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The Challenges of Collaborative Knowledge Creation in Open Innovation Teams

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In open innovation teams, people from different organizations work together to develop new products, services, or markets. This organizational diversity can positively influence collaborative knowledge creation but can frustrate and obstruct the process as well. To increase the success rates of open innovation, it is vital to learn how individuals create knowledge in open innovation teams and the problems they face. However, HRD research on this topic is still lacking. This article reviews the literature in HRD, organizational, and learning sciences, describing how individuals interact when creating knowledge collaboratively, and gives an overview of the challenges with collaborative knowledge creation in open innovation teams. The article ends with a discussion and conclusion, and implications for further research.

Keywords: *open innovation team; interorganizational learning; collaborative knowledge creation; challenges; collaborative learning; team learning*

Globalization and new (information) technology have resulted in increased competition, increased mobility of skilled workers, and consequently shorter product life cycles, smaller profit margins, and higher risks (Chesbrough,

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2003). To stay in business, companies must spread risk and must innovate, that is, develop new products and services, at a high speed and on an efficient scale. More and more companies choose for a business model in which they specialize in one area. In that area, they develop know-how, (patented) technology, and strong brand names and grow toward an efficient scale of production. The consequence of this specialization is that to innovate (discover new combinations), these companies increasingly rely on inputs from other companies. Yet because of their specialized know-how, (patented) technology, efficient production scale, and strong brand names, the companies have also become attractive partners for other companies. This "mutual attraction" has resulted in an innovation trend called "open innovation," in which companies develop new products, services, or markets collaboratively by using *each others*' know-how, technology, licenses, brands, or market channels (Chesbrough, 2003; Chesbrough & Schwartz, 2007).[1] Besides open innovation, similar concepts are mentioned in literature such as interpartner learning (Hamel, 1991), networks of learning (Powell, Koput, & SmithDoerr, 1996), learning alliances (Khanna, Gulati, & Nohria, 1998), collective knowledge development in strategic alliances (Larsson, Bengtsson, Henriksson, & Sparks, 1998), interorganizational knowledge creation (Holmqvist, 1999), interorganizational learning (Holmqvist, 2003), and shared new product development (Grant & Baden-Fuller, 2004). In this way, resources such as human resources, technology, and customer information are pooled to improve and speed up the innovation process, whereas at the same time risks are spread (see e.g. Parkhe, 1991; Ring & Van de Ven, 1994). A successful open innovation case often referred to is the Senseo coffee maker. For this innovation, employees of the consumer products division of Philips and the coffee roaster Douwe Egberts (Sara Lee) worked together in the development and marketing of the Senseo machine with corresponding coffee and coffee pads.

However, not every external collaboration results in a success story such as the Senseo case. Problems arise in many cases when open innovation teams are formed in which people from different companies (have to) work together. In a study of more than 100 U.K.-based alliances, about half of the respondents believed that this collaboration made development more complicated and costly (Tidd, Bessant, & Pavitt, 2001). The diversity of organizational backgrounds in open innovation teams may be a source for creativity (Ritter & Gemünden, 2002) but can also be a source of social and communicative dilemmas resulting in conflicts and project failures (Tidd et al., 2001). Because more and more companies choose for a business model that entails specialization and external collaboration (Powell et al., 1996), an increasing number of open innovation teams will be formed in the near future. Human resource development (HRD) could play an important role in supporting this development by providing the concepts and tools to improve external collaboration processes, which essentially entail learning or collaborative knowledge creation (Dosi, Teece, & Chytry, 1998; Harrison & Kessels, 2004;

Kessels, 2001; Madhavan & Grover, 1998). The HRD discipline can use a wide range of literature touching on collaborative knowledge creation and related topics such as "team learning," "group learning," and "organizational learning," but so far lacks literature sources on collaborative knowledge creation in the specific context of open innovation teams. Therefore, the goal of this article is to explore the specific challenges of collaborative knowledge creation in open innovation teams, building on theories and concepts from HRD, organizational, and learning sciences. In the next section, a general conceptual model (Figure 1) is developed showing loops of four subsequent stages that individuals go through when involved in collaborative knowledge creation processes. The subsequent section adds the specific context of open innovation teams and describes how this specific context will affect the four collaborative knowledge creation stages (Table 2). The article ends with a discussion and conclusion, and implications for further research.

A General Model of Collaborative Knowledge Creation

To find the most relevant models for developing the conceptual model of collaborative knowledge creation, scientific search engines, for example, ISI Web of Knowledge[sm], were used with keywords such as *collaborative learning*, *knowledge creation*, and *team learning*. Theories most cited in articles dealing with collaborative knowledge creation or learning in organizational, HRD, and learning sciences were selected. We define collaborative knowledge creation as a specific type of learning, intentional in nature and directed toward delivering a product (knowledge, service, or technology). Recently, some scholars developed the knowledge creation metaphor as a way to view learning and to explore how that process takes place (Hakkarainen, Palonen, Paavola, & Lehtinen, 2004; Paavola, Lipponen, & Hakkarainen, 2004). The idea behind the knowledge creation metaphor is that participation in social activities benefits cognitive processes, and it strongly emphasizes the aspect of collaborative knowledge creation for developing shared objects of activity (Paavola et al., 2004). As such, the knowledge creation metaphor combines two other metaphors mentioned earlier in the literature: the acquisition metaphor and the participation metaphor (Sfard, 1998). The acquisition metaphor views learning as a cognitive process. Knowledge is understood as a property of an individual mind, in which learning is a matter of construction, acquisition, and outcomes, which are realized in the process of transfer (Paavola et al., 2004, p. 557). The participation metaphor, by contrast, views learning as a social process. Learning is a matter of participation in practices and actions where knowledge is acquired by social activities. Both metaphors complement each other, rather than contradict, and therefore the knowledge creation metaphor was developed. The models used to illustrate this metaphor are the model of knowledge creation of Nonaka and Takeuchi, Engeström's model of expansive learning, and Bereiter's model of

knowledge building. In total, nine models were identified as most relevant for a conceptual model on collaborative knowledge creation: the knowledge creation model of Nonaka and Takeuchi (1995); the information processing model of Huber (1991); the social learning cycle or the new knowledge flows of Boisot (1986, 1995); the 3-T Framework by Carlile (2004); the model of work-based learning by Raelin (1997), which has similarities with the experiential learning cycle of Kolb (1984; Kolb, Osland, & Rubin, 1995); Engeström's model of expansive learning (1999); the holistic theory of knowledge and learning by Yang (2003); Beers, Boshuizen., Kirschner, and Gijselaers's model of collaborative knowledge construction (2005); the model of knowledge building by Bereiter (2002; Bereiter & Scardamalia, 1993); and the collaborative learning of Van Boxtel, Van der Linden, and Kanselaar (2000). The models embody different views on knowledge. Knowledge is for instance viewed as a commodity, a personal capability, or as something that is embedded in action and context (Patriotta, 2003). These different views on knowledge are partly related to the aggregation level at which the collaborative knowledge creation process is described. At an organizational level, knowledge is often viewed as a commodity and at the group or individual level as something that is situated in a context, or a personal capability. Although the different models describe the collaborative knowledge creation process at different aggregation levels, a recent study on the Nonaka and Takeuchi model suggests that the models can be applied on different aggregation levels (Schulze & Hoegl, 2006). Table 1 describes the models on the aggregation level and view on knowledge and compares the different process stages the models describe. Interestingly, four process stages appear in most of these models:

1. Externalizing and sharing: Professionals verbalize and share their (implicit) knowledge, information, and needs with other professionals. This stage takes place at the group level and results in distributed knowledge, often experienced as a chaotic situation.
2. Interpreting and analyzing: Professionals absorb what they hear and interpret, and they analyze it by associating it with their own knowledge. When interpreting the words of others, one is always contextualizing, linking new information to one's own framework, a process that takes place at the individual level and often results in different interpretations by different individuals, also referred to as decentralized knowledge.
3. Negotiating and revising: Professionals gather and order these different interpretations and build mutual understandings and meanings for which they sometimes need to revise their own way of thinking. They engage critically but constructively with each other's ideas (Mercer, 2000). This process at the group level may result in shared knowledge, a common communication language (Davenport & Prusak, 1998), shared meanings (Dougherty, 1992), and common ground (Beers et al, 2005) about concepts, ideas, roles, tasks, and goals.
4. Combining and creating: Professionals combine different knowledge bases and accumulate and create new ideas. This process, taking place at the individual level, results in cocreated knowledge that depending on the innovation, can bring about new ideas for innovation, the innovation goal, an action plan, new technologies, or ideas about how things can improve.

TABLE 1: Nine Different Models of Collaborative Knowledge Creation Denoted by Process Stages, Foci, Levels, and Nature of Knowledge

	Process Stages							
Model		*Externalizing and Sharing*	*Interpreting and Analyzing*	*Negotiating and Revising*	*Combining and Creating*		*Focus on*	*Level*	*Knowledge*
Organizational Science									
Knowledge creation (Nonaka & Takeuchi, 1995)	Socializing	Articulating, externalizing			Connecting, combining	Embodying, internalizing	External processes, transforming knowledge	Organization Group	Commodity
Information processing (Huber, 1991)	Acquiring knowledge	Distributing information	Interpreting information			Organizational memory	External processes, transforming knowledge	Organization	Commodity
Social learning cycle (Boisot, 1986, 1995)		Knowledge diffusion	Knowledge absorption	Information scanning	Problem solving		External processes, transforming knowledge	Organization	Commodity
3-T Framework (Carlile, 2004)		Transferring	translating		Transforming		External and internal processes	Group	Personal capability
Work-based learning (Kolb, 1984; Kolb, Osland, & Rubin, 1995; Raelin, 1997		Experiencing	Reflecting, processing	Conceptualizing, generalizing	Experimenting, applying		Internal and external processes	Group, individual	Situated in action context

(continued)

TABLE 1: (continued)

Model	Process Stages						Focus on	Level	Knowledge
		Externalizing and Sharing	*Interpreting and Analyzing*	*Negotiating and Revising*	*Combining and Creating*				
HRD science									
Expansive learning cycle (Engeström, 1999)			Reconceptualizing	Transforming	Creating		Activities	Group	Situated in action context
Holistic theory of knowledge and learning (Yang, 2003)	Participation, interpretation	Conceptualizing	Contextualization, systematization	Validation, legitimization	Transformation	Materialization	Internal, external processes, transforming knowledge	Individual, group	Personal capability
Learning science									
Collaborative knowledge construction (Beers, et al. 2005)		Externalizing	Internalizing	Negotiating	Integrating		Internal processes, transforming knowledge	Group	Personal capability
Knowledge building (Bereiter, 2002)				Asking, answering			Progressive discourse	Group	Commodity
Collaborative learning (Van Boxtel et al, 2000)		Verbalization, understanding of concepts	Reasoning with concepts	Questioning answering, conflict elaboration	Generation, comparison, evaluation		Internal processes	Group, individual	Personal capability

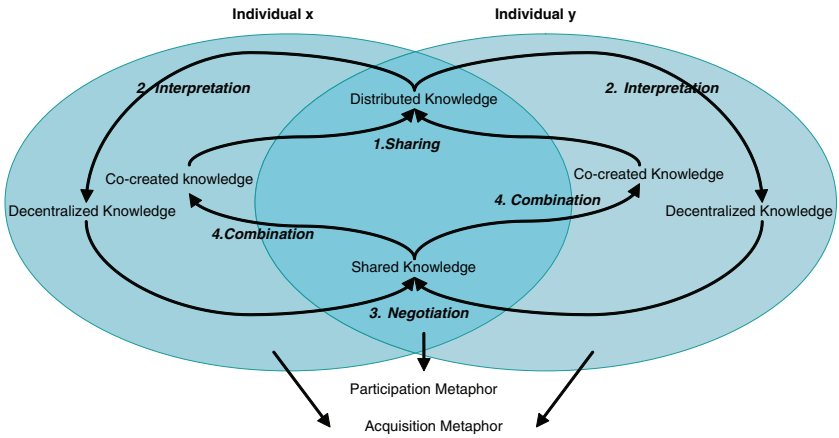

FIGURE 1: A Conceptual Model of Collaborative Knowledge Creation

In Figure 1 our conceptual model of collaborative knowledge creation, based on the four stages derived earlier and the combination of the two metaphors in the knowledge creation, is visualized. The figure shows that collaborative knowledge is created in a process where two (or more) individuals switch between interactive stages and individual stages, resulting in different kinds of knowledge, that is, knowledge exclusive to the individuals and knowledge in common within the group. The model also combines different foci on the process: internal and external, and the transformation of knowledge. Although the figure suggests a sequential process between two persons, it may involve more people and stages can be skipped or occur concurrently, which is common to processes that have to do with thinking and reflection (Dewey, 1933).

As mentioned in the introduction, collaborative knowledge creation in open innovation teams, having a diversity of organizational backgrounds, may be a source for creativity (Ritter & Gemünden, 2002) but can also be a source of social and communicative dilemmas resulting in conflicts and project failures (Tidd et al., 2001). The next section will focus on this specific context by exploring how typical characteristics of open innovation teams may affect the collaborative knowledge creation stages as visualized in Figure 1.

Characteristics of Open Innovation Teams and Their Impact on Collaborative Knowledge Creation

To explore the typical characteristics of open innovation teams and how they influence the process of collaborative knowledge creation, a literature search was carried out using key words such as learning, (inter)organizational

learning, (open) innovation management, strategic alliances and networks in scientific search engines, and journals in HRD, learning, organizational, and management studies. It appeared that various streams of literature use different labels for similar or identical concepts (see appendix). Whenever empirical studies were available, these were selected and analyzed as follows. First, factors at team level influencing collaborative knowledge creation in general were identified. The elicited factors were categorized in a table by discipline and labeled. The diverse factors were clustered using the categories of Mathieu, Maynard, Rapp, and Gilson (2008) labeled by "team emergent states," "team composition inputs," "and team-level inputs." Team emergent states refers to the cognitive, motivational, and affective states that may occur when team members start working together. Team composition inputs refers to the diversity of people assigned to the team and their background and characteristics. Team-level inputs refers to the opportunities given and conditions set by the parent firms. Next, an additional literature search was carried out to explore the impact of these factors, how they are featured in open innovation teams, and how they influence collaborative knowledge creation in the specific open innovation context. This resulted in a list of challenges for professionals operating in open innovation teams. The next sections describe the findings, which are summarized in Table 2.

Team Emergent States

Marks, Mathieu, and Zaccaro (2001, p. 357) described emergent states as "cognitive, motivational, and affective states of teams [that are] . . . dynamic in nature and vary as function of team context, inputs, processes, and outcomes." Examples of emergent states that will be discussed here are group efficacy, social cohesion, learning climate, cognitive distance, and power distribution.

Group efficacy. Group efficacy is a group's belief in its capability to perform its objectives, which can be a very powerful motivator in a team (Gibson, 1999). High perceived collective efficacy is vital for successful effective team learning performance (Van den Bossche Gijselaers, Segers, & Kirschner, 2006). A concept underlying group efficacy is reciprocal commitment, which means that a team member is willing to help another team member because he or she may expect that the other team member will return the favor when needed. The concept of reciprocal commitment is derived from social exchange theories and appears to be positively related to learning and knowledge transfer in strategic alliances (Muthusamy & White, 2006). It is also referred to as equity, defined as "fair dealing," which does not require that inputs or outcomes are always divided equally between the parties (Ring & Van de Ven 1994, p. 93). However, in alliances one must be alert for free riders: members who enjoy the benefits of the collective good without contributing to its establishment and/or maintenance (Dyer & Nobeoka, 2000, p. 348). This is also

TABLE 2: Factors Influencing Collaborative Knowledge Creation, Categorized by Team Emergent States, Team Composition Inputs, and Team-Level Inputs, the Stages in Collaborative Knowledge Creation Mostly Affected by These Factors, and the Resulting Challenges for Open Innovation Teams

Team Factor Categories	*Factors Influencing Collaborative Knowledge Creation*	*Impact (especially on stages in Figure 1 and/or other factors)*	*Challenges for Open Innovation Teams*
Team emergent states	Group efficacy	Sharing	Being a good partner, but preventing free riding
	Social cohesion	Sharing Interpretation Negotiation	
	Learning climate	Sharing Interpretation Negotiation	Balancing openness and closure and building trust in a nontrusting environment
	Cognitive distance	Sharing Interpretation Negotiation Combination Learning climate	Balancing individual and alliance interests, creating common meanings, goals and work plans
	Power distribution	Sharing Negotiation	Balancing influencing and being out of influence
Team composition inputs	Team diversity	Cognitive distance Power distribution Structural composition	
	Team stability	Negotiation Combination Level of uncertainty	Fostering optimal dynamics
	Hierarchy	Overall process	Balancing being in control and being out of control
	Leadership	Overall process	
	Structural composition	Combination Team diversity Leadership	Deciding when to work together and when apart
	Functional composition	Overall process	Coping with role overload
	Geographical proximity	Sharing	Efficiently and effectively organizing teamwork
	Learning history	Learning climate Cognitive distance	Rapidly building good relationships
Team-level inputs	Autonomy	Resource availability	
	Resource availability	Overall process	Mobilizing commitment inside and outside mother organization
	Innovation goal	Nature of knowledge	
	Nature of knowledge	Sharing	Sharing complex information, knowing when to share and when to withhold
	Level of uncertainty	Overall process Resource availability	Balancing short- and long-term goals; stability and risk
	Learning future	Overall process Level of uncertainty	Sustaining good relationships

referred to as opportunistic behavior, which means that an actor uses new ideas unfairly, or takes advantage of the openness of other actors in the network (Teece, 2002). In alliances, it appears difficult to have partners bring in human,

technological, or marketing resources equally. Not only in scale alliances but also in link alliances, "natural conflicts emerge over pricing, the timing of new product releases and who captures the greatest value at different phases of product generations" (Casadesus-Masanell & Yoffie, 2007, p. 584). A major dilemma in alliances is that being a good partner can invite exploitation from partners attempting to maximize their individual appropriation of the joint learning, which undercuts the collective knowledge development (Larsson et al., 1998). Professionals operating in open innovation teams therefore have to find a way to be good partners, and at the same time they have to prevent free riding. They have to motivate members to participate and openly share information and at the same time prevent undesirable spillover of strategic information to (potential) competitors (Dyer & Nobeoka, 2000).

Social cohesion. Social cohesion refers to the nature and quality of the emotional bonds of friendship such as liking, caring, and closeness among group members (Van den Bossche et al., 2006, p. 499). According to De Dreu (2007) a good relationship is crucial, because conflicts about goals and actions can be solved by collaborative problem solving, but conflicts at the level of relationships, about for example personal taste, political preferences, values, or interpersonal style, are far more difficult to solve. The network literature also refers to relational embeddedness, or strong or weak ties (Granovetter, 1983). Management literature also mentions the concept of care. When organizational relationships are fostered through care, knowledge can be created and shared (Lee & Choi, 2003). Social cohesion is supposed to enhance knowledge transfer, although strong social cohesion may also lead to uncritical agreements within the team and consequently have a negative impact on problem solving (Janis, 1972), impeding the partners to pursue their own goals (Haakansson & Ford, 2002). Team members of highly socially cohesive teams will focus more on maintaining relationships, tending to seek concurrence, instead of criticizing each others' ideas, which diminishes innovative performance (Sethi, Smith, & Park, 2002). Van den Bossche et al. (2006) found however no relationship between social cohesion and team learning behaviors, whereas learning climate was highly related to team learning behaviors.

Learning climate. The learning climate, including elements of psychological safety, team culture, and atmosphere, refers to the qualities of an environment that facilitate learning (Knowles, 1990). An optimal learning climate exudes a spirit of mutual respect for different opinions, there is lenience in judgment, empathy, collaboration rather than competition, access to help, courage, people eager to share what they know and feel rather than to hold back, and mutual trust (Knowles, 1990; Zarraga & Bonache, 2003). Psychological safety ensues from mutual respect and trust among team members (Edmondson, 1999). Trusting one another to be honest, capable, and committed to joint aims can lead to and is a necessary condition for

cooperative behavior among individuals, groups, or organizations, learning and knowledge transfer, experimenting, admitting mistakes, and questioning current team practices, thereby reducing the fear of taking risks (Dodgson, 1994; Edmondson, 1999; Hausler, Hohn, & Lutz, 1994; Jones & George, 1998; Lee & Choi, 2003; Lundvall, 1988; Uzzi, 1997). Based on other studies, Inkpen and Pien (2006) argued that a high level of trust contributes to information sharing because the holders do not feel that they have to protect themselves against opportunistic behavior. Too much trust however can diminish the innovativeness of a team, because the team members do not check each other's activities anymore (Hite, 2003, 2005). Trust is assumed to be problematic to develop and maintain in open innovation teams. In many new alliances, the partners are often suspicious of each other (Doz & Hamel, 1998), because the team is not governed by traditional hierarchical relationships (Ring, 1997). Next to that, more permeable firm boundaries provide for easier access to external knowledge but also allow for more rapid dissemination of a firm's unique stock of knowledge outside its boundaries (Matusik & Hill, 1998). Alliance partners may relinquish their competitive position by loss or transfer of core competencies because of the sense of security pressures created through the strategic partnership. The possibility of skill depreciation and the creation of future competitors makes professionals suspicious of one another and afraid to leak knowledge, which inhibits open knowledge sharing and honest feedback (Brown & Duguid, 2002; Szulanski, 2000). Dodgson (1994), aware of the social problems of collaboration, argues that one of the most important aspects of interorganizational networking is creating and sustaining trusting or personal relationships between the parties for ensuring effective exchange of knowledge and resources. Yet a trusting relationship is also developed by sharing information, which makes development and maintenance of trust problematic (Ring, 1997). Professionals operating in open innovation teams therefore often encounter the dilemma between dialogue versus keeping information, and openness versus closure, to form an alliance without revealing trade secrets (Khilji, Mroczkowski, & Bernstein, 2006) and build trust in a nontrusting environment.

Cognitive distance. Cognitive distance, or reversely framed as shared cognition, describes the degree of similarity among actors concerning their representations, interpretations, and systems of meaning or beliefs about the types of issues perceived to be important, how such issues are conceptualized, and alternative approaches for dealing with such issues (Cohen & Levinthal, 1990; Simsek, Lubatkin, & Floyd, 2003). In this article, a distinction is made between differences in information and conceptualizations, goals, and working culture.

Differences in conceptualizations or oppositely, shared cognition, refers to the degree to which team members share the same understanding of certain concepts. Research

shows that individuals' perspectives, visions, and opinions influence their commitment and contribution to knowledge creation processes (Hofer & Pintrich, 2002). The differences in open innovation teams can be so big that team members no longer understand each other (Horwitz, 2005; Von Hippel, 1994) and stop sharing knowledge. Making different perspectives explicit may help to overcome this problem, but even then an open reflective dialogue can be difficult by unawareness of the problem and the fact that individuals find it difficult to view other interpretations of the problem situation and revise their perspectives (Brooks, 1994). In addition, cognitive or information overload can bog down the process, canceling out the advantage of team diversity (Sethi et al., 2002).

Differences in goals, or the opposite, task cohesion, refers to the shared commitment among team members to achieve a goal that requires the collective efforts of the group (Van den Bossche et al., 2006, p. 499). Firm diversity may cause team members from different companies to have similar as well as competitive aims (Hamel, 1991). Competing goals make balancing individual and alliance interests difficult. This threatens the negotiation stage, because in these situations searching and finding a common goal is almost impossible (Inkpen, 2000). It may even cause projects to fail (Bessant, Kaplinsky, & Lamming, 2003), because common goals and common interests are key factors in effective knowledge creation (Senge, 1990). A concern in open innovation teams is therefore how the team members can use their relationships to their advantage, without restricting each other in the pursuit of their individual aspirations (Haakansson & Ford, 2002). Inkpen (2000) views this as the dilemma between competition and cooperation. Jap and Anderson (2003) conclude that (absolute) goal congruence is important only when high levels of opportunism exist among the partners.

Differences in working culture, or business culture, refers to a pattern of basic assumptions to develop solutions to everyday problems, how to take actions, how to determine what information is relevant, when there is enough information, and to know whether to act and what to do (Schein, 1985). Differences in the way of thinking and management methods among the members in open innovation teams can cause serious operational difficulties (Inkpen & Pien, 2006). Different working cultures cause misunderstandings and make it difficult to develop common work plans (Bessant et al., 2003). It may even prohibit collaborative knowledge creation, when the group decides to decompose and work in subgroups (Newell & Swan, 2000; Sethi et al., 2002).

To summarize, the firm diversity in open innovation teams influences cognitive distances in conceptualizations, goals, and work plans. This may cause conflicts that either inhibit or stimulate the sharing, interpretation, negotiation, or combination stage, and the degree of trust among team members. It is thus a challenge for open innovation teams to balance individual and alliance interest, to create common goals, meanings, and work plans.

Power distribution. Power can be seen as the medium of responsible collective action and can depend on factors such as status, position (Thomas-Hunt, Ogden, & Neale, 2003), or mastery (Blackler & McDonald, 2000). Power strongly influences the ability of people to construct the parameters of

debate and the extent to which one's voice is heard (Blackler & McDonald, 2000). Learning theories state that interdependencies between team members are necessary for achieving desired learning outcomes. Interdependence means, among others, that participants perceive that they need each other to reach their goals (Johnson, Johnson, & Smith, 1998). Brooks (1994) found that the production of knowledge occurs either when there is no difference in available power between team members or when these differences are controlled. The dispersion of power would facilitate information exchange (Bolhuis & Simons, 2001). Muthusamy and White (2005) found the same result with strategic alliances, where mutual power or influence between partners was positively related to learning and knowledge transfer. The presence of dominant network members would reduce the willingness of team members to exchange information, and feelings of dependency would inhibit knowledge sharing (Gulati, 1995). Although traditional hierarchical relationships are lacking in open innovation teams (Ring & Van de Ven, 1992), power differences do exist. Suppliers, for instance, are often more dependent on their buyers than buyers are on their suppliers because of the fear of harming or losing the buyer (Bessant et al., 2003). In addition, it appears that large firms have lower degrees of dependence and are thus more difficult to influence (Bessant et al., 2003). Although power differences have advantages and disadvantages, it is very likely that professionals operating in open innovation teams have to deal with issues such as dominance of a partner, the threat of ostracism, and the loss of reputation, which may cause a loss of control or ownership and negatively influence sharing knowledge and negotiating in the knowledge creation process. These professionals are therefore challenged to find a good balance between influencing and being influenced (Haakansson & Ford, 2002).

Team Composition Inputs

Team composition inputs deal with attributes of team members and the impact of the combination of such attributes on processes, emergent states, and outcomes (Mathieu et al., 2008). The following sections describe the factors of team diversity, team stability, hierarchy, leadership, structural composition, functional composition, geographical proximity, and learning history.

Team diversity. This factor refers to the degree of demographic, job, expertise, and firm diversity in the team (D'Abate, Eddy, & Tannenbaum, 2003). It is not yet clear how diversity affects team output but Van Knippenberg and Schippers (2007) emphasize that multiple dimensions of diversity (social, information, and decision making) have to be taken into account. Demographic diversity is also investigated as multicultural teams and job diversity as interdisciplinary teams (Lattuca, Voigt, & Fath, 2004) or group heterogeneity (Dillenbourg, Baker, Blaye, & O'Malley, 1996). The degree of firm diversity is always high in open innovation, but the degree of job and demographic or

cultural diversity may vary across open innovation teams. Studies on business alliances often discern between asymmetric versus symmetric and scale versus link alliances. In asymmetric alliances the cooperating firms differ in size, whereas in symmetric alliances they are about the same size. Scale alliances refer to partnerships in which resources are pooled for activities in the same stage(s) of the value chain (Kalaignanam, Shankar, & Varadarajan, 2007), also referred to as partner resource similarity (Inkpen & Pien, 2006). Link alliances refer to partnerships in which resources are exchanged for activities performed at different stages of the value chain (Kalaignanam et al., 2007), also referred to as partner resource complementarity (Inkpen & Pien, 2006). Studies on business alliances find that link alliances lead to higher levels of learning between the partners than do scale alliances (Dussauge, Garette, & Mitchell, 2000). Others find the opposite, stating that groups consisting of potential competitors, sources of complementary technological or market know-how, or scale alliances were more successful than alliances with buyers or suppliers, sources of supplementary knowledge, or link alliances (Inkpen, 1996). The great variety in perspectives and partner characteristics would actually reduce the creation and diffusion of innovative ideas (Newell & Swan, 2000) and the longevity and effectiveness of collaboration (Parkhe, 1991, 1993). Similarly, studies in innovation management state that heterogeneous teams with a broad range of skills and experiences promote creativity, innovation, and problem solving (McCain, 1996), whereas others find that merely including people from a large number of functional areas does not improve its innovative capacity (Sethi et al., 2002). Homogeneous teams with similar basic knowledge would be likely to be more productive than heterogeneous teams because of mutual attraction of team members with similar characteristics (Horwitz, 2005, p. 224). In the learning sciences, the effect of interdisciplinary learning on learning outcomes does not seem to be clear yet (Lattuca et al., 2004). Diversity could provide a variety of perspectives and ideas essential for creative combining, but although more ideas may come to the table, sharing information, interpretation, negotiation, and combination among teams may get harder because team diversity influences the cognitive distance between the team members.

Team stability. Stability refers to the rate of entry and exit of members (Gilsing & Nooteboom, 2005). A stable group is expected to be more likely to create a lock-in effect, or groupthink, than a more flexible group. This implies the danger of creating certain habits and assumptions that make a team blind to new developments (Johannisson, 2000). Although working in teams potentially creates synergies resulting in team outputs that are superior to the collective outputs of individuals, the exact opposite may also occur (Hackman, 1990). The danger of routinization with explicit and implicit rules of behavior and rituals is present in business alliances (Haakansson & Snehota, 1995). This danger will however be small in open innovation teams, because the sole constant is the ongoing mix of contributors, tasks, and tools and the long-term

pattern associated with it (Engeström, Engeström, & Vahaaho, 1999). This avoids on one hand the danger of groupthink but on the other hand increases the degree of uncertainty in the team, which is discussed later on in this article. Next to that, part-time and temporary participation of team members could result in loss of organizational memory (Van de Ven & Polley, 1992). Therefore, it is necessary to foster a network that on one hand prevents groupthink by allowing entry and exit of network members but on the other remains quite stable with respect to its size in order to keep organizational memory in the network (Dhanaraj & Parkhe, 2006).

Hierarchy. This factor refers to the positions people take in the network and the division of power and the locus of decision authority and control *within* an organizational entity (Hoang & Antoncic, 2003). A negative relation between a strong hierarchy and knowledge creation was found, because a strong hierarchy appears to inhibit a constant flow of communication and ideas (Lee & Choi, 2003). Groups with flat communication structures would positively influence information exchange (Bolhuis & Simons, 2001). Interfirm alliances fall, in terms of the theory of economic organization, between the polar models of markets and hierarchies (Grant & Baden-Fuller, 2004), which means that they are not governed by for example formal contracts, ownership, and hierarchical lines. The fact that these teams are not governed by traditional hierarchical relationships (Ring, 1997) should have positive influence on the knowledge creation process. However, it also implies that nobody has the authority to issue commands and none of the members is obliged to obey, which makes influencing, controlling, leading, or efficient coordination of the project more complicated (Dhanaraj & Parkhe, 2006; West & Gallagher, 2006). It is thus a challenge for open innovation professionals to find a good balance between being in control and being out of control (Haakansson & Ford, 2002).

Leadership. This factor is also called regulation, direction, or distribution of responsibilities (Bolhuis & Simons, 2001; Knowles, 1990). It describes the way an innovation team is managed, coordinated, or facilitated, which determines to a high extent the kind of innovation outcomes (Gieskes & Van der Heijden, 2004). Innovation management literature often stresses the importance of strong and pluralistic leadership in innovation projects that allows for a variety of competing perspectives (Fagerberg, 2005), whereas studies on (organizational) learning stress the importance of self-direction and mutual responsibilities for the success of learning teams (Knowles, 1990). Somech (2006) suggests that the way alliances should be managed depends on the functional heterogeneity, or job diversity, in the team. In a study of 136 primary care teams, Somech found that in highly functionally heterogeneous teams, a participative leadership style ("asking for ideas") was positively associated with team reflection (which in turn fostered team innovation). Only in case of low functional heterogeneity is team reflection positively affected by

directive leadership ("setting rules for behavior"). Subtle leadership is needed in innovation teams because as Van Aken and Weggeman (2000) argue, too little management efforts may lead to the underexploitation of potential and poor productivity. Too much management efforts, however, may destroy informality and hence the creative and explorative potential of the team. Especially in open innovation teams, it appears difficult to find a good balance between controlling and coordinating (Khilji et al., 2006), because open innovation teams often lack a single overview or center of control (Engeström et al., 1999). Control is dangerous, but also important (Haakansson & Ford, 2002). It is suggested that in the absence of hierarchical authority or "loose coupling," subtle leadership becomes essential (Orton & Weick, 1990).

Structural composition. To describe the network structure, network literature refers to the size, density, structural holes, and closure of the network, which influence the amount and quality of resources that one can access (Hoang & Antoncic, 2003; Simsek et al., 2003). The kind of network necessary for successful (open) innovation depends however on the complexity of the innovation goal (Gilsing & Nooteboom, 2005). Because the kinds of networks and innovation goals may vary across open innovation teams, it makes no sense to discuss what kind of challenges structural composition would cause for open innovation teams in general. Innovation and organizational literature refer to hierarchical decomposition (Leenders, Van Engelen, & Kratzer, 2007) or the splitting up of the team into subgroups to describe the structure of a team. Highly diverse teams often tend to split up into subgroups because of the problems caused by the diversity (Newell & Swan, 2000). The degrees of freedom in the resulting tasks are so low then that creativity is unlikely to happen at all (Enberg, Lindkvist, & Tell, 2006). Next to that, there is less communication between the team members. In the product development literature, successful performance is often associated with promoting direct and extensive communication between members from different functions. Enberg et al. (2006) state that the influence of much communication or interaction between team members depends on the homogeneity of the group. In contexts such as project work where frequency and homogeneity are high, work may be successfully undertaken without much communication or interaction between project members, even though substantial computational and epistemic complexity may prevail. Team members of an interdisciplinary team should have close and constant interaction and work together from start to finish (Enberg et al., 2006), although this may also enhance the possibility that conflicts emerge. Because the diversity in open innovation teams is typically high, they will likely split up in subgroups. The possibility of conflicts diminishes then, but also the probability of coming up with (innovative) new combinations. It is therefore a challenge for open innovation teams to make a choice between when to decide to split up into subgroups and when to decide to collaborate (at the risk of having a conflict).

Functional composition. This factor refers to the team roles that are present in the team. It is argued that a healthy balance between different roles is necessary for team success (Belbin, 1993). These roles are often defined in a functional or task-related way. Belbin (1993) defines nine team roles that seem to blend closely to how people behave naturally (the plant, the resource investigator, the coordinator, the shaper, the monitor, the evaluator, the team worker, the implementer, the completer or finisher, and the specialist). In innovation literature, the importance of a dedicated accountable team leader is stressed, who is not doing too many other projects at the same time and is held accountable for the entire project from the beginning to the end, including its results (Cooper, 1999). Zhang and Doll (2001) brought forward that an innovation team needs a "heavyweight manager," someone in the organization who has political influence, someone who has access to the necessary resources, and is championed by someone who is an enthusiastic salesperson for the new idea. Reid and De Brentani (2004) suggest that innovation teams need roles that concern championing, boundary spanning, gatekeeping, and pattern recognition. No specific literature on roles in open innovation teams was found. However, also in open innovation teams there may be competitive roles, absence of certain roles, and conflicting team roles, which Belbin (1993) states to be important causes for team failure. Apart from that the team members may experience role overload because they need to perform a certain role both in their own organization and in the open innovation team (Marrone, Tesluk, & Carson, 2007).

Geographical proximity. Geographical proximity, also called physical proximity, or oppositely team dispersion (Hoegl, Ernst, & Proserpio, 2007) or distance (Bessant et al., 2003), describes how far team members work from each other. The physical distance influences the way team members have access to one another (Cross, Parker, Prusak, & Borgatti, 2001) and some studies state that high proximity positively influences the collaborative learning process (Bessant et al., 2003). The geographical proximity in open innovation teams is likely to be low because the team members typically are located at different company locations. This could make the network inefficient at knowledge sharing, because the speed and ease with which network members can find and access valuable knowledge within the network is then slower and costs are higher (Dyer & Nobeoka, 2000). Low proximity should however not be regarded as an inconvenience to be overcome or avoided (Hoegl et al., 2007; Kirat & Lung, 1999). It may be an opportunity as these teams can reach higher levels of effectiveness and efficiency than colocated ones if they manage to achieve high levels of teamwork over distance (Hoegl et al., 2007). So low proximity in open innovation teams could not only be an opportunity but also a challenge for the team members to organize the sequence and content of collaborative knowledge creation processes more efficiently and effectively.

Learning history. Learning history has to do with the period of time that team members worked with each other before joining the team (Bolhuis &

Simons, 2001). Prior related interaction between the partners has a positive impact on team performance as partners already know each other's languages and have learned, for instance, to trust each other (Zollo, Reuer, & Singh, 2002). In alliances, interpartner trust will be increased when the partners have successfully completed transactions in the past (Ring & Van de Ven, 1992). Yet although companies may have a long-lasting relationship, this does not necessarily imply that the members in open innovation teams share a relationship over time. In many cases, members of open innovation teams do not know each other in advance and thus have no learning history. This threatens collaborative knowledge creation because there may be different languages in the team and less trust. In addition, because innovation teams in general need to get results as quickly as possible, open innovation professionals are challenged to rapidly build good relationships.

Team-Level Inputs

Team-level input factors refer to the opportunities given and conditions set by the parent firm(s) that could influence the collaborative knowledge creation process in open innovation teams: autonomy, resource availability, innovation goal, nature of knowledge, level of uncertainty, and learning future.

Autonomy. The degree of autonomy describes the kinds of power relationships between the team and actors *outside* the team (Langfred, 2007) or the decision-making authority (Zellmer-Bruhn & Gibson, 2006). This indicates the degree to which the team is allowed to make its own decisions about the content and results of the innovation process. Team autonomy appears to be positively related to team learning (Zellmer-Bruhn & Gibson, 2006). There are indications that most (innovation) teams in (large) organizations are not autonomous (Tjepkema, 2002). According to Cooper (1999) there are, for example, too many presentations to senior management, too many status reports, and generally too much deference and reporting to senior managers, which inhibits the team to design its own process and get to the market quickly and successfully. It was also found that in alliances, professionals were dependent on their management for obtaining funding, which made them present overoptimistic plans and triggered a cycle of impression management and uncritical, sugarcoated administrative reviews (Van de Ven & Polley, 1992). However, it was also found that "within limits close monitoring by senior management signals team members and the rest of the company that their project is important, which motivates team members and enhances the team's creativity" (Sethi et al., 2002, p. 17). In addition, it makes organizational resources more available to the team because it is hard not to cooperate with a team that is visibly on management (Sethi et al., 2002).

Resource availability. Resource availability refers to the degree to which team members have access to the necessary resources for performing their

tasks successfully. Availability to the required resources, whether they are economic, material, legal, or intellectual, is needed for successful learning outcomes (Knowles, 1990). Limited financial resources and high costs are important failure factors for innovation projects (Garcia Martinez & Briz, 2000). In most situations, the organization is responsible for supplying enough financial support. There are indications that in an open innovation context, the financial and intellectual support of the mother organizations is often inadequate and inconsistent (Haakansson & Snehota, 1995). So in brief, sufficient resource availability is not obvious for professionals operating in open innovation teams, because the mother organizations and/or the partners are not very eager to provide them. This negatively influences the success of the overall innovation project, and to avoid this problem open innovation professionals face the challenge of mobilizing commitment to provide the necessary resources inside and outside their own mother organizations.

Innovation goal. The innovation goal describes what has to be made and/or learned, the "nature of the task" (Dillenbourg et al., 1996). Research in learning sciences focuses on the influence of the complexity of the learning goal. The taxonomy of Bloom, who discerns between knowledge, comprehension, application, analysis, synthesis, and evaluation (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956), is often used to describe the complexity of learning goals. To indicate the complexity of innovation goals, innovation management literature distinguishes between radical or discontinuous versus incremental or marginal innovation. Continuous improvements are often characterized as incremental or marginal innovations, as opposed to radical innovations (such as the introduction of a totally new type of machinery) or technological revolutions (consisting of a cluster of innovations that together may have a very far-reaching impact; Freeman & Soete, 1997). Literature on business alliances and networks refer to radical innovation as exploration and to incremental innovation as exploitation (Nooteboom, 2000). Organizational learning theories distinguish between low and higher order learning (Fiol & Lyles, 1985), single- and double-loop learning (Argyris & Schön, 1978), or Mode 1 and Mode 2 learning (Gibbons, 1994). Innovation management literature often distinguishes between the development of new products, new methods of production, new sources of supply, exploitations of new markets, and new ways to organize business (Fagerberg, 2005). In the learning sciences, a distinction is made in types of skills, such as organizational skills, analytical skills, etc. Both disciplines assume that the type of innovation or learning goal influences the type of activities that must be undertaken to reach that goal (Inkpen & Dinur, 1998), but no empirical studies were found describing this relationship. The complexity or radicality is assumed to influence the nature of knowledge.

Nature of knowledge. Literature on knowledge creation, both in the field of HRD and organizational studies, discerns between types of knowledge,

knowledge tacitness, knowledge stickiness (knowledge that is difficult to transfer), and knowledge importance (Inkpen, 2000). The innovation goal influences the "tacitness of technology" (Roy, Sivakumar, & Wilkinson, 2004) and the stickiness of knowledge (Szulanski, 2000). Hislop (2002) however argues that all knowledge has tacit and explicit components. This would mean that whatever the innovation goal is, it is always a challenge to share knowledge effectively, but that it may be more challenging in radical innovation projects because of the different backgrounds and political agendas of the team members. Apart from that, the context influences the importance or value of knowledge. Open innovation teams typically operate in a highly competitive environment, in which their knowledge may have a high commercial and scientific value. This means that professionals operating in open innovation teams regularly have to balance whether to share their knowledge with the other team members.

Level of uncertainty. Uncertainty is defined as "the inability to assign probabilities to outcomes" (Zhang & Doll, 2001, p. 97). Fundamental uncertainty is typical of innovation projects (Schumpeter, 1934) and the level of uncertainty is often high because of the nonlinear or disorderly character of innovation processes, the instability of the team, and the lack of clarity in the information that circulates (Zhang & Doll, 2001). In addition, long-term goals generate a higher level of uncertainty as they make the causal relationships between decisions and the corresponding results unclear and increase the time span of feedback about the results of decisions (Zhang & Doll, 2001). Apart from these sources of uncertainty, open innovation team members also need to deal with uncertainties regarding the future of the relations and uncertainty about whether they can trust each other (Ring & Van de Ven, 1994). In such an environment with high levels of uncertainty and at the same time high competitive pressures to "discover new combinations," a creative turmoil may create the dynamics to leave traditional paths behind and come up with radical innovations (Kessels, 2001). Yet empirical research shows that high levels of uncertainty (with respect to future costs and benefits) is also an important reason for the failure of many innovation projects (Garcia Martinez & Briz, 2000). Simpson, French, and Vince (2000) studied learning groups as complex systems and explained this paradox. According to these authors, learning implies to come to know what is not known. This generates uncertainty, which in turn stimulates positive or negative responses, such as explorative or defensive behavior. It can therefore be a significant challenge for the actors to discover ways of working effectively with these limiting forces in the learning process as well as with the more creative dynamics. Next to that, it is a challenge for professionals operating in open innovation teams to determine whether, and how, to continue a developmental effort in the absence of concrete performance information (Van de Ven & Polley, 1992), to strive for equilibrium in short- and long-term goals of innovation projects (Hermens, 2001), and to find a balance between stability and risk (Brooks, 1994).

Learning future. Learning future is the period of time participants will collaborate in the open innovation team. The relationship can be short-term or long-term, from up to 6 months of interactions to 6 months and more (Haakansson & Snehota, 1995). A long-term orientation is likely to empower the collective learning process (Larsson et al., 1998), but more empirical research is necessary about how exactly and in which situations. Open innovation usually takes quite some time, suggesting that the teams have a long learning future and thus time to develop a good working relationship. However, alliance duration is often uncertain (Kogut, 1991) and a long-term relationship also means that relations must be sustained. It is therefore a challenge for open innovation team members to sustain a good relationship.

Discussion and Conclusion

Collaborative knowledge creation in open innovation teams can spark creativity, but many pitfalls, related to for example power distributions and political agendas, can make the process difficult and frustrating as well (Crossan & Inkpen, 1995). So far, HRD research has not paid much attention to open innovation teams. The growing interest of companies to form open innovation teams is however an opportunity for HRD to realize its strategic potential by extending personnel training and development to an interorganizational level, thereby enhancing the interactive learning abilities of alliance personnel (Larsson et al., 1998). This article explores the way in which individuals interact and the challenges they may face when creating knowledge collaboratively in open innovation teams. An extensive review and synthesis of studies and theories in HRD, organizational, and learning sciences was executed and led to a richer understanding of the processes taking place. It resulted in a knowledge creation model (see Figure 1) that shows how individuals interact at both the individual and group level, leading to different kinds of knowledge situated at different levels. In this respect, the model fills a gap in knowledge creation models used in HRD because the model clearly shows how knowledge is created on an individual and group level, thereby integrating different views on knowledge. Table 2 supplements the HRD literature with an overview of the challenges of working in open innovation teams. The review of the team characteristics makes clear that interorganizational learning has advantages as well as disadvantages. The involvement of different organizations in the process may reduce the risk and uncertainty of product success, but it may, at the same time, cause many difficulties for professionals operating in open innovation teams. HRD tends not to explore how topics such as power and political agendas cause problems to learning (Blackler & McDonald, 2000), through which an "overly romanticised view of collaboration" has been developed (Raeithel, 1996). Bing, Kehrhahn, and Short (2003) suggest that studies in HRD should be more focused on solving real problems that matter to stakeholders outside HRD, to strengthen

the strategic importance of HRD in the organization. By exploring the collaborative knowledge creation process and highlighting the challenges of collaborative knowledge creation in open innovation teams, we have taken a first step in explaining the high failure rates of open innovation teams and elicit the real problems that matter to stakeholders outside HRD. Obviously more steps have to be taken to get a complete picture, not to mention to discover the means by which to lower failure rates and the role HRD could play in this. We suggest three areas for further research:

1. Research on the robustness of findings.

The different research disciplines appeared to complement each other surprisingly well. In the learning sciences, for instance, it was hard to find studies on power differences within the team, whereas there is a wealth of knowledge on power differences outside the team or autonomy. In the organizational sciences, we found the opposite. Combining these different strands of thoughts resulted in an extensive overview of the processes that play a role in open innovation teams and how they are interrelated. However, the many interrelated factors in the literature raise questions on the robustness of these findings. For instance, we may see team diversity as a positive aspect for an open innovation team, but this might be true only when there is a good learning climate. Furthermore, it is not clear whether this interaction between team diversity and learning climate holds for different types of open innovation teams, because the contexts of the studies were very different. And maybe there are other intervening variables that we have not considered yet. Moreover, many studies in organizational sciences use concepts at the team and individual levels but measure them at the organizational level. The concept of cognitive distance, for instance, is in both learning and organizational sciences defined as the difference in beliefs between individuals, which is used to measure the diversity in teams. In organizational studies, however, the cognitive distance is operationalized at the organizational level by for example the different types of patents various organizations possess, whereas in other disciplines attempts are made to measure the concept at an individual level. Next to that, many researchers do not make a distinction between, for instance, team diversity and cognitive distance. They claim to measure cognitive distances by measuring team diversity. Team diversity in itself does not necessarily imply that there are cognitive distances. We simply do not know yet what the impact of the different measurement methods is on the outcomes of the various studies and therefore have to be very careful when interpreting results and drawing conclusions on what challenges are more or less relevant to explain failures of open innovation teams. Further research should therefore include empirical studies to validate the factors and interrelationships identified in the present study.

2. Research on the uniqueness of challenges for open innovation teams

In this article we claim to have identified challenges typical for collaborative knowledge creation *in open innovation teams*. However, we do not know to what extent these challenges are unique for an open innovation setting. Interdisciplinary teams or closed innovation teams (especially those within large companies) may have to cope with the same kinds of challenges as (some) open innovation teams. Further empirical research should therefore investigate whether the challenges derived are unique to an open innovation setting.

3. Research on how to facilitate open innovation teams

Additional research is needed to investigate how to deal with the identified challenges most effectively. Some authors question the usefulness of diverse teams because of the challenges (Newell & Swan, 2000), but others think that collaboration is in itself neither efficient nor inefficient but works under certain conditions (Dillenbourg et al., 1996) and needs support (Horwitz, 2005). The involvement of HRD expertise is recommended to take advantage of the organizational diversity in open innovation teams and to master their challenges. It is not only an opportunity for open innovation teams to integrate knowledge about interpersonal aspects of collaboration and prepare for working in open innovation contexts but also a chance for HRD to realize its strategic potential in the organization. HRD practitioners should familiarize themselves with the dilemmas professionals encounter in innovation teams. There is for instance much knowledge on how to create a safe learning climate, but this knowledge rarely is applied in an interorganizational context. HRD practitioners could for instance offer strong incentives for learning on the job, such as coaching by more experienced peers. However, "more" experienced peers are not always available and on top of that, learning by doing can have tremendous costly side effects. To illustrate, good external partners are hard to find, trust is slowly built, but with one mistake by one employee it can be gone, and with that a fruitful collaboration. More accurate knowledge has therefore to be built on how professionals need to deal with the challenges they face. With this knowledge, HRD professionals can select and train open innovation professionals ex ante and mingle in the composition of the team. It is suggested that the way open innovation professionals operate largely determines the success rate of open innovation teams (Larsson et al., 1998) and that they need strong influencing and trust-building skills, but this human side of innovation has not been investigated yet (Moss Kanter, 2006). As such, additional insight is needed on which competencies individuals should be selected, trained, and grouped into teams. Further research should therefore focus on the competencies that professionals operating in open innovation teams need. HRD researchers can then focus on these competences and learn how to facilitate open innovation teams.

APPENDIX
Factors Influencing Collaborative Knowledge Creation and Similar or Identical Labels in Various Streams of Literature

Factors Influencing Collaborative Knowledge Creation	*Referred to in Learning Literature as:*	*Referred to in (Inter)organizational Learning Literature as:*	*Referred to in Innovation Management Literature as:*	*Referred to in Business Alliances and Networks Literature as:*
Group efficacy	Group efficacy			
Social cohesion	Social cohesion	Care		Relational embeddedness, strong ties, weak ties
Learning climate	Psychological safety	Learning climate	Team atmosphere, trust,	Psychological proximity
Cognitive distance	Shared cognition	Common meanings	Cognitive distance	Cognitive distance
Power distribution	Interdependencies	Power	Power (distribution)	Dominance
Team diversity	Interdisciplinary Multicultural teams	Team diversity Multicultural teams	Firm, job, demographics-related diversity	Link, scale, complementary, supplementary alliances, symmetry
Reciprocal commitment		Reciprocity	Equity, fair dealing	Reciprocity
Team stability		Stability	Stability	Stability
Hierarchy	Interdependencies	Hierarchy		Centrality or hierarchy
Leadership	Regulation	Facilitation	Coordination, controlling	Managing
Structural composition		Splitting up of teams into subgroups	Hierarchical decomposition	Network structure
Functional composition		Team roles	Roles	
Geographical proximity		Team dispersion	Geographical proximity	Physical proximity
Learning history	Learning history	Learning history	Partner-specific experience	
Autonomy	Autonomy	Autonomy	Autonomy	
Resource availability	Resource availability	Resource availability	Resource availability	Resource availability

(continued)

APPENDIX (continued)

Factors Influencing Collaborative Knowledge Creation	*Referred to in Learning Literature as:*	*Referred to in (Inter)organizational Learning Literature as:*	*Referred to in Innovation Management Literature as:*	*Referred to in Business Alliances and Networks Literature as:*
Innovation goal	Discipline, taxonomy of Bloom	Single loop, double loop or Mode 1, Mode 2, or first- and second-order learning	Incremental, radical, products, methods of production, sources of supply, markets, organize business	Exploitation and exploration
Nature of knowledge		Tacitness, stickiness, value	Tacitness, stickiness, value	Tacitness, stickiness, value
Level of uncertainty		Creative turmoil	Level of uncertainty	
Learning future				Short- and long-term relationship alliance duration

Note

1. As opposed to "closed innovation" where companies develop and market innovations by themselves.

References

Argyris, C., & Schön, D. A. (1978). *Learning organizations: A theory of action perspective*. Reading, MA: Addison-Wesley.

Beers, P. J., Boshuizen, H. P. A., Kirschner, P. A., & Gijselaers, W. H. (2005). Computer support for knowledge construction in collaborative learning environments. *Computers in Human Behavior, 21*(4), 623-643.

Belbin, R. M. (1993). *Team roles at work.* Oxford, UK: Butterworth-Heinemann.

Bereiter, C. (2002). *Education and mind in the knowledge age.* Mahwah, NJ: Lawrence Erlbaum.

Bereiter, C., & Scardamalia, M. (1993). *Surpassing ourselves: An inquiry into the nature and implications of expertise*. Chicago: Open Court.

Bessant, J., Kaplinsky, R., & Lamming, R. (2003). Putting supply chain learning into practice. *International Journal of Operations and Production Management, 23*(2), 167-181.

Bing, J. W., Kehrhahn, M., & Short, D. C. (2003). Challenges to the field of human resource development. *Advances in Developing Human Resources, 5*(3), 342-351.

Blackler, F., & McDonald, S. (2000). Power, mastery and organizational learning. *Journal of Management Studies, 37*(6), 833-851.

Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals: Handbook 1; The cognitive domain*. White Plains, NY: Longman.

Boisot, M. H. (1986). Markets and hierarchies. *A Cultural-Perspective Organization Studies, 7*(2), 135-158.

Boisot, M. H. (1995). Is your firm a creative destroyer: Competitive learning and knowledge flows in the technological strategies of firms. *Research Policy, 24*(4), 489-506.

Bolhuis, S. M., & Simons, P. R. J. (2001). *Leren en werken* [Learning and working]. Alphen aan den Rijn, Netherlands: Samsom.

Brooks, A. K. (1994). Power and the production of knowledge: Collective team learning in work organizations. *HRD Quarterly, 5*, 213-228.

Brown, J. S., & Duguid, P. (2002). Local knowledge: Innovation in the networked age. *Management Learning, 33*(4), 427-437.

Carlile, P. R. (2004). Transferring, translating and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science, 15*(5), 555-568.

Casadesus-Masanell, R., & Yoffie, D. B. (2007). Wintel: Cooperation and conflict. *Management Science, 53*(4), 584-598.

Chesbrough, H. (2003). *Open innovation.* Cambridge, MA: Harvard University Press.

Chesbrough, H., & Schwartz, K. (2007). Innovating business models with co-development partnerships. *Research Technology Management, 50*(1), 55-59.

Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly, 35*(1), 128-152.

Cooper, R. G. (1999). The invisible success factors in product innovation. *Journal of Product Innovation Management, 16*(2), 115-133.

Cross, R., Parker, A., Prusak, L., & Borgatti, S. P. (2001). Knowing what we know: Supporting knowledge creation and sharing in social networks. *Organizational Dynamics, 30*(2), 100-120.

Crossan, M. M., & Inkpen, A. C. (1995). The subtle art of learning through alliances. *Business Quarterly, 60*(2), 69-78.

D'Abate, C., Eddy, E. R., & Tannenbaum, S. I. (2003). What's in a name? A literature-based approach to understanding mentoring, coaching, and other constructs that describe developmental interactions. *HRD Review, 2*(4), 360-384.

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Boston: Harvard Business School Press.

De Dreu, C. K. (2007). Cooperative outcome interdependence, task reflexivity, and team effectiveness: A motivated information processing perspective. *Journal of Applied Psychology, 92*(3), 628-663.

Dewey, J. (1933). *How we think*. New York: Heath.

Dhanaraj, C., & Parkhe, A. (2006). Orchestrating innovation networks. *Academy of Management Review, 31*(3), 659-669.

Dillenbourg, P., Baker, M., Blaye, A., & O'Malley, C. (1996). The evolution of research on collaborative learning. In E. Spada & P. Reiman (Eds.), *Learning in humans and machine: Towards an interdisciplinary learning science* (pp. 189-211). Oxford, UK: Elsevier.

Dodgson, M. (1994). Technological collaboration and innovation. In M. Dodgson & R. Rothwell (Eds.), *The handbook of industrial innovation* (pp. 285-292). Aldershot, UK: Edward Elgar.

Dosi, G., Teece, D. J., & Chytry, J. (1998). *Technology, organization, and competitiveness: Perspectives on industrial and corporate change*. Oxford, UK: Oxford University Press.

Dougherty, D. (1992). Interpretive barriers to successful product innovation in large firms. *Organization Science, 3*(2), 179-202.

Doz, Y. L., & Hamel, G. (1998). *Alliance advantage: The art of creating value through partnering.* Boston: Harvard Business School Press.

Dussauge, P., Garette, B., & Mitchell, W. (2000). Learning from competing partners: Outcomes and durations of scale and link alliances in Europe, North America and Asia. *Strategic Management Journal, 21*(2), 99-126.

Dyer, J. H., & Nobeoka, K. (2000). Creating and managing a high-performance knowledge-sharing network: The Toyota case. *Strategic Management Journal, 21*(3), 345-367.

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*(2), 350-383.

Enberg, C., Lindkvist, L., & Tell, F. (2006). Exploring the dynamics of knowledge integration acting and interacting in project teams. *Management Learning, 37*(2), 143-165.

Engeström, Y. (1999). Innovative learning in work teams: Analyzing cycles of knowledge creation in practice. In Y. Engeström, R. Miettinen, & R. L. Punamäki (Eds.), *Perspectives on activity theory* (pp. 377-406). Cambridge, UK: Cambridge University Press.

Engeström, Y., Engeström, R., & Vahaaho, T. (1999). When the centre does not hold: The importance of knotworking. In S. Chaiklin, M. Hedegaard, & U. Jensen (Eds.), *Activity theory and social practice: Cultural-historical approaches* (pp. 345-375). Aarhus, Denmark: Aarhus University Press.

Fagerberg, J. (2005). Innovation: A guide to the literature. In J. Fagerberg, D. C. Mowery, & R. R. R. Nelson (Eds.), *The Oxford handbook of innovation* (pp. 1-26). Oxford, UK: Oxford University Press.

Fiol, C. M., & Lyles, M. A. (1985). Organizational learning. *The Academy of Management Review, 10*(4), 803-813.

Freeman, C., & Soete, L. (1997). *The economics of industrial innovation* (3rd ed.). Cambridge, MA: MIT Press.

Garcia Martinez, M., & Briz, J. (2000). Innovation in the Spanish food & drink industry. *The International Food and Agribusiness Management Review, 3*(2), 155-176.

Gibbons, M. L. R. (1994). *The new production of knowledge: The dynamics of science and research in contemporary societies*. London: Sage.

Gibson, C. B. (1999). Do they do what they believe they can? Group efficacy and group effectiveness across tasks and cultures. *The Academy of Management Journal, 42*(2), 138-152.

Gieskes, J., & Van der Heijden, B. (2004). Measuring and enabling learning behaviour in product innovation processes. *Creativity and Innovation Management, 13*(2), 109-125.

Gilsing, V., & Nooteboom, B. (2005). Density and strength of ties in innovation networks: An analysis of multimedia and biotechnology. *European Management Review, 2*(3), 179-197.

Granovetter, M. S. (1983). The strengths of weak ties: A network theory revisited. *Sociological Theory, 1*, 201-233.

Grant, R. M., & Baden-Fuller, C. (2004). A knowledge accessing theory of strategic alliances. *Journal of Management Studies, 41*(1), 61-84.

Gulati, R. (1995). Social structure and alliance formation patterns: A longitudinal analysis. *Administrative Science Quarterly, 40*(4), 619-652.

Haakansson, H., & Ford, D. (2002). How should companies interact in business networks? *Journal of Business Research, 55*(2), 133-139.

Haakansson, H., & Snehota, I. (1995). *Developing relationships in business networks*. London: Routledge.

Hakkarainen, K., Palonen, T., Paavola, S., & Lehtinen, E. (2004). *Communities of networked expertise: Professional and educational perspectives*. Amsterdam: Elsevier.

Hackman, R. (1990). *Groups that work (and those that don't): Conditions for effective teamwork*. San Francisco: Jossey-Bass.

Hamel, G. (1991, Summer). Competition for competence and inter-partner learning within international strategic alliances. *Strategic Management Journal, 12*, 83-103.

Harrison, R., & Kessels, J. W. M. (2004). *Human resource development in a knowledge economy: An organizational view*. New York: Palgrave Macmillan.

Hausler, J., Hohn, H., & Lutz, S. (1994). Contingencies of innovative networks: A case study of successful R&D collaboration. *Research Policy, 23*(1), 47-66.

Hermens, A. (2001). Knowledge exchange in strategic alliances: Learning in tension. *Creativity and Innovation Management, 10*(3), 189-200.

Hislop, D. (2002). Mission impossible? Communicating and sharing knowledge via information technology. *Journal of Information Technology, 17*(3), 165-177.

Hite, J. M. (2003). Patterns of multidimensionality among embedded network ties: A typology of relational embeddedness in emerging entrepreneurial firms. *Strategic Organization, 1*(1), 9-50.

Hite, J. M. (2005). Evolutionary processes and paths of relationally embedded network ties in emerging entrepreneurial firms. *Entrepreneurship Theory and Practice, 29*(1), 113-144.

Hoang, H., & Antoncic, B. (2003). Network-based research in entrepreneurship: A critical review. *Journal of Business Venturing, 18*(2), 165-187.

Hoegl, M., Ernst, H., & Proserpio, L. (2007). How teamwork matters more as team member dispersion increases. *Journal of Product Innovation Management, 24*(2), 156-165.

Hofer, B., & Pintrich, P. R. (2002). *Personal epistemology: The psychology of beliefs about knowledge and knowing*. Mahwah, NJ: Lawrence Erlbaum.

Holmqvist, M. (1999). Learning in imaginary organizations: Creating interorganizational knowledge. *Journal of Organizational Change Management, 12*(5), 419-438.

Holmqvist, M. (2003). A dynamic model of intra- and interorganizational learning. *Organization Studies, 24*(1), 95-123.

Horwitz, S. K. (2005). The compositional impact of team diversity on performance: Theoretical considerations. *HRD Review, 4*(2), 219-245.

Huber, G. P. (1991). Organizational learning: The contributing processes and the literatures. *Organization Science, 2*(1), 88-115.

Inkpen, A. C. (1996). Creating knowledge through collaboration. *California Management Review, 39*(1), 123-140.

Inkpen, A. C. (2000). A note on the dynamics of learning alliances: Competition, cooperation, and relative scope. *Strategic Management Journal, 21*(7), 775-779.

Inkpen, A. C., & Dinur, A. (1998). Knowledge management processes and international joint ventures. *Organization Science, 9*(4), 454-468.

Inkpen, A. C., & Pien, W. (2006). An examination of collaboration and knowledge transfer: China-Singapore Suzhou Industrial Park. *Journal of Management Studies, 43*(4), 779-781.

Janis, I. L. (1972). *Victims of groupthink*. Boston: Houghton Mifflin.

Jap, S. D., & Anderson, E. (2003). Safeguarding interorganizational performance and continuity under ex post opportunism. *Management Science, 49*(12), 1684-1701.

Johannisson, B. (2000). Networking and entrepreneurial growth. In D. L. Sexton & H. Landstrom (Eds.), *The Blackwell handbook of entrepreneurship* (pp. 368-386). Oxford, UK: Blackwell.

Johnson, D. W., Johnson, R., & Smith, K. (1998). *Active learning: Cooperation in the college classroom*. Edina, MN: Interaction.

Jones, G., & George, J. (1998). The experience and evolution of trust: Implications for cooperation and teamwork. *Academy of Management Review, 23*(3), 531-546.

Kalaignanam, K., Shankar, V., & Varadarajan, R. (2007). Asymmetric new product development alliances: Win-win or win-lose partnerships? *Management Science, 53*(3), 357-374.

Kessels, J. W. M. (2001). Learning in organisations: A corporate curriculum for the knowledge economy. *Futures, 33*(6), 497-506.

Khanna, T., Gulati, R., & Nohria, N. (1998). The dynamics of learning alliances: Competition, cooperation, and relative scope. *Strategic Management Journal, 19*(3), 193-210.

Khilji, S. E., Mroczkowski, T., & Bernstein, B. (2006). From invention to innovation: Toward developing an integrated innovation model for biotech firms. *Journal of Product Innovation Management, 23*(6), 528-540.

Kirat, T., & Lung, Y. (1999). Innovation and proximity: Territories as loci of collective learning processes. *European Urban and Regional Studies, 6*(1), 27-38.

Knowles, M. S. (1990). *The adult learner: A neglected species* (4th ed.). Houston, TX: Gulf.

Kogut, B. (1991). Joint ventures and the option to expand and acquire. *Management Science, 37*(1), 19-33.

Kolb, D. A. (1984). *Experiential learning*. Englewood Cliffs, NJ: Prentice Hall.

Kolb, D. A., Osland, J. S., & Rubin, I. M. (1995). *Organizational behavior: An experiential approach*. Englewood Cliffs, NJ: Prentice Hall.

Langfred, C. W. (2007). The downside of self-management: A longitudinal study of the effects of conflict on trust, autonomy, and task interdependence in self-managing teams. *The Academy of Management Journal, 50*(4), 885-900.

Larsson, R., Bengtsson, L., Henriksson, K., & Sparks, J. (1998). The interorganizational learning dilemma: Collective knowledge development in strategic alliances. *Organization Science, 9*(3), 285-305.

Lattuca, L. R., Voigt, L. J., & Fath, K. Q. (2004). Does interdisciplinarity promote learning? Theoretical support and researchable questions. *The Review of Higher Education, 28*(1), 23-48.

Lee, H., & Choi, B. (2003). Knowledge management enablers, processes, and organizational performance: An integrative view and empirical examination. *Journal of Management Information Systems, 20*(1), 179-228.

Leenders, R. Th. A. J., Van Engelen, J. M. L., & Kratzer, J. (2007). Systematic design methods and the creative performance of new product teams: Do they contradict or complement each other? *Journal of Product Innovation Management, 24*(2), 166-179.

Lundvall, B. (1988). Innovation as an interactive process from user-producer interaction to national systems of innovation. In G. Dosi, C. Freeman, R. Nelson, G. Silverberg, & L. Soete (Eds.), *Cooperative strategies in international business* (pp. 349-369). Lexington, MA: Lexington Books.

Madhavan, R., & Grover, R. (1998). From embedded knowledge to embodied knowledge: New product development as knowledge management. *Journal of Marketing, 62*(4), 1-12.

Marks, M. A., Mathieu, J. E., & Zaccaro, S. J. (2001). A temporally based framework and taxonomy of team processes. *Academy of Management Review, 26*(3): 356-376.

Marrone, J. A., Tesluk, P. E., & Carson, J. B. (2007). A multilevel investigation of antecedents and consequences of team member boundary-spanning behaviour. *Academy of Management Journal, 50*(6), 1423-1439.

Mathieu, J., Maynard, M. T., Rapp, T. L., & Gilson, L. L. (2008). Team effectiveness 1997-2007: A review of recent advancements and a glimpse into the future. *Journal of Management, 34*(3), 410-476.

Matusik, S. F., & Hill, C. W. L. (1998). The utilization of contingent work, knowledge creation, and competitive advantage. *Academy of Management Review, 23*(4), 680-697.

McCain, B. (1996). Multicultural team learning: An approach towards communication competency. *Management Decision, 34*(6), 65-68.

Mercer, N. (2000). *Words and minds*. London: Routledge.
Moss Kanter, R. (2006). Innovation: The classic traps. *Harvard Business Review, 84*(11), 72-83.
Muthusamy, S. K., & White, M. A. (2005). Learning and knowledge transfer in strategic alliances: A social exchange view. *Organization Studies, 26*(3), 415-441.
Muthusamy, S. K., & White, M. A. (2006). Does power sharing matter? The role of power and influence in alliance performance. *Journal of Business Research, 59*(7), 811-819.
Newell, S., & Swan, J. (2000). Trust and inter-organizational networking. *Human Relations, 53*(10), 1287-1328.
Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company: How Japanese companies create the dynamics of innovation.* Oxford, UK: Oxford University Press.
Nooteboom, B. (2000). *Learning and innovation in organizations and economics*. Oxford, UK: Oxford University Press.
Orton, J. D., & Weick, K. E. (1990). Loosely coupled systems: A reconceptualization. *The Academy of Management Review, 15*(2), 203-223.
Paavola, S., Lipponen, L., & Hakkarainen, K. (2004). Models of innovative knowledge communities and three metaphors of learning. *Review of Educational Research, 74*(4), 557-576.
Parkhe, A. (1991). Interfirm diversity, organizational learning, and longevity in global strategic alliances. *Journal of International Business Studies, 22*(4), 579-601.
Parkhe, A. (1993). Partner nationality and the structure-performance relationship in strategic alliances. *Organization science, 4*(2), 301-324.
Patriotta, G. (2003). *Organizational knowledge in the making: How firms create, use and institutionalize knowledge.* Oxford, UK: Oxford University Press.
Powell, W. W., Koput, K. W., & SmithDoerr, L. (1996). Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology. *Administrative Science Quarterly, 41*(1), 116-145.
Raeithel, A. (1996). On the ethnography of co-operative work. In Y. Engestrom & D. Middleton (Eds.), *Cognition and communication at work* (pp. 319-339). Cambridge, UK: Cambridge University Press.
Raelin, J. A. (1997). A model of workbased learning. *Organization Science, 8*(6), 563-578.
Reid, S. E., & De Brentani, U. (2004). The fuzzy front end of new product development for discontinuous innovations: A theoretical model. *Journal of Product Innovation Management, 21*, 170-184.
Ring, P. S. (1997). Processes facilitating reliance on trust in inter-organisational networks. In M. Ebers (Ed.), *The formation of inter-organisational networks* (pp. 113-145). Oxford, UK: Oxford University Press.
Ring, P. S., & Van de Ven, A. H. (1992). Structuring cooperative relationships between organizations. *Strategic Management Journal, 13*(7), 483-498.
Ring, P. S., & Van de Ven, A. H. (1994). Development processes of cooperative interorganizational relationships. *The Academy of Management Review, 19*(1), 90-118.
Ritter, T., & Gemünden, H. G. (2002). The impact of a company's business strategy on its technological competence, network competence and innovation success. *Journal of Business Research, 57*(5), 548-556.
Roy, S., Sivakumar, K., & Wilkinson, I. F. (2004). Innovation generation in supply chain relationships: A conceptual model and research propositions. *Journal of the Academy of Marketing Science, 32*(1), 61-79.
Schein, E. H. (1985). *Organizational culture and leadership*. San Francisco: Jossey-Bass.
Schulze, A., & Hoegl, M. (2006). Knowledge creation in new product development projects. *Journal of Management, 32*(2), 210-236.
Schumpeter, J. A. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.
Senge, P. M. (1990). *The fifth discipline: The art and practice of the learning organization*. Garden City, NY: Doubleday/Currency.

Sethi, R., Smith, D. C., & Park, W. (2002). How to kill a team's creativity. *Harvard Business Review, 80*(8), 16-17.

Sfard, A. (1998). On the two metaphors for learning and the dangers of choosing just one. *Educational Researcher, 27*(2), 4-13.

Simpson, P., French, R., & Vince, R. (2000). The upside of the downside: How utilizing defensive dynamics can support learning in groups. *Management Learning, 31*(4), 457-470.

Simsek, Z., Lubatkin, M. H., & Floyd, S. W. (2003). Inter-firm networks and entrepreneurial behavior: A structural embeddedness perspective. *Journal of Management, 29*(3), 427-422.

Somech, A. (2006). The effects of leadership style and team process on performance and innovation in functionally heterogeneous teams. *Journal of Management, 32*(1), 132-157.

Szulanski, G. (2000). The process of knowledge transfer: A diachronic analysis of stickiness. *Organizational Behavior and Human Decision Processes, 82*(1), 9-27.

Thomas-Hunt, M. C., Ogden, T. Y., & Neale, M. A. (2003). Who's really sharing? Effects of social and expert status on knowledge exchange within groups. *Management Science, 49*(4), 464-477.

Teece, D. J. (2002). *Managing intellectual capital: Organizational, strategic, and policy dimensions.* London: Oxford University Press.

Tidd, J., Bessant, J., & Pavitt, K. (2001). *Managing innovation: Integrating technological, market and organizational change* (2nd ed.). Chichester, UK: Wiley.

Tjepkema, S. (2002). *The learning infrastructure of self-managing work teams*. PhD dissertation, University of Twente, Enschede, Netherlands.

Uzzi, B. (1997). Social structure and competition in interfirm networks: The paradox of embeddedness. *Administrative Science Quarterly, 42*(1), 35-67.

Van Aken, J. E., & Weggeman, M. P. (2000). Managing learning in informal innovation networks: Overcoming the Daphne-dilemma. *R&D Management, 30*(2), 139-150.

Van Boxtel, C., Van der Linden, J., & Kanselaar, G. (2000). Collaborative learning tasks and the elaboration of conceptual knowledge. *Learning and Instruction, 10*(4), 311-330.

Van de Ven, A. H. V., & Polley, D. (1992). Learning while innovating. *Organization Science, 3*(1), 92-116.

Van den Bossche, P., Gijselaers, W. H., Segers, M., & Kirschner, P. A. (2006). Social and cognitive factors driving teamwork in collaborative learning environments: Team learning beliefs and behaviors. *Small Group Research, 37*(5), 490-521.

Van Knippenberg, D., & Schippers, M.C. (2007). Work group diversity. *Annual Review of Psychology, 58*, 515-541.

Von Hippel, E. (1994). Sticky information and the locus of problem solving: Implications for innovation. *Management Science, 40*(4), 429-439.

West, J., & Gallagher, S. (2006). Challenges of open innovation: The paradox of firm investment in open-source software. *R&D Management, 36*(3), 319-331.

Yang, B. (2003). Toward a holistic theory of knowledge and adult learning. *HRD Review, 2*(2), 106-129.

Zarraga, C., & Bonache, J. (2003). Assessing the team environment for knowledge sharing: An empirical analysis. *International Journal of Human Resource Management, 14*(7), 1227-1245.

Zellmer-Bruhn, M., & Gibson, C. (2006). Multinational organization context: Implications for team learning and performance. *Academy of Management Journal, 49*(3), 501-518.

Zhang, Q., & Doll, W. J. (2001). The fuzzy front end and success of new product development: A causal model. *European Journal of Innovation Management, 4*(2), 95-112.

Zollo, M., Reuer, J. J., & Singh, H. (2002). Interorganizational routines and performance in strategic alliances. *Organization Science, 13*(6), 701-713.

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