innovation in organizations, In: Shaw, B.M. & L.L. Cummings (1988), *Research in organizational behavior*, 10, 123-167.

Amabile, T.M. (1996), *Creativity in context*, Boulder: Westview.

Amabile, T.M., E.A. Schatzel, G.B. Moneta & S.J Kramer (2004), Leader behaviors and the work environment for creativity: perceived leader support, *Leadership Quarterly*, 15(1), 5-32.

Amabile, T.M., R. Conti, H. Coon, J. Lazenby & M. Herron (1996), Assessing the work environment for creativity, *Academy of Management Journal*, 39, 1154-1184.

Anderson, J.C., D.W. Gerbing & J.E. Hunter (1987), The assessment of unidimensional measurement: internal and external consistency and overall consistency criteria, *Journal of Marketing Research*, 24, 432-437.

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

Anderson, N.R., C.K.W. de Dreu & B.A. Nijstad (2004), The routinization of innovation research: a constructively critical review of the state-of-the-science, *Journal of Organizational Behavior*, 25(2), 147-174.

Anxo, D. & D. Storrie (2001), *The job creation potential of the service sector in Europe*, Luxembourg: European Commission.

Arbuckle, J.L. & W. Wothke (1999), *Amos 4.0 user's guide*, Chicago: Smallwaters.

Archibugi, D. & G. Sirilli (2001), The direct measurement of technological

innovation in business: The state of the art, In: Thuriaux, B., E. Arnold & C. Couchot (2001), *Innovation and enterprise creation*, Luxembourg: European Commision, 38-49.

Armstrong, J.S. & T.S. Overton (1977), Estimating non-response bias in mail surveys, *Journal of Marketing research*, 14, 396-402.

Audretsch, D.B. (1998), Agglomeration and the Location of Innovative Activity, *Oxford Review of Economic Policy*, 12 (2), 18-29.

Axtell, C., D. Holman & T. Wall (2006), Promoting innovation: A change study, *Journal of Organisational and Occupational Psychology*, 79(3), 509-516.

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

Baer, M., G.R. Oldham & A. Cummings (2003), Rewarding creativity: when does it really matter?, *Leadership Quarterly*, 14(4-5), 569-586.

Bain P.G., L. Mann & A. Pirola-Merlo (2001), The Innovation Imperative: The Relationships Between Team Climate, Innovation, and Performance in Research and Development Teams, *Small Group Research*, 32(1), 55-73.

Bandura, A. (1969), *Principles of behavior modification*, New York: Holt, Rinehart & Winston.

Bandura, A. (1982), Self-efficacy mechanism in human agency, *American Psychologist*, 37, 122-147.

Bandura, A. (1986), *Social foundations of thought and action: a social cognitive theory*, Englewood Cliffs: Prentice Hall.

Barkema, H.G. (1995), Do job executives work harder when they are monitored?, *Kyklos*, 48, 19-42.

Barrick, M. & M. Mount (1991), The big five personality dimensions and job performance: a meta analysis, *Personnel Psychology*, 44, 1-26.

Barron, F. & D.M. Harrington (1981), Creativity, intelligence and personality, *Annual Reviews of psychology*, 32, 439-476.

Basadur, M. (2004), Leading others to think innovatively together: Creative leadership, *Leadership Quarterly*, 15(1), 103-121.

Bass, B.M. & B.J. Avolio (1989), *Manual for the multifactor leaderhip questionnaire*, Palo Alto: Consulting Psychologists Press.

Bass, B.M. (1985), *Leadership and performance beyond expectations*, New York: Free Press.

Basu, R. & S.G. Green (1997), Leader-member exchange and transformational leadership: An empirical examination of innovative behaviors in leader-member dyads, *Journal of Applied Social Psychology*, 27(6), 477-499.

Bennis, W.G. & B. Nanus (1985), *Leaders: the strategies for taking charge*, New York: Harper & Row.

Bijker, W.E., T.P. Hughes & T.J. Pinch (1987), *The social construction of technological systems*, Cambridge: MIT Press.

Blake, R.R. & Mouton, J.S. (1982), Management by grid principles or situationalism: Which?, *Group and Organization Studies*, 7, 207-210.

Bliese, P.D. (2000), Within-group agreement, non-independence, and reliability: implications for data aggregation and analysis, In: Klein, K.J. & W.J. Kozlowski

(2000), *Multilevel theory, research, and methods in organisations*, San Francisco: Jossey-Bass, 349-381.
Bodewes, W. E. J. (2000), *Neither Chaos Nor Rigidity: An empirical study on the effect partial formalization on organizational innovativeness*, Tilburg: Dutch University Press.
Bodewes, W.E.J. & J.P.J. de Jong (2003), Innovatie in het midden- en kleinbedrijf, In: Risseeuw, P. & R. Thurik (2003), *Handboek ondernemers en adviseurs: management en economie van het midden- en kleinbedrijf*, Deventer: Kluwer, 323-338.
Bollen, K.A. (1989), *Structural equations with latent variables*, New York: John Wiley.
Bordia, P. (1997), Face-to-face versus computer mediated communication: A synthesis of the experimental literature, *Journal of Business Communication*, 34, 99-121.
Bozeman, B. (2000), Technology transfer and public policy: a review of research and theory, *Research Policy*, 29, 627-655.
Braaksma, R.M. & J.P.J. de Jong (2005), *Spin-offs van grote bedrijven in Nederland: een verkennend onderzoek* (Spin-offs of large firms in the Netherlands: an exploratory research), Zoetermeer: EIM.
Brand, A. (1998), Knowledge management and innovation at 3M, *Journal of knowledge Management*, 2(1), 179-184.
Brown, S.L. & K.M. Eisenhardt (1995), Product Development: Past Research, Present Findings, and Future Directions, *Academy of Management Review*, 20(2), 343-378.
Bryman, A. (1992), *Charisma and Leadership in organizations*, London: Sage.
Buijs, J. (2003), Modelling Product Innovation Processes, from Linear Logic to Circular Chaos, *Creativity and Innovation Management*, 12(2), 76-93.
Bunce, D. & M.A. West (1995), Personality and perceptions of group climate factors as predictors of individual innovation at work, *Applied Psychology: an international review*, 44, 199-215.
Bürgel, O. & G. Murray (2000), *Internationalisation of Hightech Start-Ups and fast growth*, Centre for for European Economic Research, paper no. 00-35.
Burningham, C. & M.A. West (1995), Individual, climate, and group interaction processes as predictors of work team innovation, *Small Group Research*, 26, 106-117.
Burns, J.M. (1978), *Leadership*, New York: Harper & Row.
Caldwell, R. (2003), Model of change agency: a fourfold classification, *British Journal of Management*, 14, 131-142.
Campbell, D.T. & D.W. Fiske (1959), Convergent and discriminant validation by the multitrait-multimethod matrix, *Psychological Bulletin*, 56, 81-105.
Campbell, J.P., M.B. Gasser & F.L. Oswald (1996), The substantive nature of job performance variability, In: Murphy, K.R. (1996), *Individual difference and behaviours in organisations*, San Francisco: Jossey Bass, 258-299.
Cardwell, D. (1994), *The Fontana History of Technology*, New York: HarperCollins.
Carmeli, A. & J. Schaubroeck (2007), The influence of leaders' and other referents' normative expectations on individual involvement in creative work, *Leadership Quarterly*, 18, 35-48.

Cattell, R.B. (1966), The scree test for the number of factors, *Multivariate behavioural research*, 1, 140-161.
CBS (2003), *Kennis en economie*, Voorburg: CBS.
Chang, A., P. Bordia & J. Duck (2003), Punctuated equilibrium and linear progression: Toward a new understanding of group development, *Academy of Management Journal*, 46, 106-117.
Chen, Z.X. & S. Aryee (2007), Delegation and employee work outcomes: An examination of the cultural context of mediating processes in China, *Academy of Management Journal*, 50(1), 1-36.
Chesbrough, H.W. (2003), *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Boston: Harvard Business School Press.
Choi, J.N. (2007), Change-oriented organizational citizenship behavior: effects of work environment characteristics and intervening psychological processes, *Journal of Organizational Behavior*, 28 (4), 467–484.
Christensen, C.M. (1997), *The Innovator's Dilemma*, Boston: Harvard Business School Press.
Churchill, G.A. (1999), *Marketing research: methodological foundations*, Forth Worth: The Dryden Press.
Churchill, N. & V. Lewis (1983), The five stages of small business growth, *Harvard Business Review*, May-June, 30-50.
Clark, J. & K. Guy (1998), Innovation and Competitiveness: A Review, *Technology Analysis & Strategic Management*, 10(3): 363-395.
Cohen, J., S.G. West, L. Aiken & P. Cohen (1983), *Applied multiple regression/correlation analysis for the behavioural sciences*, Hillsdale: Erlbaum.
Cooper, R.G. (2003), Profitable product innovation: the critical success factors, In: Shavinina, L.V. (2003), *The International Handbook on Innovation*, Elsevier Science, 139-157.
Cortina, J.M. (1993), What is coefficient Alpha? An examination of theory and applications, *Journal of Applied Psychology*, 78, 98-104.
Crant, J.M. (2000), Proactive behavior in organizations, *Journal of Management*, 26, 435-462.
Da Silveira, G. (2001), Innovation diffusion: research agenda for developing economies, *Technovation*, 21, 767-773.
Damanpour, F. (1991), Organizational innovation: a meta-analysis of effects of determinants and moderators, *Academy of Management Journal*, 34(3), 555-590.
De Brentani, U. (2001), Innovative versus incremental new business services: different keys for achieving success, *Journal of Product Innovation Management*, 18(3), 169-187.
De Dreu, C.K.W. & M.A. West (2001), Minority dissent and team innovation: the importance of participation in decision making, *Journal of Applied Psychology*, 86(6), 1191-1201.
De Dreu, C.K.W. (2002), Team innovation and team effectiveness: the importance of minority dissent and reflexivity, *European Journal of Work and Organizational Psychology*, 3, 285-298.
De Hoe, S., R. Smits & R. Petrella (1987), *Technology assessment: an opportunity for Europe*, Brussels: European Commision.
De Jong, J.P.J. & D.N. den Hartog (2005), Determinanten van innovatief gedrag: een onderzoek onder kenniswerkers in het MKB, *Gedrag & Organisatie*, 18(5), 235-

259.
De Jong, J.P.J. & O. Marsili (2006), The fruit flies of innovation: a taxonomy of innovative small firms, *Research Policy*, 35, 213-229.
De Jong, J.P.J. & P.A.M. Vermeulen (2005), Innovatie in onderzoek en onderwijs: wat leren onze studenten? (Innovation in research and education: what do our students learn?), *Tijdschrift voor Hoger Onderwijs*, 43(1), 17-43.
Deci, E.L. & R.M. Ryan (1987), The support of autonomy and the control of behavior, *Journal of Personality and Social Psychology*, 53, 1024-1037.
Den Hartog, D.N. & P.L. Koopman (2001), Leadership in organizations, In: Anderson, N., D.S. Ones, H. Kepir–Sinangil & C. Viswesvaran (2001), *Handbook of industrial, work and organizational psychology, volume 2*, London: Sage.
Den Hartog, D.N. (1997), *Inspirational leadership*, VU doctoral dissertation, KLI-dissertation series 1997-nr 2, Enschede: Ipskamp.
Den Hartog, D.N. (2003), Leadership in a global context, In: Lane, H., M. Maznevski, M. Mendenhall & J. McNett (2003), *Handbook of cross-cultural management*, Oxford: Blackwell.
Den Hartog, D.N., A.H.B. de Hoogh & A.E. Keegan (2007), The Interactive Effects of Belongingness and Charisma on Helping and Compliance, *Journal of Applied Psychology*, 92(4), 1131-1139.
Detert, J.R. & E.R. Burris (2007), Leadership behavior and employee voice: is the door really open?, *Academy of Management Journal*, 50(4), 868-884.
Dewett, T. (2007), Linking intrinsic motivation, risk taking, and employee creativity in an R&D environment, *R&D Management*, 37(3), 197-208.
Dorenbosch, L., M. van Engen & M. Verhagen (2005), On-the-job Innovation: The Impact of Job Design and Human Resource Management through Production Ownership, *Creativity and innovation management*, 14(2), 129-141.
Dosi, G. (1988), Sources, Procedures and Microeconomic Effects of Innovation, *Journal of Economic Literature*, 26(3), 1120-1171.
Drucker, P.F. (1985), *Innovation and Entrepreneurship: practice and principles*, New York: Harper & Row.
Duarte, D.L. & N.T. Snyder (1999), *Mastering virtual teams: Strategies, tools and techniques that succeed*, San Francisco: Jossey-Bass.
Duncan, R.B. (1976), The ambidextrous organization: designing dual structures for innovation, In: Kilmann, R.H., L.R. Pondy & D.P Slevin (1976), *The Management of Organizations: Strategy and Implementation, volume 1*, North-Holland: New York, 167-188.
Eden, D. (1984), Self-Fulfilling Prophecy as a Management Tool: Harnessing Pygmalion, *Academy of Management Review*, 9(1), 64-73.
Edmondson, A.C. (1999), Psychological safety and learning behavior in work teams, *Administrative Science Quarterly*, 4, 350-383.
Ehigie, B.O. & R.C. Akpan (2004), Roles of perceived leadership styles and rewards in the practice of total quality management, *Leadership & Organization Development Journal*, 25(1), 24-40.
Eisenberger, R. & L. Rhoades (2001), Incremental effects of reward on creativity, *Journal of Personality and applied psychology*, 81, 728-741.
Eisenberger, R. & S. Armeli (1997), Can salient reward increase creative performance

without reducing intrinsic creative interest?, *Journal of personality and social psychology*, 72, 652-663.
Eisenhardt, K.M. (1989), Building theories from case study research, *Academy of Management Review*, 14(4), 532-550.
Ekvall, G. & Arvonen, J. (1991), Change-centered leadership: An extention of the two-dimensional model, *Scandinavian Journal of Management*, 7(1), 17-26.
Ekvall, G. & Arvonen, J. (1994), Leadership profiles, situation and effectiveness, *Creativity and Innovation Management*, 3(3), 139-161.
Ekvall, G. & L. Ryhammer (1999), The creative climate: its determinants and effects at a Swedish university, *Creativity research journal*, 12, 303-310.
Ekvall, G. (1996), Organizational climate for creativity and innovation, *European Journal of work and organizational psychology*, 5(1), 105-123.
Elfring, T. (2003), Intrapreneurship: corporate ondernemerschap en venturing, In: Risseeuw, P. & R. Thurik (2003), *Handboek ondernemers en adviseurs: management en economie van het midden- en kleinbedrijf*, Deventer: Kluwer, 147-164.
Elkins T. & R.T. Keller (2003), Leadership in research and development organizations: A literature review and conceptual framework, *Leadership Quarterly*, 14(4-5), 587-606.
Ellul, J. (1964), *The technological society*, Paris: Vintage.
Evangelista, R. (2000), Sectoral patterns of technological change in services, *Economics of Innovation and New Technology*, 9, 183-221.
Farr, J. & C. Ford (1990), Individual innovation, In: West, M.A. & J.L. Farr (1990), Innovation and creativity at Work: Psychological and Organisational Strategies, Chichester: John Wiley, 63-80.
Fiedler, F.E. (1967), *A contingency theory of leadership effectiveness*, New York: McGraw-Hill.
Fleishman, E.A. & E.F. Harris (1962), Patterns of leadership behavior related to employee grievances and turnover, *Personnel Psychology*, 15, 43-56.
Fleming, L. & M. Marx (2006), Managing Creativity in Small Worlds, *California Management Review*, 48 (4), 6-27.
Ford, C.M. (1996), A theory of individual creative action in multiple social domains, *Academy of Management review*, 21(4), 1112-1142.
Freel, M. (2003), Sectoral patterns of small firm innovation, networking and proximity, *Research Policy*, 32, 751-770.
Freeman, C., L. Clark & L. Soete (1982), *Unemployment and technical innovation, a study of long waves and economic development*, London: Frances Pinter.
Frese, M., E. Teng & C.J. Wijnen (1999), Helping to improve suggestion systems: Predictors of making suggestions in companies, *Journal of Organizational Behavior*, 20, 1139-1155.
Frese, M., W. Kring, A. Soose & J. Zempel (1996), Personal initiative at work: Differences between East and West Germany, *Academy of Management Journal*, 39, 37-63.
Frey, B.S. & R. Jegen (2001), Motivation crowding theory, *Journal of Economic Surveys*, 15(5), 589-611.
Fuller, J.B., L.E. Marler & K. Hester (2006), Promoting felt responsibility for constructive change and proactive behavior: exploring aspects of an elaborated

model of work design, *Journal of Organizational Behavior*, 27(8), 1089-1120.
Gabbay, S.M. & R.Th.A.J. Leenders (1999), Corporate social capital: the structure of advantage and disadvantage, In: Leenders, R.Th.A.J. & S.M. Gabbay (1999), *Corporate social capital and liability*, Dordrecht: Kluwer Academic Publishers.
Garcia, R. & R. Calantone (2002), A critical look at technological innovation typology and innovativeness terminology: a literature review, *Journal of Product Innovation Management*, 19, 110-132.
Gebert, D. (1987), Führung und innovation (Leadership and innovation), *Zeitschrift für betriebswirtschaftliche Forschung*, 39(10), 941-952.
Gebert, D., S. Boerner & R. Lanwehr (2003), The risks of autonomy: empirical evidence for the necessity of a balance management in promoting organisational innovativeness, *Creativity and innovation management*, 12(1), 41-49.
Getz, I. & A.G. Robinson (2003), Innovate or die: is that a fact?, *Creativity and innovation management*, 12(3), 130-136.
Goodman, R.A. & M.W. Lawless (1994), *Technology and strategy: conceptuals models and diagnostics*, Oxford: Oxford University Press.
Gough, H.G. (1979), A creative personality scale for the adjective check list, *Journal of personality and social psychology*, 37: 1398-1405.
Graen, G. & J.F. Cashman (1975), A role-making model of leadership in formal organizations: A developmental approach, In: Hunt, J.G. & L.L. Larson (1975), *Leadership Frontiers*, Kent: State University Press, 143-165.
Graen, G. & M. Uhl-Bien (1995), Relationship-based approach to leadership: Development of leader-member exchange (LMX) theory of leadership over 25 years, applying a multi-level multi-domain perspective, *Leadership Quarterly*, 6, 219-247.
Graen, G. & T. Scandura (1987), Towards a psychology of dyadic organizing. In: Cummings, L.L. & B.M. Staw (1987), *Research in organizational behavior*, Greenwich: JAI Press, 9, 175-208.
Granovetter, M.S. (1973), The Strength of Weak Ties, *American Journal of Sociology*, 78(6), 1360-1380.
Granovetter, M.S. (1982), The strength of weak ties: a network theory revisited, In: Marsden, P.V. & N. Lin (1982), *Social structure and network analysis*, Beverly Hills: Sage, 105-130.
Greiner, L.E. (1972), Evolution and Revolution as Organizations Grow, *Harvard Business Review*, 50, 37-46.
Hair, J.F., R.E. Anderson, R.L. Tatham, W.C. Black (1998), *Multivariate data analysis: fifth edition*, Englewood Cliffs: Prentice Hall.
Hambrick, D.C. & P. Mason (1984), Upper echelons: the organisation as a reflection of its top managers, *Academy of Management Review*, 9, 193-206.
Harborne, P. & A. Johne (2003), Creating a project climate for successful product innovation, *European Journal of innovation management*, 6(2), 118-132.
Harper, D. (1996), *Entrepreneurship and the market process*, London: Routledge.
Hater, J.J. & B.M. Bass (1988), Superiors' evaluations and subordinates' perceptions of transformational and transactional leadership, *Journal of Applied Psychology*, 73, 695-702.
Hellström, C. & T. Hellström (2002), Highways, alleys and by-lanes: charting the pathways for ideas and innovation in organizations, *Creativity and Innovation*

management, 11(2), 107-114.
Hemphill, J.K. & A.E. Coons (1957), Development of the leader behavior description questionnaire, In: Stogdill, R.M. & A.E. Coons (1957), *Leader behavior: Its description and measurement*, Columbus: Bureau of Business research, Ohio State University, 6-38.
Henderson, R. & K.B. Clark (1990), Architectural innovation: the reconfiguration of existing product technologies and the failure of established firms, *Administrative Science Quarterly*, 35, 9-30.
Hersey, P. & K.H. Blanchard (1969), *The management of organizational behavior*, Englewood Cliffs: Prentice Hall.
Hill, R. & L.W. Johnson (2003), When creativity is a must: professional 'applied creative' services, *Creativity and Innovation Management*, 12(4), 221-229.
Hislop, D. (2005), *Knowledge management in organizations – a critical introduction*, Oxford: Oxford University Press.
Hitt, M.A., R.E. Hoskisson, R.A. Johnson & D.D. Moesel (1996), The market for corporate control and firm innovation, *Academy of management journal*, 39, 1084-1196.
Hoang, H. & B. Antoncic (2003), Network-based research in entrepreneurship: A critical review, *Journal of Business Venturing*, 18, 165-187.
Hoffman K., M. Parejo, J. Bessant & L. Perren (1998), Small firms, R&D, technology and innovation in the UK: a literature review, *Technovation*, 18(1), 39-55.
Hofstede, G. (1993), Cultural constraints in management theories, *Academy of Management Executive*, 7(1), 81-94.
Hounsell, E.A. (1992), Invention in the industrial research laboratory: individual act or collective process, In: RJ. Weber & D.N. Perkins (1992), *Inventive minds: creativity in technology*, New York: Oxford University Press, 273-291.
House, R.J. & B. Shamir (1993), Toward the integration of transformational, charismatic and visionary theories, In: Chemers, M.M. & Y. Ayman (1993), *Leadership theory and research: Perspectives and directions*, 81-107.
House, R.J. & G. Dessler (1974), The Path-Goal Theory of Leadership: some post hoc and a priori tests, In: Hunt, J.G. & L.L. Larson (1974), *Contingency approaches to leadership*, Carbondale: Southern Illinois University Press.
House, R.J. (1971), A path-goal theory of leadership effectiveness, *Administrative Science Quarterly*, 16, 321-338.
House, R.J., A. Delbecq & T.W. Taris (1997), *Value based leadership: an integrated theory and an empirical test*, Unpublished report.
House, R.J., J. Woycke & E.M. Fodor (1988), Charismatic and noncharismatic leaders: differences in behavior and effectiveness. In: Conger, J.A. & R.N. Kanungo (1988), *Charismatic Leadership: the Elusive Factor in Organizational Effectiveness*, San Francisco: Jossey-Bass, 98-121.
Howell, J. & C. Higgins (1990), Champions of change: identifying, understanding, and supporting champions of technological change, *Organizational Dynamics*, 19 (1), 40-55.
Howell, J., P.W. Dorfman & S. Kerr (1986), Moderator variables in leadership research, *Academy of management review*, 11, 88-102.
Hunter, S.T., K.E. Bedell & M.D. Mumford (2007), Climate for Creativity: A Quantitative Review, *Creativity Research Journal*, 19(1), 69–90.

Hurt, H., K. Joseph & C. Cook (1977), Scale for the measurement of innovativeness, *Human Communication Research*, 4, 58-65.
Imai, M. (1986), *Kaizen: the key to Japan's competitive success*, New York: McGraw-Hill.
Jackson, P.R., T.D. Wall, R. Martin & K. Davids (1993), New measures of job control, job complexity, and suggestion contribution under gainsharing plans, *Journal of Applied Psychology*, 78, 753-762.
Janssen, O. & B. Buil (1998), Carrière-ankers en innovatief gedrag van leidinggevenden, *Gedrag en Organisatie*, 11(4), 194-202.
Janssen, O. & N.W. van Yperen (2004), Employees' goal orientations, the quality of leader-member exchange, and the role of job performance and job satisfaction, *Academy of Management Journal*, 47(3), 368-384.
Janssen, O. (2000), Job demands, perceptions of effort-reward fairness, and innovative work behavior, *Journal of Occupational and organizational psychology*, 73, 287-302.
Janssen, O. (2002), Transformationeel leiderschap en innovatief werkgedrag van medewerkers: een kwestie van benaderbaarheid van de leider (Transformational leadership and innovative work behaviour: a matter of approachability of the leader), *Gedrag & Organisatie*, 15, 275-293.
Janssen, O. (2003), Innovative behaviour and job involvement at the price of conflict and less satisfaction with co-workers, *Journal of occupational and organizational psychology*, 76 (3), 347-364.
Janssen, O. (2005), The joint impact of perceived influence and supervisor supportiveness on employee innovative behaviour, *Journal of occupational and organizational psychology*, 78 (4), 573-580.
Jaussi, K.S. & S.D. Dionne (2003), Leading for creativity: The role of unconventional leader behavior, *Leadership Quarterly*, 14(4-5), 475-498.
Jaworski, B.J. & A.K. Kohli (1993), Market orientation: antecedents and consequences, *Journal of Marketing*, 57, 53-70.
Johne, A & C. Storey (1998), New Service Development: A Review of the Literature and Annotated Bibliography, *European Journal of Marketing*, 32(3/4), 184-252.
Jones, G.R. (2004), *Organisational theory, design and change: text and cases*, Upper Saddle River: Pearson.
Judge, W.Q., G.E. Gryxell & R.S. Dooley (1997), The new task of R&D management: creating goal-directed communities for innovation, *California Management Review*, 39, 72-85.
Jung D.I., C. Chow & A. Wu (2003), The role of transformational leadership in enhancing organizational innovation: Hypotheses and some preliminary findings, *Leadership Quarterly*, 14(4-5), 525-544.
Kahai, S.S., J.J. Sosik & B.J. Avolio (2003), Effects of leadership style, anonymity, and rewards on creativity-relevant processes and outcomes in an electronic meeting system context, *Leadership Quarterly*, 14(4-5), 499-524.
Kanter, R.M. (1983), *The change masters*, New York: Simon & Schuster.
Kanter, R.M. (1988), When a thousand flowers bloom: structural, collective and social conditions for innovation in organization, *Research in Organizational behavior*, 10, 169-211.
Kantrow, A.M. (1980), The strategy-technology connection, *Harvard Business*

Review, 58(4), 13-21.
Kasperson, C.J. (1978), Psychology of the scientist: XXXVII. Scientific creativity: A relationship with information channels, *Psychological Reports*, 42, 691-694.
Katz, D. & R.L. Kahn (1978). *The social psychology of organizations*, New York: Wiley.
Katz, D. (1964), The motivational basis of organizational behavior, *Behavioral Science*, 9, 131-133.
Katz, R. (1997), *The human side of managing technological innovation*, Oxford: Oxford University Press.
Keller, R.T. (1989), A test of the path-goal theory of leadership with need for clarity as a moderator in research and development organizations, *Journal of applied psychology*, 74, 208-212.
Keller, R.T. (2006), Transformational Leadership, Initiating Structure, and Substitutes for Leadership: A Longitudinal Study of Research and Development Project Team Performance, *Journal of Applied Psychology*, 91(1), 202-210.
Kerr, S. & J.M. Jermier (1978), Substitutes for leadership: their meaning and measurement, *Organizational Behavior and Human Performance*, 22, 375-403.
Kimberley, J.R. & M.J. Evanisko (1981), Organizational innovation: the influence of individual, organizational and contextual factors on hospital adoption of technological and administrative innovations, *Academy of management journal*, 24, 689-713.
King N. & N. Anderson (2002), *Managing innovation and change: a critical guide for organizations*, London: Thomson.
Kipnis, D., F.M. Schmidt & I. Wilkinson (1980), Intra-organizational influence tactics: Explorations in getting one's way. *Journal of Applied Psychology*, 65, 440-452.
Kirkpatrick, S.A. & E.A. Locke (1991), Leadership: Do traits matter?, *Academy of Management Excecutive*, 5, 48-60.
Kirton, M. (1976), Adaptors and innovators: a description and measure, *Journal of Applied Psychology*, 61, 622-629.
Kleysen, R.F. & C.T. Street (2001), Towards a Multi-dimensional measure of individual innovative behavior, *Journal of Intellectual Capital*, 2(3), 284-296.
Kohli, A.K. (1985), Contingent approving supervisory behaviour, In: Brunner, G.C. & P.J. Hensel (1994), *Marketing scales handbook: A compilation of multi-item measures*, Chicago: American Marketing Association, 844-845.
Koopman, P.L. (1980), *Besluitvorming in organisaties*, Assen: Van Gorcum.
Korman, A.K. (1966), Consideration, initiating structure, and organizational criteria: A review, *Personnel Psychology*, 19, 349-361.
Kotter, J.P. (1990), *A Force for Change: How Leadership Differs from Management*, New York: Free Press.
Kouzes, J.M. & B.Z. Posner (1987), *The leadership challenge: How to get extraordinary things done in organizations*, San Francisco: Jossey-Bass.
Krause, D.E. (2004), Influence-based leadership as a determinant of the inclination to innovate and of innovation-related behaviors: An empirical investigation, *LeadershipQuarterly*, 15(1), 79-102.
Krueger, N.F. (2000), The cognitive structure of opportunity emergence, *Entrepreneurship theory and practice*, spring, 5-23.

Kruglanski, A.W., I. Friedman & G. Zeevi (1971), The effects of extrinsic incentive on some qualitative aspects of task performance, *Journal of Personality*, 39, 606-617.

Lazarus, R.S. (1966), *Psychological stress and the coping process*, New York: McGraw-Hill.

Leonard, D. & W. Swap (2005), *When sparks fly: harnessing the power of group creativity*, Boston: Harvard Business Publishers.

Likert, R. (1967), *The human organization*, New York: McGraw-Hill.

Lincoln, J.R. & J. Miller (1979), Work and friendship ties in organizations: A comparative analysis of relational networks, *Administrative Science Quarterly*, 24, 181-199.

Lubart, T.I. (1994), *Product centered self-evaluation and the creative process*, New Haven: Yale University.

Malerba, F. & L. Orsenigo (1996), Schumpeterian patterns of innovation are technology-specific, *Research Policy*, 25(3), 451-478.

Manz, C.C. & H.P. Sims jr. (1989), *Superleadership: Leading others to lead themselves*, Englewood Cliffs: Prentice Hall.

March, J.G. & H.A. Simon (1958), *Organizations*, New York: Wiley.

Mathisen, G. & S. Einarsen (2004), Review of instruments assessing creative and innovative environments within organizations, *Creativity Research Journal*, 16(1), 119-140.

Mathisen, G., T. Torsheim & S. Einarsen (2006), The team-level model of climate for innovation: a two-level confirmatory factor analysis, *Journal of occupational and organizational psychology*, 79(1), 23-36.

McAdam, R. & J. McClelland (2002), Individual and team-based idea generation within innovation management: organizational and research agendas, *European Journal of Innovation Management*, 5(2), 86-97.

McDonough, E.F. (2000), Investigation of factors contributing to the success of cross-functional teams, *Journal of Product Innovation Management*, 17, 221-235.

Meeus, M., L. Oerlemans & J. Hage (2001), Patterns of interactive learning in a high-tech region, *Organisation Studies*, 22(1), 145-172.

Mintzberg, H. (1973), *The nature of managerial work*, New York: Harper & Row.

Miron, E., M. Erez & E. Naveh (2004), Do personal characteristics and cultural values that promote innovation, quality, and efficiency compete or complement each other?, *Journal of Organisational Behavior*, 25(2), 175-199.

Morrison, E.W. & C.C. Phelps (1999), Taking charge at work: Extra-role efforts to initiate workplace change, *Academy of Management Journal*, 42, 403-419.

Mouly, V.S. & J.K. Sankaran (1999), The permanent acting leader: insights from a dying Indian R&D organization, *LeadershipQuarterly*, 10, 673-652.

Mulder, P., H.L.F. de Groot & M.W. Hofkes (2001), Economic growth and technological change: a comparison of insights from a neo-classical and evolutionary perspective, *Technological Forecast and Social Change*, 68, 151-171.

Mumford, M.D. & B. Licuanan (2004), Leading for innovation: Conclusions, issues, and directions, *Leadership Quarterly*, 15(1), 163-171.

Mumford, M.D. (2000), Managing creative people: strategies and tactics for innovation, *Human Resources Management Review*, 10(3), 313-351.

Mumford, M.D. (2003), Where have we been, where are we going? Taking stock in creativity research, *Creativity Research Journal*, 15(2-3), 107-120.
Mumford, M.D., G.M. Scott, B. Gladdis & J.M. Strange (2002), Leading creative people: Orchestrating expertise and relationships, *Leadership Quarterly*, 13, 705-750.
Mumford, M.D., W.A. Baughman & R. Reiter-Palmon (1997), Thinking creativity at work: organizational influence on creative problem solving, *Journal of creative behavior*, 31, 7-17.
Needham, J. (1969), *The Grand Titration: Science and society in East and West*, London: Allen & Unwin.
Nelson, R.R. (1992), National innovation systems: a retrospective on a study, *Industrial Corporate Change*, 1, 347-374.
Nijhof, A., K. Krabbendam & J.K. Looise (2002), Innovation through exemptions: building upon the existing creativity of employees, *Technovation*, 22(11), 675-683.
Nonaka, I., H. Takeuchi (1995), *The Knowledge-creating company*, Oxford University Press: New York.
Nooteboom, B. (1994), Innovation and diffusion in small firms: theory and evidence, *Small Business Economics*, 6(5), 327-347.
Nystrom, H. (1990), Organizational innovation, In: West, M.A. & J.L. Farr (1990), *Innovation and creativity at work: psychological and organizational strategies*, Chichester: Wiley.
Oakey, R.P. & S.M. Mukhtar (1999), United Kingdom High-technology Small Firms in Theory and Practice: A Review of Recent Trends, *International Small Business Journal*, 17(2), 48-64.
OECD (2000), *Promoting innovation and growth in services*, Paris: OECD.
OECD (2005), *Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data, 3rd Edition*, Paris: OECD.
Oldham, G.R., & A. Cummings (1996), Employee creativity: Personal and contextual factors at work, *Academy of Management Journal*, 39(3), 607-634.
Ong, C.H., D.W. Wan & S.H. Chang (2003), Factors affecting individual innovation: an examination within a Japanese subsidiary in Singapore, *Technovation*, 23(7), 617-632.
Ozgen, E. & R.A. Baron (2007), Social sources of information in opportunity recognition: Effects of mentors, industry networks, and professional forums, *Journal of Business Venturing*, 22(2), 174-192.
Parker, S.K. & C.M. Axtell (2001), Seeing another viewpoint: Antecedents and outcomes of employee perspective taking, *Academy of Management Journal*, 44, 1085-1100.
Parker, S.K. & P.R. Jackson (1993), The implementation of high-performance work-teams, In: Gowler, D., K. Legge & C. Clegg (1993), *Case studies in organizational behaviour and human resource management*, London: Paul Chapman Publishing.
Parker, S.K., H.M. Williams & N. Turner (2006), Modeling the antecedents of proactive behavior at work, *Journal of Applied Psychology*, 91 (3), 636-652.
Parker, S.K., N. Chmiel & T. Wall (1997), Work characteristics and employee well-being within a context of strategic downsizing, *Journal of Occupational Health*

Psychology, 2, 289-303.
Parnes, S.J., R.B. Noller & A.M. Biondi (1977), *Guide to creative action*, New York: Charles Scribner's Sons.
Patterson, M.G. (1999), *Innovation potential predictor*, Oxford: Oxford University Press.
Pavitt, K. (1984), Sectoral patterns of technical change: towards a taxonomy and a theory, *Research Policy*, 13, 343-373.
Perry-Smith, J.E. & C.E. Shalley (2003), The social side of creativity: a static and dynamic social network perspective, *Academy of Management Review*, 28, 89-106.
Perry-Smith, J.E. (2006), Social Yet Creative: The Role of Social Relationships, *Academy of Management journal*, 49(1), 85-102.
Peters, T.J. & R.H. Waterman (1982), *In search of excellence: lessons from America's best run companies*, New York: Harper&Row.
Petroski, H. (1992), Form follows failure, *Invention & Technology*, Fall, 54-61.
Porter, M.E. (1979), How competitive forces shape strategy, *Harvard Business Review*, March-April, 137-145.
Porter, M.E. (1985), *Competitive advantage: creating and sustaining superior performance*, New York: Free Press.
Quinn, R.E. (1988), *Beyond rational management: mastering the paradoxes and competing demands of high performance*, San Francisco: Jossey-Bass.
Ragazzoni, P., P. Baiardi, A. Zotti, N. Anderson & M. West (2002), Italian validation of the team climate inventory: A measure of team climate for innovation, *Journal of Managerial Psychology*, 17, 325-336.
Rank, J., V.L. Pace & M. Frese (2004), Three Avenues for Future Research on Creativity, Innovation, and Initiative, *Applied Psychology: an international review*, 53(4), 518-528.
Rauch, C.F. & Behling, O. (1984), Functionalism: Basis for an alternate approach to the study of leadership, In: Hunt, J.G., D.M. Hosking, C.A. Schriesheim & R.Stewart (1984), *Leaders and Managers: International perspectives on managerial behavior and leadership*, Elmsford: Pergamon Press.
Raven, B.H. (1992), A power/interaction model of interpersonal influence: French and Raven thirty years later, *Journal of Social Behaviour and Personality*, 7(2), 217-244.
Redmond, M.R. M.D. Mumford & R.J. Teach (1993), Putting creativity to work: Leader influences on subordinate creativity, *Organizational behavior and human decision processes*, 55, 120-151.
Reichers, A.E. & B. Schneider (1990), Climate and culture: an evolution of constructs, In: Schneider, B. (1990), *Organizational Climate and Culture*, San Francisco: Jossey Bass, 5-39.
Rickards, T. & S. Moger (2006), Creative leaders: A decade of contributions from creativity and innovation management, *Creativity and Innovation Management*, 15(1), 4-18.
Rogers, E.M. (1983), *Diffusion of innovations*, New York: Free Press.
Rothenberg, A. (1996), The Janusian process in scientific discovery, *Creativity research journal*, 9, 207-232.
Ruigrok, W., L. Achtenhagen, J. Rügg-Stürm & M. Wagner (2000), Hilti AG: Shared

leadership and the rise of the communication organization, In: Pettigrew, A. & E. Fenton (2000), *The innovating organization*, London: Sage.
Runco, M.A. & I. Chand (1994), *Problem finding, problem solving, and creativity*, Norwood: Ablex.
Schein, E.H. (1992), *Organisational culture and leadership*, San Francisco: Jossey-Bass.
Scherer, F.M. (1965), Firm Size, Market Structure, Opportunity, and the Output of Patented Inventions, *American Economic Review*, 55(5), 1097-1125.
Schippers, M.C. (2003), *Reflexivity in teams*, Amsterdam: Vrije Universiteit.
Schmookler, J. (1966), *Invention and economic growth*, Cambridge: Harvard University Press.
Schneider, B. (1990), The climate for service: an application of the climate construct, In: Schneider, B. (1990), *Organisational climate and culture*, San Francisco: Jossey-Bass, 383-412.
Schoemaker, P.J.H. (1993), Strategic Decisions in Organizations: Rational and behavioural views, *Journal of Management Studies*, 30(1), 107-129.
Schumpeter, J.A. (1934), *Theory of economic development*, Cambridge: Harvard University Press.
Scott, S.G. & R.A. Bruce (1994), Determinants of innovative behavior: A path model of individual innovation in the workplace, *Academy of Management Journal*, 38, 1442-1465.
Scott, S.G. & R.A. Bruce (1998), Following the leader in R&D: The joint effect of subordinate problem-solving style and leader-member relations on innovative behavior, *IEEE Transactions on Engineering Management*, 45(1), 3-10.
Seibert, S.E., M.L. Kramer & J.M. Crant (2001), What do proactive people do? A longitudinal model linking proactive personality and career success, *Personnel Psychology*, 54, 845-874.
Senge, P. (1990), *The fifth discipline: the art and practice of the learning organisation*, New York: Doubleday.
Shalley, C.E. & J.E. Perry-Smith (2001), Effects of social-psychological factors on creative performance: the role of informational and controlling expected evaluation and modelling experience, *Organisational behaviour and human decision processes*, 84, 1-22.
Shalley, C.E. & L.L. Gilson (2004), What leaders need to know: A review of social and contextual factors that can foster or hinder creativity, *Leadership Quarterly*, 15(1), 33-54.
Shamir, B., R.J. House & M.B. Arthur (1993), The motivational effects of charismatic leadership: A self-concept based theory, *Organization Science*, 4, 577-594.
Shane, S. & S. Venkataraman (2000), The promise of entrepreneurship as a field of research, *Academy of Management Review*, 26(1), 13-17.
Shane, S. (1994), Are champions different from non-champions?, *Journal of Business Venturing*, 9(5), 397-421.
Shane, S. (2003), *A General Theory of Entrepreneurship: The Individual-Opportunity Nexus*, Aldershot: Edward Elgar.
Shin, J. (1997), *The effects of executive leadership on organizational innovation in nonprofit, human service organizations*, Pittsburgh: University of Pittsburgh.
Shin, S.J. & J. Zhou (2003), Transformational leadership, conservation, and

creativity: evidence from Korea, *Academy of Management Journal*, 46(6), 703-714.
Siegel, S., & W. Kaemmerer (1978), Measuring the perceived support for innovation in organisations, *Journal of Applied Psychology*, 63, 553-562.
Simon, H.A. (1957), *Administrative Behaviour*, New York: MacMillan.
Simonton, D.K. (1983), Intergenerational transfer of individual differences in hereditary monarchs: genetic, rolemodeling, cohort, or sociocultural effects?, *Journal of personality and social psychology*, 44, 354-364.
Simonton, D.K. (1999), *Origins of genius*, New York: Oxford University Press.
Smith, G.P. (2002), *The new leader: bringing creativity and innovation to the workplace*, Conyers: Chart Your Course.
Snijders, T. & R.J. Bosker (1999), *Multilevel Analysis: An introduction to basic and advanced multilevel modelling*, London: Sage.
Sosik, J.J., S.S. Kahai & B.J. Avolio (1998), Transformational leadership and dimensions of creativity: Motivating idea generation in computer-mediated groups, *Creativity Research Journal*, 11, 111-121.
Speller K.G. & G.M. Schumacher (1975), Age and set in creative test performance, *Psychological reports*, 36, 447-450.
Spreitzer, G.M. (1995), Psychological empowerment in the workplace: Dimensions, measurement, and validation, *Academy of Management Journal*, 38, 1442-1465.
Staw, B.M. (1990), An evolutionary approach to creativity and innovation, In: West, M.A. & J.L. Farr (1990), *Innovation and creativity at work: Psychological and Organisational Strategies*, Chichester: Wiley, 287-308.
Stogdill, R.M. (1974), *Handbook of leadership: a survey of the literature*, New York: Free Press.
Stoneman, P. (1983), *The Economic Analysis of Technological Change*, Oxford: Oxford University Press.
Strauss, A.L. & J. Corbin (1990), *Basics of qualitative research: grounded theory procedures and techniques*, London: Sage.
Tesluk, P.E., J.L. Farr & S.R. Klein (1997), Influences of organisational culture and climate on individual creativity, *Journal of Creative Behaviour*, 31(1), 27-41.
Thamhain, H.J. & G.R. Gemmill (1974), Influence styles of project managers: some project performance correlates, *Academy of Management Journal*, 17, 216-224.
Tidd, J., J. Bessant & K. Pavitt (2001), *Managing Innovation: Integrating Technological, Market and Organizational Change*, John Wiley & Sons.
Tierney, P. &. S.M. Farmer (2004), The Pygmalion Process and Employee Creativity, *Journal of Management*, 30: 413-432.
Tierney, P., S.M. Farmer & G.B. Graen (1999), An examination of leadership and employee creativity: The relevance of traits and relationships, *Personnel Psychology*, 52, 591-620.
Van de Ven, A. (1986), Central problems in the management of innovation, *Management Science*, 32, 590-607.
Van Dijk, C. & J. van den Ende (2002), Suggestion Systems: Transferring Employee Creativity Into Practicable Ideas, *R&D Management*, 32, 387-395.
Van Dyne, L. & J. LePine (1998), Helping and voice extra-role behaviors: Evidence of construct and predictive validity, *Academy of Management Journal*, 41, 108-119.

Venkataraman, S. (1997), The distinctive domain of entrepreneurship research: an editor's perspective, In: Katz, J. & R. Brockhaus (1997), *Advances in Entrepreneurship, Firm Emergence, and Growth*, Greenwich: JAI Press, 119-138.

Von Hippel, E. (2005), *Democratizing Innovation*, Cambridge: MIT Press.

Vroom, V.H. & P.W. Yetton (1973), *Leadership and decision-making*, Pittsburgh: University of Pittsburgh Press.

Waldman, D. & L. Atwater (1992), The nature of effective leadership and championing processes at different level in an R&D hierarchy, *Journal of High Technology Management Research*, 5, 233-245.

Wallas, G. (1926), *The art of thought*, New York: Harcourt.

Weber, M. (1947), *The theory of social and economic organization*, Glencoe: Free Press.

West, M.A. & J.L. Farr (1990), Innovation at work, In: West, M.A. & J.L. Farr (1990), *Innovation and creativity at work: Psychological and Organisational Strategies*, Chichester: John Wiley, 3-13.

West, M.A. & N. Anderson (1996), Innovation in top management teams, *Journal of Applied Psychology*, 81, 680-693.

West, M.A. & W.M.M. Altink (1996), Innovation at Work: Individual, Group, Organizational, and Socio-historical Perspectives, *European Journal of Work and Organizational Psychology*, 5(1): 3-11.

West, M.A. (1987), A measure of role innovation at work, *British Journal of Social Psychology*, 26, 83-85.

West, M.A. (1990), The social psychology of innovation in groups, In: West, M.A. & J.L. Farr (1990), *Innovation and creativity at work: Psychological and Organisational Strategies*, Chichester: Wiley, 309-333.

West, M.A. (2002), Sparkling fountains or stagnant ponds: An integrative model of creativity and innovation implementation in work groups, *Applied Psychology: An International Review*, 51(3), 355-387.

Wheelwright, S. & K. Clark (1992), *Revolutionising product development*, New York: Free Press.

Wolfe, R.A. (1994), Organizational innovation: Review, critique and suggested research directions, *Journal of Management Studies*, 31, 405-431.

Yammarino, F.J. & B.M. Bass (1990), Long-term forecasting of transformational leadership and its effects among naval officers: some preliminary findings, In: Clark, K.E. & M.B. Clark (1990), *Measures of Leadership*, West Orange: Leadership Library of America, 151-170.

Yammarino, F.J., S.D. Dionne, C.J. Uk & F. Dansereau (2005), Leadership and levels of analysis: a state-of-the-science review, *Leadership Quarterly*, 16(6), 879-920.

Yin, R.K. (1994), *Case study research: design and methods*, Thousand Oaks: Sage.

Yukl, G. & B. Tracey (1992), Consequences of influence tactics used with subordinates, peers, and the boss, *Journal of Applied Psychology*, 77, 525-535.

Yukl, G. (2002), *Leadership in organizations*, New York: Prentice Hall.

Yukl, G., S. Wall & R. Lepsinger (1990), Preliminary report on validation of the managerial practices survey, In: Clark, K.E. & M.B. Clark (1990), *Measures of leadership*, West Orange: Leadership library of America, 223-238.

Zaleznik, A. (1977), Managers and leaders: are they different?, *Harvard Business*

Review, 55(5), 67-78.
Zaltman, G., R. Duncan & J. Holbek (1973), *Innovations and Organizations*, New York: John Wiley.
Zhou, J. & C.E. Shalley (2003), Research on employee creativity: a critical review and proposal for future research directions, In: Martocchio, J.J. & G.R. Ferris (2003), *Research in personnel and human resource management*, Oxford: Elsevier.
Zhou, J. & J.M. George (2001), When job dissatisfaction leads to creativity: Encouraging the expression of voice, *Academy of Management Journal*, 44, 682-696.
Zhou, J. (1998), Feedback valence, feedback style, task autonomy, and achievement orientation: interactive effects of creative performance, *Journal of Applied Psychology*, 83, 261-276.
Zhou, J. (2003), When the presence of creative coworkers is related to creativity: role of supervisor close monitoring, developmental feedback, and creative personality, *Journal of Applied Psychology*, 88, 413-422.

Brief summary

This study had two objectives. First, it developed and tested a measure for employees' innovative work behavior (IWB). Second and most important, it analysed the relationship between leadership and IWB, and explored if innovation climate and external work contacts neutralize this relationship, i.e. serve as moderating variables.

We defined innovative work behavior (IWB) as individuals' behaviors directed towards the initiation and intentional introduction (within a work role, group or organization) of new and useful ideas, processes, products or procedures. Innovative work behavior is restricted to intentional efforts to provide beneficial novel outcomes. It entails both the initiation and implementation of innovations, and is strongly related with employee creativity. The main difference with creativity is however that the IWB construct also captures implementation-oriented behaviors. We hypothesized that IWB is a four-dimensional construct, including opportunity exploration, idea generation, championing and application.

Previous studies mainly focused on the impact of theory-based leadership styles. Here, drawing on in-depth interviews (with leaders in knowledge-intensive business services) and a literature review 13 leader behaviors were found that could be antecedents of IWB: innovative role-modeling, intellectual stimulation, stimulating knowledge diffusion, providing vision, consulting, delegating, support for innovation, organizing feedback, recognizing, rewarding, providing resources, monitoring and challenging task assignment. With the exception of monitoring, a positive relationship with IWB was expected for each of these behaviors.

We also hypothesized that the relationship between leadership and IWB is moderated by innovation climate and employees' external work contacts. We explored this for three dimensions of innovation climate: participative safety, striving for excellence and support for innovation. We anticipated positive correlations between IWB and each of these dimensions. Moreover, it was presupposed that the connection between leader behaviors and employees' IWB would be stronger when innovation climate dimensions were perceived as unfavorable. We argued that favorable climates could substitute for leadership and vice versa. As for employees' external work contacts, a positive connection with IWB was expected. Moreover, it was hypothesized

that the connection between leader behaviors and employees' IWB would be stronger in situations of few external work contacts.

A pilot study was done to develop measures for our main study. The setting was a Dutch research firm. Responses were obtained from two sources, namely 81 knowledge workers and their leaders. All constructs were measured with multiple-item measures, i.e. for our IWB construct (leader-rated) and leadership behaviors, innovation climate and external work contacts (all rated by employees). As for the IWB measure, an item-selection process produced ten items that were further tested in the main study.

The main study was done among 703 knowledge workers and their leaders in 94 different organizations. The sample covered individuals in four knowledge-intensive service industries: IT services, legal and accounting services, economic/consultancy services and engineering services. We again obtained responses from knowledge workers and their leaders. Drawing on confirmatory factor analyses the ten-item IWB measure was found to be sufficiently reliable and valid in terms of convergent and criterion validity. Divergent validity was however rather weak. We found strong correlations between the dimensions of opportunity exploration, idea generation, championing and application, so in subsequent analyses one summative IWB scale was used. For the other measures we found satisfactory psychometric properties. One notable exception was that in our innovation climate measure the participative safety dimension had to be split into two subdimensions ('fellowship' and 'minority acceptance').

Our hypotheses were tested with hierarchical multilevel regression models to account for the nested structure of our data (employees within firms). Six out of the 13 leader behaviors proved to be significantly related with IWB, namely consulting, delegating, support for innovation, recognizing, providing resources and task assignment. Besides, monitoring produced the expected negative sign. As for the control variables, external work contacts were significantly related with IWB, while – rather surprisingly – all dimensions of innovation climate were not. Next, the supposed interaction effects was also analysed with multilevel modelling. For external work contacts no significant interactions were found. Innovation climate however provided a lot of significant parameters. Support for innovation in the work group was demonstrated to be an important neutralizer of the relationship between leadership and IWB.

The ten-item IWB measure was recommended for application in future individual innovation surveys. We also recommended that this measure needs to be further

developed to improve our understanding of the IWB construct. As indicated, its divergent validity needs attention. In order to explore pros and cons the measure should be applied in other settings than knowledge-intensive services, and data should also be obtained from others than leaders (e.g. colleagues or spouses).

Implications for leaders with a desire to stimulate individual innovation are twofold. First, the most important aspects of innovation-stimulating leadership relate to participation and direct support. Participation includes consulting, delegating and assigning employees with challenging tasks. The more employees can participate in decision-making, have freedom to plan and act, and feel challenged by their tasks, the more enthusiastic and committed they will be to innovate. Direct support relates to providing support, recognition and resources for innovation. The more leaders demonstrate confidence in their employees, praise and appreciate innovative efforts, and demonstrate enacted support by providing time and money, the more employees can focus on being innovative rather than having to worry of being punished or unable to realise innovations. Second, our results indicated that the connection between leader behaviors and IWB is stronger in situations of unfavorable innovation climates. This especially applies to work group support for innovation, i.e. the amount of support that knowledge workers perceived from their colleagues. The above-mentioned leaders behaviors were even stronger related with IWB when work group support was low. Besides, the insignificant leaders behaviors of innovative role-modeling, intellectual stimulation and providing vision became significant in case of low work group support. In all, work group support for innovation neutralizes the impact of leadership and vice versa.

Finally, although some leader behaviors remained unrelated with IWB, one cannot immediately discard these constructs as antecedents of IWB. The same applies to the innovation climate construct. Other variables may moderate their relationship with IWB; our view of relevant variables may be clouded. Other avenues for future work include the replication of findings with longitudinal data, and the application of our constructs in other settings than knowledge-intensive services.

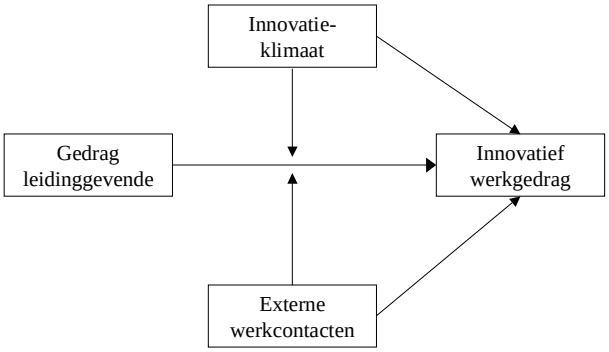
Samenvatting

Innovatie door individuen: Het verband tussen leiderschap en innovatief gedrag van medewerkers

Innovatie is essentieel voor het voortbestaan en functioneren van organisaties. Dit onderzoek richtte zich op het innovatief gedrag van medewerkers in organisaties. We ontwikkelden een meetschaal om innovatief gedrag in kaart te brengen, en analyseerden hoe leidinggevenden met hun eigen gedrag innovatief gedrag van medewerkers beïnvloeden.

Of medewerkers innoveren hangt sterk af van de vraag of en hoe zij met andere personen in hun werk interacteren. Reacties van andere personen zoals de leidinggevende, collega's en klanten kunnen innovatief gedrag stimuleren of ontmoedigen. Behalve leiderschap namen we ook de rol van andere personen in de werkomgeving mee. Bijna iedere werknemer heeft te maken met collega's die innovatie kunnen stimuleren (innovatieklimaat), en met klanten, leveranciers en andere contacten (externe werkcontacten). De verwachting was dat innovatieklimaat en externe werkcontacten van invloed zijn op het innovatieve gedrag van medewerkers. Bovendien hebben we getoetst of beide factoren het effect van leiderschap op innovatief werkgedrag modereren. Het gehanteerde onderzoeksmodel is weergegeven in figuur S1.

figuur S1. Onderzoeksmodel



Het onderzoek bestond uit literatuurstudie, diepte-interviews met leidinggevenden, een pilotstudie onder de medewerkers van een onderzoeksbureau, en een hoofdstudie in 94 verschillende bedrijven. Verreweg de meeste studies hebben gekeken naar beroepen waar innovatie onderdeel is van het dagelijkse werk, zoals R&D-medewerkers, wetenschappers en artiesten. Hier onderzochten we het innovatieve gedrag van kenniswerkers: consultants, ingenieurs, architecten, ICT'ers, advocaten en accountants. Voor hen is innovatie belangrijk, maar niet iets dat in het dagelijkse werk per se centraal staat. Kenniswerkers zijn nog maar weinig onderzocht, terwijl hun aandeel in de beroepsbevolking omvangrijk is en groeit.

Innovatief gedrag

Innovatief werkgedrag is gedefinieerd als alle gedragingen van individuen die zijn gericht op de initiatie en bewuste introductie (in hun werk, groep of organisatie) van nieuwe en bruikbare ideeën, producten, processen of procedures. Met deze definitie sluiten we aan bij het in de innovatieliteratuur veel gehanteerde fasenmodel, waarbij we twee fasen hebben onderscheiden: de initiatie en de implementatie van innovaties. De initiatiefase is een divergente fase waarin een individu innovatiekansen signaleert en op ideeën komt. De implementatiefase is een convergente fase waarin een idee wordt ontwikkeld en gerealiseerd. De fasen zijn gescheiden door het moment waarop iemand beslist om met een idee verder te gaan.

Innovatief werkgedrag is sterk verwant met de creativiteit van medewerkers. In de context van organisaties definieert men creativiteit vaak als de productie van nieuwe en bruikbare ideeën voor producten, diensten, processen, etc. Een belangrijk verschil is dat innovatief werkgedrag ook de implementatie van ideeën omvat. Creativiteit is als deelverzameling van innovatief werkgedrag te beschouwen, met name in de initiërende fase van het innovatieproces.

Bestaande meetinstrumenten voor innovatief gedrag kennen een aantal nadelen. De meeste beschouwen innovatief gedrag als een ééndimensionaal begrip. Daarmee houden zij onvoldoende rekening met verschillende typen van innovatief gedrag in beide fasen van het innovatieproces. Verder laten bestaande meetinstrumenten na om data te verzamelen bij een onafhankelijke bron, dat wil zeggen, medewerkers geven vaak zelf aan of zij innovatief zijn geweest. Dit kan leiden tot sociale wenselijkheid in de gegeven antwoorden. Ten slotte zijn nog geen uitgebreide validatiestudies uitgevoerd. In dit onderzoek hielden we met deze zaken rekening.

Onze hypothese was dat innovatief gedrag van medewerkers een vierdimensionaal construct is, bestaande uit 1. ideeverkenning, 2. ideegeneratie, 3.

ideepromotie en 4. ideerealisatie. Ideeverkenning houdt in dat een medewerker actief zoekt naar innovatiekansen. Ideegeneratie staat voor het vermogen van medewerkers om oplossingen te bedenken voor geïdentificeerde innovatiekansen. Ideepromotie zorgt ervoor dat anderen (leidinggevenden, collega's, sponsoren, afnemers, etc.) worden overtuigd van de waarde van een idee. Ideerealisatie is de daadwerkelijke implementatie bestaande uit het ontwikkelen, testen en introduceren van de innovatie.

Leiderschap

Leiderschap werd gedefinieerd als het proces gericht op de beïnvloeding van medewerkers om hun gedrag en onderlinge relaties te richten, structureren en faciliteren, zodanig dat zij bepaalde gewenste uitkomsten realiseren. Leiderschap is een onderwerp dat al vele decennia wordt bestudeerd en dat verschillende stromingen kent. In dit onderzoek hebben we gekeken naar het gedrag van leidinggevenden en twee specifieke situatiekenmerken die daarbij een rol spelen, namelijk innovatieklimaat en externe werkcontacten. Eerdere studies naar de relatie tussen leiderschap en innovatief werkgedrag zijn relatief zeldzaam. Het accent lag daarbij vooral op toepassing van leiderschapsmodellen die zijn ontwikkeld om de algemene werkprestaties van medewerkers te verklaren. Voorbeelden zijn transformationeel en participerend leiderschap. Het is echter niet vanzelfsprekend dat leiderschapsgedragingen die beogen om medewerkers tot betere (algemene) werkprestaties aan te zetten, ook geschikt zijn om innovatie te stimuleren.

Op basis van literatuurstudie en diepte-interviews vonden we 13 gedragingen van leidinggevenden die zouden kunnen samenhangen met innovatief werkgedrag. De gevonden aspecten van leiderschap waren de volgende:

a. Het voorbeeld geven. Een leidinggevende die zelf innovatief is zou medewerkers tot hetzelfde kunnen stimuleren, zoals mensen gedrag nadoen dat zij gedemonstreerd zien.
b. Intellectueel uitdagen, ofwel stimuleren en uitdagen om bestaande zaken in nieuwe perspectieven te plaatsen. Dit kan medewerkers motiveren tot innovatie, ook omdat zo'n leidinggevende impliciet de verwachting uitspreekt dat innovatie gewenst is.
c. Stimuleren van kennisoverdracht. Het stimuleren van medewerkers om elkaar goed te informeren kan leiden tot meer beschikbare kennis en informatie waardoor innovatiekansen eerder worden gezien en gegrepen.
d. Visie uitdragen. Een langetermijnvisie op innovatie in het bedrijf zou medewerkers kunnen motiveren om aan innovatie bij te dragen.
e. Consulteren. Medewerkers laten deelnemen in de besluitvorming kan prikkelen tot

meer innovatief gedrag. Zij zijn vaak gemotiveerder voor veranderingen en verbeteringen door de invloed die zij hebben kunnen uitoefenen.

f. Delegeren. Als medewerkers zelf kunnen beslissen voelen zij zich meer 'eigenaar' van problemen/knelpunten, hetgeen de bereidheid tot verbetering zou kunnen bevorderen.
g. Steun voor innovatie. Dit kan bijdragen aan de motivatie voor en het geloof van medewerkers in de haalbaarheid van innovatie.
h. Organiseren van feedback. Feedback van de leidinggevende of een andere aangewezen persoon zou een idee kunnen verbeteren en de kans op een succesvolle implementatie ten goede kunnen komen.
i. Erkenning. Waardering voor innovatieve inspanningen kan de motivatie van medewerkers om te innoveren verhogen.
j. Belonen. Een geldelijke beloning kan ervoor zorgen dat medewerkers zien dat innovatief gedrag ook loont, dat wil zeggen een zeker persoonlijk voordeel oplevert.
k. Verschaffen van middelen. Voor innovatie is vaak tijd en geld nodig; zonder middelen zou innovatief gedrag ontmoedigd kunnen worden.
l. Strikt monitoren. Dit betekent dat leidinggevenden scherp controleren of medewerkers wel de juiste prestaties leveren en werken volgens voorgeschreven methoden. Het kan medewerkers ontmoedigen om te innoveren.
m. Toewijzing van uitdagende taken. Als medewerkers zich voelen uitgedaagd (werk sluit aan bij de eigen voorkeuren en kwaliteiten) worden zij naar verwachting geprikkeld tot innovatie omdat hun motivatie voor het werk toeneemt.

Innovatieklimaat en externe werkcontacten

Het klimaat in een organisatie staat voor de heersende gevoelens, houdingen en normen in een organisatie. Het vertelt medewerkers wat belangrijk is en wat men beter kan laten. Hoewel het logisch lijkt om een positief verband te veronderstellen tussen innovatieklimaat en innovatief gedrag van medewerkers, lieten voorgaande studies wisselende resultaten zien. Eerder onderzoek suggereerde dat innovatieklimaat een meerdimensionaal begrip is, waarbij verschillende dimensies op hun eigen wijze met innovatief gedrag kunnen samenhangen. We namen daarom drie dimensies van innovatieklimaat in het onderzoek mee:

a. Veiligheidsbeleving. De mate waarin medewerkers zich in hun werkgroep gemakkelijk voelen en waarin een eigen mening is toegestaan, zelfs als die afwijkt van het meerderheidsstandpunt.
b. Streven naar excellentie. Een gedeeld streven om taken zo goed mogelijk uit te

voeren en om te zoeken naar verbetermogelijkheden.

c. Steun voor innovatie. De mate waarin medewerkers van hun collega's verbale en fysieke steun (denken te) krijgen als zij innoveren.

Behalve een positieve samenhang tussen de deze dimensies en innovatief gedrag, is ook getoetst in hoeverre innovatieklimaat de samenhang tussen leiderschap en innovatief gedrag modereert. De verwachting was dat leiderschap en innovatief gedrag sterker samenhangen als het innovatieklimaat ongunstig is, en vice versa. Een gunstig innovatieklimaat kan het verband tussen leiderschap en innovatief gedrag neutraliseren omdat medewerkers van hun collega's al druk ervaren om te innoveren.

Een andere controlevariabele was de mate waarin medewerkers externe werkcontacten onderhouden. Eerder onderzoek heeft laten zien dat frequente en intensieve contacten met afnemers, leveranciers, concurrenten, etc, innovatief gedrag van medewerkers bevordert. Dergelijke medewerkers hebben toegang tot meer inspiratie- en hulpbronnen. Met externe werkcontacten is eveneens getoetst of dit de relatie tussen leiderschap en innovatief gedrag modereert. De verwachting was dat beide minder zouden samenhangen bij meer externe werkcontacten, omdat leidinggevenden minder gelegenheid hebben om medewerkers te beïnvloeden als zij vaak buiten de deur zijn.

Pilotstudie

Een pilotstudie diende om meetschalen te ontwikkelen voor het hoofdonderzoek. De pilot vond plaats in een commercieel onderzoeksbureau in Nederland. Om vertekening in de uitkomsten te voorkomen gebruikten we twee databronnen. Medewerkers werd gevraagd naar hun leidinggevende, innovatieklimaat en externe werkcontacten. Bovendien kregen zij vragen over hun innovatieve resultaten in de afgelopen periode. Deze vragen dienden ter validering van de meetschaal voor innovatief werkgedrag. Leidinggevenden gaven in een aparte vragenlijst een oordeel over het innovatief gedrag van hun medewerkers.

Eerst werd een database ontwikkeld met vraagitems in de vorm van stellingen. Ieder construct werd met ten minste zes items gemeten. De vragenlijsten werden schriftelijk afgenomen. Respondenten konden antwoorden op vijfpuntsschalen, meestal van het type 'helemaal mee eens-helemaal mee oneens'. Het onderzoeksbureau had ten tijde van het onderzoek 102 kenniswerkers in dienst waarvan er 81 aan het onderzoek meededen. Ook van hun leidinggevenden werden antwoorden verkregen.

De antwoorden dienden vervolgens als basis voor de ontwikkeling van meetschalen. Daarbij waren de criteria: zuinigheid, betrouwbaarheid, controle van het aantal dimensies in een schaal en begripsvaliditeit. Innovatief werkgedrag werd oorspronkelijk met 17 items gemeten. Op basis van factoranalyse vonden we tien items die samen een goede vierdimensionele schaal vormden. De dertien leiderschapsconstructen werden na een item-selectieproces elk met drie of vier items gemeten. Innovatieklimaat werd met een driedimensionale schaal gemeten. De dimensies van veiligheidsbeleving, streven naar excellentie en steun voor innovatie kwamen in een factoranalyse duidelijk naar voren. Externe werkcontacten werd ten slotte met een eendimensionale schaal gemeten, bestaande uit vijf items.

Hoofdstudie

De geselecteerde vraagitems werden in het hoofdonderzoek opnieuw toegepast. Respondenten waren medewerkers van 94 verschillende kennisintensieve dienstverleners in het MKB, alsmede hun leidinggevenden. Betrokken bedrijven hielden zich bezig met accountancy, juridische diensten, consultancy, engineering, architectuur en ICT-dienstverlening. De data werden opnieuw verzameld bij medewerkers en hun leidinggevenden. We kregen respons van 703 kenniswerkers en beoordelingen van leidinggevenden die betrekking hadden op 879 kenniswerkers (na koppeling van beide bestanden beschikten we over 693 waarnemingen).

Met de data werd een definitieve meetschaal geconstrueerd voor innovatief werkgedrag. Om de tien resterende vraagitems te toetsen op convergente en divergente validiteit gebruikten we confirmatieve factoranalyse. Confirmatieve analyse gaf aan dat een vier-factormodel het best bij de data paste; beter dan uit de theorie afgeleide alternatieve modellen met één, twee of drie factoren. Criteriumvaliditeit werd ondersteund door een positief verband tussen de meetschaal van innovatief werkgedrag en de eigen beoordeling door medewerkers van hun innovatieve prestaties. Een nadeel van de geconstrueerde meetschaal is dat slechts zwakke steun werd gevonden voor de divergente validiteit tussen de vier dimensies. De dimensies ideeverkenning, -generatie, -promotie en -realisatie bleven vrij sterk gecorreleerd. Daarom werden de vier dimensies gecombineerd tot een overkoepelende schaal voor innovatief werkgedrag.

Voor de overige constructen werden opnieuw goede resultaten gevonden. Alle leiderschapsgedragingen waren eendimensionaal en betrouwbaar. Ook de schaal voor externe werkcontacten was van voldoende kwaliteit. Op basis van confirmatieve factoranalyse bleek dat de dimensie veiligheidsbeleving beter kon worden gesplitst in 'acceptatie van minderheidsstandpunten' en 'kameraadschap'. Dit model met vier

factoren (de genoemde factoren plus 'streven naar excellentie' en 'steun voor innovatie') bleek optimaal in termen van convergente en divergente validiteit.

Bevindingen

We hebben eerst onze hypothesen over de samenhang tussen het gedrag van leidinggevenden en innovatief werkgedrag van kenniswerkers getoetst. Omdat onze data een geneste structuur kennen (medewerkers in organisaties) hebben we verschillende multilevel regressiemodellen geschat. De controlevariabelen waren het geslacht van de respondent, een dummy voor de bedrijfsomvang (> 20 werknemers), dummies voor het type sector (met ICT-diensten als referentiegroep), vier dimensies van innovatieklimaat, en externe werkcontacten. Zoals verwacht bleek externe werkcontacten sterk en significant gecorreleerd met het innovatieve gedrag van kenniswerkers. Voor de dimensies van innovatieklimaat kon verrassend geen connectie worden vastgesteld. Geen van de dimensies bleek gerelateerd aan innovatief gedrag.

Daarna werden dertien modellen geschat om het effect van de diverse leiderschapsgedragingen te schatten. Voor een aantal gedragingen werden onze hypothesen bevestigd: consulteren, delegeren, steun voor innovatie, erkenning, verschaffen van middelen en toewijzing van uitdagende taken bleken positief samen te hangen met innovatief werkgedrag. Ook de hypothese over een negatieve samenhang met strikt monitoren werd bevestigd. De overige hypothesen werden verworpen.

Ten slotte zijn verschillende interactie-effecten geschat om te toetsen of innovatieklimaat en externe werkcontacten inderdaad de samenhang tussen leiderschap en innovatief gedrag modereren. Voor externe werkcontacten vonden we geen significante interactie-effecten. Voor de dimensies van innovatieklimaat vonden we gedeeltelijke steun voor onze hypothese dat een gunstig klimaat de samenhang tussen leiderschap en innovatief gedrag verzwakt, terwijl een ongunstig klimaat de invloed van leidinggeven juist doet toenemen. Vooral de dimensie ‘steun voor innovatie van collega's’ bleek belangrijk. Negen van de 13 leiderschapsgedragingen waren sterker met innovatief gedrag verbonden als medewerkers van hun collega's weinig steun zeiden te ontvangen. Dit was niet alleen van toepassing op aspecten van leiderschap die ook al direct met innovatief gedrag correleerden (bijvoorbeeld consulteren en delegeren), maar ook op sommige gedragingen waar een directe samenhang ontbrak (bijvoorbeeld intellectueel uitdagen en het uitdragen van een visie).

Ook voor andere dimensies van innovatieklimaat vonden we significante interacties. Als medewerkers van collega’s weinig kameraadschap ervoeren bleken leidinggevenden die medewerkers intellectueel uitdagen innovatief gedrag positief te

beïnvloeden, terwijl dit verband bij hoge percepties van kameraadschap verdween. In situaties van een lage acceptatie van minderheidsstandpunten in de werkgroep bleek het consulteren van medewerkers sterker samen te hangen met innovatief gedrag en vice versa. Als het streven naar excellentie ten slotte laag was, bleken leidinggevenden die hun medewerkers van uitdagende taken voorzien meer innovatief gedrag te rapporteren en vice versa.

Discussie

Met het onderzoek droegen we op twee manieren bij aan de literatuur over individuele innovatie. Ten eerste hebben we een meetschaal ontwikkeld voor het innovatieve gedrag van medewerkers. Deze schaal omvat tien vraagitems die betrekking hebben op ideeverkenning, -generatie, -promotie en -realisatie. In toekomstige studies kunnen deze items worden gebruikt om individuele innovatie te meten. Vooral als objective innovatie-indicatoren (zoals registraties van uitvindingen of patenten) ontbreken ligt toepassing van de meetschaal voor de hand. Dit zal met name het geval zijn in bedrijfstakken waar innovatie níet het centrale kenmerk van het werk is zoals de industrie, bouwnijverheid, handel en transportsector. De divergente validiteit van de meetschaal is overigens nog voor verbetering vatbaar. Er zou grondig moeten worden onderzocht hoe de meetschaal zich gedraagt in andere situaties dan kenniswerkers. Ook een andere bron van de gegevens (beoordeling voor innovatief gedrag door collega's in plaats van de leidinggevende) zou verschil kunnen maken.

Ten tweede is in kaart gebracht welke samenhang bestaat tussen het gedrag van leidinggevenden en innovatief gedrag van medewerkers, en of innovatieklimaat en externe werkcontacten deze samenhang modereren. Onze bevindingen zijn samengevat in tabel S1.

In de gedragsaspecten die direct en positief samenhangen met innovatief gedrag kunnen we twee dimensies onderscheiden: participatie en directe steun. Beide vormen van leidinggeven zullen in de praktijk het innovatieve gedrag van kenniswerkers ten goede komen. Participatie omvat het consulteren van medewerkers, het delegeren en het toewijzen van uitdagende taken. Directe steun omvat steun aan medewerkers met innovatieve ideeën, erkenning geven voor innovatieve inspanningen, en de beschikbaarstelling van middelen om te kunnen innoveren. Beide zaken motiveren medewerkers voor de inhoud van hun werk en verhogen hun betrokkenheid en gevoel zelf in staat te zijn om innovaties te realiseren.

tabel S1. Samenvatting bevindingen

Gedrag leidinggevende:	*Directe samenhang*	*Interactie met dimensies van innovatieklimaat: verband met innovatief gedrag is..*
Het voorbeeld geven	-	…positief bij weinig steun voor innovatie van collega's.
Intellectueel uitdagen	-	…positief bij weinig kameraadschap onder collega's; …positief bij weinig steun voor innovatie van collega's.
Stimuleren van kennisoverdracht	-	-
Visie uitdragen	-	…positief bij weinig steun voor innovatie van collega's.
Consulteren	Positief	…positiever bij weinig acceptatie van minderheids-standpunten door collega's; …positiever bij weinig steun voor innovatie van collega's.
Delegeren	Positief	…positiever bij weinig steun voor innovatie van collega's.
Steun voor innovatie	Positief	…positiever bij weinig steun voor innovatie van collega's.
Organiseren van feedback	-	-
Erkenning	Positief	…positiever bij weinig steun voor innovatie van collega's.
Belonen	-	-
Verschaffen van middelen	Positief	…positiever bij weinig steun voor innovatie van collega's.
Strikt monitoren	Negatief	…negatiever bij veel steun voor innovatie van collega's.
Toewijzing uitdagende taken	Positief	…positiever bij weinig streven naar excellentie onder collega's.
Controlevariabelen:		
Innovatieklimaat	-	
Externe werkcontacten	Positief	

Een andere belangrijke uitkomst is de rol van innovatieklimaat als modererende variabele. Vooral de mate waarin medewerkers door hun collega's worden gesteund is van belang, niet alleen voor de leiderschapsgedragingen die direct met innovatief gedrag samenhangen (het verband wordt dan sterker als steun van collega's ontbreekt, en zwakker bij veel steun van collega's), maar ook voor sommige gedragingen die geen direct verband hebben. Zo beïnvloeden leidinggevenden die een innovatief voorbeeld zijn, medewerkers intellectueel uitdagen, en een innovatieve visie uitdragen, hun medewerkers wel degelijk bij weinig steun van innovatie van collega’s. De resultaten onderbouwen de hypothese dat een gunstig klimaat de invloed van leiderschap doet afnemen, en omgekeerd de invloed van de leidinggevende sterker maakt in een ongunstig klimaat.

Sommige aspecten van leiderschap bleven ongerelateerd met innovatief gedrag: stimuleren van kennisoverdracht, organiseren van feedback, en het financieel belonen van innovatieve inspanningen. Ook tussen innovatieklimaat an sich en innovatief gedrag vonden we geen (direct) verband. We kunnen deze constructen echter niet afschrijven als determinant van individuele innovatie, omdat lang niet alle potentiële modererende factoren zijn onderzocht. Voor het organiseren van feedback is

bijvoorbeeld van belang hóe de feedback precies wordt gegeven: op een informatieve, opbouwende dan wel een controlerende manier. In het eerste geval ligt een positief verband met innovatief gedrag voor de hand, terwijl bij controlerende feedback het verband negatief zou kunnen zijn. Omdat we dit onderscheid niet hebben gemaakt, kan dit de oorzaak zijn van het vinden van een niet-significant resultaat. Voor toekomstig onderzoek is het een uitdaging alternatieve verklaringen te toetsen.

Naast het verder bestuderen van interactie-effecten zijn er nog andere richtingen voor toekomstig onderzoek. Impliciet hebben we vele argumenten gebruikt om verbanden te leggen tussen leiderschap en innovatief gedrag, onder ander de motivatie van medewerkers, hun percepties van controle, verwachte opbrengsten en de invloed van sociale netwerken. Deze tussenliggende mechanismen zijn in het veldonderzoek zelf niet expliciet gemeten. Een andere, algemene aanbeveling is dat met onze veldstudies cross-sectionele data zijn verzameld. Harde conclusies over de causaliteit zijn - hoewel aannemelijk - niet te trekken. Daarvoor is onderzoek met longitudinale gegevens nodig. Een laatste belangrijke richting is om de robuustheid van onze bevindingen te toetsen door ook in andere omgevingen dan kenniswerkers onderzoek te doen. Er zijn nog vele andere bedrijfstakken en beroepsgroepen waar de aard van het werk wezenlijk verschilt, en de vraag is welke aspecten van leidinggeven daar het meest relevant zijn.

Nawoord

‘Knap van je om dat naast je gewone werk te doen’. Een collega met wie ik al tien jaar samenwerk, complimenteerde me bij de koffieautomaat met dit proefschrift. Het is me de laatste jaren vaker gevraagd. Hoe combineer je dat met je gewone werk? Is het niet zwaar? Keer op keer heb ik geantwoord dat dat reuze meeviel. Het heeft alles te maken met doen wat je leuk vindt. Anders zou ik een proefschrift schrijven aan niemand aanraden. Of zoals die bekende filosoof uit het Oosten ooit zei: de reis is belangrijker dan de bestemming, of zoiets. Op de fiets naar huis besefte ik me dat dit ook geldt voor het onderwerp uit dit proefschrift. Zorg dat je medewerkers veel plezier hebben in wat zij doen, dan heb je de belangrijkste voorwaarde voor innovatie al te pakken.

Zonder de hulp van Deanne den Hartog was dit proefschrift niet geworden wat het nu is. Je enthousiaste, scherpe en altijd pragmatische begeleiding heb ik zeer op prijs gesteld. En ik was blij met een leeftijdgenoot als promotor, dat gaf toch een hoop meer om over te praten dan alleen het onderzoek. We gaan nu ongetwijfeld mooie artikelen maken. Verder wil ik Peter van Hoesel danken voor zijn begeleiding in de eerste jaren, en voor zijn aanmoedigingen vooraf om door te gaan. Ook Jürgen Hanemaaijer, die in het eerste jaar als stagiair heeft meegeholpen met het literatuuronderzoek, wil ik hier graag noemen. Tenslotte dank ik Shirley Cooper die de uiteindelijke tekst onder handen heeft genomen op de kwaliteit van het Engels.

Zoetermeer, 30 september 2007

Geschreven ondanks het prettige gezelschap van Mirjam, en later ook Lennard en Arno