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Sandor Lowik Jeroen Kraaijenbrink Aard Groen

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The team absorptive capacity triad: a configurational study of individual, enabling, and motivating factors

Sandor Lowik, Jeroen Kraaijenbrink and Aard Groen



Sandor Lowik and Jeroen Kraaijenbrink are both based at the Netherlands Institute for Knowledge Intensive Entrepreneurship (NIKOS), University of Twente, Enschede, The Netherlands.
Aard Groen is based at the Netherlands Institute for Knowledge Intensive Entrepreneurship (NIKOS), University of Twente, Enschede, The Netherlands, and Faculty of Economics and Business, Innovation management & Strategy, University of Groningen, Groningen, The Netherlands.

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Abstract

Purpose – *The paper aims to understand how knowledge-intensive teams can develop and enhance their team absorptive capacity (ACAP) level, by exploring whether individual and organizational factors are complements or substitutes for team ACAP.*

Design/methodology/approach – *The study applies a configurational approach using fuzzy-set qualitative comparative analysis to identify combinations of individual and team factors that are associated with team ACAP. Data were gathered through a survey among 297 employees of four medium-sized Dutch firms, working in 48 functional teams.*

Findings – *The primary finding is that knowledge-intensive team ACAP depends on a triad of complementary factors: team members' individual ACAP, factors that enable knowledge integration and factors that motivate knowledge integration. Underdevelopment of one or more factors leads to lower team ACAP.*

Research limitations/implications – *The study contributes to the discussion on the* locus *of knowledge-creation and enhances understandings of why knowledge-intensive teams differ in knowledge processing capabilities. It suggests future research on cross-functional teams in new ventures and large firms.*

Practical implications – *The paper informs managers and team leaders about the factors that determine knowledge-intensive teams' ACAP, enabling them to develop team-specific strategies to increase their teams' performance.*

Originality/value – *The study takes a holistic perspective on knowledge-intensive team ACAP by using a configurational approach. It also highlights the potential of team-level research in the knowledge management literature for both researchers and practitioners.*

Keywords *Knowledge integration, Micro-foundations, Qualitative comparative analysis, Configurational approach, Individual absorptive capacity, Knowledge-intensive teams*

Paper type *Research paper*

Introduction

Knowledge-intensive teams are key to innovations and competitive advantage (Grant, 1996b; Taylor and Greve, 2006). Although in principle all teams use knowledge to some extent, knowledge-intensive teams are characterized by highly qualified individuals who use creativity, ideas and concepts to solve complex tasks (Alvesson, 2004; Chung and Jackson, 2013; Perry-Smith and Shalley, 2003; Starbuck, 1992). Typical examples of knowledge-intensive teams are research teams, product development teams and strategic planning teams (Alvesson, 2004; Chung and Jackson, 2013).

A core competence of knowledge-intensive teams is the ability to acquire new external knowledge to secure a continuous inflow of ideas to enable teams' learning processes. Such learning from external knowledge can increase team creativity (Sung and Choi, 2012) and team performance (Ancona and Caldwell, 1992; Bresman, 2010; Wong, 2004). To date, studies on external team learning have mostly focused on the acquisition of new knowledge and the importance of external linkages (Bresman, 2010; Faraj and Yan, 2009). However, acquiring knowledge is not sufficient to gain

> "A core competence of knowledge-intensive teams is the ability to acquire new external knowledge to secure a continuous inflow of ideas to enable teams' learning processes."

sustainable competitive advantage (Argote *et al.*, 2003; Grant, 1996b). Knowledge-intensive teams need sufficient absorptive capacity (ACAP) to recognize, assimilate, transform and exploit new knowledge to create new products and services (Cohen and Levinthal, 1990; Tiwana and McLean, 2005; Zahra and George, 2002). However, the literature has largely neglected team ACAP, leaving opportunities unexplored to break down the construct into its micro-foundations, i.e. its constituent parts of individual and team-level factors. We seek to better understand how these individual and team-level factors relate to each other, to inform scholars and practitioners on how to create and develop team ACAP. We investigate which combinations of individual and team-level factors lead to high or low team ACAP and whether these factors are complements or substitutes. We also explore equifinality in these combinations, indicating different paths towards creating and developing team ACAP.

By taking a configurational approach (Fiss, 2007, 2011; Ragin, 2008), we examine the configurations of the micro-foundations of team ACAP (Volberda *et al.*, 2010). Particularly, we study how team members' individual ACAP, in combination with team social integration mechanisms, interact to create team ACAP. Our sample consisted of 48 functional teams within four medium-sized industrial firms in The Netherlands. We measured the individual and team factors through a survey among 297 employees of these firms and analyzed the data using fuzzy-set qualitative comparative analysis (fs/QCA) (Ragin, 2008).

Our study contributes to the knowledge management literature by explaining why knowledge-intensive teams differ in their abilities to recognize, assimilate, transform and exploit knowledge. We show that team ACAP is determined by a triad of factors:

- team members' individual ACAP levels;
- mechanisms that enable knowledge integration; and
- mechanisms that motivate knowledge integration.

We find that if one or more of these three factors are poorly developed, a team's ACAP will be low.

This study also addresses some of the questions in the ACAP and the micro-foundations literatures by investigating the relationships between individual and collective characteristics of team ACAP. In the ACAP literature, there are contradictory findings concerning the relative importance of individual and organizational factors for developing organizational ACAP (Matusik and Heeley, 2005; Nemanich *et al.*, 2010; Zhao and Anand, 2009). Also, in the micro-foundations literature, there is a debate on the *locus* of knowledge-creation – whether this is at the individual or the collective level (Abell *et al.*, 2008; Felin and Foss, 2011, 2012; Felin and Hesterly, 2007; Hodgson, 2012; Hodgson and Knudsen, 2011). Our results show that individual and collective team characteristics *complement* each other, instead of being substitutes. We show that knowledge-creation is a complex phenomenon that includes interactions between individual and team-level factors.

Furthermore, we show how a configurational approach can advance new understandings of complex organizational phenomena, such as ACAP processes in knowledge-intensive

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teams. A configurational approach shows equifinality of solutions, which informs scholars and practitioners that there are multiple paths to develop team ACAP, depending on the specific context of their teams and organizations. This insight allows managers and team leaders to determine team-specific strategies to increase their knowledge-intensive teams' ACAP, as long as they consider the triad of team factors.

Theoretical background

Team absorptive capacity and its micro-foundations

As we seek to understand how knowledge-intensive teams' ACAP can be improved, we need to analyze the main building blocks of team ACAP. To do so, we draw on the micro-foundations literature, the main goal of which is to understand multilevel constructs where individuals' actions and interactions create organizational routines and capabilities (Abell *et al.*, 2008; Barney and Felin, 2013; Felin *et al.*, 2012). ACAP is typically considered to be a multilevel (dynamic) capability (Cohen and Levinthal, 1990; Lane *et al.*, 2006; Nielsen, 2006; Sun, 2010; Volberda *et al.*, 2010; Zahra and George, 2002). Its multilevel nature concerns each individual's ACAP and organizational-level social integration mechanisms (Cohen and Levinthal, 1990; Zahra and George, 2002).

To date, a few empirical studies have examined the micro-foundations of organizational ACAP. At the individual level, Lowik *et al.* (2012) studied the characteristics of individual ACAP, such as knowledge diversity, network diversity and cognitive style. Others have studied social integration mechanisms' effects at the organization level – such as Jansen *et al.* (2005). Still others have explored individual-organizational multilevel aspects of ACAP, such as Matusik and Heeley (2005), Lenox and King (2004), Zhao and Anand (2009) and Minbaeva *et al.* (2003). Surprisingly, few studies have taken a *team-level* perspective on ACAP. For instance, in their conceptual paper, Sun and Anderson (2010) argue that the ACAP processes of knowledge acquisition, assimilation and transformation primarily take place at the team level. Additionally, Hayton and Zahra's (2005) empirical study showed that top management team knowledge diversity explained both knowledge acquisition and exploitation in high-technology ventures. Furthermore, Nemanich *et al.* (2010) showed that R&D teams' ACAP depends on both individual and team characteristics.

Despite the aforementioned research efforts, it remains unclear which combinations of individual ACAP and social integration mechanisms are most effective in creating team ACAP. A primary assumption in the ACAP literature that has not been empirically examined is that "a firm's ACAP is not, however, simply the sum of absorptive capacities of its employees, and therefore, it is useful to consider what aspects of ACAP are distinctly organizational" (Cohen and Levinthal, 1990, p. 131). Our study of team-level ACAP is one of the first to address this core characteristic of the ACAP construct.

A configurational approach to team absorptive capacity

To answer our research question, we chose a set-theoretical or configurational approach (Fiss, 2007; Ragin, 2008). In a configurational approach, the researcher takes a holistic perspective on the studied phenomenon by assuming complex interrelationships between variables. As an approach, it takes an intermediate position between in-depth qualitative case studies with a limited number of cases and large-N quantitative statistically oriented studies (Rihoux and Ragin, 2009).

"We found that high individual team members' ACAP is a necessary condition for high team ACAP."

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> **"Team ACAP depends on high individual ACAP complemented by knowledge integration enabling mechanisms as well as motivating mechanisms."**

In comparison with in-depth case studies, configurational methods allow more cases and offer better techniques to systematically compare multiple characteristics of these cases. Configurational methods differ from quantitative statistical methods (such as regression analysis) in two main assumptions (Fiss, 2007; Rihoux and Ragin, 2009). First, statistical methods mostly assume a single cause-and-effect relationship between independent and dependent variables, meaning that multiple independent variables compete with each other over their effects on the dependent variables. In contrast, in configurational approaches *conditions* (the term *independent variable* is not used) can affect the outcomes in multiple combinations. Second, statistical techniques try to fit one best model to the data, whereas configurational approaches allow for equifinality, which means that there are multiple "paths" to the intended outcome (Fiss, 2007; Meyer *et al.*, 1993; Rihoux and Ragin, 2009).

A configurational approach is appropriate to study the micro-foundations of team ACAP for two reasons. First, it is a complex multilevel phenomenon (Cohen and Levinthal, 1990; Lane *et al.*, 2006; Volberda *et al.*, 2010), with reciprocal relationships between variables (Nemanich *et al.*, 2010). As Zhao and Anand (2009, p. 977) conclude in their multilevel study on organizational ACAP, this asks for "a multilevel and holistic approach to understand organizational phenomena such as knowledge transfer". Second, equifinality is a key assumption in the dynamic capabilities literature (Eisenhardt and Martin, 2000). Managers begin to develop capabilities from different starting positions, as these depend on a firm's idiosyncratic characteristics. Yet, although the developmental paths vary, the resulting capabilities are quite similar (Eisenhardt and Martin, 2000; Zahra and George, 2002). To our knowledge, no other study has yet examined this equifinality characteristic of team ACAP.

Although configurational approaches are well known in the management literature (Meyer *et al.*, 1993) – such as Mintzberg's (1980) classification of organization structures and Miles and Snow's (1978) innovation strategy typology – they have barely been used in the knowledge management literature. We expect that this approach can explain some of the contradictory findings in extant literature and can provide new insights to advance knowledge management theory.

Hypotheses

Individual characteristics of team absorptive capacity

One of the key assumptions in ACAP literature is that "an organization's ACAP will depend on the absorptive capacities of its individual members" (Cohen and Levinthal, 1990, p. 131). This assumes that there is a distinction between individual ACAP and team or organizational ACAP. Based on the notion of organizational ACAP as a dynamic capability (Zahra and George, 2002), micro-foundations theory suggests that organizational ACAP consists of routines (Feldman and Pentland, 2003) at the collective level, which are affected by individuals' activities at the individual level (Abell *et al.*, 2008). In line with micro-foundational research, we follow Lowik *et al.*'s (2012) and Ojo *et al.*'s (2014) conceptualizations of individual ACAP as the *activities* of individuals to recognize, assimilate, transform and exploit new external knowledge. This conceptualization differs from most extant literature, in which individual ACAP is conceptualized as a set of competences consisting of individuals' prior knowledge and experience (Hayton and

Zahra, 2005; Zhao and Anand, 2009), technical skills, values and beliefs (Matusik and Heeley, 2005), as well as motivations (Minbaeva *et al.*, 2003).

In contrast, our conceptualization consists of four individual ACAP activities. First, individuals interact with the external environment and thereby *recognize* and acquire new knowledge. Second, individuals *assimilate* knowledge by articulating it, making it understandable to others (Zollo and Winter, 2002), storing it in their memory and retrieving the knowledge when needed or when others ask for advice or assistance. Third, individuals *transform* knowledge when exchanging it with others, which requires creativity (Amabile, 1988) and cognitive skills to (re)combine new and existing knowledge (Koestler, 1964). Finally, through their absorptive capabilities to *exploit* knowledge, individuals turn ideas into practice by applying the new knowledge to create new products, processes and services.

In micro-foundations theory, individuals' actions and interactions are at the heart of the development of routines and capabilities (Abell *et al.*, 2008). Felin and Hesterly (2007) argued that the *locus* of knowledge-creation is at the individual level. Following their line of reasoning, heterogeneity of individuals' ACAP could explain differences in team ACAP. Matusik and Heeley (2005) found empirical support for the primacy of individual factors at the expense of organizational factors. In their multilevel study, they found that individuals' ACAP had a positive significant relationship with knowledge-creation capabilities, while organizational knowledge integration mechanisms such as transfer structures and routines did not.

From this, we infer that team ACAP depends on team members' ACAP, and that differences between teams' ACAP can be explained by the overall ACAP levels of their members. This results in the first hypothesis:

> *H1.* A team consisting of members with overall high individual ACAP will create higher team ACAP, compared to teams with members with overall low ACAP.

Individual and collective characteristics of team absorptive capacity

Cohen and Levinthal (1990) argued that organizational ACAP not only depends on the distribution of individuals' ACAP, but also on the organizational mechanisms that facilitate communication and knowledge exchanges between these individuals. These mechanisms are called *social integration mechanisms* by Zahra and George (2002) to denote the formal and informal mechanisms that lower knowledge-sharing barriers between individuals and increase the efficiency of knowledge recognition, assimilation, transformation and exploitation (Todorova and Durisin, 2007; Zahra and George, 2002). Several studies showed that these barriers could be divided into two categories: barriers that relate to the *ability* to integrate knowledge and the *willingness or motivation* to integrate knowledge (Zhao and Anand, 2009; Minbaeva *et al.*, 2003; Szulanski, 1996).

Organizational barriers concerning the *ability* to exchange and integrate knowledge relate to the lack of organizational infrastructure, or conduits, through which knowledge flows (Cohen and Levinthal, 1990). The social integration mechanisms that can reduce these barriers can be both formal and informal and are called *combinative capabilities* (Kogut and Zander, 1992; Van den Bosch *et al.*, 1999). In the ACAP literature, three combinative capability types are discussed: coordination capabilities, systems capabilities and socialization capabilities (Jansen *et al.*, 2005; Van den Bosch *et al.*, 1999). *Coordination capabilities* refer to the use of horizontal communication structures, job rotation and participation in decision-making to facilitate knowledge exchanges between members of a group (Cohen and Levinthal, 1990; Van den Bosch *et al.*, 1999). *Systems capabilities* refer to direction, policies, procedures and manuals that are used to integrate knowledge via formalization and routinization (Grant, 1996a; Van den Bosch *et al.*, 1999). *Socialization capabilities* refer to an organization's ability to establish a shared ideology, values and norms, which offer employees an identity and collective interpretation of reality (Van den

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Bosch *et al.*, 1999). They relate to the extent to which organizations have strong cultures (Sørensen, 2002), which provide a *common knowledge* (Cohen and Levinthal, 1990; Grant, 1996a) via connectedness and socialization tactics (Galunic and Rodan, 1998; Jansen *et al.*, 2005; March, 1991).

Organizational barriers concerning the *motivation* to exchange and integrate knowledge relate to the lack of a supportive climate to encourage employees to exchange and integrate their knowledge. Social integration mechanisms that reduce these motivational barriers are a supportive managerial decision-making style (Carlile, 2004; Todorova and Durisin, 2007; Zahra and George, 2002) and an integrative culture (Cohen and Levinthal, 1990; Gold *et al.*, 2001; Grant, 1996a). A *supportive management style* can stimulate and facilitate idea-generation by encouraging employees to express their opinions and ideas and considering these when making decisions at lower organizational levels (Arnold *et al.*, 2000). Furthermore, managers can facilitate the implementation of ideas by acquiring and maintaining the resources needed for innovation projects and improvements, especially when higher-level managers or shareholders need to be convinced to allocate scarce resources that are needed for effective ACAP integration (Carlile, 2004; Howell *et al.*, 2005; Todorova and Durisin, 2007; Zahra and George, 2002). In addition, an *integrative culture* creates a certain shared understanding, which relates to shared goals (Carlile, 2004; Lane *et al.*, 2001), shared norms, cognition and dominant logic (Grant, 1996a). While socialization capabilities determine a culture's *strength*, integrative culture is about the culture's *content*. For an effective collaboration and knowledge exchange, organizational goals need to be clearly stated and understood by all organizational members (Gold *et al.*, 2001; Simsek *et al.*, 2005).

Although the ACAP and organizational learning literature stress the importance of organizational knowledge integration mechanisms (Jansen *et al.*, 2005; Ojo *et al.*, 2014; Todorova and Durisin, 2007; Zahra and George, 2002), the relationship with individuals' ACAP is ambiguous as a result of contradictory findings in empirical studies, which leads to two contradicting hypotheses (later). First, based on their empirical study in China's automobile industry, Zhao and Anand (2009) argue that organizational knowledge integration mechanisms are more important for collective knowledge-creation capabilities than individual learning capabilities. Besides a multilevel quantitative study that shows statistically significant relationships between organizational integration mechanisms and collective learning at the expense of individual-level factors, they also describe two illustrative cases. Their first case was the Pan Asia Technical Automotive Center (PATAC), a joint venture between General Motors and Shanghai Automotive Industry Inc., which employed mostly new college graduates but was started as a greenfield organization and had to create its own organizational structures. The other case was Beijing Jeep, a joint venture between American Motors and Beijing Automotive Industry Holding Inc. that was mostly staffed with experienced engineers from Beijing Automotive Industry Holding, thereby also introducing its inefficient hierarchical and cultural knowledge integration mechanisms. It appeared that PATAC was much more successful in designing and commercializing new cars, even though its employees' ACAP was much lower than those of Beijing Jeep.

Zhao and Anand (2009) concluded that organizational knowledge integration mechanisms are more important than individual ACAP. In other words, their study suggests that knowledge integration mechanisms can substitute for low individual ACAP. For team ACAP, this implies that teams with overall low individual ACAP can still achieve high team ACAP provided that knowledge exchange is enabled and stimulated via social integration mechanisms. Therefore, we hypothesize as follows:

H2. Team-level social integration mechanisms substitute for low overall individual team member ACAP, resulting in configurations of low individual ACAP and high social integration mechanisms that are associated with high team ACAP.

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In contrast, other scholars emphasize that organizational ACAP and team ACAP are the product of both individual ACAP and social integration mechanisms (Cohen and Levinthal, 1990; Ojo *et al.*, 2014; Zahra and George, 2002). For instance, Sung and Choi (2012) found that team members' knowledge stock only affected team creativity in combination with the team leader's cognitive style. Nemanich *et al.* (2010) found clear interaction effects of individuals' assimilation capabilities and team factors such as task autonomy on the team's knowledge application capabilities.

These studies suggest that it is not an *either-or*, but an *and-and* relationship between individual ACAP and social integration mechanisms. The individual and team-level factors complement and reinforce each other to produce team ACAP. This leads us to our third hypothesis:

H3. Team-level social integration mechanisms complement overall individual team member ACAP, resulting in configurations of high individual ACAP and high social integration mechanisms that are associated with high team ACAP.

While the aforementioned hypotheses relate to teams in general, our study also seeks to identify specific characteristics of knowledge-intensive teams. One could argue that all teamwork requires some knowledge input, knowledge processing and knowledge output, as teamwork often involves analysis, the exercise of judgment and problem-solving (Newell *et al.*, 2002). This suggests that teams always require some level of team ACAP. However, teams' knowledge intensity may differ. Knowledge-intensive teams, such as R&D teams, are generally characterized by highly qualified individuals who use ideas and concepts in their work to find creative solutions (Alvesson, 2004). The team members rely on idiosyncratic and personal knowledge instead of widely shared knowledge to solve problems (Starbuck, 1992). This distinguishes knowledge-intensive teams from less knowledge-intensive teams, the latter generally being concerned with the transformation of material objects or the carrying out of tangible services (Alvesson, 2004).

Owing to the specific characteristics of knowledge-intensive teams, we expect these teams to have higher team ACAP, compared to less knowledge-intensive teams. Knowledge-intensive teams deal with high uncertainty and high problem awareness, which require the acquisition of new knowledge and intensive internal communication for coordination and problem-solving (Alvesson, 2004). For instance, empirical research shows that knowledge-intensive teams establish strong internal and external networks so as to perform better (Chung and Jackson, 2013). Also, knowledge-intensive teams that establish and maintain a shared knowledge repository achieve higher team performance (Lewis, 2004). Therefore, we hypothesize as follows:

H4. Knowledge-intensive teams are more likely to have high team ACAP, compared to less knowledge-intensive teams.

Method

Research setting and design

As noted, we chose a micro-foundational and configurational approach to examine how team ACAP is composed of its constituent individual and team-level elements to improve team ACAP. A configurational approach allows "systematic cross-case comparisons, while at the same time giving justice to within-case complexity, particularly in small- and intermediate-N research designs" (Rihoux and Ragin, 2009, p. 18). Our cases are functional teams in four Dutch medium-sized industrial firms.

We chose functional teams instead of cross-functional teams for the following reasons. Although most research on knowledge-intensive teams focus on R&D or academic research teams (Chung and Jackson, 2013; Liu *et al.*, 2011), we want cases to compare knowledge-intensive teams to less knowledge-intensive teams. The four selected medium-tech firms are active in sales, development and production, which ensured knowledge intensity diversity across the functional teams. We defined a functional team based on the following characteristics:

- the team had an identified supervisor (Mintzberg, 1979, p. 106);
- the team had at least two employees;
- the team's activities were clearly distinct from that of other teams; and
- the team's activities were coherent, i.e. they shared common resources and encouraged mutual adjustments (Mintzberg, 1979, p. 106).

The firms were active in kitchen furniture (197 employees, 23 teams), machine building (75 employees, 12 teams), paper machinery (63 employees, 4 teams) and glass fiber (91 employees, 9 teams). An overview of the main team characteristics is presented in Table II.

To collect data, we administered a paper-and-pencil survey among almost all employees, in one-hour group sessions during working hours so as to assure a high response rate. Each group consisted of about ten employees, and the first author was always present to explain the research goal and confidentiality issues, to guide the survey process and to provide assistance when needed. To minimize the effects of common method bias, we administered the survey anonymously to avoid socially desirable answers (Podsakoff *et al.*, 2003). To avoid the stylistic answering of questions, the questionnaire used reversed wording and changed item ordering (Conway and Lance, 2010). After data collection, we assessed common method bias using Harman's single-factor test (Podsakoff *et al.*, 2003). Based on principal component analysis without rotation, we found 23 factors with eigenvalues > 1.0, with the largest factor accounting for 19 per cent of all variance. As no single factor emerged, and not one factor accounted for most of the variance, we infer that common method bias is unlikely (Podsakoff and Organ, 1986). In total, 297 responses were used in the final analysis, a 70 per cent response rate.

Measures

We derived measures for the constructs from the existing literature for all variables. We assessed the validity and reliability of measures using the variance-based structural equation modeling (SEM) technique of partial least squares (PLS). We used PLS, as it allows latent constructs, smaller sample sizes and non-normal distributed data (Chin, 2010). The Kolmogorov–Smirnov test for normality on individual item scores was

Table I Descriptives of team conditions

Condition	*Mean*	*SD*	*Minimum*	*Maximum*	*Percentiles* *25th*	*50th*	*75th*	*Normality K-S test*
Team recognition	3.22	0.98	1.50	5.67	2.67	3.00	3.75	0.17*
Team assimilation	4.51	0.79	2.25	6.25	4.00	4.39	5.13	0.08
Team transformation	3.99	0.77	2.63	5.83	3.44	4.00	4.50	0.07
Team exploitation	5.10	0.90	3.50	6.50	4.70	5.13	5.49	0.09
Team ACAP	4.21	0.60	2.90	5.93	3.85	4.12	4.92	0.09
Management style	5.15	0.77	2.50	6.33	4.58	5.27	5.75	0.14*
Culture	4.72	0.76	2.96	6.58	4.13	4.75	5.15	0.07
Coordination	3.46	0.70	2.25	5.75	3.03	3.50	3.90	0.10
Participation	3.25	0.81	1.84	5.50	2.64	3.06	3.89	0.11
Job rotation	2.62	1.04	1.00	5.50	1.81	2.41	3.24	0.10
Formalization	4.15	0.57	3.00	5.33	3.70	4.20	4.55	0.10
Routinization	4.43	0.88	2.70	5.80	3.75	4.64	5.02	0.12
Connectedness	5.54	0.64	4.03	6.50	5.24	5.56	6.00	0.09
Socialization	4.58	0.70	3.13	6.17	4.10	4.42	5.07	0.12
Individual ACAP	61.99	8.84	38.00	80.17	56.33	63.12	68.00	0.08
Size (number of employees)	6.08	6.83	2.00	38.00	–	–	–	0.28***

Notes: K-S = Kolmogorov-Smirnov normality test, which tests the null-hypothesis of non-normality; ***$p < 0.001$; **$p <. 01$; *$p < 0.05$; $n = 48$; thresholds: non-membership is the 25th percentile, full membership is the 75th percentile, cross-over point is the 50th percentile

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Table II Team characteristics

Team no.	*No. of employees*	*Team name*
Firm 1. Kitchen furniture		
1	11	Sales projects
2	11	Sales back office projects
3	11	Order administration
4	3	Sales back office retail
5	5	Sales retail
6	3	Information and communications technology (ICT)
7	2	Reception
8	3	Finance
9	4	Procurement
10	4	Service
11	2	Executive secretary
12	3	Planning
13	9	Process engineering
14	2	Technical maintenance
15	8	Shipping
16	9	Production
17	9	Production
18	3	Logistics
19	6	Production
20	4	Production
21	9	Production
22	9	Production
23	8	Production
2. Machine building		
24	7	Marketing, sales and services
25	3	Process technology and ICT
26	4	Engineering
27	2	Procurement
28	5	Project management
29	8	Mechanical engineering
30	3	Standards/Documentation
31	4	Quality control
32	3	Logistics
33	7	Production
34	2	Transportation
35	4	Finance
Firm 3. Paper machinery		
36	2	Logistics
37	33	Production
38	2	Technical services
39	2	Customer service
Firm 4. Glass fiber		
40	3	Sales and marketing
41	6	R&D
42	38	Production
43	3	Quality control
44	2	Planning
45	2	Procurement
46	2	Logistics
47	4	Sales administration
48	3	Sales engineering

significantly non-normal ($p < 0.001$) for all measurement items. However, almost all latent constructs (conditions) showed a normal distribution (Table I). To assess construct reliability, we applied the threshold value of 0.7 for composite reliability (CR) (Nunnally and Bernstein, 1994). We assessed construct convergent validity by the average variance extracted (AVE), which should be higher than 0.5 (Fornell and Larcker, 1981). We assured discriminant validity between the constructs by the square root of the construct's AVE, which should be higher than the interconstruct correlations

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(Fornell and Larcker, 1981). The values for all constructs are calculated as the scores' means or as the sum of scores.

Individual absorptive capacity. We used Lowik *et al.*'s (2012) 14-item individual ACAP scale. The measurement scale takes individual ACAP as a second-order construct, consisting of the four dimensions recognition (CR = 0.85, AVE = 0.59), assimilation (CR = 0.86, AVE = 0.66), transformation (CR = 0.87, AVE = 0.63) and exploitation (CR = 0.83, AVE = 0.62). The items are listed in the Appendix.

Team absorptive capacity. We adapted Jansen *et al.*'s (2005) measure for unit-level ACAP to make it appropriate for general use across different functional teams within industrial firms. From their original 21-item scale, we retained 12 items for analysis that met the required reliability and validity standards. We used team ACAP as a formative second-order construct consisting of recognition (CR = 0.79, AVE = 0.56), assimilation (CR = 0.83, AVE = 0.72), transformation (CR = 0.77, AVE = 0.53) and exploitation (CR = 0.80, AVE = 0.50).

Combinative capabilities. We also derived the measures for the variables of combinative capabilities from Jansen *et al.* (2005). We measured *cross-functional interfaces* (CR = 0.74; AVE = 0.59) by the use of temporary teams and the use of permanent teams. From the original scale of *formalization* (CR = 0.71, AVE = 0.46), we kept three out of five items. From Jansen *et al.*'s (2005) *socialization tactics*, we only used the subscale of serial socialization tactics (CR = 0.80; AVE = 0.49). Further, we applied Jansen *et al.*'s (2005) scales for *participation* (CR = 0.81, AVE = 0.51), *job rotation* (CR = 0.78, AVE = 0.66), *routinization* (CR = 0.84, AVE = 0.51) and *connectedness* (CR = 0.78, AVE = 0.48).

Integrative culture. We derived the scale for integrative culture (CR = 0.92, AVE = 0.48) from Gold *et al.* (2001), whose 13-item scale captures aspects of an integrative culture that supports team-level ACAP: a clear vision and goals, encouraging interpersonal interactions and knowledge-sharing and facilitating knowledge exchange.

Supportive management style. We constructed the scale for supportive management style based on items that reflected both a participative decision-making style (Arnold *et al.*, 2000) and championing (Howell *et al.*, 2005). Both aspects showed high multicollinearity, with VIF = 3.85, which is above the 3.3 threshold value (Diamantopoulos and Siguaw, 2006), which justified the combination of both scales to reflect the construct supportive management style (CR = 0.95, AVE = 0.69).

Team knowledge intensity. We assessed the functional teams' knowledge intensity based on the following qualitative criteria:

- the extent to which activities are non-routine;
- the extent to which activities require ideas and concepts; and
- the extent to which activities require transformation of knowledge instead of the transformation of material objects or the carrying out of tangible services (Alvesson, 2004; Starbuck, 1992).

Based on these criteria, we classified the teams as knowledge-intensive (e.g. R&D, engineering, sales and marketing, quality control and procurement) or less knowledge-intensive (e.g. order processing, production and administration).

Analysis

We analyzed the data in a two-step approach. First, to analyze configurations, we used fs/QCA (Rihoux and Ragin, 2009). Second, we assessed the relationship between knowledge intensity and team ACAP level using Pearson's chi-square test.

Step 1: fuzzy-set qualitative comparative analysis. As fs/QCA is not commonly used in knowledge management, we will briefly explain its basic features in this section. We refer to Ragin (2008), Rihoux and Ragin (2009), Schneider and Wagemann (2006, 2010) and Wagemann and Schneider (2010) for more detailed information on fs/QCA as a method.

The results of an fs/QCA analysis are configurations, which are combinations of conditions that are relevant to a given outcome. Conditions are the explanatory variables that may affect the outcome. Applied to our study, team ACAP is the outcome and integrative culture is an example of a condition. With fs/QCA, the combinations of conditions are determined based on Boolean algebra and *set membership* for each of the conditions. Analogous to Fiss (2011), this works as follows. Consider a set of teams "Z" with high team ACAP and a set of teams "A" with high individual ACAP. It is to be expected that teams with high individual ACAP show high team ACAP, as hypothesized in *H1*, which means that A is a subset of Z, and is denoted as $A \subset Z$. Now consider a set of teams with high integrative culture, set "B". It could be that teams with high integrative culture also have high team ACAP, which means that B is also a subset of Z, denoted as $B \subset Z$. When A and B are independent, but both are subsets of Z, we have equifinality, meaning that there are two paths that lead to high team ACAP. The two sets are substitutes (as hypothesized in *H2*), which is denoted as $A + B \rightarrow Z$, with + as the Boolean "OR". However, it might appear that a high integrative culture strengthens team members' individual ACAP, to create high team ACAP. In that case, subsets A and B overlap and are associated in combination with set Z, meaning that the two sets are complements (as hypothesized in *H3*), which is denoted as $A * B \rightarrow Z$, with * as the Boolean "AND".

To analyze the data, we used fs/QCA software 2.0 (Ragin *et al.*, 2006). To achieve configurations, fs/QCA first calibrates the cases' values into a numerical data range from 0 to 1 (0 = *non-membership* and 1 = *full membership*). However, in this study, many conditions can take intermediate values. For instance, integrative culture is not either present or not; instead, various degrees of integrative culture can be present and, therefore, can take values such as 0.8 (mostly but not fully membership) or 0.4 (more or less out of full membership) (Ragin, 2008). An overview of the thresholds (as percentiles) used to calibrate with fs/QCA 2.0 software (Ragin *et al.*, 2006) is shown in Table I.

After calibration, the main steps in fs/QCA are the analysis of necessary conditions and sufficient conditions. A necessary condition means that the condition is always present in a configuration that is associated with the outcome (Ragin, 2008). A sufficient condition means that the condition is present with the outcome, but the outcome can also be present without this condition (Ragin, 2008; Schneider and Wagemann, 2006). Owing to the relatively large number of conditions in our study, we used Schneider and Wagemann's (2006) two-step approach, in which the conditions are split in two groups and are subsequently analyzed in relation to each other. We assessed the configurations that emerged from this two-step approach using the frequency threshold of 1 and the minimum consistency threshold set at 0.8 (Ragin, 2008). We chose the intermediate solution with consistency $\geq$ 0.9 to ascertain that the solution formula only relates to cases with the intended outcome. From these analyses, configurations of necessary and sufficient conditions emerge as solutions. A more detailed description of our fs/QCA procedure is available upon request.

To assess the quality of the solutions, the consistency and coverage of the configurations must be assessed. Consistency is the extent to which empirical evidence supports a solution's claim and "indicates how closely a perfect subset relation is approximated" (Ragin, 2008, p. 44). The recommended threshold for consistency is at least 0.8 (Greckhamer *et al.*, 2008; Ragin, 2008). Coverage is the extent to which a solution is found among the observed cases, thereby indicating the solution's empirical relevance (Ragin, 2008; Rihoux and Ragin, 2009).

Step 2: assessing relationship between knowledge intensity and team-level absorptive capacity. To answer *H4*, we assigned two categorical variables to each team. The first variable team ACAP was assigned a value of 1 to high team ACAP, and 0 to low team ACAP. This is based on the membership value as used in fs/QCA, meaning that

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membership in team ACAP > 0.5 = high team ACAP, while a membership value < 0.5 = low team ACAP. The second categorical variable knowledge intensity was assigned a value of 1 to high knowledge intensity, and 0 to low knowledge intensity, based on the criteria as mentioned in our section on measures. We then applied the Pearson chi-square test to the 2×2 cross-tabulation table.

Results

H1, H2 *and* H3*: fuzzy-set qualitative comparative analysis results*

Necessary conditions. The analysis of necessary causal conditions shows that individual ACAP and team size are necessary conditions for high team ACAP and its underlying dimensions, recognition, assimilation, transformation and exploitation. For low team ACAP and its underlying dimensions, we found no necessary conditions. This implies that having high individual ACAP and small team size are non-trivial necessary conditions to establish high team ACAP, as they are not necessarily conditions for low team ACAP (Braumoeller and Goertz, 2000).

These results suggest that teams with high ACAP are always composed of members whose overall individual ACAP are high. This reasoning only goes in one direction; it does not imply that teams with high overall individual ACAP always have high team ACAP. The necessary condition of team size as control variable can be explained by the fact that most large teams are production teams, which appear to have relatively low team ACAP. Thus, the likelihood that small teams are a subset of teams with high team ACAP is fairly high, which is reflected in the necessary condition of size.

Sufficient conditions. The final fs/QCA analysis results are presented in Table III, which shows, for each intended outcome, the configuration as (a combination of) solution formulas, the coverage, the consistency and the percentage of cases with more than 0.9 membership in the outcome.

A solid circle (●) indicates that the condition is present, while ⊗ means that the condition is absent. As we are primarily interested in the outcomes of high and low team ACAP, we will first discuss Solutions 1, 2 and 3.

Table III shows that two paths to high team ACAP emerge: Solutions 1 and 2. The first path is the combination of high individual ACAP, participation, a supportive management style and an integrative culture. The second path to high team ACAP is the combination of high individual ACAP, a participative management style, low task routinization and a small team. The combined paths account for 81 per cent of the cases with a membership of high team ACAP ≥ 0.90.

Once we determined the solution of the positive outcome, we needed to examine the negation of the outcome, which is low team ACAP (Ragin, 2008). It cannot automatically be inferred that when a causal condition is related to the positive outcome, the non-occurrence of the causal condition is related to the negative outcome (Schneider and Wagemann, 2010). The results show that low team ACAP levels are associated with a combination of low individual ACAP levels and high routinized work levels (Solution 3). This suggests that the conditions for high and low team ACAP are in fact different.

For the team ACAP dimensions recognition, assimilation, transformation and exploitation, the solution formulas are also shown in Table III (Solutions 4 to 16). One can see that the consistency of the solutions is high (≥ 0.86) and that, for most dimensions, the coverage of cases with membership ≥ 0.9 in the outcome is above 70 per cent (last row, Table III). For high team recognition and high team exploitation, and for low team exploitation, the solutions have high consistency but low coverage. This implies that, for the cases that are not covered by solution formulas, there is less clarity about relationships between conditions and outcomes.

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Table III Summary of final solutions' formulas

Conditions	*Team ACAP high*		*Team ACAP low*	*Team recognition high*	*Team recognition low*		*Team assimilation high*		*Team assimilation low*		*Team transformation high*		*Team transformation low*		*Team exploitation high*	*Team exploitation low*
Solution	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*
Individual ACAP	●	●	⊗	●		⊗	●	●	⊗		●	●		⊗	●	⊗
Enabling factors																
Coordination				●								⊗				
Participation	●			●						⊗	●		⊗	⊗		
Rotation				⊗	●											
Formalization																
Routinization		⊗	●			●	⊗					⊗		●	●	
Connectedness					⊗			●	⊗							⊗
Socialization					⊗										●	
Motivating factors																
Management style	●	●					●				●	●		⊗		⊗
Culture	●				⊗			●		⊗	●		⊗		●	
Size	⊗	⊗					⊗	⊗		●	⊗	⊗			⊗	
Consistency	0.93	0.94	0.96	0.92	0.90	0.86	0.87	0.86	0.92	0.95	0.93	0.96	0.91	0.94	0.90	0.91
Coverage	0.50	0.54	0.50	0.30	0.32	0.44	0.42	0.45	0.47	0.37	0.51	0.36	0.44	0.38	0.30	0.40
% cases > 0.9 membership in outcome	81		71	33	75		75		82		77		75		35	50

Notes: ● Indicate that the condition is present; ⊗ indicate that the condition is absent; blank spaces mean *does not care*. Consistency is the extent to which empirical evidence supports the solution's claim; coverage is the extent to which the solution is found among the observed cases, thereby indicating the solution's empirical relevance (Ragin, 2008; Rihoux and Ragin, 2009)

The fs/QCA analysis results show that individual ACAP is a necessary condition, and that social integration mechanisms are sufficient conditions for team ACAP. A closer look at the combinations of conditions reveals that each solution formula for high team ACAP consists of three types of conditions: high individual ACAP *and* combinative capabilities to enhance the ability for knowledge integration *and* capabilities to enhance the motivation for knowledge integration. This suggests that teams need to consider this triad of conditions simultaneously to improve their ACAP. This only lends support for *H3*, which states that individual ACAP and social integration mechanisms are complementary. As we found no solutions with only individual ACAP in relation to high team ACAP, we cannot support *H1*; nor did we find combinations with low individual ACAP and social integration mechanisms in relation to high team ACAP; therefore, *H2* is not supported:

H4*: team ACAP of knowledge-intensive teams*

To test *H4*, we calculated Pearson's chi-square based on a 2×2 cross-tabulation table in SPSS (version 21) containing the number of cases with high or low team ACAP, and high or low knowledge intensity. There is a significant association between team ACAP level and team knowledge intensity level χ^2 (1) = 21.48, $p < 0.001$, which strongly supports *H4*, which states that knowledge-intensive teams are likely to have higher team ACAP compared to less knowledge-intensive teams.

Discussion

This study sought to inform managers and scholars about how knowledge-intensive teams can improve their ACAP to be more innovative and sustain competitive advantage. We took a configurational approach to examine the interrelationships of the micro-foundational factors of team ACAP. We found that high individual team members' ACAP is a necessary condition for high team ACAP. Furthermore, the results show multiple paths of combinations with social integration mechanisms to team ACAP and its underlying dimensions of recognition, assimilation, transformation and exploitation. This implies equifinality in solutions, which confirms Eisenhardt and Martin's (2000) argument that similar dynamic capabilities can be developed from different starting points. Yet, they also argue that there are some commonalities across these different paths that characterize capabilities. In our study, we suggest that these commonalities are found in the combinations of *enabling* and *motivating* integration mechanisms, which are sufficient conditions for high team ACAP. Our study also empirically shows that knowledge-intensive teams have higher team ACAP levels compared to less knowledge-intensive teams. Taken together, these findings suggest that knowledge-intensive teams can increase their ACAP by a triad of factors. Team ACAP depends on high individual ACAP *complemented* by knowledge integration enabling mechanisms as well as motivating mechanisms.

Our study contributes to the knowledge management and ACAP literature in three ways. First, knowledge-intensive team success depends on teams' ability to acquire new external knowledge (Ancona and Caldwell, 1992; Bresman, 2010; Sung and Choi, 2012). Yet, merely acquiring knowledge is insufficient (Argote *et al.*, 2003; Grant, 1996a); the new knowledge also needs to be disseminated among and across team members and to ultimately find its application in new or improved products and services. This requires a team to maintain high ACAP levels. Our study is among the few to have taken a team-level perspective on ACAP. By examining the micro-foundations of team ACAP, we provide insights into the basic building blocks of team ACAP and their interrelationships, which explains why knowledge-intensive teams differ in their abilities to successfully manage knowledge processes.

Second, our study contributes to the ongoing debate about the *locus* of knowledge-creation. Our first three hypotheses reflect the contradictory findings in ACAP literature concerning whether organizational ACAP is created solely by individuals (Matusik and Heeley, 2005), mainly by organizational mechanisms (Zhao and Anand, 2009), or by a

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combination of these two (Nemanich *et al.*, 2010; Ojo *et al.*, 2014; Sung and Choi, 2012). A similar debate on whether knowledge-creation has its *locus* in the individual and/or the organizational level is found in the micro-foundations literature, for instance in the debates between Felin and Foss (2011, 2012) and Hodgson (2012) and Hodgson and Knudsen (2011). Taking a holistic configurational perspective, our empirical results suggest that individual and collective factors complement one another, to create team ACAP. Thus, while individual ACAP is indispensable, organizational integration mechanisms are also needed to develop team ACAP. Our empirical findings support Cohen and Levinthal's (1990, p. 131) argument that "a firm's ACAP is not, however, simply the sum of the absorptive capacities of its employees, and therefore, it is useful to consider what aspects of ACAP are distinctly organizational."

Our third contribution is that we show how a configurational approach can advance our understanding of complex organizational phenomena, such as ACAP processes in knowledge-intensive teams. While statistical regression based techniques examine the relative importance of variables in cause-and-effect relationships with a specific outcome, configurations seek to identify combinations of variables that are associated with a specific outcome in complex ways (Fiss, 2007). Assuming linear cause-and-effect relationships in a complex, multilevel and multidimensional construct, as ACAP might be too simplistic. This is illustrated by equifinality in two different combinations of factors, which both result in high team ACAP.

Our study also has implications for practice. This study informs managers and project team leaders on their possibilities to develop idiosyncratic strategies to further enhance their teams' ACAP. First of all, they need to staff their teams with employees with high individual ACAP. These are employees who have broad knowledge and experience, a diverse personal network to access new knowledge and cognitive skills for creative problem-solving (Koestler, 1964; Lowik *et al.*, 2012). Additionally, project team managers need to facilitate knowledge exchange by actively bringing team members in contact with each other. This can be done through organized activities such as team meetings and job rotation, but also by preventing routine tasks for which interaction is not as crucial. Finally, managers should create an atmosphere that motivates employees to share and integrate knowledge. Although managers have considerable freedom in determining the right strategy, our study suggests that they should pay attention to the aforementioned three aspects simultaneously.

Limitations and future research

Our study results should be considered in relation to its limitations. We chose to study functional teams, as this enabled us to distinguish knowledge-intensive teams from more routine-oriented ones, which was appropriate to this study. However, knowledge-intensive firms often use cross-functional or project teams. As the characteristics of cross-functional or project teams differ from those of functional teams (Holland *et al.*, 2000), future research is needed to explore the triad of team ACAP in more heterogeneous teams.

Another limitation relates to the organizational context of teams. Although we used four firms with similar characteristics – medium-sized, industrial and medium-tech – these firms differ regarding organizational characteristics. As several studies have shown that team performance is affected by organizational context (Bresman and Zellmer-Bruhn, 2013) and environmental conditions (Sung and Choi, 2012), we recommend that future studies include these contextual factors in their analysis.

Furthermore, we did not consider the teams' composition in relation to team members' individual ACAP; rather, we used the mean value of individual team members' ACAP scores. The reason is a practical one, as the number of conditions that fs/QCA allows is limited. We already had to use a two-step approach for analysis (Schneider and Wagemann, 2006). However, we encourage future studies on individual team member

ACAP composition. This would enhance our understanding about whether all team members should need high ACAP or whether some kind of mix between team members with high and low individual ACAP is preferable.

Finally, one of the strengths of this configurational approach, its holism, can also be considered its weakness. One of the assumptions in fs/QCA is that all conditions are weighted equally (Rihoux and Ragin, 2009). This is the *black box* problem of fs/QCA: it does not explain *how* causal conditions explain an outcome. In this sense, configurational approaches should be seen as complementary to statistical methods such as regression analysis, rather than as a substitute.

To further build on our findings, we suggest two research avenues. First, research on team-level ACAP adds a new layer to the conceptual models of Cohen and Levinthal (1990) and Zahra and George (2002). An interesting research question for individual and team-level studies is how team member characteristics affect individual ACAP, and thereby team-level ACAP. In line with the micro-foundations research stream, another interesting question for future research is how team members' interactions affect the factors that enable knowledge integration and motivating factors at the team level. Finally, the interactions between team-level and organization-level factors is also interesting. Studies by Jansen *et al.* (2005) and Minbaeva *et al.* (2003) have shown the relevance of enabling or motivating factors at the organizational level, yet their complementary character with individuals' ACAP or team ACAP has not been studied to date.

A second suggestion for further research is the study of ACAP in new ventures, which has received little attention to date (Hayton and Zahra, 2005). Especially new ventures have a need for new knowledge to grow rapidly (Autio *et al.*, 2000; Freeman *et al.*, 2010), yet they have limited ACAP to begin with (Fernhaber *et al.*, 2009). Furthermore, in these ventures, the (management) team also comprises the organization. Studying new ventures' ACAP might further inform practitioners and scholars on which individual and team-level factors can speed up team ACAP development.

Conclusion

Managers who seek to improve knowledge-intensive teams' performance are advised to take a holistic approach and to consider the triad of team ACAP: team members' individual ACAP, mechanisms that enable knowledge integration and mechanisms that motivate knowledge integration. Furthermore, this study shows how a configurational approach deepens understandings of the micro-foundations of team ACAP.

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Appendix. Survey items for individual absorptive capacity

Recognition

I am always actively looking for new knowledge for my work.

I intentionally search for knowledge in many different domains to look "outside the box".

I am good at distinguishing between profitable opportunities and not-so- profitable information or opportunities.

I easily identify what new knowledge is most valuable to us.

Assimilation

I frequently share my new knowledge with colleagues to establish a common understanding.

I translate new knowledge in such a way that my colleagues understand what I mean.

I communicate newly acquired knowledge that might be of interest for our unit.

Transformation

I often sit together with colleagues to come up with good ideas.

I attend meetings with people from different departments to come up with new ideas.

I develop new insights from knowledge that is available within our firm.

I can turn existing knowledge into new ideas.

Exploitation

I often apply newly acquired knowledge to my work.

I exploit new knowledge to create new products, services, or work methods.

I constantly consider how I can apply new knowledge to improve my work.

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About the authors

Sandor Lowik is Assistant Professor of innovation management at the University of Twente, the Netherlands. His research interests relate to innovation capabilities challenges of small and medium-sized firms and their ability to collaborate with other organizations. His research centers on topics such as micro-foundations, absorptive capacity, ambidexterity and innovation ecosystems. He holds a PhD of the University of Twente and has more than 12 years of industry experience in operations management. Sandor Lowik is the corresponding author and can be contacted at: s.j.a.lowik@utwente.nl

Jeroen Kraaijenbrink is Associate Professor of strategic entrepreneurship at the University of Twente, the Netherlands. He is also an independent strategy lecturer and consultant and co-founder of the New Strategy Group. He has a PhD from the University of Twente and has been visiting scholar at the University of Virginia and the University of Minnesota. Kraaijenbrink has published in various journals including *Journal of Management*, *Knowledge Management Research & Practice* and *Journal of Product Innovation Management*. Based on his research and his lecturing and consulting experience, his most recent book, “The Strategy Handbook”, offers a practical guide for making strategy work.

Aard Groen is Double Professor of innovative entrepreneurship and valorization at the University of Twente and University of Groningen, the Netherlands. His research is focused on processes of entrepreneurship inspired by social system approaches and currently looking into technology-, social- and corporate-based entrepreneurship. Groen edited several books based on the series of High Tech Small Firms conferences, and published in journals as *Journal of Management*, *Technovation*, *Technology Forecasting & Social Change*, *Journal of Small Business Management*, *Journal of Enterprising Culture* and *Creativity and Innovation Management*. Groen is designer and owner of Venturelab International accelerator methods.

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