

# Supporting intrinsic motivation of knowledge workers within teams

*Distributed leadership and a climate for informal learning as social  
conditions for facilitating autonomy and competence satisfaction*

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## 1. Abstract

In the current economy work depends on the creativity, commitment, perseverance, and ability to learn of knowledge workers. Intrinsic motivation is a key concept to ensure the productivity of knowledge workers. The main purpose of this study is to investigate how the intrinsic motivation of knowledge workers within a team can be supported. The Self-determination theory describes the importance of a supportive social context in facilitating intrinsic motivation through the satisfaction of the basic psychological need for autonomy and competence. We theoretically argue that the theory of distributed leadership and a climate for informal learning are social conditions that can facilitate satisfaction of the need for autonomy (in terms of self-direction, self-initiation and self-determination) and competence (in terms of learning, development and knowledge productivity). To empirically study these theoretical relationships a survey has been conducted in 21 teams of knowledge workers in an organization for child and youth support in the Netherlands. The results show that only a climate for informal learning has a positive relationship with autonomy satisfaction. This indicates that the quality of social interaction is more important than the mere presence of it. For competence satisfaction, a positive and significant relationship with a knowledge worker's personal influence within a team was found. This indicates that the granting of influence can be perceived as positive feedback, which satisfies the need for competence. Due to a low between-group variance the team level effects on competence could neither be confirmed nor rejected. Theoretical and practical implications are discussed.

## 2. Introduction

In a knowledge economy the core assets of the modern organization are not its buildings, machinery, and real estate, but the intelligence, understanding, skills, and experience of its employees (Manville & Ober, 2003). The emphasis upon individual physical labor and ability to regulate and coordinate this has given way to an emphasis upon the potential human contribution to the production and application of knowledge (Kessels, 2004). Economic success requires the ability to create new knowledge and to apply that new knowledge to the improvement of products, services, and working processes (Drucker, 1993; Kessels, 1996). This ability is well known as Knowledge productivity (Kessels, 2001). The demand for knowledge productivity has a direct influence on the way work is organized. Kessels (2004) points out that knowledge work depends on the creativity, commitment, perseverance, and ability to learn of knowledge workers. Drucker (1993, p. 8) defines these workers as: "knowledge executives who know how to allocate knowledge to productive use". Developing the capabilities and commitment of knowledge workers currently is the biggest challenge of organizations (Drucker, 1993; Manville & Ober, 2003; Senge, 1990). One of the most important factors in this challenge is that of what motivates people to work, because "motivation produces" (Ryan & Deci, 2000).

Current systems of reward and punishment do not motivate the knowledge worker to be productive (Pink, 2009). Research on the Self-Determination Theory (SDT) shows that intrinsic motivation contributes the most to being productive, especially when considering cognitively complex tasks and creativity (Amabile, 1996; Deci & Ryan, 2000). Also, external motivators such as monetary rewards have proven counterproductive (Deci, Koestner, & Ryan, 1999). According to the SDT for intrinsic motivation to flourish three basic psychological needs have to be satisfied: autonomy, competence and relatedness. The social context is the most important factor in either supporting or diminishing the satisfaction of these needs (Deci & Ryan, 2008). Intrinsic motivation is defined as what someone finds interesting and would do in the absence of external consequences (Ryan & Deci, 2000). This puts an emphasis on the individual person, which means that the need for autonomy and competence have the most powerful influences on intrinsic motivation (Deci & Ryan, 2000). This doesn't mean that relatedness is irrelevant, but it plays a more distal role. This implies that focusing on social conditions in which the need for autonomy and competence are satisfied are most likely to yield the positive results, like better learning, performance, and well-being, intrinsic motivation is associated with (Deci & Ryan, 2000).

Providing insights on how organizations can attain the potential productivity of their knowledge workers has become the most important challenge for the field of Human Resource Development (HRD) (Kessels, 2004). In order to be knowledge productive, learning and working have to be integrated (Kessels & Poell, 2011). This calls for an integrated approach of learning at the workplace and a focus on creating a learning environment (Harrison & Kessels, 2004; Kessels, 2007).

Tjepkema (2003) underlines that creating an environment for learning where knowledge workers become motivated, can not be based on hierarchy and power, but is achieved through relevant and meaningful work, in cooperation with colleagues who face the same challenges, dilemma's and questions (see also De Laat, 2012). This partially explains the increase in interest towards teamwork in the past two decades. Teamwork has been heralded as one of the answers to the challenge of the organization to increase knowledge productivity (Sofu, 1999). Especially self-managing teams are believed to provide a fitting context to achieve both individual and organizational learning (Tjepkema, 2003). Tjepkema (2003, p. 6) defines a self-managing team as:

A permanent group of employees who work together on a daily basis, who, as a team, share the responsibility for all interdependent activities necessary to deliver a well-defined product or service to an internal or external customer. The team is, to a certain degree, responsible for managing itself and the tasks it performs, on the basis of a clear common purpose. In order to do so, the team has access to relevant information, possesses relevant competences and other resources, and has the authority to independently make decisions with regard to the work process (e.g. solving problems).

With the theory of the corporate curriculum, Kessels (1996) describes a learning climate in which employees and teams can develop knowledge productivity. Such a climate depends on self-regulation and self-determination of the knowledge worker. Stimulating and facilitating, opposed to commanding and controlling, are key components in creating such a climate (Kessels, 1996). Eraut (2004) also highlights the importance of a climate that promotes informal learning. Teams operate best in an open climate, where relationships are based on trust, mutual protection and support (Bennet, Wise, Woods, & Harvey, 2003). For teams working within knowledge intensive organizations, learning together is one of the key activities helping workers to overcome obstacles and engage in reflective activity (Marsick & Volpe, 1999). This suggests that learning within teams is dependent on the quality of the informal relationships between team members. This makes a climate for informal learning an important social condition for learning. Although this implies that it also supports the satisfaction of the need for autonomy and competence, this relationship has not been empirically established yet.

The development towards knowledge productive workers organized in teams also sheds a different light on leadership within organizations. Drucker (1993, p. 45) argues that "no one knowledge ranks higher than another. (...) The modern organization cannot be an organization of boss and subordinate; it must be organized as a team of associates". A model of leadership in which an individual or small group decides for the whole is not sufficient in a knowledge economy (Manville & Ober, 2003). The basis for this model is command and control, but when employees feel controlled, their need for autonomy is forestalled (Deci & Ryan, 2000). In the knowledge economy there is a call for a different view on leadership within organizations, one that suits the knowledge worker's need for self-determination (Manville & Ober, 2003). This inspires the academic field of leadership to move to a more integrated model centered around social interactions (Dijkstra & Feld, 2012; Gronn, 2000; Spillane, 2006; Uhl-Bien, Marion, & McKelvey, 2007). Distributed leadership theory regards leadership as the product of social interactions between leaders (individual agents), followers and their context. At the core of the distributed leadership theory is the dynamic process of claiming and granting social influence within a social network (DeRue & Ashford, 2010; Hulsbos, Andersen, Wassink, & Kessels, 2012). This allows individuals who have relevant expertise, competencies and motivation for the job at hand to assert influence (Kessels, 2012). Many theorists and practitioners rely on distributed leadership for providing the answers to the questions of leadership in the knowledge economy (e.g. Dijkstra & Feld, 2012; McBeth, 2008; Thorpe, Gold, & Lawler, 2011; Uhl-Bien et al., 2007). However empirical evidence remains thin, especially within the context of teams (Harris, Leithwood, Day, Sammons, & Hopkins, 2007).

In sum, the literature on knowledge work and the associated learning shows a strong emphasis on the individual workers and their ability to self-direct. Being able to initiate behavior on the basis of intrinsic motivation, the expression of the human tendency toward learning and creativity, is a key component for knowledge workers to be self-directed and yields positive effects for effective knowledge work (such as perseverance, creativity and performance). The SDT focuses on facilitating (specifically not directing or creating) intrinsic motivation through the satisfaction of the basic psychological need for autonomy, competence and relatedness. The satisfaction of the need for autonomy and competence have been found to have the strongest relationship with intrinsic motivation (Deci & Ryan, 2000). Therefore, this study focuses solely on these two needs.

Hirschler (2013) elaborates further on the relationship of distributed leadership and a climate for informal learning with the satisfaction of the need for competence and relatedness. The satisfaction of autonomy and competence requires supportive social conditions (Ryan & Deci, 2000). According to Tjepkema (2003) self-managing teams provide a fitting social context to support the development of knowledge workers (Tjepkema, 2003). Following this, we argue that the theory of distributed leadership and a climate for informal learning are important social conditions within a team, specifically for knowledge workers. Theoretically these social conditions are linked to the need for autonomy (in terms of self-direction, self-initiation and self-determination) and competence (in terms of learning, development and knowledge productivity). These relationships have not yet been empirically established. This study seeks to provide evidence for the positive relationship between these social conditions within teams and the facilitation of intrinsic motivation of knowledge workers. This provides insight for theorists, HRD practitioners and organizations in what social conditions knowledge workers can flourish.

We conducted a study in 21 teams of a child and youth support organization in the east of the Netherlands. These teams fit the definition of Tjepkema (2003) of self-managing teams. The employees in the child and youth support organization are best described as frontline workers: "public service workers who interact directly with citizens in the course of their jobs, and who have a substantial discretion in the execution of their work" (Bruining, 2005, p. 300). Bruining (2005, p. 159) makes a direct link between frontline work and knowledge work, stating that "organizations in public service, such as schools, hospitals and police forces, want to improve their service to society (...), they have to appreciate their employees in the frontline as knowledge workers".

### 3. Theoretical framework

The next section explores further the concept of motivation and the potential of distributed leadership and a climate for informal learning as social conditions supporting optimal motivation. This provides a theoretical background for the main research question:

*How do distributed leadership and a climate for informal learning within a team of knowledge workers relate to the satisfaction of the individual need for autonomy and competence?*

The theoretical exploration results in eight hypotheses, which will be used in the rest of the study to answer the main research question. The hypotheses will be presented throughout the section in line with the theoretical background from which they emerge. At the end of this section the research model is presented in Figure 1.

#### 3.1 Motivation and the Self-determination theory

For organizations to develop the knowledge productivity of their workers they need to know what motivates knowledge workers. Traditionally, productivity in industrial work flourishes because of extrinsic motivators like direction, reward and punishment. This is sufficient because not a lot of cognition is needed and the algorithm is simple: more physical labor equals more production, which means a larger reward (Pink, 2009). But the question is if this is still sufficient for knowledge work, because it depends on a person's creativity, perseverance, and ability to learn (Kessels, 2001). Motivating the knowledge worker will have to be done by satisfying their values, and by giving them social recognition and social power (Drucker, 1993). Knowledge work relies more on intrinsic motivation, which includes self-direction, interest and purpose (Pink, 2009). Intrinsic motivation is the inherent tendency to seek out novelty and challenges, to extend and exercise one's capacities, to explore, and to learn (Ryan & Deci, 2000). When people who are intrinsically motivated are compared to extrinsically motivated people the former show more interest, excitement, and confidence. This is related to enhanced performance, persistence, creativity (Deci & Ryan, 1991; Sheldon, Ryan, Rawsthorne, & Ilardi, 1997), self-esteem (Deci & Ryan, 1995), and general well-being (Ryan, Deci, & Grolnick, 1995). In addition, research by Deci and Ryan (1985) shows that extrinsic motivators like tangible rewards, threats, deadlines, directives, pressured evaluations, and imposed goals diminish intrinsic motivation because people feel as if their behavior is determined for them. On the other hand, choice, acknowledgment of feelings, and opportunities for self-direction enhance intrinsic motivation because people feel that their behavior is self-determined.

The Self-Determination Theory (SDT) is a general theory on motivation and focuses on how social and cultural factors facilitate or undermine people's sense of volition and initiative, in addition to their well-being and the quality of their performance (Deci & Ryan, 2000). Intrinsic motivation, or autonomous motivation, is an important part of the SDT. The theory is based on the assumption that people are proactive and engaged, with tendencies toward growing, mastering challenges, and seeking new experiences. The social context can either support or thwart these natural tendencies. Central to the theory is the satisfaction of three basic psychological needs: autonomy, competence and relatedness. These basic psychological needs are considered to be innate, fundamental propensities, much like biological needs (Deci & Ryan, 2000).

Autonomy describes the need to feel volitional and to experience a sense of choice and psychological freedom when you engage in an activity (DeCharms, 1968). It's important to note that autonomy is not the same as independence (Ryan & Deci, 2000). Independence means to function alone and not rely on others. You can still experience autonomy when you depend on others and even when you follow others' requests (Van den Broeck, Vansteenkiste, Witte, Soenens, & Lens, 2010). The need for competence is to feel effective in interacting with your environment (White, 1959). It is the urge to explore and change your environment and to seek challenging tasks to test and extend your skills. Satisfying the need for competence allows you to adapt to complex and changing environments, whereas dissatisfaction results in helplessness (Deci & Ryan, 2000). The need for relatedness is to feel connected to others, to be a member of a group, and develop close relationships with others (Baumeister & Leary, 1995; Deci & Ryan, 2000).

The satisfaction of each of these basic psychological needs correlate positively with workers' optimal functioning, including enhanced performance, persistence, and creativity (Deci & Ryan, 2000; Van den Broeck et al., 2010). In addition, it yields positive results for the worker as well. Need satisfaction is associated with less burnout at work (Fernet, Guay, & Senécal, 2004), higher job satisfaction (Millette & Gagné, 2008), and general well-being (Fernet, 2013). This means that high-quality motivation is positive for both the organization and the worker (Deci & Ryan, 2008).

### **3.2 Distributed leadership**

Traditional views approach leadership as a function of an individual person and studies leaders' traits and behaviors (Yukl, 2002). In this view leaders are portrayed as heroes on top of the organization, whose knowledge and direction flows down the organization and more than once they 'save the day' (Conger, 1999; Spillane, 2006; Yukl, 2002). However, there is a lack of evidence for this perceived dramatic impact in organizations of a single individual (Thorpe et al., 2011). Senge (2002, p. 22) notes that "as such myths prevail, they reinforce a focus on short-term events and charismatic heroes rather than on systemic forces and collective learning". The traditional view on leadership roots in the industrial era and worked in very different circumstances than the current work environment (Uhl-Bien et al., 2007). Because of today's radically different context, a radically different perspective on leadership is demanded (Osborn, Hunt, & Jauch, 2002). Organizations now have flatter structures and are more similar to a linked network, than a hierarchy of individuals (Thorpe et al., 2011). Work has become knowledge-based and innovation occurs through social processes within networks (Hallikas, Karkkainen, & Lampela, 2009). Gronn (2002) views leadership as a social process. In this view leadership is stretched over people and situations and focuses on the influence exerted in situations to achieve successful outcomes. Leadership is therefore considered to be a shared attribute of a network (e.g. teams or organizations) (Thorpe et al., 2011).

The theory of distributed leadership takes a holistic view on leadership and focuses on social influence (Thorpe et al., 2011). Distributed leadership is the product of social interactions between leaders (individual agents), followers and their context (Gronn, 2002; Spillane, 2006). Different contexts or circumstances ask for different leaders (Osborn et al., 2002; Van Vugt, Hogan, & Kaiser, 2008). Therefore influence needs to be located at those individuals and groups who have relevant expertise, competencies and motivation for the job at hand (Kessels, 2012). Central to the distributed leadership theory is the process of claiming and granting social influence by organizational members (DeRue & Ashford, 2010). Social influence is perceived as a bottom-up, emerging, reciprocal process within a network (opposed to the traditional top-down perception) in which leadership roles dynamically shift between network members (DeRue & Ashford, 2010; Kessels, 2012; Sussmann & Vecchio, 1982; Thorpe et al., 2011). In the context of teams Morgeson, DeRue & Karam (2009, p. 8) state that "team leadership can thus be viewed as oriented around team need satisfaction [...] Whoever (inside or outside the team) assumes responsibility for satisfying a team's needs can be

viewed as taking on a team leadership role". The distributed leadership theory is regarded to be the answer to the question of how to lead a knowledge-based organization. However, there is little empirical evidence to support this (Bennet et al., 2003; Harris et al., 2007; Thorpe et al., 2011). The dynamic process of claiming and granting allows workers to take responsibility in their work, which may contribute to the satisfaction of the basic psychological needs for intrinsic motivation. However, this relationship has not yet been established.

**Operationalizing distributed leadership.** Within the theory of distributed leadership, Spillane (2006, p. 11) defines leadership as follows:

Leadership refers to activities tied to the core work of the organization that are designed by organizational members to influence the motivation, knowledge, affect, and practices of other organizational members or that are understood by organizational members as intended to influence their motivation, knowledge, affect, and practices.

This definition emphasizes two important aspects which are essential for the operationalisation of distributed leadership. First, only 'activities tied to the core work of the organization' can be subject of leadership. Second, leadership contains activities designed by an organizational member to influence other organizational members, as well as the influence perceived by organizational members that wasn't specifically designed as such. To operationalize the first aspect, the activities related to the core work of the organization, the concept of *leadership functions* is helpful. Leadership functions are the needs of a team in order to be effective (Morgeson et al., 2009). Derksen, de Caluwé and Simons (2011) differentiate four functions that are important for teams to be innovative. They highlight that teams who are able to fulfill all four functions are more effective on complex tasks, than teams who fulfill only one or two of these leadership functions. The four functions are (Derksen et al., 2011):

- **Organizing** is making appointments, scheduling, making sure the work is divided, who, when and how.
- **Creating future** is formulating a shared vision for the future, defining the mutual cause and asserting the added value that the team needs to deliver
- **Reflecting** is taking a perspective on one's work and social processes, rethinking habits, processes and collaborations. Also known as 'taking the helicopter view'
- **Dialoguing** is conducting a conversation in which norms, values and visions are shared and explored while postponing judgement.

The process of claiming and granting influence based on what the situation demands (DeRue & Ashford, 2010; Hulsbos et al., 2012; Kessels, 2012) gives insight in operationalizing the second aspect of Spillane (2006), social influence. The demand for flexibility of knowledge intensive organizations, teams and workers should also be expressed in leadership (Osborn et al., 2002). Different situations ask for different leaders (Van Vugt et al., 2008). This dynamism is reflected in the flexibility of leader and follower roles, which can change according to the demands of a team and its context (DeRue & Ashford, 2010). This means when the process of claiming and granting is dynamic, teams will be able to respond more effectively to new situations and stay away from conforming to established leadership patterns (DeRue & Ashford, 2010).

**Distributed leadership studied from a social network approach.** To expose the claiming and granting process within a team the social network approach (Pastor & Mayo, 2002) is suitable. The social network approach analyzes the relationships and structure of influence within networks (Pastor & Mayo, 2002). Research on leadership using a social network approach to leadership is scarce (Mehra, Smith, Dixon, & Robertson, 2006; Pastor & Mayo, 2002), but it is promising for examining social influence within teams. Three aspects of the social network approach are relevant for this study: individual centrality, team centrality and team density.

Individual centrality represents an individual's influence in the social system (Pastor & Mayo, 2002). It reflects how many members of a network grant someone influence. This also reflects an individual's ability to successfully claim influence on the basis of relevant expertise, competencies and motivation (Kessels, 2012). The process of claiming and granting allows workers to take responsibility and can therefore provide a feeling of choice, acknowledgment and a perceived influence on one's environment (Deci & Ryan, 2000) and thus providing satisfaction of the need for autonomy.

In addition, Deci and Ryan (1980) argue that positive feedback can provide satisfaction of the need for competence. The granting of influence can be perceived as positive feedback about one's competence and therefore the individual centrality is hypothesized to have a positive relationship with the need for competence. The above leads to the following hypotheses:

*Hypothesis 1a: A higher individual centrality of knowledge workers within a team relates to higher satisfaction of the need for autonomy.*

*Hypothesis 1b: A higher individual centrality of knowledge workers within a team relates to higher satisfaction of the need for competence.*

The team centrality represents the relative difference in social influence between different team members. If one team member is perceived to have more influence than others, the network is said to be more hierarchical. In turn, a network in which team members share equal amounts of influence is said to be distributed (Pastor & Mayo, 2002). A more distributed network indicates that the social context within the team allows more members to have influence. Therefore the workers can perceive the threshold of claiming influence as low and therefore feel free to initiate behavior on the basis of their personal needs. This relates positively to the need for autonomy. A strong component in feeling competent is the comparison to others with the same tasks and the received feedback on one's effectiveness (Deci & Ryan, 2000). Applying the argument of Drucker (1993, p.45) that "no one knowledge ranks higher than another" leads to the assumption that a more distributed team leads to an individual's competence satisfaction, because the team seems to value everyone's contribution to the network equally. This leads to the following hypotheses:

*Hypothesis 2a: A higher team centrality in a team of knowledge workers relates to higher satisfaction of the need for autonomy.*

*Hypothesis 2b: A higher team centrality in a team of knowledge workers relates to higher satisfaction of the need for competence.*

The team density is indicative of the amount of social interaction that team members have in their work, so to what extent every member has been able to build a relationship with all the other members (Pastor & Mayo, 2002). A high team density indicates that all the members have a relationship with each other and therefore the team has a high social interaction. Since the need for autonomy and competence are a strong personal sense of volition and ability, merely the presence of social interaction does not necessarily satisfy these needs. The following is therefore hypothesized:

*Hypothesis 3a: Team density of a team of knowledge workers is not related to the satisfaction of the need for autonomy.*

*Hypothesis 3b: Team density of a team of knowledge workers is not related to the satisfaction of the need for competence.*

### **3.3 Climate for informal learning**

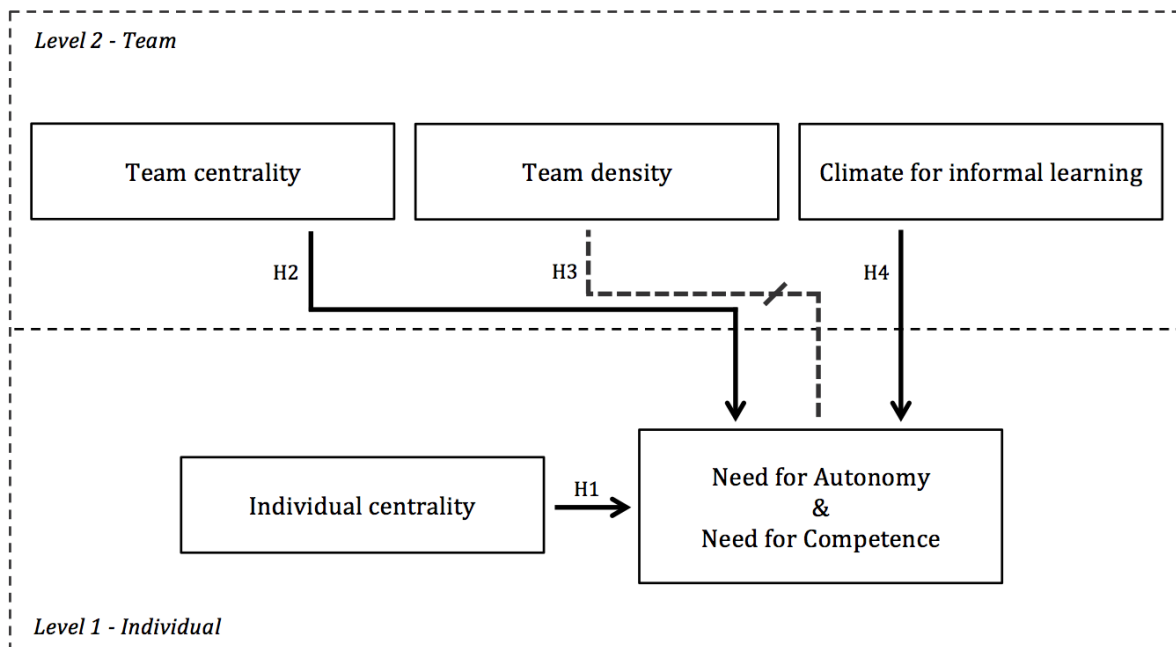
The traditional view on work-related learning focuses mainly on formal (classroom-based) settings. Learning is perceived to happen outside the work context in a controlled environment and knowledge and skills developed need to be transferred as soon as the worker goes back to work (Evers, 2012). This view, though still partially relevant, has proved to be incomplete for capturing all the meaningful learning activities in and outside the workplace (Eraut, 2004). Learning includes informal activities as well, and the social context of work is a typical place where informal learning may occur (Cheetham & Chivers, 2001; Eraut, 2004; Marsick & Volpe, 1999). Marsick and Volpe (1999, p. 4) define informal learning as "learning that is predominantly unstructured, experiential, and non-institutional. Informal learning takes place as people go about their daily activities at work or in other spheres of life. It is driven by people's choices, preferences, and intentions". Organizations are increasingly acknowledging that informal learning is the most pervasive type of learning (Marsick & Volpe, 1999). Marsick and Volpe (1999, p. 3) state: "Alongside this recognition, organizations need to purposefully provide a working environment that promotes and encourages opportunities for continual informal learning".

Other researchers also underline that learning at work is undermined or facilitated by the relationships and the social climate of the workplace (Eraut, 2004; Kessels, 2001). A climate that promotes informal learning provides a basic trust for workers, so they know that asking a question or making a mistake will not be punished or misunderstood (Marsick & Volpe, 1999). It also encompasses easy accessibility of colleagues through willingness to act as sounding boards for ideas and to provide feedback on each other's work. This conveys a feeling of being interested in and of valuing each other (Van der Heijden, 2003). Research by Liao, Chang, Cheng, and Kuo (2004) indicates that when relationships between employees are perceived as good, sharing knowledge and experiences with these colleagues is perceived as unconditional and voluntary. On the other hand, when the relationship between employees is perceived as not good, the employees are hesitant to share knowledge and experiences (Liao et al., 2004). Pahor, Škerlavaj, Dimovski (2008) describe that in learning in networks, the individual is the primary source and destination of learning and that learning takes place primarily in social interaction. The learning process is not determined by the organization, but by the individual (Marsick & Volpe, 1999). This emphasizes the importance of self-determination, or intrinsic motivation, to engage in networks for solving personal questions and challenges.

A positive climate for informal learning can encourage the establishment of relationships so members feel free to address their personal questions. This provides a sense of self-initiation and trust, which relates to the need for autonomy. A large part of learning in everyday work situations originates from social interactions among people (Eraut, 2004). These social interactions in the workplace (e.g. talking with colleagues) facilitate the exchange of information, which may be relevant for competence development (Kraut, Egido & Galegher, 1990 in Evers, 2012). This leads to the following hypotheses:

*Hypothesis 4a: A positive climate for informal learning within a team of knowledge workers relates to higher satisfaction of the need for autonomy.*

*Hypothesis 4b: A positive climate for informal learning within a team of knowledge workers relates to higher satisfaction of the need for competence.*



*Figure 1.* The research model showing an overview of the cross-level relationships between the variables.



## 4. Method

### 4.1 Context

The study was conducted in an organization for child and youth support in the east of the Netherlands. The organization is medium sized with a total of about 400 employees and around 30 teams (22 of which are active in primary youth care activities). The type of work follows the definition of *frontline workers* by Bruining (2005). The data used in this research were gathered as a part of a one-year consultancy project focused around supporting teams to become increasingly self-organizing. 14 of the participating teams were part of this consultancy project and had met the researchers at least three times before going into data collection. These teams all volunteered for this consultancy project after an open invitation to all teams. No use was made of external roles (e.g. management) to persuade teams to participate in the research project.

### 4.2 Sample

To test the practicality of the survey we ran a pilot online survey with four randomly selected teams. At the end of the survey participants were asked to provide general feedback through an open question. Participants generally responded positive, indicating that they recognized the survey content and perceived it as relevant to their work. Also, the duration and the clarity of questions were good in their opinion. Besides this, we noticed that the limited capacity for interaction and explanation by the researchers caused a low response rate (23%), which is specifically negative for the social network part of the survey. Aiming to increase response rates, we decided to make physical appointments with the teams during their regular meetings to gather the final data on paper. To collect the final data for the present study an open invitation was sent via e-mail directly to all teams in the organization. This resulted in 21 participating teams (response rate = 70%). The data collection resulted in 163 participating individuals (level 1 N = 163, response rate = 96%) in 21 teams (level 2 N = 21, response rate = 70%). Level 1 non-response was due to the absence of individuals during the data collection. Level 2 non-response was caused mainly by time constraints. Teams consisted of approximately 4 to 20 employees, with an average of 9.37 (SD = 4.10). Of the 163 respondents, 141 were female (86%, 3 missing). The ages ranged from 20 to 64 years, averaging 40.48 (SD = 12.20, 8 missing). The education level averaged 6.68 (SD = 0.97, 4 missing) indicating that the vast majority of the employees had at least a vocational education background. See Table 1 for an overview of the descriptive statistics.

### 4.3 Measures

All the measures described below were combined into a single and on paper survey. All 89 items were posed in Dutch, because this is the native language of the target group.

**Demographics.** The first section of the survey consists of *demographic items* on gender (female = 1, male = 2), age (years), and education (highest finished, ranging from 1 = *primary school* to 8 = *graduate school*).

**Climate for informal learning.** The second section measured the variable *climate for informal learning*. The development of this measure was part of this study. A pool of 63 items was generated by Stam (2007) based on the corporate curriculum theory (Kessels, 1996). Items were based on a 5-point Likert scale (ranging from 1 = *strongly disagree* to 5 = *strongly agree* and 6 = *not applicable*). The whole survey was administered, but for this study only items on the climate for informal learning were used (see Table 1 for a sample item). Data for the validation were collected in two organizations. Organization 1 (N=163, response rate = 50%) is the child and youth support organization also used for the rest of this study. Organization 2 is an accountancy software developer in the center of The Netherlands (N=47, response rate = 37%). The data for organization 2 were collected through an online survey, for which participants had been invited by e-mail. Organization 2 only provided data for the validation of this part of the survey and not for the rest of this study.

The first step was to examine the item completeness and the distributions of the item scores using the mean, standard deviation, skewness, and kurtosis. All items showed to meet the criteria (skewness and kurtosis of < 2). All items were normally distributed. Therefore no items were removed during this step.

In the second step an Exploratory Factor Analysis (EFA) was conducted using Principal Axis Factoring and an Oblique rotation (in SPSS v21: Direct Oblimin) (Field, 2009; O'Connor, 2000). The Kaiser-Meyer-Olkin measure (KMO = .87) and Bartlett's test of Sphericity ( $p < .01$ ) confirm that the sample is adequate for factor analysis. The scree plot suggested between three and five factors. Subsequent parallel analysis in combination with item-content analysis (Hayton, Allen, & Scarpello, 2004; O'Connor, 2000) supported a three factor solution, because four and five factors solutions yielded results difficult to interpret and factors with too few items ( $< 3$ ).

The third step was to select the items that fitted best in the three-factor model. Based on Worthington and Whittaker (2006) the following removal criteria were used: factor loading of  $>.30$  onto multiple factors; factor loading of  $>.30$  on one factor and with a distance of  $<.15$  to other factor loadings; a factor loading of  $>.30$  on no factor at all. A total of 47 items were removed in this step. This resulted in three scales. Scale 1 consisted of 8 items with 3 reversed items (Cronbach's alpha = .80). Scale 2 consisted of 5 items (Cronbach's alpha = .66). Scale 3 consisted of 3 reversed items (Cronbach's alpha = .73).

In the fourth and final step the reliability (using Cronbach's alpha) was checked and six researchers theoretically interpreted the scales independently. Scale 1 was interpreted as measuring the perception of the individual worker of the climate for informal learning within his or her team. One item didn't fit this interpretation and the factor loading was relatively low (.39) compared to the other items. Therefore this item was excluded from scale 1, having no impact on the cronbach's alpha. Since only climate for informal learning (scale 1) is subject of this study, scale 2 (self-directed innovation) and 3 (stress) were excluded.

**Basic psychological need satisfaction.** The third section measured the *satisfaction of the SDT needs*. Van den Broeck, Vansteenkiste, Witte, Soenens and Lens (2010) developed the Work-related Basic Need Satisfaction scale (W-BNS). This 18-item survey measures to what extent a person feels the need for autonomy, competence and relatedness is satisfied at work. Items were based on a 5-point Likert scale (ranging from 1 = *strongly disagree* to 5 = *strongly agree*). Each scale consists of six items and the final score is the average score on these items (see Table 1 for sample items). A higher score indicates greater need satisfaction. The measure relies on self-report, because the SDT considers the degree to which people are able to satisfy their fundamental needs as the most important predictor for optimal functioning and does not focus on individual differences in need strength (Deci & Ryan, 2000). For this study only the results on the scales of autonomy and competence are used. The Cronbach's alpha of the scales for autonomy satisfaction and competence satisfaction are .76 and .74 respectively (see Table 1).

**Distributed leadership.** The fourth section measured distribution of leadership through four social network questions (Fombrun, 1982; Tichy, Tushman, & Fombrun, 1979). We developed one question for each leadership function of Derksen et al. (2011). Each question consists of a short explanation of one of the functions and the question who in the team incites the respondent to do so (see Table 1). Following the question the respondent's team members were listed from which to select relevant colleagues. Respondents were allowed to indicate their own name and an option was included to indicate 'no one'. These social network questions captured the influence that individual team members have with regard to each specific leadership function, in terms of the amount of received nominations. The resulting matrix of answers reflects the leadership network of that particular leadership function. The matrices provide the scores on individual centrality, team centrality and team density, which are used to measure the construct of distributed leadership.

Table 1.  
Means, Standard Deviations, Cronbach's alpha's and Sample items for the variables

Variable	$\mu$	$\sigma$	$\alpha$	Sample item
<i>Control variables</i>				
Gender	1.11	.36	-	-
Age	40.84	12.20	-	-
Education	6.68	.97	-	-
Team size	9.37	4.10	-	-
<i>Level 1 variables</i>				
Autonomy	3.76	.56	.76	I feel like I can be myself at work
Competence	4.03	.45	.74	I am good at the things I do in my job
Individual centrality	.50	.23		Who in the team incites you to [leadership function]?*
<i>Level 2 variables</i>				
Climate for informal learning	3.87	.53	.80	Knowledge and experiences are difficult to access
Team centrality	.34	.14	-	-
Team density	.54	.17	-	-

Note. N = 163 at level 1; N = 21 at level 2. \*This sample item is also used for measuring the variables team centrality and team density

#### 4.4 Procedure

The survey started with a short oral briefing about the purpose of the survey and a check whether all the members were present. When a member was absent a team member was asked to give the survey to him or her and mail it to the researchers. The survey took about 20 minutes to fill in, participants were asked not to interact with each other during this time. The researcher was present for any questions and to collect the finished surveys.

#### 4.5 Data analysis

**Social network measures of leadership.** Before the analysis we removed all missing data and deleted all self-nominations from the team's leadership matrices. When a person had responded 'no one' to a leadership question, we filled in a zero for all relationships. A team member was removed from the network data entirely when we could confirm an extended period of absence (e.g. sick leave or pregnancy). A total of 5 persons in 4 teams were removed from their team's network this way. To confirm the person's absence we checked the person's in-degrees, which should be low to none if the person was indeed absent for an extended period. In all cases, this corroborated our decision to remove the data. A second approach was to treat data as missing and replacing it with zero scores (as if the person had marked 'no one'). We did this when a members' absence went unexplained, but we could confirm the person being a part of the current team. A total of 1 person was replaced in this fashion.

Second, we calculated the team level and individual level scores. Individual centrality and team density were calculated using Freeman's (1978) formulae. Team centrality is calculated using a slightly adapted version of Freeman's formula. Because we have operationalized leadership based on influence relationships we are drawing on the in-degrees only. All out-degrees should be ignored when calculating the team level leadership scores, because they do not provide any information on whether or not an individual is central to the influence network (Pastor & Mayo, 2002). To calculate the team centrality we used Freeman's base formula and adapted the denominator to reflect only the in-degree counts:

$$Team\ centrality = \frac{\sum_{i=1}^n [C_D(P^*) - C_D(P_i)]}{\max \sum_{i=1}^n [C_D(P^*) - C_D(P_i)]}$$

In this formula, n is the number of team members in that team.  $C_D(P_i)$  is the in-degree (number of received nominations) of a person in the team's network and  $C_D(P^*)$  is the largest value of  $C_D(P_i)$  for any person in the network. To correct for the influence of team size, the denominator should take the maximum value that the numerator can take within that team. Since  $P_i$  can only take a maximum value of n-1 for each team member the numerator takes the maximum value of  $(n-1)^2$ . This was because when one team member was to receive the maximum number of nominations, the maximum

distance to the n-1 remaining team members will be n-1. This leads to the following adapted formula:

$$\text{Team centrality} = \frac{\sum_{i=1}^n [C_D(P^*) - C_D(P_i)]}{(n-1)^2}$$

The individual centrality is a level 1 measure which ranges from 0 (a person has received no nominations) to 1 (a person has received the maximum possible number of nominations). The team centrality measure is a level 2 variable and ranges from 0 (maximally hierarchical) to 1 (total equality of all team members). It expresses the relative equality of the team members' social influence within the network. The team density measure is also a level 2 variable and it ranges from 1 (all possible relationships are present) to 0 (no relationships at all), it expresses the percentage of possible connections within the team.

The three social network measures correlated strongly for all four leadership functions (see Table 2) and suggested that the four leadership functions overlapped significantly. We therefore averaged the scores of the four leadership functions, so each team yielded a single score for team centrality and team density and each individual a single score on individual centrality.

Table 2.  
*Pearson correlations of the four leadership functions.*

	Team level				Individual level (individual centrality)			
	CRE	REF	ORG	DIA	CRE	REF	ORG	DIA
CRE	.21	.801**	.521*	.558**	.163	.751**	.662**	.699**
REF	.850**	.21	.526*	.761**		.163	.556**	.748**
ORG	.876**	.811**	.21	.616**			.163	.513**
DIA	.793**	.896**	.781**	.21				.163

Note. Labels as follows: CRE = creating future; REF = reflecting; ORG = organizing; DIA = dialoguing. Team centrality is displayed above the diagonal, network density below. N is displayed on the diagonal. Significance (two-tailed): \*  $p < .05$ ; \*\*  $p < .01$ .

**Multilevel analysis.** Chen and Kanfer (2006) urge researchers to adapt a multilevel model between individuals and the team context when studying motivational outcomes in teams. Autonomy satisfaction, competence satisfaction and individual centrality are properties of the individual worker and are therefore measured on the individual level (level 1). Team centrality and team density are properties of a team and are therefore measured on a higher level, the team level (level 2). Climate for informal learning is a property of a team, but is measured on the individual level. The individual level scores were aggregated to the team level by using the group mean. Statistical analysis showed that the data were suited for aggregation ( $ICC = .55$ ,  $p < .01$ ).

Hierarchical Linear Modeling (HLM) is an appropriate method for examining cross-level main effects where the dependent variable is measured at the lowest level (Hofmann, Griffin, & Gavin, 2000). HLM can estimate the within-team effects (Level 1) and the separate effects of team-level predictors (Level 2) on the intercepts and slopes (of the regression line) at the individual level (Kozlowski & Klein, 2000). For computing the multilevel models, Linear Mixed Models in statistical software SPSS v21 was used, with the method set to Maximum Likelihood (ML) and covariance type to Variance Components (VC). Grand mean centering was used on all level 1 and 2 variables to reduce potential collinearity (Hofmann et al., 2000).

First, we checked if HLM is the adequate analysis technique. Null models (model 1) were run with no independent variables and autonomy satisfaction or competence satisfaction as the dependent variable. The ICC for autonomy satisfaction is .34 ( $p = .02$ ), indicating that 34% of the variance in autonomy satisfaction occurs between teams. This justifies the use of HLM as the technique for data analysis. The null model for competence satisfaction shows that a little amount of variance is accounted for at the team level ( $ICC = .04$ ,  $p = .41$ ). This means that there is no significant between-group variance present in the dependent variable. Nezlek (2008) argues that a multilevel model should be used when there is a meaningful nested hierarchy in the data, irrespective of a low ICC. This means that in this study it is impossible to measure a meaningful relationship between level 2 variables and competence satisfaction (hypotheses 2b, 3b and 4b), because the explained variance will not exceed 4%. The relationship between individual centrality and competence satisfaction (hypothesis 1b) could still be examined, because they operate on the same level of analysis and are therefore not subject to the between-group variance.

To test for the main effects of the independent variables on competence and relatedness, we built HLM models by adding variables step by step. In each step we retained the newly added variable(s) only if the model improved significantly, as measured by the  $X^2_{change}$ . For autonomy satisfaction, model 1 is the null model. In model 2 the level 1 control variables (gender, age and education) were added. In model 3 the level 2 control variable team size was added. In model 4 we added the level 1 independent variable individual centrality. In model 5 the level 2 independent variables (climate for informal learning, team centrality and team density) were added. For competence satisfaction, model 1 is the null model. In model 2 the level 1 control variables (gender, age and education) were added. In model 3 the level 1 independent variable individual centrality was added.

## 5. Results

### 5.1 Main effects on autonomy satisfaction

Table 3 shows that the addition of level 1 control variables in model 2 provided a significant better model ( $X^2_{change} (3) = 22.82, p < .01$ ) than model 1. Model 3, the addition of team size, did not provide a significant better model than model 2 ( $X^2_{change} (3) = .76, p > .05$ ). Model 4, with individual centrality, was also rejected ( $X^2_{change} (1) = 1.67, p > .05$ ). This means no evidence was found for hypothesis 1a. Finally, model 5 was retained, because it provided a better fit than model 2 ( $X^2_{change} (3) = 15.69, p < .01$ ). The relationship between team centrality and autonomy satisfaction did not prove to be significant (Est. =  $-.08, p > .05$ ), providing no evidence for hypothesis 2a. The relationship between team density and autonomy satisfaction is not significant (Est. =  $.36, p > .05$ ), which supports hypothesis 3a. The positive relationship between climate for informal learning and autonomy satisfaction proved to be significant (Est. =  $.94, p < .01$ ), supporting hypothesis 4a.

Table 3.

*HLM Results: The Cross-Level Main Effects of Distributed leadership and Climate for informal learning on Autonomy satisfaction.*

Variable	Model 1		Model 2		Model 3		Model 4		Model 5	
	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercept	.02	.15	.43	.69	.52	.76	.69	.72	-.28	.98
<i>Level 1 control variables</i>										
Gender			.39	.23	.39	.23	.31	.24	.42	.22
Age			-.01	.01	-.01	.01	-.01	.01	-.01	.01
Education			-.08	.09	-.07	.09	-.10	.09	-.05	.08
<i>Level 2 control variable</i>										
Team size					-.01	.04				
<i>Level 1 independent variable</i>										
Individual centrality							.11	.08		
<i>Level 2 independent variables</i>										
Climate for informal learning									.36**	.13
Team centrality									-.08	.96
Team density									.94	.96
<i>Model summary</i>										
-2*log likelihood		431.720		408.902		408.826		407.236		393.212
$X^2_{change}$ (df)		-		22.82 (3)**		.76 (1)		1.67 (1)		15.69 (3)**
Number of parameters		3		6		7		7		9

*Note.* Est. = Estimate, S.E. = Standard Error, df = Degrees of freedom for  $X^2_{change}$ . Significance (two-tailed): \* $p < .05$ . \*\* $p < .01$ .

## 5.2 Main effects on competence satisfaction

Table 4 shows that the addition of level 1 control variables in model 2 provided a significant better model ( $X^2_{change}(3) = 28.39, p < .01$ ) than model 1. Within model 2 age proved to have a significant positive relationship (Est. = .02,  $p < .01$ ) with competence satisfaction. However, due to a low Estimate the effect size of age is small. Table 4 also shows that the addition of individual centrality in model 3 provided a significant better model ( $X^2_{change}(1) = 18.50, p < .01$ ) than model 2. The positive relationship between individual centrality and competence satisfaction proved to be significant (Est. = .35,  $p < .01$ ), supporting hypothesis 1b. The effect of age has remained the same in model 3. As stated before, the data proved to be insufficient for either confirming or rejecting hypotheses 2b, 3b and 4b.

Table 4.

*HLM Results: The Cross-Level Main Effects of Distributed leadership and Climate for informal learning on Competence satisfaction.*

Variables	Model 1		Model 2		Model 3	
	Est.	S.E.	Est.	S.E.	Est.	S.E.
Intercept	.02	.09	.03	.05	-.48	.67
<i>Level 1 control variables</i>						
Gender			.24	.25	-.08	.24
Age			.02**	.01	.02**	.01
Education			.05	.09	-.04	.08
<i>Level 1 independent variable</i>						
Individual centrality					.35**	.08
<i>Model summary</i>						
-2*log likelihood	457.688		429.303		410.807	
$X^2_{change}$ (df)	-		28.39 (3)**		18.50 (1)**	
Number of parameters	3		6		7	

Note. Est. = Estimate, S.E. = Standard Error, df = Degrees of freedom for  $X^2_{change}$ . Significance (two-tailed): \* $p < .05$ . \*\* $p < .01$ .

## 6. Discussion

### 6.1 Conclusions

To goal of this study is to answer the main research question: How do distributed leadership and a climate for informal learning within a team of knowledge workers relate to the satisfaction of the individual need for autonomy and competence? For autonomy, the results of this study show that there is no relationship between distributed leadership and autonomy satisfaction (hypotheses 1a, 2a, 3a) and that there is a significant positive relationship between a climate for informal learning and autonomy satisfaction (hypothesis 4a). For competence, only the relationship between individual centrality and competence satisfaction could be examined (hypothesis 1b) and this proved to be significant and positive. The theoretical implications for autonomy and competence satisfaction are discussed separately below.

**Autonomy satisfaction.** The results show that there is no evidence for a relationship between the concepts of distributed leadership and autonomy satisfaction, because hypotheses 1a and 2a are rejected and 3a is supported. This contradicts the theoretical expectation. Deci and Ryan (2000) define autonomy as the personal feeling of volition. This means there is a strong focus on the way the individual perceives his or her social context. It can be perceived as either autonomy supportive or not. The concepts of distributed leadership used in this study only captured the granting of influence by others and the network configuration (dense vs. loose and hierarchical vs. distributed). The granting of influence by others in this study is not fed back to the team members, which is why the measures might say little about the way the worker perceives his or her environment. A team member could have been granted influence by a lot of other team members, but in the same time he or she

can perceive their influence as low. So, for autonomy the process of claiming influence may be of more importance, because it relates directly to a perceived possibility to assert influence on what someone finds important. In addition, Van den Broeck et al. (2010) describe that you can still experience autonomy when you depend on others and even when you follow others' requests. For this the process of internalization is important. Internalization is the degree to which "a worker accepts an influence attempt because the encouraged actions are congruent with a personal value system and/or are intrinsically rewarding to the individual" (Sussmann & Vecchio, 1982, p. 178). Essential for the process of internalization is the support of "significant others" (e.g. team members) (Deci & Ryan, 2008). So, autonomy within a network might be more related to the quality of social interaction than the mere presence of it. This also highlights the importance of the need for relatedness, which is further discussed by Hirschler (2013). The importance of the quality of social interaction is supported by the evidence for hypothesis 4a, the positive relationship between a climate for informal learning and autonomy satisfaction. This means that when the climate for informal learning within a team is more positive, the individual need for autonomy is more satisfied. A climate for informal learning can encourage the interaction between team members, so all members feel free to address their personal questions and issues. This provides a sense of self-determination and self-direction (Marsick & Volpe, 1999; Pahor et al., 2008).

**Competence satisfaction.** A positive and significant relationship between individual centrality, a team member's personal influence within the team, and competence satisfaction (hypothesis 1b) has been established. This supports the assumption that the granting of influence can be perceived as positive feedback, which satisfies the need for competence (Deci & Ryan, 1980). The problem in measuring the relationship between team level variables and competence satisfaction in this study was the low between-group variance. This means that the differences in the satisfaction of the need for competence, cannot be explained by being a member of a specific team. Whether this problem is due to the sample, procedure or another part of this study is difficult to say. A replication of this study in other health care organizations could shed light on this. What remains is that the theoretical relationship between competence satisfaction, distributed leadership and a climate for informal learning described in this study is strong and can be subject of further research.

## **6.2 Practical implications**

Although this study has been conducted in only one organization for child and youth support, the practical implications of this study are relevant to other health care organizations in which knowledge work plays an important role. This study provides insight for theorists, HRD practitioners and organizations on how the intrinsic motivation of knowledge workers can be supported. A positive climate for informal learning yields positive results for autonomy satisfaction and a strong personal influence (as part of distributed leadership) within a team relates to higher competence satisfaction. This emphasizes the importance of social interaction, so knowledge workers can create new knowledge for themselves that is relevant to professional situations and needs (De Laat, 2012). The informal organization is where the real action happens (Homan, 2006), which means it is important to seek for ways to facilitate positive social relations. The tasks of HRD practitioners and organizations is not to create a learning climate, but to promote and enable access to social spaces in which knowledge workers can learn and solve work-related issues, so a positive learning climate can emerge (De Laat, 2012; Kessels, 1996).

## **6.3 Limitations and directions for future research**

Studies on positive feedback have revealed that positive feedback has a facilitating effect on intrinsic motivation only when individuals perceive their behavior as self-determined or when it is provided in a way that does not eclipse their feelings of autonomy (Deci & Ryan, 2000). This means there is arguably a relation between the need for autonomy and competence. However, this study did not take this in account. For further research it is encouraged to encompass the possible relationship between these needs.

There is a clear need for research to identify, document and analyze leadership practices that appear to contribute to the creation and maintenance of distributed leadership (Bennet et al., 2003). Research using a social network approach to measure distributed leadership is scarce (Hulsbos et al., 2012; Mehra et al., 2006) and therefore the experience with the use of this method is low. This study contributes to this experience by showing that solely measuring the network configuration provides a

limited insight in the span of the distributed leadership theory. So, more social network research is necessary, especially in combination with additional variables (e.g. team performance), to empirically study the distributed leadership theory.

Within the context of organizations the setting of goals or values for the entire organization by formally constituted leaders who are directly accountable to outsiders for the performance of the organization is imminent (Graetz, 2000). These goals and values are perceived to be undiscussable, which contradicts with the need for autonomy. This possible influence is positioned outside teams, but can have an important impact on the satisfaction of the need for autonomy of the knowledge worker. The present study did not include external social conditions of teams. For further research it is encouraged to take external social conditions into account.

Bennett et al. (2003) highlight that distributed leadership is an emergent property of a group or network of interacting individuals. This distinguishes distributed leadership from other theories of leadership that focus on individual characteristics and behavior (Bennett et al., 2003). In addition, the dynamic process of claiming and granting influence is an important part of distributed leadership developing over time (DeRue & Ashford, 2010; Gronn, 2002; Van Vugt et al., 2008). The measures used in this study were only used at one point in time. Therefore the data were not adequate for measuring the emergence of leadership and the dynamic process of claiming and granting influence. A longitudinal study could provide insight in this. The use of a multilevel model is advised, because it is also highly suitable for analyzing different measures over time (Kozlowski & Klein, 2000).

The power of the sample in this study is low (Maas & Hox, 2005), which means that only large effects can be measured in this study. A larger sample of teams is needed to increase the power of the sample and therefore be able to measure small effects. Also, the generalizability of the study is limited, because only one specific health care organization was studied.

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