Information Technology and Management (2022) 23:1–21
https://doi.org/10.1007/s10799-021-00337-5

The effects of interaction between team climates and KMS value perception on knowledge activities: a multilevel socio-technical systems approach

Jinyoung Min[1] · Junyeong Lee[2] · Sunghan Ryu[3] · Heeseok Lee[4]

Accepted: 20 August 2021 / Published online: 31 August 2021

Abstract
As individuals are the actual agents of knowledge management (KM) activities, they are influenced by the technical and social aspects of an organization. The effects of social and technical aspects on KM, however, have either been studied separately, or one aspect has been emphasized over the other. This study used the multilevel approach to investigate the interaction between technical and social systems within the work system of KM by examining how the social system moderates the effects of the technical system on KM activities. The social system is operationalized as a team climate, which is the socially shared perception among members within a team, whereas the technical system is operationalized as the perceived value of the KM systems (KMS), which is the technical information system that deals with organizational knowledge and is realized in the work setting in the form of the perception of individuals. We conducted a field study that involved 80 teams of 419 individuals from three knowledge-intensive companies. A hierarchical linear model was employed to analyze the multilevel structure: individual-level KMS perceptions for operational support and strategic decision support, and KM activities with the team-level affective and innovative climates. Our findings show that the innovative team climate magnifies the effect of the perceived KMS value of individuals for strategic decision support on their knowledge adoption; whereas, the affective climate strengthens the effect of the perceived KMS value of individuals for operational support on their knowledge transformation.

Keywords Perceived KMS value for strategic decision and operational support · Knowledge adoption · Knowledge transformation · Multilevel research · Affective climate · Innovative climate

✉ Junyeong Lee
junyeong.lee@cbnu.ac.kr

Jinyoung Min
saharamin@chosun.ac.kr

Sunghan Ryu
shryu@sjtu.edu.cn

Heeseok Lee
hsl@kaist.ac.kr

[1] College of Business, Chosun University, 309 Pilmundaero Donggu, Gwangju 61452, Korea

[2] Department of Management Information Systems, Chungbuk National University, 1 Chungdae-ro, Seowon-gu, Cheongju, Chungbuk 28644, Korea

[3] USC-SJTU Institute of Cultural and Creative Industry, Shanghai Jiao Tong University, 800 Dongchuan Road, Shanghai 200240, China

[4] College of Business, Korea Advanced Institute of Science and Technology, 85 Hoegiro Dongdaemoongu, Seoul 02455, Korea

1 Introduction

Knowledge management (KM) activities occur in an organization through a work system that integrates organizational knowledge and individual knowledge [1, 2], ultimately requiring an individual activity to embrace and transform organizational knowledge [3]. In this sense, it is crucial to examine how individuals, the actual agents of KM activities, perform knowledge activities. Individuals who deal with organizational knowledge receive technical support in their knowledge activities [4] and operate as social actors within specific social contexts [5]. Therefore, when taking individuals as principal agents, it is also important to consider that individuals are under the influence of the organization's socio-technical systems. The socio-technical systems perspective emphasizes the importance of considering the social and technical systems together, suggesting that "a work system is made up of two jointly independent, but correlative interacting systems—the social and technical" (p.

17) [6]. In a work system of KM, the social systems influence KM through organizational culture or shared values and technical systems are related to the activities and tasks that individuals conduct to transform inputs into outputs within the organization [6]. Therefore, technical systems offer a direct link between individuals and the work system, and social systems become a higher-level contingency of this link [7]. Thus, individuals and their KM activities within an organization should be studied in conjunction with the social and technical aspects of KM. It is worth noting that while technical systems directly support the work-related activities of individuals, social systems indirectly affect those activities by providing certain contextual cues for work systems. That is, the use of technical systems is directly dependent on an individual worker within a work system [3] social systems, however, are formed by a group of individuals in a manner that reflects the context that they inhabit [6]. Therefore, KM activities should be understood considering the interaction between the technical and social systems. Additionally, their interaction should be dealt with as a multilevel process that how individuals value technical systems and embrace them in their KM activities, is influenced by the higher organizational level of social perceptions that the individuals share.

Previous KM literature has neglected either this technical and social system interaction or its multilevel process. Existing works mainly examine each system separately, dealing with either only technical systems or only social systems [8–10]. A certain strand of literature dealt with the aspect of social and technical systems of KM activities simultaneously, but the majority of these studies mainly focused on either the technical system [11] or the social system [12, 13] with most adopting the single-level approach, rather than the multilevel approach. Overlooking the interrelationship and the multilevel aspect of the social and technical systems may be problematic because it is necessary to deal with technical and social systems in an integrative manner to understand work outcomes that result from the interaction between the systems [6]. This is because the technical and social systems are entangled with one another and intertwined with individuals in an organization in a manner whereby their effects are assimilated at multiple levels of an organization [14]. To fill the gaps in the literature, our study investigates how an organization's social context interacts with individuals' perception of the technical component for KM and influences their knowledge activities by examining the multilevel process of how social perceptions of the organizational context can moderate the relationship between the knowledge management systems (KMS) value perceptions of individuals working in such a context and their knowledge activities.

For this purpose, we delve into the representative social and technical systems that can influence KM work systems significantly. As a social system, we select the climate, which is the shared perception of the group regarding the types of behaviors and procedures [15]. Shared perception is the background knowledge that is taken for granted and is embedded in the social relations surrounding the work group; it is socially determined [14]. Therefore, the climate, which is an important source of social influence [16] may be a crucial and representative social system of KM. KMS provide individual employees with the knowledge they need to work as organizational members, and allow their input to be transformed further into organizational knowledge [4]. As these are the primary roles of technical systems [6] and KMS are essential technical parts of KM work systems [17], we select the KMS as a target technical system for investigation. Moreover, as perception determines the appropriateness of the social and technical system of a work system and how it is used in a work setting [18], we operationalize it not as technology per se (KMS), but as the perception that individuals have of the KMS (individuals' perceived value of KMS).

Taken together, this study investigates how the perception of the social system, which is represented as a climate, moderates the perception of technical systems, which is represented as the KMS perception of individuals, and affects the knowledge activities of individuals. For this purpose, we conducted a field study collecting responses from 419 individuals within 80 teams from three knowledge-intensive companies. As our research questions are designed to incorporate the individuals and the social context on which the climate is built, our study targets multiple levels of an organization (i.e., the individual level and climate level, that become the social context in which the individuals are influenced). Thus, we analyzed the data using a hierarchical linear modeling (HLM) approach. The results support our arguments on a socio-technical aspect in the multilevel KM context, providing academic and practical implications.

2 Theoretical background and literature review

2.1 Technical and social subsystems in KM literature

Individuals work in the systems of the organization as they perform tasks in a specific organizational environment, which is socially and technologically fabricated. The socio-technical systems theory implies that organizational work systems are constructed by people who use technology to generate products or services [18]. It recognizes that social and technical factors are interwoven in the manner in which people work, and thus, suggests embracing the interrelatedness of the social and technical parts of the work system in its design, explicating it as the interaction of the social and technical systems of a work system [2]. The social system is concerned with the attributes of people, while the technical system is concerned with the processes, tasks, and technology that are required to transform inputs into outputs within the organization [6]. The technical systems provide a reliable relationship between individuals and the work system and social systems become contingencies of this relationship as they change and evolve [7]. In this sense, the socio-technical systems approach also implies multilevel interaction between the contextual social and technical factors [19, 20]

The recent KM literature has acknowledged the need to embrace a socio-technical systems perspective on studying knowledge activities in organizations. However, this approach has been mostly presented as an attempt to bring the social part of the system rather than delving into the interaction between social and technical systems. For example, social ties and interpersonal trust [21], cultural value [22], organizational climate [10, 23], relational capital [24], and organizational value [25] have been brought as social factors that affect knowledge activities and system use, implying that these social factors are the antecedents of technical systems, or that social and technical systems affect knowledge activities separately, rather than considering the moderating effect of social systems on the relationship between the technical systems and knowledge activities. In addition, as their focus was on the social system, their finding is also focused on determining the role of the social system such that the social initiatives are more important than the technical ones [26]. However, socio-technical systems theory suggests two systems as an integrated work system rather than simply adding the social system to technical infrastructure or vice versa [7]. If an organization focuses on technical systems but is ignorant of their interaction with social aspects, technologies will not be fully leveraged; thus, their expected performance level will never be achieved [5]. Conversely, when social systems are overemphasized and their interaction with the technical counterpart is underestimated, it will be extremely difficult to understand and thus to facilitate how knowledge is accessed and distributed beyond the established social boundary in an organization [27].

Furthermore, the KM literature has recognized the existence of multilevel interactions, in which socially determined factors enclose technically determined factors [14]. However, only a few studies have adopted a multilevel approach to investigate the relationships between higher-level social factors and individual technical factors. For example, Zhang [28] found that the effects of rich KMS use of individuals, such as cognitive absorption and deep structure use, on their job performance were moderated by contingency factors, such as transformational leadership at the business unit. Jahmani et al. [29] demonstrated that the perceived usefulness of KMS by individuals and the subsequent KMS use were influenced by the leadership of a team leader. Despite the significance of their findings, their concern regarding social factors relates to the higher level of the organizational structure, rather than whether it was a socially formed contextual work environment. The implications of the research findings may be inadequately applied without deeply considering socially formed contextual factors [30]. That is, it is easy to underestimate and overlook the fact that the shared perception among the group, in addition to the force of the organizational structure, can influence the perception of the technical system use of the individual members.

Therefore, how technical and social systems affect knowledge activities in conjunction with each other from a multilevel perspective is more than necessary to understand how the KM work system as a whole embodies the various components of the system and how they operate. In the following sections, we explain in detail how we operationalized the KM work system, as well as the social and technical systems therein.

2.2 Operationalization of KM work system

Both technical and social systems are facilitated through involvement of the actors in the system and those actors' perceptions and activities [20]. It is therefore imperative to understand how the technical and social systems are incorporated by individuals within the work system. In the specific work system of KM, it is realized by individuals dealing with organizational knowledge through knowledge activities, which are mainly represented as knowledge adoption and transformation [31]. Knowledge adoption can be viewed as the act of pursuing efficiency by utilizing the certainty and clarity of an organization's knowledge without changing its value [32]. For example, individuals may find and adopt a manual to improve task productivity and the shared best practices for enhancing performance. This activity is for acquiring and exploiting relevant knowledge quickly and does not necessarily involve changing it. Instead, knowledge transformation can be understood as the act of experimentation and the transformation of existing knowledge to improve it [32]. Individuals may explore specific knowledge in KMS and transform it into a more applicable form for a new context or purpose and put it back to KMS with its changed form. For example, well-codified numerical information related to the organization can be easily explored, integrated with other information, and transformed into another form for application in a new context. Therefore, for the work system of KM, technical and social systems should be understood with specific activities, knowledge adoption, and knowledge transformation.

Among technologies that operate as a technical system of an organization, KMS, a type of information systems (IS), has received great attention for its power to institutionalize and perpetuate organizational knowledge in the organization [33] and thus enhances individuals' knowledge activities that interact with it [4]. The primary role of the technical system is to enable the inputs of individuals to become outputs within the organization, and the basic function of the KMS is to provide individuals with easy access to organizational knowledge and to apply this knowledge in their work [17]. The KMS, therefore, is an essential technical system of a KM work system. As noted earlier, as the perception drives how the technical system of a work system is actualized [18], we operationalize it not as KMS per se, but as individuals' perceived value of KMS.

Meanwhile, a social system is related to the attributes of people [6]. When it is socially realized, it becomes the shared perception of a work group [14], which suggests a climate. Therefore, we investigate the climate as a social system. A climate refers to the shared perception of the group and affects the behaviors of employees by promoting them to process information socially [16]. Furthermore, the climate plays an essential role in promoting the knowledge activities of employees within a KM work system [34].

Therefore, we suggest the perception of KMS as technical systems and climate as a social system needed to understand individuals' knowledge activities within an organization. In the next subsections, we further operationalize them in a way that can best describe their incorporation in the work systems of KM.

2.2.1 Operational of a technical subsystem: perception of KMS value and KM activities

KMS refer to "a class of information systems applied to managing organizational knowledge" (p. 114) [17]. Regarding KMS as technical systems, the design framework of socio-technical systems gives the owners of the problems the control of how the technical systems are used [7], and how KMS are facilitated depends on how people perceive them [35]. Socio-technical systems theory also emphasizes the importance of individual perceptions, suggesting an interaction between the subjective perceptions of employees and the objective characteristics of the work process [14]. Therefore, it is through the perceived KMS value that the technical system is realized in an organization.

As technical systems, the value of KMS can be magnified in the task environment [36, 37]. Given that KMS have been developed and evolved to support various work purposes [17], tightly linking KMS to organizational work will be required to understand how perceived values of KMS influence the individuals' knowledge activities becoming valuable outputs. We connect KMS to organizational work by relating KMS to management activities in an organization. The two ends of management activities can be characterized as operational and strategic [38].

The strategic and operational importance of KM has been emphasized and distinguished in the field of KM [32, 39–42]. Therefore, we incorporate KMS in the work system of KM such that the perceived values of KMS for strategic decision support and operational support are linked with knowledge activities.

2.2.2 Operation of social subsystem: team climate

As many organizations operate in team units, team contexts rather than organizational contexts have been more strongly related to individuals' work-related activities [43]. Therefore, the climate of each team, rather than the climate of the entire organization, most affects individuals' motivations and team outcomes [44, 45]. This is in line with the findings that an individual's behavior tends to be affected more by the variables closest to that individual [46].

Team climate is defined as "team members' shared perceptions of the kinds of behaviors, practices, and procedures that are supported within a team" (p. 84) [15]. It provides the members of a team consistent interpretation of the surrounding environment and, in consequence, they are drawn to better decisions for performing tasks [47]. Team climate has long been treated as one of the most important sources of social influence that has effects on individual behaviors in the team environment.

Within the domain of team climate, Ostroff [48] suggested three important dimensions: affective, cognitive, and instrumental. The affective dimension concerns social and interpersonal relations among team members, such as warmth and cooperation. The cognitive dimension is concerned with the self or individuals' involvement in work-related activities, such as innovation and growth. The instrumental dimension, hierarchical or structural factors, for instance, is concerned with completing work or task involvement in the organization. As we intend to investigate the operation of social systems rather than a structural system in this study, we focus on affective and cognitive dimensions rather than the instrumental dimension.

Among climates of affective and cognitive dimensions, innovative and affective climates are particularly known to enhance KM activities [49–52]. For example, Chen et al. [51] showed that an innovative climate encourages individuals to be involved in knowledge exchange and sharing, as it enables them to acquire new knowledge and share it openly [53, 54]. In the case of affective climate, Brown, Eisenhardt [49] showed that affective climate could facilitate the transformation of knowledge for creative problem-solving in team processes, as team members feel more comfortable and confident, because of the psychological safety under this type of climate [48, 55, 56]. Hence, as the target team climates of this study, we examine innovative climate in the cognitive dimension and affective climate in the affective dimension, proposing that each operates differently on knowledge activities.

3 Hypotheses development

Using the previously explained theoretical base, which social system moderates the relationship between the perception of the technical system and knowledge activities, and the selection of their representative operationalization—social systems as innovative and affective climate; technical systems as the perception of KMS values for operational support and for strategic decision making; and knowledge activities as knowledge adoption and knowledge transformation—we delineate hypotheses that accommodate the specific application of the theory.

3.1 Impact of innovative climates on the relationships between perceived KMS values and knowledge adoption

An innovative climate is characterized by "the notion of openness to new ideas as an aspect of a firm's culture" (p. 44) [57] and portrayed as the psychological notion about novel skills and approaches to accomplish work [58]. An innovative climate has been considered a key factor for team processes and effectiveness via encouragement of team members' knowledge activities [59, 60]. This type of team climate is essential for teams, since it can favor the appearance of novel ways of doing tasks and improving the way team members acquire different knowledge [61]. The innovative climate encourages individuals to actively seek suitable solutions with novel and different approaches to their problems from outside knowledge sources [62], to engage in knowledge acquisition [63, 64], and knowledge exchange activities [50, 51] focusing on the knowledge inflow [65]. Accordingly, an innovative climate is likely to be closely related to the process of knowledge adoption.

In the information systems and teams context, an innovative climate is positively associated with the usage and benefits of information technology (IT) to look for new and different ways [50, 66, 67]: for example, this climate is expected to play a key role in IT implementation through valuing information sharing with new ways and technologies [68]. As this type of climate enables individuals to actively utilize IT to support KM processes and practices [69–71], previous studies have shown the positive moderation effect of innovative climate on knowledge-related activities [72–74]. An innovative climate, for example, is found to strengthen the relationship between the use of information systems and extended knowledge use [72]. The innovative climate is related to the shared cognition about the KMS of team members, which strongly affects each member's perception of KMS [75]. As the innovative climate significantly affects the aggressiveness of a strategy regarding technology [76, 77], this climate guides employees to absorb new ideas and thoughts to complete tasks by prompting employees to adopt knowledge provided by KM tools [78, 79]. Thus, in a team with a highly innovative climate, there is a tendency that members' recognition of KMS value is linked to finding and adopting novel ways to accomplish their work using organizational knowledge [50, 75]. Hence, the following hypotheses posit that an innovative climate is likely to strengthen the relationship between perceived KMS value and knowledge adoption:

Hypothesis 1 The innovative climate strengthens the positive relationship between the perceived KMS value for strategic decision support and knowledge adoption.

Hypothesis 2 The innovative climate strengthens the positive relationship between the perceived KMS value for operational support and knowledge adoption.

3.2 Impact of affective climates on the relationships between perceived KMS values and knowledge transformation

The affective climate is characterized by "shared affective responses by a work team's members" (p. 98) [80]. Since this kind of climate would elicit a pleasant and positive work environment and a risk-taking style of cognitive strategies [81, 82], the impacts of the affective climate have been noted on various outcomes including team coordination, creativity and performance [55, 82, 83]. Under a highly affective climate, team members feel more comfortable and confident; thus, they can be engaged in experiment and transformation activities [48]. The affective climate has a substantial influence on organizational dynamics such as knowledge creation by supporting team members' autonomy, encouraging them to achieve their jobs in transformational ways [49, 84, 85]. Many studies show similar findings. A case study showed that the affective climate should be well managed to foster individuals' ability to produce knowledge for knowledge-based organizations [86]. As affective climate offers them psychological safety [56], team members reduce the fear and the risk of frequent failure associated with the experimentation of ideas [55, 87, 88]. When the affective climate is enriched within a team, its members attempt to make fresh task-related knowledge by combining their knowledge and what they seek to apply to their knowledge [89]. The affective climate also makes individuals engage in shaping knowledge and information integration [90] because it tends to trigger a transformation of knowledge gained in an organization (e.g. [61]). Taken together, the affective climate is likely to be intertwined with knowledge transformation.

Affective climate can also act as a significant driver that managers can apply to provide a supportive environment for behavior regarding IT [85]. It is positively related to creativity by enhancing the information processing efficiency of team members and encouraging them to make connections with the relevant information and develop additional options, using the support of IT artifacts including KMS [91–93]. Therefore, we suggest that an affective climate is expected to strengthen the relationship between perceived KMS value and knowledge transformation:

Hypothesis 3 The affective climate strengthens the positive relationship between the perceived KMS value for strategic decision support and knowledge transformation.

Hypothesis 4 The affective climate strengthens the positive relationship between the perceived KMS value for operational support and knowledge transformation.

Knowledge adoption and knowledge transformation are two different activities, that have distinct characteristics. Knowledge adoption is distinguished by exploitation, in which knowledge is acquired and used without experimentation, whereas knowledge transformation is characterized by its experimental and adapting activities [31]. These opposite characteristics of the two knowledge activities suggest that a certain social system that is relevant to facilitating one type of knowledge activity may be irrelevant in facilitating the other type. The literature implies that an innovative climate is effective in enhancing the adoption of knowledge [63, 64] and an affective climate is valuable for fostering the experimentation of knowledge [55, 87, 88]. Therefore, we focus on investigating the moderating effect of the innovative climate on knowledge adoption and the moderating effect of the affective climate on knowledge transformation, and not vice versa. To support this argument, we empirically test not only the hypothesized moderating effects of the climates, but also their non-hypothesized moderating effects. We present the results and a discussion in the following sections.

4 Research methodology

4.1 Measurement and multilevel design

This study used HLM designed for the simultaneous analysis of multilevel variables, as our research model is composed of two levels of constructs. At the individual level (level 1), the perceived value of KMS for operational support and the perceived value of KMS for strategic decision support are independent variables, and knowledge adoption and transformation are used as dependent variables. At the team level (level 2), affective climate and innovative climate are used as moderating variables.

We adopted the measurements from the literature and modified their wording according to our study's context. For knowledge adoption, we dropped one question on supplier knowledge from the original measurement because suppliers cannot be identified clearly for some of our target companies. For the perceived KMS value for operational support, three measurement items were dropped from the original measures due to concerns of their potential overlap with strategic decision support measures (for their operational definitions and sources and a list of survey questions, see Table 5). Using a seven-point Likert scale to measure variables, participants were asked to answer using a range between "strongly disagree" (1) and "strongly agree" (7). We also added four control variables at the individual-level, namely age, gender, tenure on the team (i.e., an individual's tenure on the current team at the moment of data collection), and company (two dummy variables as we have three companies in our data), and one control variable at the team level, which is a team type (i.e., whether staff team or not).

Then, HLM is designed for each dependent variable. Each model is constructed hierarchically with multiple stages in the way variables are added to the previous stage model. At the first stage, the simplest model that includes only the control variables and dependent variable are tested (Model 1). At the second stage, the independent variables are added to the model and their main effects are tested (Model 2). At the third and final stage, climate variables are added and their moderating effects proposed in the hypotheses are tested (Model 3) [94, 95].

As an example, we explicitly delineate the final stage equations for knowledge adoption (Model 3), which examines the effects of the control variables and perceived KMS value, as well as the moderating effects of the climates. Descriptions of all variables in the equations are provided in Table 1.

First, to estimate the within-team effects at the individual level, the within-team (level 1: individual) model is expressed as follows:

$$\begin{aligned}\text{Knowledge adoption}_{\text{ij}}\,(\text{Y}_{\text{ij}}) &= \beta_{0j} + \beta_{1j}(Company\ 2)_{ij}\\ &+ \beta_{2j}(Company\ 3)_{ij} + \beta_{3j}(Gender)_{ij}\\ &+ \beta_{4j}(Age)_{ij} + \beta_{5j}(Tenure\ on\ team)_{ij}\\ &+ \beta_{6j}(KMS\ value\ for\ strategic\ decision\ support)_{ij}\\ &+ \beta_{7j}(KMS\ value\ for\ operational\ support)_{ij} + \tau_{ij},\end{aligned}$$

where the subscript i indexes individuals, the subscript j indexes teams, Y_{ij} represents knowledge adoption as an outcome variable for individual i in team j, β_{0j} is the mean (i.e.,

Table 1 Descriptions of variables in equations

Category	Variables	Description
Independent variables	Perceived KMS value for operational support$_{ij}$	The degree to which an individual *i* in team *j* perceives the KMS value for monitoring and controlling day-to-day operations
	Perceived KMS value for strategic decision support$_{ij}$	The degree to which an individual *i* in team *j* perceives the KMS value for long-term planning or futurity
Moderation variables	Affective climate$_{j}$	The extent to which a team *j* shares the affective responses of its members
	Innovative climate$_{j}$	The extent to which a team *j* is open to new ideas
Dependent variables	Knowledge adoption$_{ij}$	The degree to which an individual *i* in team *j* acquires knowledge within an organization and uses it without conversion
	Knowledge transformation$_{ij}$	The degree to which an individual *i* in team *j* modifies the organizational knowledge by creating new knowledge or adding to existing knowledge
Control variables	Age$_{ij}$	Age of an individual *i* in team *j*
	Gender$_{ij}$	1 if an individual *i* in team *j* is female; 0 otherwise
	Tenure on team$_{ij}$	The number of months that an individual *i* has been in team *j*
	Company 2$_{ij}$	1 if a individual *i* in team *j* is in company 2; 0 otherwise
	Company 3$_{ij}$	1 if a individual *i* in team *j* is in company 3; 0 otherwise
	Team type$_{j}$	1 if a team *j* is a staff-type team; 0 otherwise

All variables except for binary variables were standardized in the analysis

j is determined by the affiliated team of individual *i*

intercept) of knowledge adoption in team *j*, $\beta_{1j} - \beta_{7j}$ are the slopes for the relationship between the level 1 predictors (i.e., companies, gender, age, tenure on a team, KMS value for strategic decision support, and KMS value for operational support) and knowledge adoption in team *j*, and τ_{ij} indicates an error term for level 1.

Second, to capture the between-team effects, which estimate the team level, the between-team (level 2) model is expressed as follows:

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(Team\ type)_j + \gamma_{02}(Innovative\ team\ climate)_j + u_{0j}$$
$$\beta_{kj} = \gamma_{k0}, (k = 1, 2, 3, 4, 5)$$
$$\beta_{6j} = \gamma_{60} + \gamma_{61}(Innovative\ team\ climate)_j + u_{6j}$$
$$\beta_{7j} = \gamma_{70} + \gamma_{71}(Innovative\ team\ climate)_j + u_{7j},$$

where γ_{00} is a fixed intercept of knowledge adoption across teams, $\gamma_{10} - \gamma_{70}$ are the mean effects (average regression slopes) of the level 1 predictors (i.e., company, gender, age, tenure on a team, KMS value for strategic decision support, and KMS value for operational support) across teams, γ_{01} and γ_{02} are the mean effects (intercepts) of the level 2 predictors (team type and innovative team climate), γ_{61} and γ_{71} are the slopes of the innovative team climate (level 2 predictor) for the impact of both perceived KMS values, u_{0j} is a random intercept, and u_{6j} and u_{7j} indicate the level 2 error for both perceived KMS values. The model includes the intercepts-as-outcomes (γ_{02}) and slopes-as-outcomes (γ_{61} and γ_{71}) models to determine whether the level 2 predictor (innovative team climate in the example model) predicts the intercept parameter (γ_{02}) and/or growth (slopes) in the measurement of knowledge adoption for team *j* with the level 1 predictors (perceived KMS values for strategic decision support and operational support; γ_{61} and γ_{71}, respectively). Note that γ_{61} and γ_{71} indicate the cross-level moderation effects.

By combining the first (within-team) and second (between-team) models into a single equation, the equation of the combined multilevel model can be described as follows:

$$\begin{aligned} \text{Knowledge adoption}_{ij}\left(\mathrm{Y}_{ij}\right) =& \gamma_{00} + \gamma_{01}(Team\ type)_j + \gamma_{02}(Innovative\ team\ climate)_j + \gamma_{10}(Company\ 2)_{ij} + \gamma_{20}(Company\ 3)_{ij} \\ &+ \gamma_{30}(Gender)_{ij} + \gamma_{40}(Age)_{ij} + \gamma_{50}(Tenure\ on\ team)_{ij} + \gamma_{60}(KMS\ value\ for\ strategic\ decision\ support)_{ij} \\ &+ \gamma_{61}(Innovative\ team\ climate)_j * (KMS\ value\ for\ strategic\ decision\ support)_{ij} \\ &+ \gamma_{70}(KMS\ value\ for\ operational\ support)_{ij} + \gamma_{71}(Innovative\ team\ climate)_j * (KMS\ value\ for\ operational\ support)_{ij} \\ &+ u_{0j} + u_{6j}(KMS\ value\ for\ strategic\ decision\ support)_{ij} + u_{7j}(KMS\ value\ for\ operational\ support)_{ij} + \tau_{ij}. \end{aligned}$$

The equation of the combined multilevel model for knowledge adoption exhibits the single mixed-model equation, and reveals that our model has 12 fixed effects (coefficients of γ) and four random effects (coefficients of u and τ).

The equations are the same in the case of knowledge transformation$_{ij}$ (Y_{ij}), except for the use of the affective climate instead of the innovative climate. The equation of the combined multilevel model for knowledge transformation (Model 3 of knowledge transformation in Table 4) is expressed as follows:

$$\begin{aligned}\text{Knowledge transformation}_{ij}(Y_{ij}) = {} & \gamma_{00} + \gamma_{01}(\textit{Team type})_j + \gamma_{02}(\textit{Affective team climate})_j + \gamma_{10}(\textit{Company 2})_{ij} + \gamma_{20}(\textit{Company 3})_{ij} + \gamma_{30}(\textit{Gender})_{ij} + \gamma_{40}(\textit{Age})_{ij} \\ & + \gamma_{50}(\textit{Tenure on team})_{ij} + \gamma_{60}(\textit{KMS value for strategic decision support})_{ij} \\ & + \gamma_{61}(\textit{Affective team climate})_j * (\textit{KMS value for strategic decision support})_{ij} + \gamma_{70}(\textit{KMS value for operational support})_{ij} \\ & + \gamma_{71}(\textit{Affective team climate})_j * (\textit{KMS value for operational support})_{ij} + u_{0j} + u_{6j}(\textit{KMS value for strategic decision support})_{ij} \\ & + u_{7j}(\textit{KMS value for operational support})_{ij} + \tau_{ij}.\end{aligned}$$

4.2 Research setting and data collection

We closely collaborated with knowledge-intensive companies across different domains, all of whom were members of KM industry–university cooperation programs. Among them, three companies volunteered to participate in the study: company A is a public corporation whose business includes insolvent debenture adjustment, credit recovery assistance, and online bidding; company B is a hospital and company C is a construction management company. Companies A, B, and C each have approximately 1000, 1000, and 600 employees, respectively. They have all been operating KMS for well over 10 years. Their KMS offer various ways of providing knowledge, including bulletin boards, questions and answers (Q&A's), communities of practices (CoP), and best practices, and also support integrated search within their systems. There are different types of knowledge, such as routine documents, statistics, reports, project outputs, and raw data in their KMS. Individual KMS usage, such as the number of knowledge uploads and responses, are measured and linked to employees' performance indexes. Therefore, KMS usage is mandatory for all employees. They learn to work through KMS and go to KMS whenever they need knowledge.

An online survey was administered to a total of 1548 employees in 229 teams in the three companies. This process was assisted by each company's personnel in charge of KM. The total response collected was 916 (59.2% response rate). For validity purposes, when aggregating individual responses into team-level variables, the responses of participants who were members of teams with less than three persons responded were removed to meet the minimum requirement for inter-rater reliability [96]. In the result section, the responses from 419 individuals within 80 teams were used for further analysis (27.07% of the total distribution, 47.74% of the total responses, 82, 268, and 69 responses from company A, B, and C, respectively). To identify potential non-response bias [97], we conducted a time trend extrapolation test [98], which was based on the assumption that late respondents are similar to non-respondents. As we encouraged the potential respondents to participate in the survey a week from the starting date, we defined early respondents as those who had completed the online questionnaires within the initial week (72.6%, or 304 out of 419), and late respondents as those who completed the questionnaires thereafter. The analysis results indicated no difference (Wilks's lambda = 0.97, $p > 0.10$) for the responses on the six constructs in our research model. Therefore, the potential non-response bias, if any, was not significant. The demographic profile of respondents is presented in Table 2.

Table 2 Demographic profile

Individual (n = 419)			Team (n = 80)		
Characteristic	Frequency	Percentage	Characteristic	Frequency	Percentage
Gender			Type		
Male	190	45.3	Staff	20	25.0
Female	229	54.7	Non-staff	60	75.0
Tenure on a team (years)			Number of teams		
< 2	227	54.2	Company A	26	32.5
2–5	89	21.2	Company B	40	50.0
5 +	103	24.6	Company C	14	17.5

Table 3 Correlation matrix for constructs

	KMSOP	KMSSD	KMA	KMT	AC	IC	Age	Gender	TT	C2	C3
Perceived KMS value for operational support (KMSOP)[a]	*.741*										
Perceived KMS value for strategic decision support (KMSSD)[a]	.623**	*.860*									
Knowledge adoption (KMA)[a]	.520**	.383**	*.758*								
Knowledge transformation (KMT)[a]	.505**	.361**	.649**	*.735*							
Affective climate (AC)[a]	.335**	.351**	.248**	.251**	*.809*						
Innovative climate (IC)[a]	.399**	.388**	.365**	.382**	.709**	*.792*					
Age[a]	.354**	.286**	.495**	.473**	.213**	.251**					
Gender	− .348**	− .260**	− .491**	− .476**	− .182**	− .242**	− .673**				
Tenure on a team (TT)[a]	− .046	− .112*	.048	− .013	− .050	− .119*	.166**	.029			
Company 2 (C2)	− .343**	− .294**	− .419**	− .453**	− .260**	− .390**	− .676**	.624**	.296**		
Company 3 (C3)	.256**	.256**	.426**	.439**	.131**	.168**	.576**	− .462**	− .111*	− .592**	
Team type	.057	− .032	.086	.069	.139**	.185**	.141**	− .232**	.107**	− .148**	− .155**

The italics numbers are the square roots of the variance shared between the constructs and their measures

[a]The selected variables were standardized for the analysis

**Correlation is significant at the 0.01 level (two-tailed)

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

5 Results

5.1 Measurement model

While conducting reliability testing, two items of an innovative climate were dropped. Afterward, the reliabilities of all constructs were found to be acceptable, as Cronbach's alpha of all constructs were above 0.70 [99], with the lowest being 0.832 (see Table 5). The initial exploratory factor analysis results showed that one item from knowledge transformation and one item from the affective climate should be dropped. After dropping them, exploratory factor analysis indicated all factor loadings were above 0.6 (see Table 6). Although several cross-loadings were considered high, all differences between cross-loadings and factor loadings exceeded the cut-off value of 0.10, indicating an acceptable level of discriminant validity [100]. The average variances extracted (AVE) of all constructs were greater than 0.50, indicating an acceptable level of convergent validity [101]. Additionally, the square roots of the AVE were greater than the correlations with the other constructs for all constructs, indicating a satisfactory level of discriminant validity [101]. Table 3 presents these results, with the correlations among all variables in the model.

Before analyzing team climate variables further, we examined the inter-rater agreement (r_{wg}) [96] and inter-class correlation coefficient (ICC) [102] to confirm our sample's legitimacy for team-level analysis, which resulted in higher values than the desired 0.7 value. As a final step, potential common method bias was checked for using two methods. First, as per Podsakoff, Organ [103]'s recommendation, we performed Harman's single factor test. The principal factor explained 21% of the total variances, indicating the potential problem caused by common method bias is minimal. Second, to explicitly decompose the total variance into variance explained by the constructs and method factor, we used a confirmatory factor model with a common method latent variable, as suggested by Liang et al. [104]. The results, reported in Table 7 indicate that for individual-level variables, the average substantively explained variance of the indicators is 0.786, whereas the average method-based variance is close to 0.003. For team level variables, the values are 0.984 and 0.062, respectively. Thus, the results of the two tests suggest that common method bias is not a serious concern.

5.2 Hypotheses testing

To test our multilevel model, we employed HLM 7.0. We conducted the two-level HLM (HLM2). Therefore, the model uses a nested data structure for individuals (level 1) within teams (level 2). To decrease the possibility of multicollinearity, we first performed group mean centering on all level 1 and grand mean centering on all level 2 predictors following Hofmann et al. [95]. We then tested the hypotheses and the results are shown in Table 4 and summarized in Fig. 1.

Among control variables, gender and company 3 were only significant at $p < 0.05$ level. Gender was significant for knowledge adoption ($\gamma = -0.437$, $t = -3.436$): males showed greater knowledge adoption compared to female employees. Company 3 was significant on knowledge adoption and transformation ($\gamma = 0.717$, $t = 5.222$ for knowledge adoption and $\gamma = 0.682$, $t = 3.468$ for knowledge transformation) indicating that the employees in company 3 had greater knowledge adoption and transformation tendency than employees in other companies.

To test the moderating effects, we first tested the direct relationship between independent and dependent variables on which the moderating effect runs because the direct relationship is required to test the moderating effects. Significant relationships between perceived KMS values and knowledge adoption were found ($\gamma = 0.130$, $t = 2.337$ for the perceived KMS value for strategic support and $\gamma = 0.253$, $t = 4.565$ for the perceived KMS value for operational support), which shows the positive association between knowledge adoption and perceived KMS values for strategic decision and operational support. Additionally, the relationships between perceived KMS values and knowledge transformation were tested. The results showed a significant association between perceived KMS value for operational support and knowledge transformation ($\gamma = 0.275$, $t = 5.863$), while the association between perceived KMS value for strategic decision support and knowledge transformation was insignificant ($\gamma = 0.059$, $t = 1.110$). Therefore, the moderating effect of affective climate on the relationship between the perceived KMS value for strategic decision support and knowledge transformation, which regards H3, was not tested further because the moderating effect did not have meaning unless the targeted direct relationship was significant. Therefore, H1, H2, and H4 were tested further.

Controlling for the direct effect of team climates, we tested our hypotheses regarding the moderating effects of team climates. Mixed results of cross-level moderating tests were found: innovative climate has a moderating effect on the relationship between the perceived KMS value for strategic decision support and knowledge adoption ($\gamma = 0.135$, $t = 3.110$) but not for the relationship between perceived KMS value for operational support and knowledge adoption ($\gamma = -0.063$, $t = -1.208$). This confirms H1 but not H2. The affective climate does moderate the relationship between perceived KMS value for operational support and knowledge transformation (γ

Table 4 Results of predicting knowledge adoption and knowledge transformation

Variables	Dependent variables											
	Knowledge adoption						Knowledge transformation					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
	γ	SE	γ	SE	γ	SE	γ	SE	γ	SE	γ	SE
Intercept, γ_{00}	0.857***	0.210	0.682**	0.209	0.649**	0.213	0.644*	0.248	0.482*	0.235	0.431†	0.237
Control variables												
Level 1 (n = 419)												
Company 2, γ_{10}	− 0.180	0.140	− 0.251†	0.143	− 0.090	0.126	− 0.390†	0.201	− 0.451*	0.197	− 0.351	0.074
Company 3, γ_{20}	0.639***	0.130	0.686***	0.136	0.717***	0.137	0.625**	0.196	0.641**	0.196	0.682**	0.197
Gender, γ_{30}	− 0.555***	0.131	− 0.409**	0.131	− 0.437**	0.131	− 0.337*	0.137	− 0.212	0.124	− 0.209	0.123
Age, γ_{40}	0.124	0.081	0.093	0.072	0.108	0.071	0.042	0.076	0.028	0.070	0.021	0.070
Tenure on a team, γ_{50}	0.075	0.047	0.054	0.045	0.053	0.045	0.055	0.044	0.053	0.045	0.052	0.044
Level 2 (n = 80)												
Team type, γ_{01}	0.104	0.116	0.096	0.122	0.053	0.110	0.133	0.168	0.158	0.167	0.118	0.163
Main effects												
Level 1 (n = 419)												
Perceived KMS value for strategic decision support, γ_{60}			0.112†	0.060	0.130*	0.055			0.077	0.050	0.059	0.053
Perceived KMS value for operational support, γ_{70}			0.277***	0.056	0.253***	0.055			0.248***	0.043	0.275***	0.047
Level 2 (n = 80)												
Affective climate, γ_{02}											0.127†	0.074
Innovative climate, γ_{03}					0.149*	0.057						
Cross-level interactions (moderations)												
Perceived KMS value for strategic decision support × affective climate, γ_{61}											0.021	0.058
Perceived KMS value for strategic decision support × Innovative climate, γ_{62}					0.135**	0.043						
Perceived KMS value for operational support × Affective climate, γ_{71}											0.095**	0.032
Perceived KMS value for operational support × Innovative climate, γ_{72}					− 0.063	0.052						
Var (within-team)	0.650		0.494		0.501		0.546		0.453		0.442	
Var (between-team)	0.050		0.087		0.072		0.191		0.226		0.228	
Pseudo R^2	0.302		0.428		0.435		0.318		0.362		0.370	
Deviance	1051.06		996.96		997.21		1027.19		991.34		993.02	

The entries corresponding to the predictors in the first column are estimations of the fixed effects, γ. SE indicates a robust standard error

The deviance is a measure of model fit; it equals − 2 × log-likelihood of a maximum likelihood estimate [94]. A smaller model deviance indicates a better fit

The pseudo R-square is calculated based on the proportion of variance explained by the predictors in the models, using the formula suggested by Snijders, Bosker [110]

$^{\dagger}p < 0.1$; $*p < 0.05$; $**p < 0.01$; $***p < 0.001$

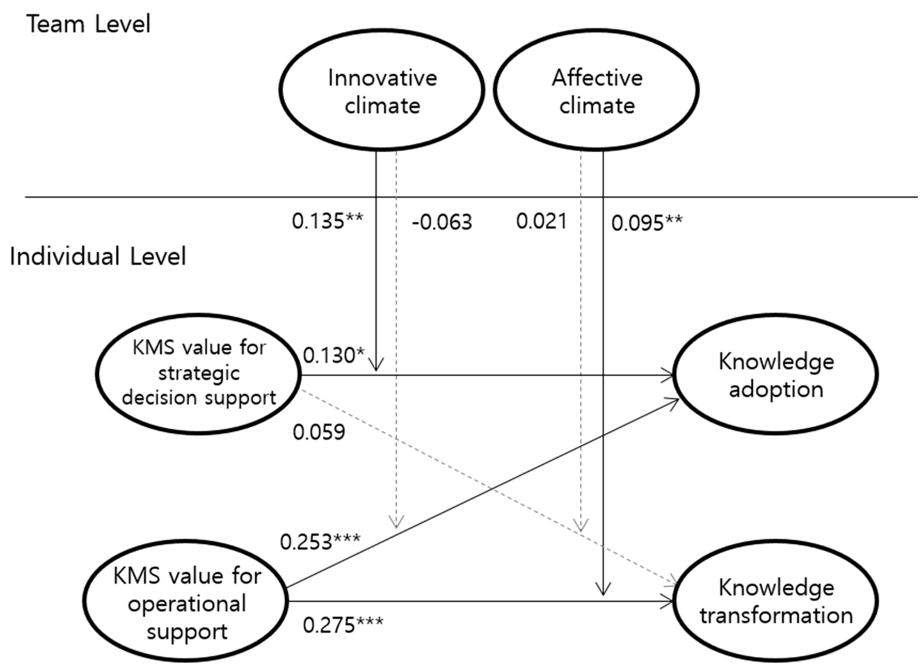

Fig. 1 Results of hypothesis testing. * Only focal constructs relating to the hypotheses are described. The control variables and direct effects of the climates are excluded in the figure and are displayed in Table 4

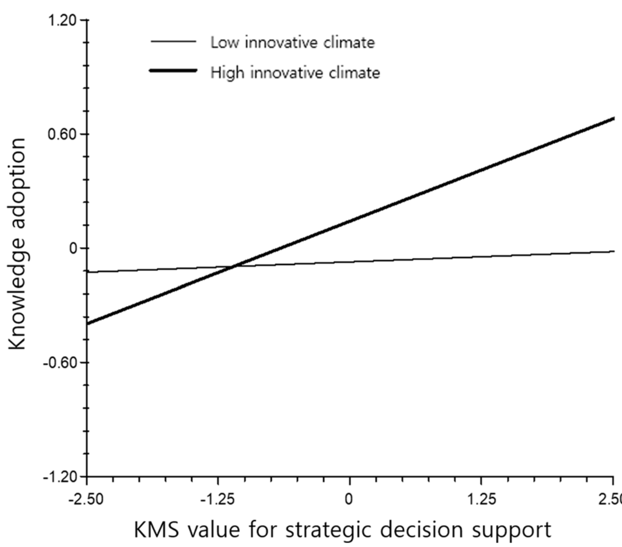

Fig. 2 Moderating effect of an innovative climate

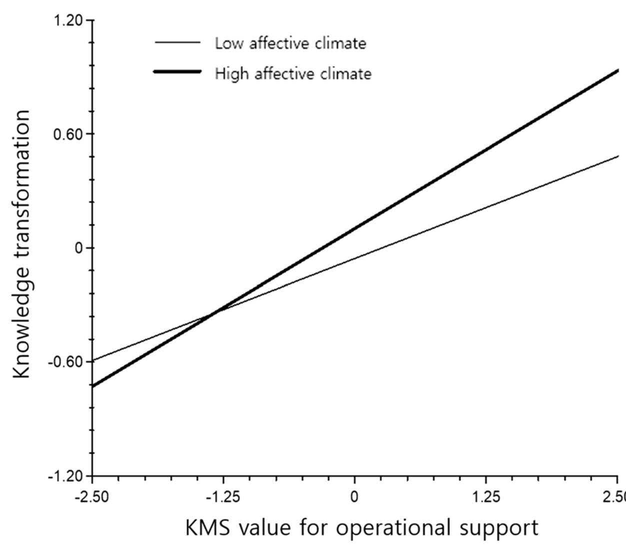

Fig. 3 Moderating effect of an affective climate

= 0.095, $t = 2.916$). Therefore, H4 is supported. Figures 2 and 3 illustrate these cross-level moderating effects. As per Fig. 2, the positive relationship between perceived KMS value for strategic decision support and knowledge adoption is stronger under a highly innovative climate. Additionally, as per Fig. 3, there is a stronger positive relationship between the perceived KMS value for operational support and knowledge transformation under highly affective climates as opposed to less affective ones.

As mentioned in the hypotheses development section, we conducted a post-hoc analysis of the full moderation model, which included not only the hypothesized moderating effects, but also those that were not hypothesized: the moderating effects of the innovative climate on the relationships between the two perceived KMS values and knowledge transformation; and those of the affective climate on the relationships between the two perceived KMS values and knowledge adoption. The results demonstrated that the innovative climate had no moderating effects on the relationships between the two perceived KMS values and knowledge transformation (Table 8, Model 4). Similarly, the affective climate did not moderate the relationship between the two perceived KMS values and knowledge adoption (Table 8, Model 4). These moderating effects were not within the main scope of the study, which proposed associations between the innovative climate and knowledge adoption, and between the affective climate and knowledge transformation. Nonetheless, the post-hoc analysis results support our argument that different climates may facilitate different knowledge activities.

6 Discussion

The results demonstrate how individuals within particular social settings of a team adopt and transform knowledge. The findings first indicate that the associations between perceived KMS value for operational support and both knowledge adoption and transformation are significant, and the perceived value of KMS for strategic decision support is associated with knowledge adoption, while the perceived value of KMS for strategic decision support is unrelated to knowledge transformation. This can be explained by the fact that individuals in an organization may perceive that the knowledge in KMS can be linked to different utilities by being transformed or adopted depending on its type and the work context. Knowledge for strategic support in KMS is more likely to be simply adopted rather than transformed mainly because of the costs of strategic activities caused by the difficulty in reaching a consensus [3]. Individuals feel less need or are not comfortable with its transformation since it is the result of established consensus. Conversely, while knowledge for operational support can simply be adopted owing to its immediate value to daily work, it is likely to be transformed because it can consist of simple facts that generate higher value when integrated with other knowledge.

Besides, the results are in line with the findings of previous research in that innovative and affective climates induce different knowledge activities [55, 105]. Our findings advance this knowledge by showing that different kinds of team climates strengthen the relationships between perceived KMS values and knowledge adoption and transformation in different ways. An innovative climate acts as a reinforcing factor for the relationship between the perceived KMS value for strategic decision support and knowledge adoption, while an affective climate reinforces the relationship between perceived KMS value for operational support and knowledge transformation. Note that an innovative climate does not moderate the relationship between perceived KMS value for operational support and knowledge adoption. These results can be explained again by the different aspects of the knowledge used for strategic decision and operational support and the different characteristics of the task context. An innovative climate can assist members in adopting knowledge, which supports strategic decisions, but this new knowledge acceptance encouraging atmosphere is not necessarily needed for the adoption of knowledge for operational support, as this type of work is usually well structured, thus easily adaptable regardless of the presence of innovative climate.

6.1 Limitations and future study opportunities

This study has some areas that could be further refined. First, our study focuses on two dimensions of team climate. Future studies should examine how other facets of team climate interact with perceived KMS values and knowledge activities. In a similar sense, this study investigated only two perceived values of KMS. Even though valuable insights are provided by how the two values precede knowledge adoption and transformation, a study of more varied types of KMS value perceptions could further enrich our findings.

Second, the knowledge in KMS is codified, and thus, its nature is inevitably explicit. Individuals seeking the value of explicit knowledge through the system are led to knowledge activities that may include tacit knowledge. We show that explicit knowledge that is validated as organizational knowledge can create a safe and efficient knowledge base as well as become a facilitator for eliciting personal knowledge and creating further organizational knowledge [106]. In this regard, since the explicit knowledge is "internally safe" and easily shared among all employees in an organization, it is a good starting point to understand how members perceive the value of KMS and adapt and transform the knowledge obtained from KMS. However, tacit knowledge is also important for strategic decision making [107]. Thus, future studies should consider both tacit and explicit knowledge to understand individuals' knowledge activities under socio-technical systems.

6.2 Practical implications

Our findings suggest several implications for the managers who intend to encourage knowledge-related behavior in a team: build the right climate, foster the right KMS value perception, and leverage their interaction to enhance knowledge activities.

For building the right climate, managers should first be aware that innovative and affective climates encourage team members' knowledge activities in different ways: there is an optimal climate that elicits the members' target knowledge activities. For example, an innovative climate facilitates noble knowledge to be adopted promptly. Also, an innovative climate encourages knowledge adoption when team members value KMS for strategic decision support. However, an innovative climate may not be particularly necessary for adopting knowledge stored in KMS for operational support even when they value KMS for that very purpose. The knowledge for operational support usually includes well-accepted know-how thus can be regarded for simple adoption. The simple adoption, accompanied by less effort to embrace, does not necessarily need the help of an innovative climate. In contrast, a climate that nurtures affection among knowledge workers enhances their tendency to transform knowledge when they value KMS for operational support. However, the affective climate does not do so when they value KMS for strategic decision support. Managers should, therefore, carefully consider the specific benefits of different climate types.

Fostering the right KMS value perception is not only the managers' but also the enterprise's job. The specific value perception is related to individual team members' tasks and their experiences with a system, but more fundamentally, KMS are technical systems that are built and executed throughout the entire organization; thus individuals and teams have less control over how KMS create values. Therefore, the task to foster the right KMS value perception does not remain within a team but is on the entire organization. When building KMS, which are the technical backbones of storing and developing organizational knowledge by individuals, it will be necessary to picture KMS not as a sole system that is equivalently applied to the entire organization but as the set of the systems by which the variety of tasks teams and individuals handle in various environments.

Lastly, leveraging the interaction between climates and KMS value perception is particularly important because this is what managers can do with relatively less cost. Building a social atmosphere is difficult, let alone building a specific climate, and takes a long time. Building the right perception is also difficult because it partly depends on the individual experience that managers have little control of. However, understanding the matching pair of a climate and KMS value perception and focusing on related knowledge activity can be useful to further enhance task performance. For example, if an innovative climate is strong in a team and the team members' KMS value perception for strategic decision support is highly built, the desirable level of knowledge adoption will be easily achieved. These specific hints of managing the relationship between climate and KMS perception can be a useful and efficient guide for encouraging knowledge works.

6.3 Theoretical implications

Our study provides several important implications for theory. First, our hierarchical linear model contributes to the existing body of interaction studies of team climate and knowledge behavior [108, 109] by incorporating team and individual levels in a single framework without sacrificing the integrity of either. Our work considers not only team climate and individual knowledge behavior, but also their interactions that exist between different organizational levels.

Consequently, our result paves the way for a better understanding of the individual knowledge activities intertwined in climate and IT in a team setting. Given that an organization is a system that consists of multiple levels of subsystems, considering not only technical and social systems but also their interactions across different levels can shed light on and contribute to the body of multilevel interaction studies.

Second, our study contributes to the KM literature by demonstrating that team climate exerts different effects on knowledge activities depending on their interaction with specific perceptions of KMS value. Prior KM research has suggested that team climate influences individuals' KM behavior [10, 89]. Our result refines prior findings by clearly showing that team climate moderates the path from perceived KMS values to KM activities. Our finding further provides the KM research community with articulated insights into how those two team climates are interrelated with the linkage between perceived KMS values and the processing of organizational knowledge differently. It suggests focusing on a more elaborate route through which team climate affects knowledge behavior in teams.

Third, previous studies have assumed the indifferent effects of KMS value perception on knowledge activities in such a way that highly perceived KMS value will result in high knowledge activities [35], being ignorant of different types of KMS value and their different operation. The findings of this study show that KMS are part of the work system by which various tasks are supported, thus play different roles in knowledge activities depending on which tasks they are connected with. Therefore, we suggest the need to study KMS value not as unidimensional perception but as multiple different perceptions that are intertwined with the work system. The insights will shed some light on how the perceived value of KMS work on different types of knowledge activities. Also, understanding different types of KMS value and related perception can be the starting point for understanding how and why certain climate does or does not have effects on knowledge activities.

Lastly, our findings show that KMS value perception can be various and the climate does not encourage all behaviors in all circumstances. Therefore, our findings urge the granulation of KMS value perception and knowledge circumstances that different climates could improve differently. This also means that for certain social characteristics of a team such as climates to benefit target activities, they should align with how people perceive the technical system within the target work system. This strengthens the previous knowledge that there can be a fit between social and technical systems [19]. Our findings also suggest that this socio-technical fit is not universally fixed, but is highly dependent on the specific work system they are embodied in, and should therefore be handled in a more articulated manner considering the target work system.

Appendix

See Tables 5, 6, 7 and 8.

Table 5 Operational definition and measurement items of constructs

Construct	Operational definition Measurement item	Mean	SD	Cronbach's Alpha	Based on
Individual level					
Perceived KMS value for operational support	The degree to which individuals perceive the KMS value for monitoring and controlling day-to-day operations	4.63	0.832	0.850	Sabherwal and Chan [111]
	KMS improve the efficiency of our day-to-day business operations				
	KMS support effective coordination across functions (e.g., marketing, manufacturing) and product lines				
	KMS enable us to develop detailed analyses of our present business situation				
Perceived KMS value for strategic decision support	The degree to which individuals perceive the KMS value for long-term planning or futurity	4.44	0.824	0.893	Sabherwal, Chan [111]
	KMS facilitate strategic business planning				
	KMS help us model possible future outcomes of alternative courses of action				
	KMS forecast key indicators of business performance				
Knowledge adoption	The degree to which individuals acquire knowledge within an organization and uses it without conversion	4.74	0.884	0.832	Gold et al. [112]
	I acquire knowledge about new products/services with our industry				
	I acquire knowledge about competitors within our industry				
	I am devoted to identifying best practices				
Knowledge transformation	The degree to which individuals modify the organizational knowledge by creating new knowledge or adding new knowledge to existing knowledge	4.84	0.867	0.868	Flatten et al. [113]
	I have the ability to structure and to use collected knowledge				
	I successfully link existing knowledge with new insights				
	I am able to apply new knowledge in my practical work				
Team level					
Affective climate	The extent to which a team shares the affective responses of its members	5.23	1.082	0.945	Tse et al. [114]
	In general, how warm do you feel your team is?				
	In general, how sincere do you feel your team is?				
	In general, how accepting do you feel your team is?				
	In general, how supportive do you feel yourteam is?				
Innovative climate	The extent to which a team is open to new ideas	4.92	0.98	0.909	Hurley and Hult [57]
	In our team, technical innovation, based on research results, is readily accepted				
	In our team, management actively seeks innovative ideas				
	In our team, innovation is readily accepted in program/project management				

Table 6 Exploratory factor analysis

	KMSOP	KMSSD	KA	KT
Individual level constructs				
Perceived KMS value for operational support (KMSOP)				
KMSOP1	**0.805**	0.175	0.223	0.277
KMSOP2	**0.792**	0.355	0.167	0.184
KMSOP3	**0.624**	0.513	0.170	-0.002
Perceived KMS value for strategic decision support (KMSSD)				
KMSSD1	0.188	**0.852**	0.113	0.192
KMSSD2	0.256	**0.845**	0.157	0.071
KMSSD3	0.133	**0.885**	0.096	0.083
Knowledge adoption (KA)				
KA1	0.172	0.138	**0.805**	0.241
KA2	0.162	0.152	**0.816**	0.184
KA3	0.148	0.153	**0.649**	0.416
Knowledge transformation (KT)				
KT1	0.195	0.091	0.257	**0.753**
KT2	0.139	0.164	0.287	**0.706**
KT3	0.142	0.130	0.310	**0.750**

	AC	IC
Affective climate (AC)		
Team level constructs		
AC1	**0.866**	0.412
AC2	**0.816**	0.509
AC3	**0.896**	0.394
AC4	**0.848**	0.466
Innovative climate (IC)		
IC1	0.611	**0.742**
IC2	0.354	**0.910**
IC3	0.498	**0.825**

The numbers in bold are the item loadings on their own constructs

Table 7 Common method bias analysis

	Indicator	Factor loading on construct (R1)	$R1^2$	Factor loading on method (R2)	$R2^2$
Individual level					
Perceived KMS value for operational support (KMSOP)	KMSOP1	0.845***	0.715	0.052	0.003
	KMSOP2	0.935***	0.874	− 0.029	0.001
	KMSOP3	0.852***	0.725	− 0.025	0.001
Perceived KMS value for strategic decision support (KMSSD)	KMSSD1	0.900***	0.810	0.012	0.000
	KMSSD2	0.866***	0.751	0.075*	0.006
	KMSSD3	0.959***	0.920	− 0.090**	0.008
Knowledge adoption (KA)	KA1	0.901***	0.811	− 0.047	0.002
	KA2	0.912***	0.831	− 0.036	0.001
	KA3	0.783***	0.613	0.084*	0.007
Knowledge transformation (KT)	KT1	0.917***	0.840	− 0.043	0.002
	KT2	0.848***	0.718	0.038	0.001
	KT3	0.905***	0.819	0.004	0.000
	Average	0.885	0.786	0.000	0.003
Team level					
Affective climate (AC)	AC1	0.983***	0.966	− 0.025	0.001
	AC2	0.912***	0.832	0.051	0.003
	AC3	1.156***	1.336	− 0.187	0.035
	AC4	0.810***	0.656	0.162*	0.026
Innovative climate (IC)	IC1	0.560***	0.313	0.417***	0.174
	IC2	1.380***	1.904	− 0.443*	0.197
	IC3	0.940***	0.884	0.026	0.001
	Average	0.963	0.984	0.000	0.062

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Table 8 Results of predicting knowledge adoption and knowledge transformation with full moderation of team climates

Variables	Dependent variables							
	Knowledge adoption				Knowledge transformation			
	Model 3		Model 4		Model 3		Model 4	
	γ	SE	γ	SE	γ	SE	γ	SE
Intercept, γ_{00}	0.649**	0.213	0.649**	0.214	0.431†	0.237	0.401†	0.226
Control variables								
Level 1 (n = 419)								
Company 2, γ_{10}	− 0.090	0.126	− 0.286	0.125	− 0.351	0.074	− 0.199	0.181
Company 3, γ_{20}	0.717***	0.137	0.711***	0.138	0.682**	0.197	0.686**	0.199
Gender, γ_{30}	− 0.437**	0.131	− 0.435**	0.132	− 0.209	0.123	− 0.228†	0.124
Age, γ_{40}	0.108	0.071	0.109	0.073	0.021	0.070	0.015	0.071
Tenure on a team, γ_{50}	0.053	0.045	0.057	0.045	0.052	0.044	0.048	0.045
Level 2 (n = 80)								
Team type, γ_{01}	0.053	0.110	0.047	0.110	0.118	0.163	0.061	0.145
Main effects								
Level 1 (n = 419)								
Perceived KMS value for strategic decision support, γ_{60}	0.130*	0.055	0.131*	0.054	0.059	0.053	0.054	0.055
Perceived KMS value for operational support, γ_{70}	0.253***	0.055	0.256***	0.055	0.275***	0.047	0.271***	0.051
Level 2 (n = 80)								
Affective climate, γ_{02}			− 0.058	0.078	0.127†	0.074	− 0.152	0.110
Innovative climate, γ_{03}	0.149*	0.057	0.199*	0.098			0.361**	0.133
Cross-level interactions (moderations)								
Perceived KMS value for strategic decision support × affective climate, γ_{61}			− 0.131	0.124	0.021	0.058	0.081	0.139
Perceived KMS value for strategic decision support × innovative climate, γ_{62}	0.135**	0.043	0.247*	0.113			− 0.066	0.123
Perceived KMS value for operational support × affective climate, γ_{71}			0.074	0.117	0.095**	0.032	0.111	0.110
Perceived KMS value for operational support × innovative climate, γ_{72}	− 0.063	0.052	− 0.129	0.110			− 0.021	0.114
Var. (within-team)	0.501		0.501		0.442		0.442	
Var. (between-team)	0.072		0.074		0.228		0.201	
Pseudo R^2	0.435		0.433		0.370		0.399	
Deviance	997.21		1005.47		993.02		994.11	

The entries corresponding to the predictors in the first column are the estimations of the fixed effects γ. SE indicates a robust standard error

The deviance is a measure of the model fit; it equals − 2 × log-likelihood of the maximum likelihood estimate [94]. A smaller model deviance indicates a better fit

The pseudo R-square is calculated based on the proportion of variance explained by the predictors in the models, using the formula suggested by Snijders, Bosker [110]

†$p < 0.1$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

Funding This study was supported by a research fund from Chosun University, 2020.

Declaration

Conflict of interest We have no conflict of interest to declare.

References

1. Grant RM (1996) Prospering in dynamically-competitive environments: organizational capability as knowledge integration. Organ Sci 7(4):375–387
2. Trist E (1981) The evolution of socio-technical systems, vol 2. Wiley, New York
3. Grant RM (1996) Toward a knowledge-based theory of the firm. Strateg Manag J 17(S2):109–122

4. Abdullah R, Selamat MH, Sahibudin S, Alias RA (2005) A framework for knowledge management system implementation in collaborative environment for higher learning institution. J Knowl Manag Pract 6(1):1–5
5. Lamb R, Kling R (2003) Reconceptualizing users as social actors in information systems research. MIS Q 27(2):197–236
6. Bostrom RP, Heinen JS (1977) MIS problems and failures: a socio-technical perspective. Part I: the causes. MIS Q 1(3):17–32
7. Fischer G, Herrmann T (2011) Socio-technical systems: a meta-design perspective. Int J Sociotechnol Knowl Dev 3(1):1–33
8. Kulkarni UR, Ravindran S, Freeze R (2007) A knowledge management success model: theoretical development and empirical validation. J Manag Inf Syst 23(3):309–347
9. Del Giudice M, Della Peruta MR (2016) The impact of IT-based knowledge management systems on internal venturing and innovation: a structural equation modeling approach to corporate performance. J Knowl Manag 20(3):484–498
10. Bock GW, Zmud RW, Kim YG, Lee JN (2005) Behavioral intention formation in knowledge sharing: examining the roles of extrinsic motivators, social-psychological forces, and organizational climate. MIS Q 29:87–111
11. Xiaojun Z (2017) Knowledge management system use and job performance: a multilevel contingency model. MIS Q 41(3):811–840
12. Furlan A, Galeazzo A, Paggiaro A (2019) Organizational and perceived learning in the workplace: a multilevel perspective on employees' problem solving. Organ Sci 30(2):280–297
13. Li X, Zhang J, Zhang S, Zhou M (2017) A multilevel analysis of the role of interactional justice in promoting knowledge-sharing behavior: the mediated role of organizational commitment. Ind Mark Manag 62:226–233
14. Pan SL, Scarbrough H (1998) A socio-technical view of knowledge-sharing at Buckman Laboratories. J Knowl Manag 2(1):55–66
15. Maruping LM, Magni M (2012) What's the weather like? The effect of team learning climate, empowerment climate, and gender on individuals' technology exploration and use. J Manag Inf Syst 29(1):79–114
16. Glomb TM, Liao H (2003) Interpersonal aggression in work groups: social influence, reciprocal, and individual effects. Acad Manag J 46(4):486–496
17. Alavi M, Leidner DE (2001) Review: knowledge management and knowledge management systems: conceptual foundations and research issues. MIS Q 25(1):107–136. https://doi.org/10.2307/3250961
18. Pasmore W, Francis C, Haldeman J, Shani A (1982) Sociotechnical systems: a North American reflection on empirical studies of the seventies. Hum Relat 35(12):1179–1204
19. Lyytinen K, Newman M (2008) Explaining information systems change: a punctuated socio-technical change model. Eur J Inf Syst 17:589–613
20. Geels FW (2005) The dynamics of transitions in socio-technical systems: a multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930). Technol Anal Strateg Manag 17(4):445–476
21. Hsu MH, Chang CM (2014) Examining interpersonal trust as a facilitator and uncertainty as an inhibitor of intra-organisational knowledge sharing. Inf Syst J 24(2):119–142
22. Chang Y-W, Hsu P-Y, Shiau W-L, Tsai C-C (2015) Knowledge sharing intention in the United States and China: a cross-cultural study. Eur J Inf Syst 24(3):262–277
23. Boh WF, Wong SS (2013) Organizational climate and perceived manager effectiveness: influencing perceived usefulness of knowledge sharing mechanisms. J Assoc Inf Syst 14(3):122–152
24. Wasko MM, Faraj S (2005) Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. MIS Q 29(1):35–57
25. Alavi M, Kayworth TR, Leidner DE (2005) An empirical examination of the influence of organizational culture on knowledge management practices. J Manag Inf Syst 22(3):191–224
26. Handzic M (2011) Integrated socio-technical knowledge management model: an empirical evaluation. J Knowl Manag 15(2):198–211
27. Borgatti SP, Cross R (2003) A relational view of information seeking and learning in social networks. Manag Sci 49(4):432–445
28. Zhang X (2017) Knowledge management system use and job performance: a multilevel contingency model. MIS Q 41(3):811–840
29. Jahmani K, Fadiya SO, Abubakar AM, Elrehail H (2018) Knowledge content quality, perceived usefulness, KMS use for sharing and retrieval: a flock leadership application. VINE J Inf Knowl Manag Syst 48(4):470–490
30. Davison RM, Martinsons MG (2016) Context is king! Considering particularism in research design and reporting. J Inf Technol 31(3):241–249
31. March JG (1991) Exploration and exploitation in organizational learning. Organ Sci 2(1):71–87
32. Teigland R, Wasko M (2009) Knowledge transfer in MNCs: examining how intrinsic motivations and knowledge sourcing impact individual centrality and performance. J Int Manag 15(1):15–31. https://doi.org/10.1016/j.intman.2008.02.001
33. Shrivastava P (1983) A typology of organizational learning systems. J Manag Stud 20(1):7–28
34. Sveiby K-E, Simons R (2002) Collaborative climate and effectiveness of knowledge work—an empirical study. J Knowl Manag 6(5):420–433
35. Gray PH (2000) The effects of knowledge management systems on emergent teams: towards a research model. J Strat Inf Syst 9(2):175–191
36. Kim SH, Mukhopadhyay T, Kraut RE (2016) When does repository KMS use lift performance? The role of alternative knowledge sources and task environments. MIS Q 40(1):133–156
37. Zhang X, Venkatesh V (2017) A nomological network of knowledge management system use: antecedents and consequences. MIS Q 41(4):1275–1306
38. Anthony RN (1965) Management planning and control systems: a framework for analysis. Harvard Business School Press, Cambridge, MA
39. Park Y, Kim S (2006) Knowledge management system for fourth generation R&D: KNOWVATION. Technovation 26(5–6):595–602. https://doi.org/10.1016/j.technovation.2004.10.008
40. Molloy S, Schwenk CR (1995) The effects of information technology on strategic decision making. J Manag Stud 32(3):283–311
41. Floyd SW, Lane PJ (2000) Strategizing throughout the organization: managing role conflict in strategic renewal. Acad Manag Rev 25(1):154–177
42. Wijnhoven F (2003) Operational knowledge management: identification of knowledge objects, operation methods, and goals and means for the support function. J Oper Res Soc 54(2):194–203
43. Facteau JD, Dobbins GH, Russell JE, Ladd RT, Kudisch JD (1995) The influence of general perceptions of the training environment on pretraining motivation and perceived training transfer. J Manag 21(1):1–25
44. Ashkanasy NM, Wilderom CP, Peterson MF (2000) Handbook of organizational culture and climate. SAGE Publications, Beverly Hills
45. Kozlowski SW, Klein KJ (2000) A multilevel approach to theory and research in organizations: contextual, temporal, and

emergent processes. In: Klein KJ, Koslowski SW (eds) Multilevel theory, research, and methods in organizations. Jossey Bass, San Francisco, pp 3–90
46. Rousseau DM (1985) Issues of level in organizational research: multi-level and cross-level perspectives. In: Staw BM, Cummings LL (eds) Research in organizational behavior, vol 7. JAI Press, Greenwich, pp 1–37
47. Cannon-Bowers JA, Salas E (2001) Reflections on shared cognition. J Organ Behav 22(2):195–202
48. Ostroff C (1993) The effects of climate and personal influences on individual behavior and attitudes in organizations. Organ Behav Hum Decis Process 56(1):56–90
49. Brown SL, Eisenhardt KM (1995) Product development: past research, present findings, and future directions. Acad Manag Rev 20(2):343–378
50. Chen C-J, Huang J-W (2007) How organizational climate and structure affect knowledge management—the social interaction perspective. Int J Inf Manag 27(2):104–118
51. Chen C-J, Huang J-W, Hsiao Y-C (2010) Knowledge management and innovativeness: the role of organizational climate and structure. Int J Manpow 31(8):848–870
52. Islam MZ, Jasimuddin SM, Hasan I (2017) The role of technology and socialization in linking organizational context and knowledge conversion: the case of malaysian service organizations. Int J Inf Manag 37(5):497–503
53. Oliver RL, Anderson E (1994) An empirical test of the consequences of behavior-and outcome-based sales control systems. J Mark 58(4):53–67
54. Shadur MA, Kienzle R, Rodwell JJ (1999) The relationship between organizational climate and employee perceptions of involvement: the importance of support. Group Org Manag 24(4):479–503
55. Kim MJ, Choi JN, Lee K (2016) Trait affect and individual creativity: Moderating roles of affective climate and reflexivity. Soc Behav Personal Int J 44(9):1477–1498
56. West MA, Richter AW (2008) Climates and cultures for innovation and creativity at work. In: Zhou J, Shalley CE (eds) Handbook of organizational creativity. Erlbaum, New York, pp 211–236
57. Hurley RF, Hult GTM (1998) Innovation, market orientation, and organizational learning: an integration and empirical examination. J Market 62:42–54
58. Gray RJ (2001) Organisational climate and project success. Int J Project Manag 19(2):103–109
59. Hammedi W, Van Riel AC, Sasovova Z (2013) Improving screening decision making through transactive memory systems: a field study. J Prod Innov Manag 30(2):316–330
60. Lin C-P, Liu C-M, Liu N-T, Huang H-T (2020) Being excellent teams: managing innovative climate, politics, and team performance. Total Qual Manag Bus Excell 31(3–4):353–372
61. Basaglia S, Caporarello L, Magni M, Pennarola F (2010) IT knowledge integration capability and team performance: the role of team climate. Int J Inf Manag 30(6):542–551
62. Hoegl M, Parboteeah KP, Munson CL (2003) Team-level antecedents of individuals' knowledge networks*. Decis Sci 34(4):741–770
63. Liao S-H, Chang W-J, Hu D-C, Yueh Y-L (2012) Relationships among organizational culture, knowledge acquisition, organizational learning, and organizational innovation in Taiwan's banking and insurance industries. Int J Hum Resour Manag 23(1):52–70
64. Bibi S, Khan A, Qian H, Garavelli AC, Natalicchio A, Capolupo P (2020) Innovative climate, a determinant of competitiveness and business performance in Chinese law firms: the role of firm size and age. Sustainability 12(12):4948
65. Lee J, Min J, Kwak C, Pee L, Lee H (2019) Share or send and receive? The impact of team knowledge outflow/inflow with IT support on performance. J Knowl Manag 23(8):1523–1542
66. Barczak G, Sultan F, Hultink EJ (2007) Determinants of IT usage and new product performance. J Prod Innov Manag 24(6):600–613
67. Kang JH, Solomon GT, Choi DY (2015) CEOs' leadership styles and managers' innovative behaviour: investigation of intervening effects in an entrepreneurial context. J Manag Stud 52(4):531–554
68. Lai VS, Mahapatra RK (1997) Exploring the research in information technology implementation. Inf Manag 32(4):187–201
69. Jasperson J, Carter PE, Zmud RW (2005) A comprehensive conceptualization of post-adoptive behaviors associated with information technology enabled work systems. MIS Q 29(3):525–557
70. Hsieh JP-A (2007) Explaining employees' extended use of complex information systems. Eur J Inf Syst 16:216–227
71. Ke W, Tan C-H, Sia C-L, Wei K-K (2012) Inducing intrinsic motivation to explore the enterprise system: the supremacy of organizational levers. J Manag Inf Syst 29(3):257–290
72. Liang H, Peng Z, Xue Y, Guo X, Wang N (2015) Employees' exploration of complex systems: an integrative view. J Manag Inf Syst 32(1):322–357
73. Acur N, Kandemir D, De Weerd-Nederhof PC, Song M (2010) Exploring the impact of technological competence development on speed and NPD program performance. J Prod Innov Manag 27(6):915–929
74. Cai Z, Liu H, Huang Q, Liang L (2019) Developing organizational agility in product innovation: the roles of IT capability, KM capability, and innovative climate. R&D Manag 49(4):421–438
75. Liang H, Xue Y, Ke W, Wei KK (2010) Understanding the influence of team climate on IT use. J Assoc Inf Syst 11(8):414–432
76. Gatian AW, Brown RM, Hicks JO Jr (1995) Organizational innovativeness, competitive strategy and investment success. J Strat Inf Syst 4(1):43–59
77. Kellermanns FW, Eddleston KA, Sarathy R, Murphy F (2012) Innovativeness in family firms: a family influence perspective. Small Bus Econ 38(1):85–101
78. Sandhawalia BS, Dalcher D (2011) Developing knowledge management capabilities: a structured approach. J Knowl Manag 15:313–328
79. Liu S, Deng Z (2015) Understanding knowledge management capability in business process outsourcing. Manag Decis 53:124–138
80. González-Romá V, Peiró JM, Subirats M, Mañas MA (2000) The validity of affective work team climates. In: Vartiainen M, Avallone F, Anderson N (eds) Innovative theories, tools and practices in work and organizational psychology. Hogrefe & Huber, Göttingen, pp 97–109
81. Gray JA (1990) Brain systems that mediate both emotion and cognition. Cogn Emot 4(3):269–288
82. Collins AL, Lawrence SA, Troth AC, Jordan PJ (2013) Group affective tone: a review and future research directions. J Organ Behav 34(S1):S43–S62
83. Sy T, Côté S, Saavedra R (2005) The contagious leader: impact of the leader's mood on the mood of group members, group affective tone, and group processes. J Appl Psychol 90(2):295–305
84. Tran V (1998) The role of the emotional climate in learning organisations. Learn Organ 5:99–104
85. Amabile TM, Conti R, Coon H, Lazenby J, Herron M (1996) Assessing the work environment for creativity. Acad Manag J 39(5):1154–1184
86. Maimone F, Sinclair M (2010) Affective climate, organizational creativity, and knowledge creation: case study of an automotive company. In: Zerbe WJ, Hartel CEJ, Ashkanasy NM (eds)

Emotions and organizational dynamism. Emerald Group Publishing, Bingley, pp 309–332
87. Edmondson A (1999) Psychological safety and learning behavior in work teams. Adm Sci Q 44(2):350–383
88. Bierhoff HW, Müller GF (1999) Positive feelings and cooperative support in project groups. Swiss J Psychol 58(3):180–190
89. Xue Y, Bradley J, Liang H (2011) Team climate, empowering leadership, and knowledge sharing. J Knowl Manag 15(2):299–312
90. Estrada CA, Isen AM, Young MJ (1997) Positive affect facilitates integration of information and decreases anchoring in reasoning among physicians. Organ Behav Hum Decis Process 72(1):117–135
91. George JM, King EB (2007) Potential pitfalls of affect convergence in teams: functions and dysfunctions of group affective tone. In: Mannix EA, Neale MA, Anderson CP (eds) Research on managing groups and teams, vol 10. JAI Press, Greenwich, pp 97–124
92. Bloodgood JM, Salisbury WD (2001) Understanding the influence of organizational change strategies on information technology and knowledge management strategies. Decis Support Syst 31(1):55–69
93. Butler T, Murphy C (2007) Understanding the design of information technologies for knowledge management in organizations: a pragmatic perspective. Inf Syst J 17(2):143–163
94. Bryk AS, Raudenbush SW (1992) Hierarchical linear models for social and behavioral research: applications and data analysis methods. Sage, Newbury Park
95. Hofmann DA, Griffin MA, Gavin MB (2000) The application of hierarchical linear modeling to organizational research. In: Klein KJ, Kozlowski SWJ (eds) Multilevel theory, research, and methods in organizations: foundations, extensions, and new directions. Wiley, San Francisco, pp 467–511
96. James LR, Demaree RG, Wolf G (1984) Estimating within-group interrater reliability with and without response bias. J Appl Psychol 69(1):85–98
97. Fowler F (1993) Survey research methods, 2nd edn. Sage, Newbury Park
98. Armstrong JS, Overton TS (1977) Estimating non-response bias in mail surveys. J Mark Res 14(3):396–402
99. Bagozzi RP, Yi Y (1998) On the evaluation of structural equation models. Acad Market Sci 16(1):74–94
100. Wixom BH, Todd PA (2005) A theoretical integration of user satisfaction and technology acceptance. Inf Syst Res 16(1):85–102
101. Fornell C, Larcker DF (1981) Evaluating structural equation models with unobservable variables and measurement error. J Mark Res 18(1):39–50
102. Shrout PE, Fleiss JL (1979) Intraclass correlations: uses in assessing rater reliability. Psychol Bull 86(2):420–428
103. Podsakoff PM, Organ DW (1986) Self-reports in organizational research: problems and prospects. J Manag 12(4):531–544
104. Liang H, Saraf N, Hu Q, Xue Y (2007) Assimilation of enterprise systems: the effects of institutional pressures and the mediating role of top management. MIS Q 31(1):59–88
105. Mehta A, Mehta N (2018) Knowledge integration and team effectiveness: a team goal orientation approach. Decis Sci 49(3):445–486
106. Hall R, Andriani P (2003) Managing knowledge associated with innovation. J Bus Res 56(2):145–152
107. Brockmann EN, Anthony WP (2002) Tacit knowledge and strategic decision making. Group Org Manag 27(4):436–455
108. Durcikova A, Fadel KJ, Butler BS, Galletta DF (2011) Knowledge exploration and exploitation: the impacts of psychological climate and knowledge management system access. Inf Syst Res 22(4):855–866
109. Kettinger WJ, Li Y, Davis JM, Kettinger L (2015) The roles of psychological climate, information management capabilities, and IT support on knowledge-sharing: an MOA perspective. Eur J Inf Syst 24(1):59–75
110. Snijders T, Bosker R (1999) Multilevel analysis: an introduction to basic and advanced multilevel modeling. Sage, London
111. Sabherwal R, Chan YE (2001) Alignment between business and IS strategies: a study of prospectors, analyzers, and defenders. Inf Syst Res 12(1):11–33
112. Gold AH, Malhotra A, Segars AH (2001) Knowledge management: an organizational capabilities perspective. J Manag Inf Syst 18(1):185–214
113. Flatten TC, Engelen A, Zahra SA, Brettel M (2011) A measure of absorptive capacity: scale development and validation. Eur Manag J 29(2):98–116
114. Tse HHM, Dasborough MT, Ashkanasy NM (2008) A multi-level analysis of team climate and interpersonal exchange relationships at work. Leadersh Q 19(2):195–211